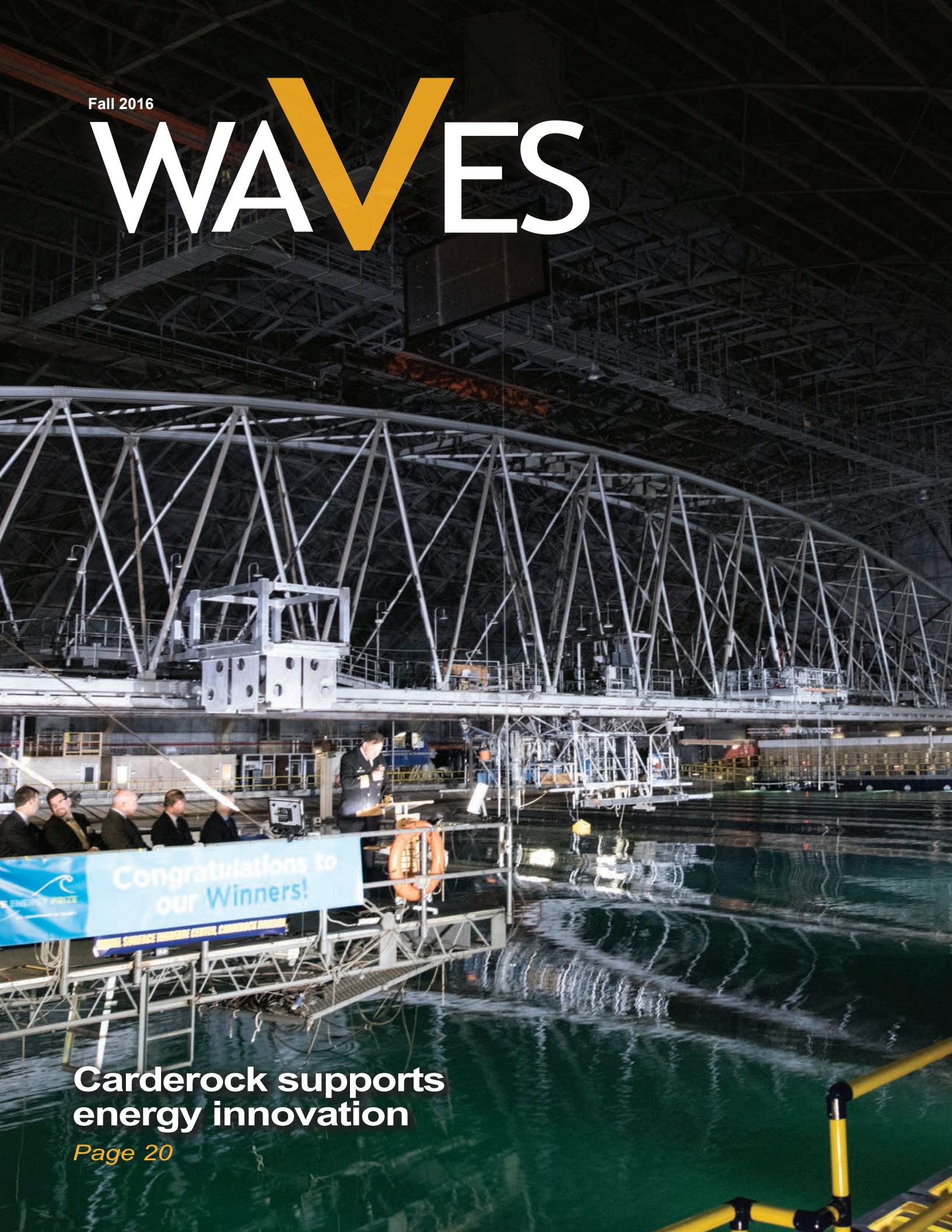
Fall 2016

WAVES



Carderock supports energy innovation

Page 20

Fall 2016

WAVES

Contents

Technology

Happenings

Partnering

Innovation

Investing

In this issue

From the chief of naval operation's "Design for Maintaining Maritime Superiority," the Navy has embraced the concept of high-velocity learning. There are plenty of examples how it is already being applied here at Carderock, some right here in this issue of Waves.

As said in the article on page 28, high-velocity learning is about innovation and approaching problems in a specific way that is tailored to yield better, faster and actually more innovative solutions. As we learn more about high-velocity learning, we see that it involves these four capabilities: See (detect the problem), Swarm (apply resources and solve problems, building knowledge), Share (spread the new knowledge throughout the organization) and Sustain (embed new knowledge into processes and continuously improve).

Where are we seeing this taking place at Carderock? Two areas that have been identified as high-velocity learning projects moving forward are knowledge preservation management and human-centered design. As far as where we have already seen it applied, we have been ahead of the curve, and it is incumbent upon us to make the connection of what we are already doing here at Carderock at the high-velocity learning level.

As you read this issue of Waves, see if you can identify how high-velocity learning is being applied. Our Manufacturing, Knowledge and Education (MAKE) Lab is a prime example. Through this lab, the workforce is empowered with the latest technology and access to Navy experts (swarm) as they explore the use of additive manufacturing (AM) for their program needs. Our folks from the MAKE Lab are always willing to share with others the capabilities of the lab, like when they went to the Modern Day Marine Expo (page 3). AM, also known as 3-D printing, enables high-velocity learning for the Carderock workforce and helps build a culture of affordability through rapid-iterative design. Using 3-D printing, our Disruptive Technologies Lab was successful in building a very large Optionally Manned Technology Demonstrator (page 24), thereby decreasing the costs of creating such vehicles.

As we become more familiar with what high-velocity learning is, we will be able to identify how we can apply it in everything we do. As you look through this issue and read about the great things going on here at Carderock, you'll start to see how Carderock "sees" a problem, "swarms" to solve it and gain new knowledge, "shares" that knowledge and "sustains" the advantage.

Dr. Tim Arcano
NSWCCD Technical Director

Cover

Capt. Mark Vandroff, commanding officer of Naval Surface Warfare Center, Carderock Division, speaks at the Wave Energy Prize innovation showcase Nov. 16, 2016, at the Maneuvering and Seakeeping basin in West Bethesda, Md. (U.S. Navy photo by Monica McCoy/Released)

Team

Dr. Tim Arcano
Daniel Daglis
Dustin Q. Diaz
Katie Ellis-Warfield
Roxie Merritt
Kelley Stirling
Kevin Sykes
Margaret Zavarelli

Carderock AM team demonstrates at Modern Day Marine

By Dustin Q. Diaz, NSWCCD Public Affairs

Personnel from multiple Department of the Navy (DON) agencies, including Naval Surface Warfare Center, Carderock Division, teamed with the U.S. Marine Corps (USMC) to demonstrate 21 additively manufactured parts to explore the "art of the possible" during the Modern Day Marine (MDM) Expo at Marine Corps Base Quantico, Virginia, Sept. 27-29.

This demonstration, directed by Marine Lt. Gen. Michael Dana, deputy commandant for Installations and Logistics (I&L), and funded by I&L Department, showcased how this emerging technology can influence parts obsolescence risks, long lead times and early failure challenges. The I&L department leveraged the DON additive manufacturing (AM) community and worked with the Naval Sea Systems Command (NAVSEA) Technology Office and Carderock to plan and execute the project. Jonathan Hopkins, a member of the Carderock AM team, serves as engineering manager to the USMC AM demonstrations and played a lead role in coordination for Modern Day Marine.

"They needed a subject-matter expert to coordinate the effort across the different commands," Hopkins said. "When we heard about this potential opportunity, we immediately wanted to take part and do it as collaboratively as possible."

Hopkins' role involved reviewing recommended parts, components, tools and training submitted by operating forces, Marine Corps Systems Command (MCSC) and Naval Air Systems Command (NAVAIR) to make recommendations on parts for logistics, ground and aviation combat systems. In addition, the parts are reviewed and assessed to make sure they can legally be printed by the government, using criteria including business-case operation impact and legal parameters.

"These are parts that came to us; they were recommended by Marines and people in program offices who said, 'With these parts, it would be really helpful if we could figure out a way to print these so we can be more agile and not have to store them, but be able to print them on

Marine Sgt. Stephen Cook, a legal service specialist with Headquarters Marine Corps, Judge Advocate Division, and amateur hobbyist 3-D printer, and Jonathan Hopkins, a member of the Additive Manufacturing Tiger Team and employee of Naval Surface Warfare Center, Carderock Division, discuss 3-D printed parts at the Modern Day Marine Expo at Marine Corps Base Quantico, Va., Sept. 28. Naval Sea Systems Command, Naval Aviation Systems Command, Marine Corps Systems Command, the Marine Corps Warfighting Laboratory, and Marine Corps Headquarters, Installations and Logistics Department collaborated on an additive manufacturing parts demonstration at the expo. (U.S. Navy photo by Dustin Q. Diaz/released)

demand as needed,'" Hopkins said. "We don't want to turn into manufacturers, but there are instances when you can't afford to be as operationally ready as you need to be because one part failed. And if you have the capability to print that part in theater, you know, that's a game changer."

Marine Maj. Brad Goldvarg of the Marine Corps Warfighting Laboratory (MCWL) gave an example of that in one of the parts on display at the expo, a pin for one of the USMC utilized radios. Goldvarg said this part costs more than $75 when purchased from the original equipment manufacturer and can take a long time to reach the person who needs it, but the proposed version on showcase at the expo can be printed in 37 minutes for a cost of $1.22.

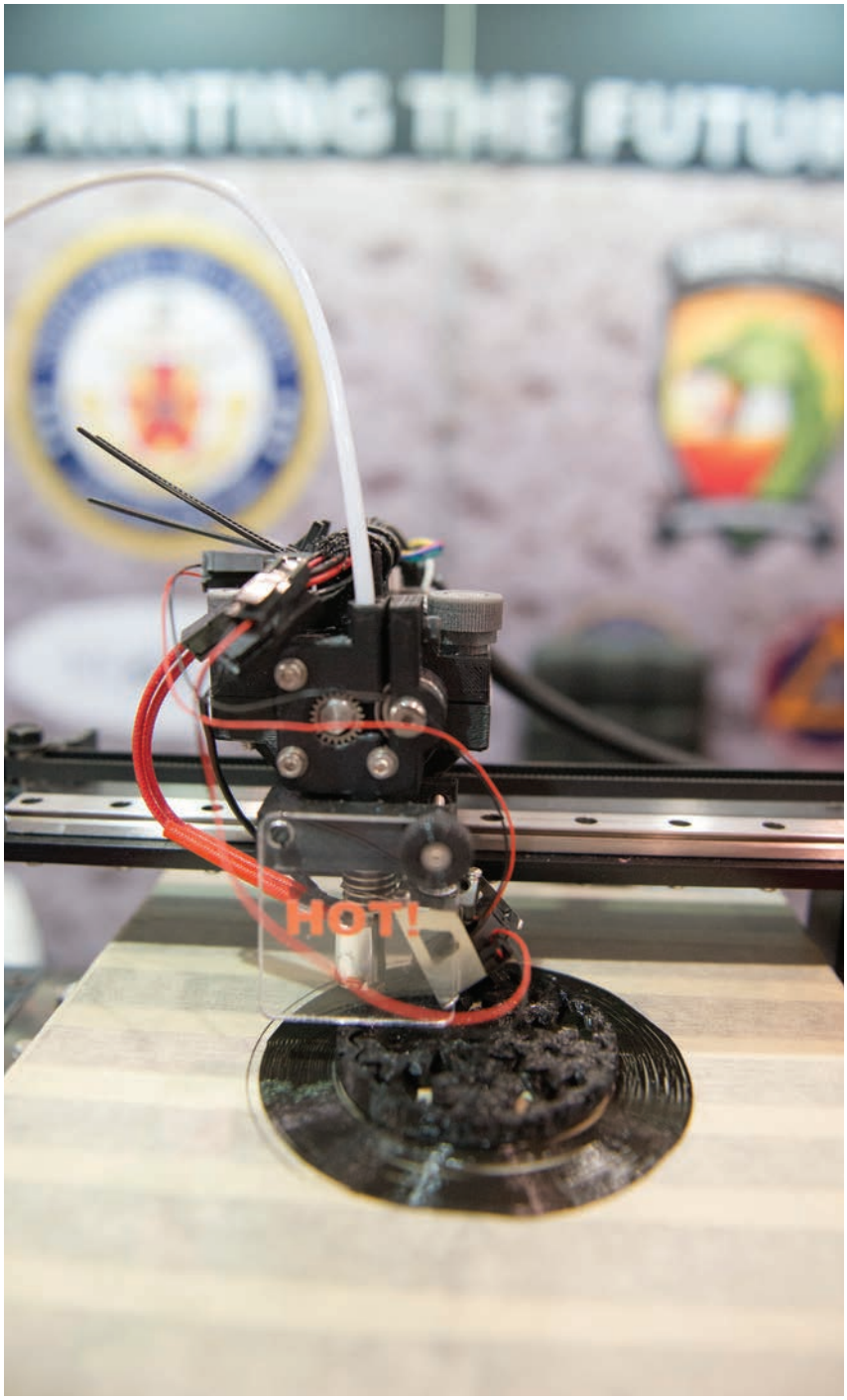
"This one pin going down renders the entire radio inoperable, and not having a radio is a huge shortfall for an operating unit," Goldvarg said. "This part is the exact same thing; if a unit has the ability to print this part and it can bring a radio back to being operational in 37 minutes, why not? Therefore, this becomes very critical to our operations.

"If you look at the printer we have here, it's a $1,200 printer. It's a very small, simple printer that could fit on any desk. It doesn't need to be complicated. Can I see this printer on a shipboard environment, where a Marine can call back to the ship and request a replacement for the radio pin and have it within the next 12-24 hours instead of waiting weeks, and in some cases months, for the exact same thing at a much higher cost? Potentially, yes!"

Other parts on display included a radio battery latch, an 18,000 lb.-capacity HMMWV tow hook bracket and safety critical AM parts for the MV-22 Osprey. In addition to the long lead time, limited source of supply and early failure challenges addressed by the radio pin, other areas addressed by these parts include the potential to use alternate materials and address early failure challenges and obsolescence risks.

"We have a lot of parts for aging platforms that we either can't get ordered in a timely fashion or simply cannot buy at all," Hopkins said. "So those

Marine Sgt. Stephen Cook, a legal service specialist with Headquarters Marine Corps, holds up a water cooler spigot in the shape of a rifle round that he printed using additive manufacturing to replace one that had broken at his office during the Modern Day Marine Expo at Marine Corps Base Quantico, Va., Sept. 28, 2016. Cook is sharing his 3-D printing expertise during an additive manufacturing parts demonstration at the expo, which Naval Sea Systems Command, Naval Aviation Systems Command, Marine Corps Systems Command, the Marine Corps Warfighting Laboratory, and Marine Corps Headquarters, Installations and Logistics Department all collaborated on. (U.S. Navy photo by Dustin Q. Diaz/released)



A 3-D printer additively manufactures a symbol at Modern Day Marine Expo at Marine Corps Base Quantico, Va., Sept. 28, 2016. The symbol represents Naval Sea Systems Command; Naval Aviation Systems Command; Marine Corps Systems Command; the Marine Corps Warfighting Laboratory; and Marine Corps Headquarters, Installations and Logistics Department, all of which collaborated on an additive manufacturing parts demonstration at the expo. (U.S. Navy photo by Dustin Q. Diaz/ released)

are parts we can reverse engineer and create through additive manufacturing. Another category is alternate materials where, for example, we can take a part that was originally metal, and due to the environment it is used in, it doesn't actually have to be metal."

Goldvarg said the production of these parts wouldn't have been possible without the collaboration and efforts of all those involved: Carderock and NAVSEA, NAVAIR, I&L, MCWL, MCSC, the operating forces who provided input and other Marines like Marine Sgt. Stephen Cook, an amateur hobbyist 3-D printer who attended the demonstration to share his knowledge on the topic with other Marines, as well as gain some for himself.

"I deal with plastics and rubbers mainly," said Cook, a legal services specialist from Walla Walla, Washington, assigned to Headquarters Marine Corps, Judge Advocate Division. "The way they're putting metal over these plastics and different types of nylons is quite new to me. I've never seen it before in my life."

Cook spoke at the expo about one of his home projects, a prosthetic he made for his 3-year-old brother who had part of one of his arms amputated at birth.

"My family can't afford a prosthetic, and they won't be able to afford replacements, so I printed him off a prosthetic," Cook said. "Since he likes Iron Man, I made it look like Iron Man's arm. People around the office heard about me doing this, and somebody met somebody who met somebody, which would be Capt. Christopher Wood (I&L Lead for AM). I got a hold of him, we met up and now I'm here.

"I also showed him a few of the other things I'm working on, such as a remotely operated submarine with a live-feed camera and sound. You can't get one that's less than $5,000 right now; I can make it for under $100. I love this stuff."

Sailors train on innovative Carderock-developed flight deck cleaning system aboard USS America

By Dustin Q. Diaz, NSWCCD Public Affairs

Six Sailors assigned to amphibious assault ship USS America (LHA 6) trained in the operation and support of a new flight deck cleaning system with the help of engineers from Naval Surface Warfare Center, Carderock Division, Sept. 12-16 in San Diego.

The Mobile Cleaning, Recovery and Recycling System (MCRRS) is a shipboard, heavy duty, self-powered cleaning vehicle that utilizes water jet technology, integrated air recovery and waste-water recycling to clean, remove foreign object debris (FOD) and restore friction to non-skid surfaces. It has been in development by Naval Sea Systems Command (NAVSEA), Carderock Division and contracting firm Triverus, LLC with sponsorship from the Office of Naval Research (ONR) through a Small Business Innovation Research (SBIR) effort to replace existing flight deck cleaning methods.

The Carderock Ship-to-Shore Team leader, William Hertel, and key subject-matter expert, Tracy Harasti, have been heavily involved since 2003 with the development of a cleaning technology and method capable of maintaining flight surface Coefficient of Friction (COF), reducing FOD (i.e. microsolids and liquid), is sufficiently intuitive to operate, be maintained by ship forces, and that integrates with mission requirements. This was the latest trip Harasti has made to train Sailors aboard an L-Class ship in the early stages of transitioning to the MCRRS.

Tracy Harasti, an environmental protection specialist with Naval Surface Warfare Center, Carderock Division, trains Seaman Uzoma Hojo in the use of the Mobile Cleaning Reclaim and Recovery System on the flight deck of the amphibious assault ship USS America (LHA 6) in San Diego, Sept. 15, 2016. (U.S. Navy photo by Dustin Q. Diaz/Released)

This low-rate initial production effort is a follow-on to prior developmental efforts that included initial deployment of the prototype MCRRS to aircraft carrier USS Ronald Reagan (CVN 76) in 2009.

"The Ship-to-Shore Team is responsible for program execution or transition of production units during the production contract," said Harasti, who has collectively spent months underway aboard Ronald Reagan, USS Abraham Lincoln (CVN 72), amphibious assault ship USS Bonhomme Richard (LHD 6), and USS Bataan (LHD 5) in his role as the subject-matter expert and technical point of contact for the Navy. "Over the last eight years, I've had the pleasure to travel to Alaska; San Diego; Norfolk; Sasebo, Japan; Bangkok, Thailand; Washington state; and various locations in Australia for development, emergency FOD remediation and conducting training/ support."

NAVSEA Surface Ship Readiness and Sustainment (PMS 443) is in the process of establishing a formal program of record for the MCRRS, which has led to the delivery of the first MCRRS initial production model unit NAVSEA and Carderock representatives accepted June 24. This version is iterative upon previous versions tested in the fleet, according

Tracy Harasti, an environmental protection specialist with Naval Surface Warfare Center, Carderock Division, instructs Air Department Sailors on operating the Mobile Cleaning Reclaim and Recovery System on the flight deck of the amphibious assault ship USS America (LHA 6) in San Diego, Sept. 15, 2016. (U.S. Navy photo by Dustin Q. Diaz/Released)

to Tristan Kenny, MCRRS engineering director for Triverus, LLC who visited America with Harasti and representatives from Carderock and NAVSEA. He said each time it has been tested aboard ships and used by Sailors who have provided feedback, the Zamboni-like vehicle has improved into the machine it is today -- one that meets all shipboard requirements and is easy for service members to train on and use.

"There have been different variations over the years; what we have now is working well, it's robust, and maintainable," Kenny said. "It's been a process of figuring out what was actually needed. This has been a constant evolution trying to get to a product that's going to be as robust as possible for the Navy. Bringing it to the Sailors has made a huge difference. It's now to the point where the system is pretty intuitive to operate and easy to understand. It's been good to see them use it and obtain that validation."

The MCRRS improves upon other methods of cleaning flight decks in numerous ways, according to Harasti. It is designed to replace the manual cleaning process involving Sailors scrubbing flight decks with scrub brushes and mops -- reducing costs, saving man-hours and increasing flight deck availability for flight operations. It also is replacing a 30-year-old warehouse sweeper modified for flight deck use. The MCRRS pumps water at 2,500 psi at its highest pressure, at a flow rate of approximately nine gallons of water per minute. It recovers and holds solid waste while recycling process water at a rate of 2.25 tank volumes, or 240 gallons, over a 60-minute operational period. The MCRRS uses no soap, minimizes wastewater through recycling, and uses no consumable media. The system picks up solids on the flight deck ranging from 4 inches to sub-micron in size, all forms of liquid FOD, and separates process water concentrates so they can be properly disposed of.

"The high-pressure, water-jet cleaning action and integrated air recovery ensure the micro-solids and liquid FOD are removed from the flight deck surface in a single pass process within the first 18 inches of travel," Harasti said. "This technology improves the flight deck coefficient of friction, is more reliable, can be supported by ship's force and reduces risk associated with all types of FOD."

Harasti said the Sailors aboard America went through a combination of instructional and on-the-job, hands-on training associated with the operation and sustainment of the MCRRS. These efforts included daily vehicle inspection requirements, system terminology, human machine interface familiarization, and driving and operation of the MCRRS in all flight deck areas. The Sailors, who had never seen or used the MCRRS before this training, said it was easy to learn and operate.

"You can maneuver it easily and it fits it into tight spaces," said Seaman Uzoma Hojo, a Sailor from Independence, Missouri, assigned to America's Air Department. "It's a nice machine, [and] much better than the one we were using currently."

Harasti and Hertel were recognized for their work with the MCRRS during Carderock's Magnificent Eight Division Honor Awards Ceremony Aug. 31, receiving the Capt. Harold E. Saunders Award for exemplary achievement in leadership of a major technical area or management of a complex technical project. Saunders (1890-1961), a naval architect and engineer, prepared the preliminary plans and specifications for Carderock's David Taylor Model Basin. At the ceremony, Hertel praised Harasti for his technical acumen and work in the field helping to bring this technology to Sailors. Harasti, a former Marine, talked about how he tried to get the best possible equipment deployed to Sailors and Marines.

"I attempted to bring to the fleet a piece of equipment that not only could be operated and maintained by 19-year-old Sailors, but was a model for other equipment on the flight deck," Harasti said. "And I think we met those goals."

According to Harasti, the plan is to continue work with PMS 443 to field more MCRRS units for cleaning, training and engineering purposes on other large deck ships for an eventual total of 47 units. For more information on the MCRRS, go to: http://www.onr.navy.mil/en/Media-Center/Fact-Sheets/Mobile-Cleaning-Reclaim-Recovery-System.aspx/.

Unmanned Vehicles and Autonomous Systems Working Group is a collaboration effort across all Warfare Centers

By John Barnett, special to NSWCCD Public Affairs

The evolution from concept to reliable, real-world application has never been an easy one. Requirements need to be developed, funding allocated, research must move concept into reality, experimentation leads to the best working results, and updates and maintenance have to be provided. This is not an easy task for any research and experimentation organization.

However, when working in a large, multidimensional organization such as the Department of the Navy, working through all the challenges facing research and development programs can be daunting to say the least. Combatting the usual challenges—along with more recent ones—makes the need for a strategy and culture of cross-discipline cooperation even greater.

Working to establish a foothold for this collaborative culture shift is Carderock's Unmanned Vehicles and Autonomous Systems (UVAS) Working Group, co-led by Reid McAllister, the director of Unmanned Maritime Mobility Systems at Naval Surface Warfare Center, Carderock Division, headquartered in West Bethesda, Maryland, and Dr. Brian McKeon, department head, Undersea Warfare Weapons, Vehicles, and Defensive Systems at Naval Undersea Warfare Center, Newport Division. So what originated as an internal strategy to balance work, expertise and resources now may be the start of a cultural mindset evolution for Naval Sea Systems Command's (NAVSEA) research and development

What Is the UVAS working group?

The group initially formed as a way to collaboratively focus manpower, resources and expertise on unmanned systems within NAVSEA's 10 surface and undersea Warfare Centers. Each Warfare Center Division provides specific expertise and capabilities, McAllister said. Combined, they deliver the expertise and capabilities for NAVSEA requirements in manned and unmanned ship and submarine vehicles. Carderock and the other Warfare Centers divisions are part of the larger Naval Research and Development Establishment (NR&DE), which coordinates the research and development efforts of more than 25,000 scientists and engineers.

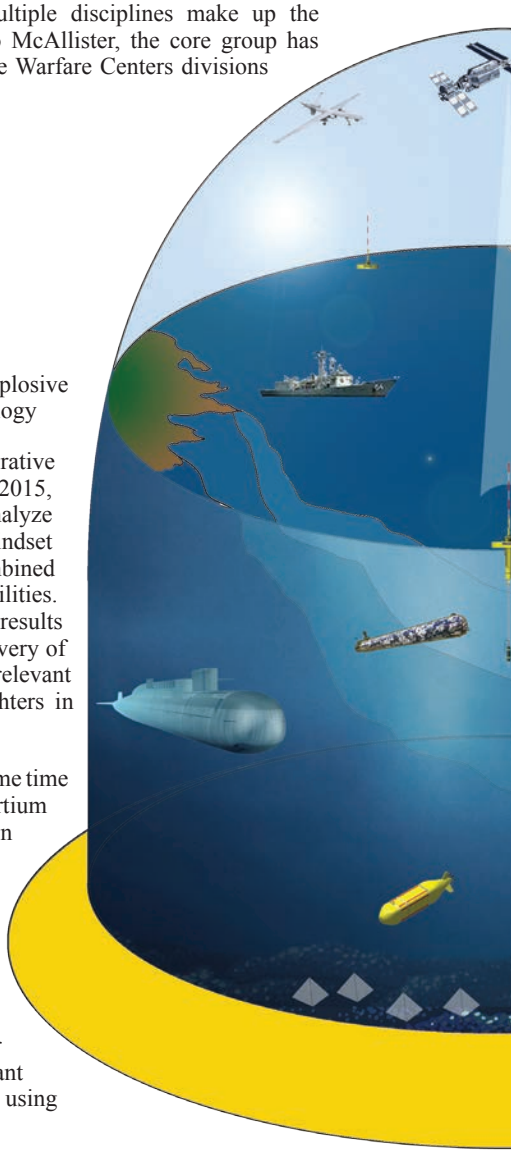
Coordinating the highly technical and complex needs of such large scientific, research and engineering organizations has been a timeless challenge. McAllister said the UVAS Working Group's mission seeks to overcome this challenge by developing a collaborative mindset across all the Warfare Centers divisions to build trust and relationships. The UVAS Working Group hopes to match capabilities and capacities within each division, offsetting the usual competitiveness that is bred by restricted funding and manpower capacity, while also eliminating redundancies, waste and unnecessary work.

"What we're trying to build [is] a muscle—a collaborative muscle—with all the other divisions in the Warfare Centers where it didn't exist before," McAllister said. "We were more in a competitive mode versus a collaborative mode. So what we're trying to do is break through the competitiveness … and the only way you can do that is through building trusting relationships."

Mission and goals

Expertise, capability and multiple disciplines make up the working group. According to McAllister, the core group has representatives from all of the Warfare Centers divisions to include:

- NUWC, Newport
- NUWC, Keyport
- NSWC, Carderock
- NSWC, Corona
- NSWC, Crane
- NSWC, Dahlgren
- NSWC, Panama City
- NSWC, Philadelphia
- NSWC, Port Hueneme
- NSWC, Indian Head Explosive Ordnance Disposal Technology



When they started the collaborative groundwork in September 2015, the main purpose was to analyze and create a collaborative mindset for the Warfare Centers' combined expertise and technical capabilities. According to McAllister, the results would be the expeditious delivery of cost-effective, reliable and relevant unmanned systems to warfighters in the field and fleet.

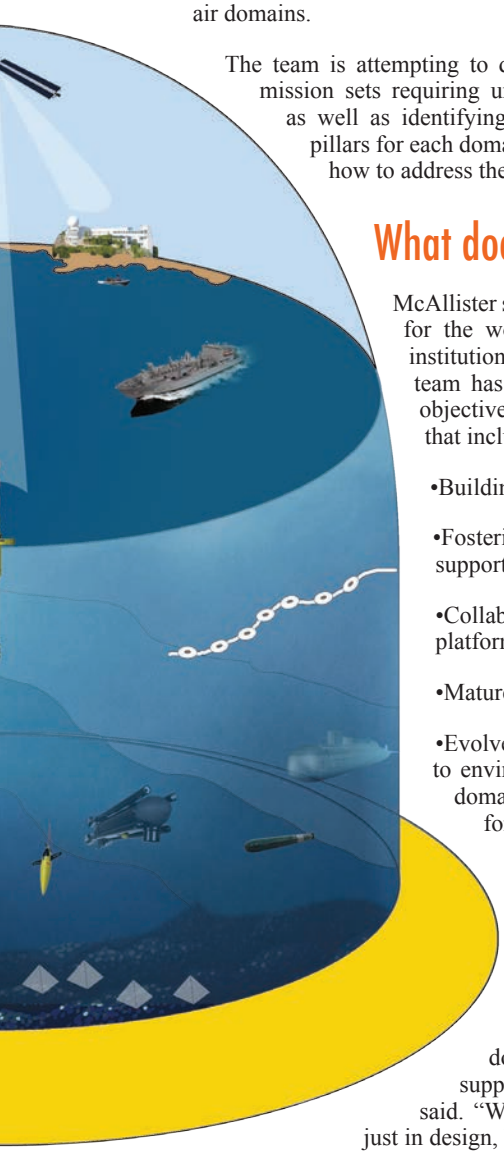
"We have been working for some time to create a collaborative consortium across the laboratories within NAVSEA," McAllister said. Now having two representatives from each of the Warfare Centers, McAllister wants the working group to focus on the planning and strategy of "how can we better facilitate and accelerate relevant warfighting capability using unmanned systems."

McAllister added that the group's cross-discipline approach would help identify and eliminate lengthy learning curves, duplicative work efforts and other factors dragging down efficient productivity. This concept reduces or eliminates the more traditional "we can do it all" mindset.

"It's a culture shift away from competitiveness to collaboration for the benefit of the warfighter," McAllister said. "It's an effort to build trust for a collaborative future together."

Moreover, since its September 2015 startup, McAllister said the working group has made significant progress toward better working-level relationships across all Warfare Center divisions. The group is trying to support foundations for investment strategy roadmaps for unmanned system development that draw from collective Warfare Center division capabilities. According to McAllister, these roadmaps will help the working group to accelerate delivery of tactically relevant unmanned vehicles that support warfighters in the undersea, surface, ground and air domains.

The team is attempting to develop a catalog of potential mission sets requiring unmanned vehicle deployment, as well as identifying the technology development pillars for each domain and gaps that may exist and how to address them.



(U.S. Navy illustration by Michael E. White/Released)

What does the future hold?

McAllister said there is a lot of work ahead for the working group as changing an institutional culture is no easy task. The team has a number of approaches and objectives to achieve a true culture shift that include:

- Building relationships and trust
- Fostering a positive, mutually supportive culture
- Collaborative work across all platforms
- Mature man-machine teaming
- Evolve from domain specific solutions to environments where all unmanned domains are collaboratively teamed for mission success.
- Applying the necessary capabilities and capacities to meet the mission

"We wanted this working group stood up and say, 'who's is the right athlete to do the work? Where's that work supposed to be done?'" McAllister said. "We're talking full lifecycle; not just in design, but full lifecycle all the way to disposal. You get the right people thinking about [the project]; you get greater modularity and commonality. And that's where we really need to go."

The working group has more on its plate than just these goals for collaboration within the Warfare Centers. Deputy Assistant Secretary of the Navy for Research, Development, Test and Evaluation Dr. John Burrow, who oversees all Navy technological and engineering research and development, took notice of the working group's efforts and added it to NR&DE's rapid prototyping research and experimentation RPED program.

In pursuit of that assignment, McAllister said Carderock hosted several Force Engagement Teams in 2016, the results of which will determine the protoyping and experimentation strategy for fielding warfighter capabilities in fiscal years 2017 and 2018.

"Dr. Burrow reached out to the working group to start working this larger issue across the NR&DE, not just within NAVSEA organization," McAllister said. "So we're working that very aggressively across all Naval System Commands."

McAllister said UVAS Working Group plans to meet in Panama City in January 2017 to continue maturing its focus and plan out its objective to the 2017 calendar year.

The ultimate sign of success, according to McAllister, will be a community mindset focused on collaborative delivery of systems the warfighter can use effectively and reliably when it is needed. Moreover, it means looking at the larger picture of cooperatively addressing all three sides of the "iron triangle" of payload, speed and endurance.

"A great analogy is your iPhone being the payload," he said. "It has a very elegant navigation system, and it gives you all the information you possibly need to know. You go out to your driveway, you go to your car, and it doesn't start. What good is your payload? If you don't have reliable speed and endurance underneath you, you're not going anywhere. You might as well put the payload on a shelf."

And while the concept seems simple enough and rooted in strong common sense, McAllister admitted there will be challenges.

"What Dr. McKeon and I are attempting to do is put collaboration at the fore of all our discussions. But we're trying to do a lot, so we're trying to build the plane as we fly along at 500 mph," he joked.

However, as resources become more limited, as researchers retire and take valuable experience with them, and as funding becomes scarce and selective, the demand for innovation and improvement continues to grow. These pressures on the research and development community are making the culture shift the UVAS Working Group is nurturing even more critical for the warfighter's technological and scientific dominance in the fleet.

Carderock Division changes command

By Kelley Stirling, NSWCCD Public Affairs

Capt. Mark R. Vandroff relieved Capt. Richard Blank as the commanding officer of Naval Surface Warfare Center, Carderock Division in a ceremony Sept. 8 in the Maritime Technology Information Center at Carderock in West Bethesda, Maryland.

Blank, who was the 36th commanding officer at Carderock, said he will miss the people of Carderock the most and thanked as many as he could during his speech at the change of command ceremony.

"All these facilities would be useless without the great men and women who operate them and their work definitely shows," Blank said of the technical expertise in Carderock's employees, adding his praise of the support staff, as well. He said he was proud that during his time, Carderock hired many new scientists and engineers to meet the demand of its customers.

Some other division milestones he highlighted included a major renovation of the Maneuvering and Seakeeping basin in 2013. The 360-foot long and 240 foot-wide facility holds approximately 12 million gallons of water and is used to evaluate the maneuverability, stability and control of scale models. There was a grand opening of the Manufacturing, Knowledge and Education Lab, as well. The additive manufacturing (3-D printing) lab provides training for all Carderock employees to provide its workforce with the tools necessary to additively manufacture parts or enhance projects using its printers.

Blank highlighted the science, technology, engineering and math (STEM) activities at Carderock as being an exciting part of his tour. "From LEGO competitions, Mathcounts, Sea Perch, Sea Glide and, of course, the world-famous International Human-Powered Submarine Races," Blank said, referring to some of the STEM activities at Carderock.

During the ceremony, guest speaker Rear Adm. Lorin Selby, chief engineer and deputy commander for Ship Design, Integration and Naval Engineering, Naval Sea Systems Command (NAVSEA), praised Blank for the many technical achievements during his time as commanding officer. He also recounted many of the awards Carderock received, to include two 2015 Secretary of the Navy Innovation Awards, the 2014 Vice Adm. Harold G. Bowen Award for Patented Inventions and the fiscal 2015 Office of Navy Research Technology and Transition Achievement Award.

Capt. Mark Vandroff relieved Capt. Rich Blank at Naval Surface Warfare Center, Carderock Division during the change of command ceremony in West Bethesda, Sept. 8, 2016. From left: Lt. Christilene Whalen, command chaplain, Naval Support Activity Bethesda; Vandroff; Blank; Rear Adm. Tom Druggan, commander, Naval Surface Warfare Center; and Rear Adm. Lorin Selby, chief engineer and deputy commander for Ship Design, Integration and Naval Engineering, Naval Sea Systems Command. (U.S. Navy photo by Ryan Hanyok/Released)

"It would literally take days for me to highlight all of the command's technical achievements over the past three years," Selby said.

Blank said there were also challenging times during his tour, such as the

realignment that separated Carderock and Naval Surface Warfare Center, Philadelphia Division into two separate commands in October 2015; sequestration and furloughs; the Washington Navy Yard shooting; and the Montgomery Mall shooting, which took the life of one Carderock civilian contract employee and wounded another.

"There were some very tough times; and in every single case, Capt. Blank always met them with compassion, perseverance and resilience," Selby said. "To say it has been a busy three years with Capt. Blank would be an understatement."

Rear Adm. Tom Druggan, commander, Naval Surface Warfare Centers, presented the Legion of Merit Medal to Blank for his performance as the commanding officer of Carderock Division and his leadership during a time of significant change and fiscal challenges, which resulted in improved business operations and a renewed focus on mission performance.

"I believe I am leaving [Carderock] a better place and have put things in motion to be trending upward, setting the stage for the future," Blank said in his final remarks as the commanding officer of Carderock.

Blank is headed back to NAVSEA to the Naval Systems Engineering Directorate (SEA05) for his next tour of duty. Prior to becoming the commanding officer of Carderock in July 2013, he was the technical director for Surface Ship Design and Systems Engineering (SEA05D).

Vandroff came to Carderock from NAVSEA, serving as the major program manager for the DDG 51 Shipbuilding Program (PMS 400D) for five years.

Naval Surface Warfare Center, Carderock Division Commanding Officer Capt. Rich Blank's children sing the national anthem as part of his change-of-command ceremony in West Bethesda, Md., Sept. 8, 2016. Capt. Mark Vandroff relieved Capt. Rich Blank as commanding officer. From left: Peter Blank, Klarissa Blank, Nicholas Blank, Martha Blank, Lt. Christilene Whalen, command chaplain, Naval Support Activity Bethesda; Vandroff; Blank; Rear Adm. Tom Druggan, commander, Naval Surface Warfare Center; and Rear Adm. Lorin Selby, chief engineer and deputy commander for Ship Design, Integration and Naval Engineering, Naval Sea Systems Command. (U.S. Navy photo by Ryan Hanyok/Released)

During his speech after taking command, Vandroff told the crowd of friends, family and Carderock employees the four things he has learned to value during his time in the Navy: safety, integrity, excellence and compliance. He expects to focus his command around those values.

Besides being grateful to the mentors who taught him the business of being a naval officer and leader over the years, he said he is grateful to have been given the opportunity to lead the team at Carderock, which provides vital services to the Navy and the nation.

"We preserve the past; we service the present; and we invent the future," Vandroff said. "I pledge that I will work to be worthy of this task."

Capt. Mark Vandroff assumes the position of commanding officer relieving Capt. Rich Blank at Naval Surface Warfare Center, Carderock Division during the change of command ceremony in West Bethesda, Sept. 8, 2016. From left: Lt. Christilene Whalen, command chaplain, Naval Support Activity Bethesda; Rear Adm. Tom Druggan, commander, Naval Surface Warfare Center; Blank; and Vandroff. (U.S. Navy photo by Ryan Hanyok/Released)

Carderock Division honors its "Magnificent Eight"

By Kelley Stirling, NSWCCD Public Affairs

For the 17th year, Naval Surface Warfare Center, Carderock Division recognized their best and brightest during the 2015 Magnificent Eight Division Honor Awards ceremony in West Bethesda, Maryland, Aug. 31, 2016.

"The Magnificent Eight ceremony, at its heart, really recognizes the commitment the men and women who work for the Navy have to our Sailors and to the Fleet," said Dr. Tim Arcano, technical director for Carderock. "Each of the Magnificent Eight award namesakes inspires us to greatness."

The awards are named for Vice Adm. Samuel L. Gravely Jr., Rear Adm. Grace M. Hopper, Rear Adm. Benjamin F. Isherwood, Vice Adm. Emory S. Land, Donald F. McCormack, Rear Adm. George W. Melville, Capt. Harold E. Saunders and Carderock's founding father, Rear Adm. David W. Taylor.

For each award, the recipients received a medal depicting the likeness of the award's namesake, along with a pin with a compass rose design.

Dr. Donald McCormack, executive director for Naval Surface and Undersea Warfare Center and for whom the McCormack award is named, attended the ceremony.

"The contributions of Carderock are well known throughout the entire Navy," McCormack said. "It's the birthplace for America's Navy, and you should be proud of what you do. If you think about what has been accomplished here, these are the technical leaders of the organization, the technical leaders of the Navy."

McCormack also said that collaboration is a key element in the success of many of the awardees, as well as the rest of the warfare centers and the Navy. He emphasized the newest initiative being pushed by Navy leadership, high-velocity learning, and said it is something the warfare centers have been doing since their inception.

"It is understanding the problem, swarming the right group of people to solve the problem, and then it's sharing those results across the entire

Vice Adm. Samuel L. Gravely Jr. Award

Marylou K. McNamara, head of the Acoustic Signatures Technology Department, receives Naval Surface Warfare Center, Carderock Division's (NSWCCD) Vice Admiral Samuel L. Gravely Jr. Award at a ceremony Aug. 31, 2016, in West Bethesda, Md. From left, Dr. Tim Arcano, technical director, NSWCCD; Capt. Rich Blank, commanding officer, NSWCCD; McNamara; and Dr. Paul Shang, Ship Signatures Department head. (U.S. Navy photo by Monica McCoy/ Released)

Rear Adm. Grace M. Hopper Award

Michael G. Vukovich, the acquisition manager for Ship Signatures Department, receives Naval Surface Warfare Center, Carderock Division's (NSWCCD) Rear Adm. Grace M. Hopper Award at a ceremony Aug. 31, 2016, in West Bethesda, Md. From left, Dr. Tim Arcano, technical director, NSWCCD; Capt. Rich Blank, former commanding officer, NSWCCD; Vukovich; and Dr. Paul Shang, Ship Signatures Department head. (U.S. Navy photo by Monica McCoy/ Released)

Vice Adm. Emory S. Land Award

William D. (Dave) Sudduth, a program manager for the Survivability, Structures, Materials and Environmental Department, receives Naval Surface Warfare Center, Carderock Division's (NSWCCD) Vice Adm. Emory S. Land Award at a ceremony Aug. 31, 2016, in West Bethesda, Md. From left, Dr. Tim Arcano, technical director, NSWCCD; Capt. Rich Blank, commanding officer, NSWCCD; Sudduth; and Michael Brown, Survivability, Structures, Materials and Environmental Department head. (U.S. Navy photo by Monica McCoy/Released)

Donald F. McCormack Director's Award for Warfare Center Collaboration

Timothy Tenopir from Naval Surface Warfare Center (NSWC), Port Hueneme Division and William D. (Dave) Sudduth, a program manager for the Survivability, Structures, Materials and Environmental Department accept the Naval Surface Warfare Center, Carderock Division's (NSWCCD) Donald F. McCormack Director's Award for Warfare Center Collaboration at a ceremony Aug. 31, 2016, in West Bethesda, Md. From left, Dr. Tim Arcano, technical director, NSWCCD; Capt. Rich Blank, commanding officer, NSWCCD; Tenopir; Sudduth; and Michael Brown, Survivability, Structures, Materials and Environmental Department head. (U.S. Navy photo by Monica McCoy/Released)

enterprise," McCormack said. "The Navy's success is really the cumulative effect of all of our employees across the warfare centers and across the Navy."

Collaboration and team effort was a consistent theme as each awardee made remarks after receiving their award. Each said that their success was not their own and that their colleagues deserved the award as much.

"This was our great American experiment in cooperation and coordination," Dave Sudduth said about the Navy Materials Community of Interest (COI) that earned the McCormack Director's Award for Warfare Center Collaboration. Sudduth is a program manager for the Survivability, Structures, Materials and Environmental Department.

The COI included members from across all the warfare centers, including Timothy Tenopir from the Naval Surface Warfare Center (NSWC), Port Hueneme Division, who was able to attend the ceremony. Other team members for the McCormack award were David Rich of Carderock; Aaron Wiest, Rebecca Stevens and Dylan Switzer of NSWC, Corona Division; Steve Seghi and Yunusa Balogun of NSWC, Crane Division; Susan Bartyczak and Karen Long of NSWC, Dahlgren Division; Jason Jouet of NSWC, Indian Head Explosive Ordnance Technology Division; Thomas Ramotowski of Naval Undersea Warfare Center (NUWC), Newport Divisions; Kyle Morris of NUWC Keyport Division; and Darryl Updegrove of NSWC Panama City Division.

Sudduth also received the Land Award, which recognizes an individual for, among other contributions, promoting the value and benefits of collaborative working relationships.

"Collaboration has been part of my journey," Sudduth said. "The people I work with have become family. So, when I talk about collaboration, you're the collaborators, you deserve this award as much."

Another team award was the Saunders Award, which recognizes the exemplary achievement in leadership of a major technical area or project. William Hertel, a mechanical engineer for the Solid Waste, P2 (pollution prevention) from the Hazardous Material Management Branch, and Tracy Harasti, an environmental specialist from the same branch, received the award for their work on the Mobile Non-Skid Cleaning, Recovery and Recycling System (MCRRS), which is a shipboard, heavy-duty, self-powered cleaning vehicle that uses water jet technology, integrated water recovery and recycling to clean

and remove debris from non-skid surfaces.

"We worked to bring to the fleet a piece of equipment that not only could be operated and maintained by 19-year-old Sailors, but was also a model for other equipment on the flight deck," Harasti said of the MCRSS.

The categories for the awards include not only technical successes, but also non-technical roles. The Gravely award is given for contributions to the promotion of understanding of cultural difference and to furthering equal opportunity at all levels within the workplace. The head of the Acoustic Signatures Technology Department, Marylou McNamara, accepted the Gravely Award.

"It has become increasingly evident that diversity in the workplace can drive creativity and innovation," McNamara said. "Every person brings a unique perspective that is shaped by our individuality. All of us need to consciously challenge ourselves to ensure equal opportunity for all, and to include diverse perspectives, ideas and experiences. Quite frankly, it's our responsibility."

Another award for a non-technical role was given to Michael Vukovich, the acquisition manager for Ship Signatures Department. He received the Hopper Award for his accomplishments in organizational support resulting in improved products or processes, particularly within the Ohio-Replacement Program, the Navy's acquisition program for ballistic missile submarines.

"At the end of the day, it's important for all of us to realize why we are here, especially those of us in support roles, and that's to support the fleet," Vukovich said.

One theme that was clear during the acceptance speeches was recognition of Carderock's support to the fleet. McCormack told the awardees and the audience during his remarks that it was important that they visit the fleet to get the sense of what they are working toward. And Michael Coakley agreed as he accepted the Isherwood Award for his innovation and expertise in technological solutions for the fleet, specifically for his leadership in the development of a ship control systems design to support a submarine's unique mission requirements.

"I've had opportunities to go to sea; watching the crews perform, from the lowest-ranking seaman to the ship's captain, gave me a real appreciation for the hard work and dedication that each one gives on a day-to-day basis," said Coakley, a systems group leader in the Ship Control Branch. "With the knowledge

Rear Adm. Benjamin F. Isherwood Award

Michael B. Coakley, a systems group leader in the Ship Control Branch, receives Naval Surface Warfare Center, Carderock Division's (NSWCCD) Rear Adm. Benjamin F. Isherwood Award at a ceremony Aug. 31, 2016, in West Bethesda, Md. From left, Dr. Tim Arcano, technical director, NSWCCD; Capt. Rich Blank, commanding officer, NSWCCD; Coakley; and Eric Duncan, Naval Architecture and Engineering Department head. (U.S. Navy photo by Monica McCoy/Released)

Rear Adm. George W. Melville Award

Dr. John E. Miesner, an engineer in the Structural Acoustics and Target Strength Branch, receives Naval Surface Warfare Center, Carderock Division's (NSWCCD) Rear Admiral George W. Melville Award at a ceremony Aug. 31, 2016, in West Bethesda, Md. From left, Dr. Tim Arcano, technical director, NSWCCD; Capt. Rich Blank, commanding officer, NSWCCD; Miesner; and Dr. Paul Shang, Ship Signatures Department head. (U.S. Navy photo by Monica McCoy/Released)

Capt. Harold E. Saunders Award

William Hertel, a mechanical engineer, and Tracy Harasti, an environmental specialist, both in the Solid Waste, P2 (pollution prevention) and Hazardous Material Management Branch, receive the Naval Surface Warfare Center, Carderock Division's (NSWCCD) Capt. Harold E. Saunders Award at a ceremony Aug. 31, 2016, in West Bethesda, Md. From left, Dr. Tim Arcano, technical director, NSWCCD; Capt. Rich Blank, commanding officer, NSWCCD; Hertel; Harasti; and Michael Brown, Survivability, Structures, Materials and Environmental Department head. (U.S. Navy photo by Monica McCoy/ Released)

Rear Adm. David W. Taylor Award

Kurt A. Junghans, a mechanical engineer in the Hydrodynamics and Maneuvering Simulation Branch, receives Naval Surface Warfare Center, Carderock Division's (NSWCCD) Rear Adm. David W. Taylor Award at a ceremony Aug. 31, 2016, in West Bethesda, Md. From left, Dr. Tim Arcano, technical director, NSWCCD; Capt. Rich Blank, commanding officer, NSWCCD; Junghans; and Eric Duncan, Naval Architecture and Engineering Department head. (U.S. Navy photo by Monica McCoy/Released)

and understanding of what the crews needed, I worked with the technical community to get their recommendations implemented."

Dr. John Miesner, an engineer in the Structural Acoustics and Target Strength Branch, also remarked about his support of the fleet. Miesner received the Melville Award for his contributions toward research and development. He has submitted 12 patent disclosures in the last two years in the area of actuator technology and acoustic signature mitigation.

"Sometimes, I think we forget how lucky we are to work for an organization where we have one goal, one common purpose, and that is to produce the best products we can, and the most powerful Navy we can for the United States of America," Miesner said. "That's our only purpose for being here."

The final award presented was the Taylor Award. Kurt Junghans, a mechanical engineer in the Hydrodynamics and Maneuvering Simulation Branch, received the award for his contributions to the development of future maritime systems, specifically as the driving force behind a submarine maneuvering simulation. And like the other recipients, Junghans credited not only his current Carderock colleagues for his successes, but also mentors and former colleagues.

"When I think about the people that molded my career, the words that come to mind are dedication, drive, enthusiasm and technical experts with the focal point always being the capability and safety of our fleet," Junghans said, adding that despite changes in the workforce, he still sees the same dedication, drive and enthusiasm from his Carderock colleagues.

Capt. Rich Blank, Carderock's commanding officer, ended the ceremony by congratulating the awardees and recognizing that each award is not simply named after a prestigious Navy officer or leader, but after true giants who have accomplished the extraordinary.

"Even if you can't achieve what the award namesakes' have accomplished, it will be great to strive for the same level of excellence, to be as innovative, imaginative and farsighted as they were," Blank said. "My challenge to you is to continue their legacy."

Carderock's "Mad Scientist" tells Army how culture affects the future

By Kelley Stirling, NSWCCD Public Affairs

The Army held its second Mad Scientist 2016 event in August when scores of like-minded people came to hear several "mad scientists," including Garth Jensen, director for innovation at Naval Surface Warfare Center, Carderock Division, speak about the future of warfare in 2025 and beyond.

Jensen spoke on culture and innovation at the conference, held at Georgetown University in the District of Columbia, and also sat on a panel about the strategic security environment, which was the theme of the conference.

"For the Army, it's a form of strategic planning," Jensen said. "It's a way to get different mindsets, different people than their traditional folks, to help them think about the future."

The Army's Training and Doctrine Command developed Mad Scientist as an ongoing initiative to bring leaders and practitioners from across the Department of Defense, other government agencies, academia and industry in an effort to expand the Army's understanding and knowledge of the current and future operational environments. The Mad Scientist has existed since early 2015 and is a series of two-day conferences held about three times a year.

It's called Mad Scientist as a hook to get big thinkers interested, Jensen said. Everyone who is invited to speak or be a panelist is officially named a "mad scientist," but Jensen joked that he should be called the "mad culturalist" since his talk was more about the culture than science.

Jensen said he was invited to be a panelist because he is "innovation buddies" with the woman who organizes the events, and she asked him to speak and be a panelist because of his work in human-centered design and innovation.

"The conference wasn't necessarily about innovation, even though you can make an easy tie to innovation when you're thinking about the future and strategy," Jensen said. "I attempted to tie together design thinking, culture and innovation, and then describe how that would affect your ability, if you do it well, to position yourself for the future."

In a simple flow chart, Jensen described his default view of innovation, where science determines what is possible or impossible; then technology determines what is feasible or infeasible; and then the marketplace either rejects or accepts. This is also where most organizations focus their time and money, Jensen said.

"But what if there is more to the picture?" Jensen asked. "At Carderock, we think there is something even further upstream than science and that's the role of culture. Culture ultimately determines what you allow yourself to imagine in the first place."

This is where Jensen talked about the intersection of culture and innovation and how the two are linked.

"You start realizing that innovation is a social phenomenon, not just a physics or technical phenomenon," Jensen said. "And once you figure that out, you realize that innovation is human centric, which points us to human-centered design. At Carderock, we are using human-centered design to design cultural interventions that impact the capacity for innovation."

Jensen likened culture to the store of potential energy. As an example, he cited an article by Henry Doss, the managing partner at Rainforest Strategies, a management consulting firm focused on innovation. Jensen said a Carderock colleague, Roxie Merritt, director Corporate Communications, pointed out this article to help him better make his point. In the article, "The Rhetoric of Innovation," which appeared in the December 2014 issue of Forbes magazine, Doss talks about leadership in a command-and-control culture, where the quality of leadership depends on how clear and concise the directive is, but it's really the culture of the organization that creates the potential energy for innovation to happen in the first place. According to his bio, Ross writes on innovation, the impact of humanities studies on personal growth, and innovation leadership. (To see the article, visit http://www.forbes.com/sites/henrydoss/2014/12/16/the-rhetoric-of-innovation/#4876e54a5e3e)

Jensen said there were many speakers at the August Mad Scientist event and he garnered a few ideas to incorporate into his work here at Carderock, such as the idea that extreme resource concentration, beyond politics of inequality, affects innovation.

Jensen said as a result of his role at the Mad Scientist, he was invited to the Army's Title 10 War Games at Carlisle Barracks, Pennsylvania. At Carderock, Jensen is also the program director for the Massive Multiplayer Online Wargame Leveraging the Internet, an online multiplayer game used by the Navy and other government agencies to harvest collective intelligence and learn potential scenarios.

Proclamation

United States Army Training and Doctrine Command
Deputy Chief of Staff, Intelligence

Mad Scientist

Whereas, The Mad Scientist Initiative encourages continuous dialogue and collaboration among academia, industry, government, and non-traditional partners;

And Whereas, The Mad Scientist Initiative identifies tomorrow's key innovations today so the U.S. Army is successful in the future operational environment;

And Whereas, The Mad Scientist Initiative supports Army Learning and Capability development;

And Whereas, Mr. Garth Jensen has provided great and valuable insights and contributions to furthering the mission, goals, and understanding of the Mad Scientist Initiative.

Now, Therefore, by virtue of the authority vested in me as the TRADOC Deputy Chief of Staff, Intelligence, I do hereby proclaim that

Mr. Garth Jensen

be known henceforth and forevermore as an official Mad Scientist, with all the rights and privileges pertaining thereto. May you always seek the future boldly, actively question conventional wisdom and assumptions, and passionately challenge the status quo.

In Witness Whereof, I hereunto set my hand this 8th day of August 2016.

Mad Scientist Initiative

THOMAS F. GRECO
Defense Intelligence Senior Executive
Deputy Chief of Staff, G-2

Garth Jensen, director for innovation at Naval Surface Warfare Cener, Carderock Division, is named a "Mad Scientist" by the Army's deputy chief of staff, Thomas Greco, for his part at the Mad Scientist 2016 conference in August. The event is an Army initiative to bring leaders and practitioners from across the DOD and other organizations together to expand the Army's understanding and knowledge of the current and future operational environments.

Landing School president discusses sustainable boat manufacturing

By Dustin Q. Diaz, NSWCCD Public Affairs

The president of The Landing School of Boat Building and Design visited maritime colleagues at Naval Surface Warfare Center, Carderock Division in West Bethesda, Maryland, to discuss advances in wooden boat manufacturing sustainability Sept. 21.

Dr. Richard J. Schuhmann participated in Carderock's ongoing series of Innovation Brown Bags, presenting "Zero Carbon Manufacture: A Cradle to Christening Materials Life-Cycle Analysis" on the invitation of Garth Jensen, Carderock's director of innovation, who has been friends with Schuhmann since they first met at Penn State nearly a decade ago.

"Many of you might think, 'Why would I come and learn about boat design?'" Jensen said. "I think there's always something to be learned from how people do things when it's close to what we do, but just enough different that we can pick something up. And Rick's one of the best thinkers I've ever met."

Schuhmann is the president and a graduate of The Landing School in Arundel, Maine, which is a nationally accredited, not-for-profit school for yacht design, boat building and marine systems technology. It began operations in 1978 with an initial focus on wooden boat building, which it retains today. Schuhmann's presentation focused on the sustainability as applied to the boats built by his students during the 10-month curriculum, comparing the 17-foot LS-17 wooden boat they built in 2014 and 2015 to the 19-foot A-19, which he designed with the help of naval architects, that they began building this year.

"When I became president of The Landing School, I decided I would take a look at how we were building boats at the school through this lens of sustainability," Schuhmann said. "Sustainability means 'meeting the needs of the present without compromising the ability of future generations to meet their needs.' As an engineer, this definition doesn't tell me how to do that; it doesn't give me data I can plug into a matrix or anything like that to solve the problem. So we use the three P's, the three indices of sustainability: prosperity, people and the planet. These are things—financial, social and environmental—that I can put into a Pugh chart and those indices can help me make decisions."

Schuhmann said prosperity was the key driver initially for him. As a not-for-profit institution, The Landing School must recover the cost of its materials used to continue operating. He said the school's primary goal is building boats that are excellent educational vehicles for its students, and that's what is most important, but as a not-for-profit institution, the secondary goal of covering the cost of the materials needed to do that is always in play.

"We try to cover the cost for our educational materials by building cool things that we can then sell to people at cost. The lower the cost, the larger our market is for selling our educational materials. When I looked at the bill of materials for the LS-17, two things jumped out at me immediately. Number one: this is a really expensive boat. Seventeen feet long and we were investing well north of $10,000 just in materials to build it. The second thing was, when I looked at the materials, the kinds of wood had funny names that didn't sound local to New England. Then I looked into the country of origin where we got that material, it was remarkable to have the epiphany that we were building this boat in Maine, at this traditional boat building shop out of wood, and this boat would not contain a single toothpick of U.S.-grown wood."

Schuhmann said he decided to look at the carbon footprint associated with the various kinds of imported wood being used, which involves the cutting down of trees, the production of the wood, the transportation involved, and other factors involving the burning of fossil fuels. In doing this, he decided the school would go back to using U.S.-grown wood, as it did when he was a student there.

"I said, 'Why don't we build a boat that people can afford exclusively out of U.S. materials that has as low of a carbon footprint as possible? Why don't we see how low we can go?'" Schuhmann said. "As a school, we have a lower footprint just by making this change."

That change alone drove down costs by 52 percent, making the new A-19 less expensive to build and easier to sell than the LS-17. He felt this change addressed the second index of people by putting money back in the pocket of the local

community, as well as the third of being environmentally responsible. He broke down the life-cycle assessment analysis of the two boats, the materials used in each and the amount of carbon dioxide produced, or carbon footprint, in building each: about 2,015 pounds for the LS-17, and 228 pounds for the A-9, nearly a 90 percent reduction for a bigger boat.

Schuhmann also discussed ways of sequestering carbon in these boats, the economic opportunities in developing technologies that produce less carbon and future applications for wood to replace other materials in mitigating future climate change. He then took questions from Carderock employees about his process in tracking data during the life-cycle assessment, whether The Landing School uses technologies under development at Carderock such as additive manufacturing and set-based design, and other topics. He said he enjoyed meeting with fellow maritime workers and sharing his findings with them and that he hopes the shipbuilding industry will continue to embrace changes like this that benefit everyone.

"We've driven down costs and invested in our local economy to produce incredibly low carbon footprint boats. I think it's a win-win-win and I don't find a lot of those in life," Schuhmann said. "The first ship that was built in the U.S. was built up in Maine in the 1600s. To preserve American shipbuilding and boat building in Maine is really important and I think the only way to do that is by being innovative and thinking about the next big thing before it comes along."

Australian engineer works alongside Americans in advanced power and energy

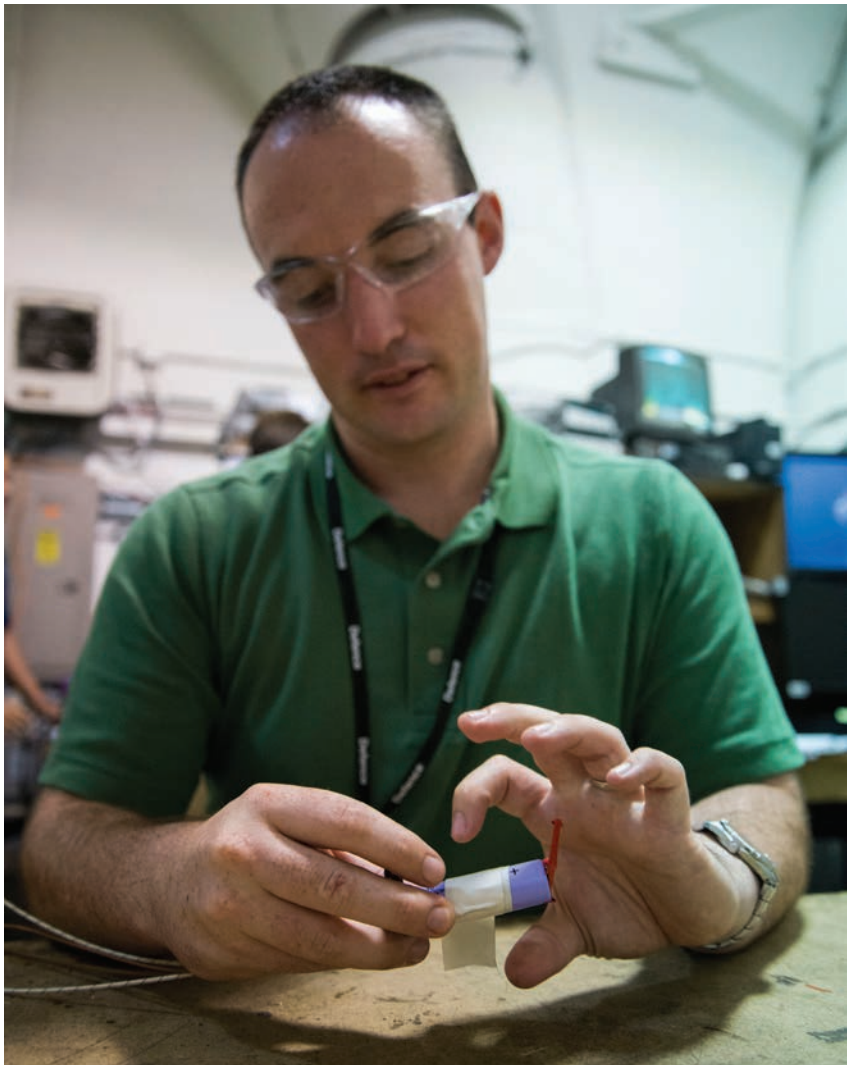
By Dustin Q. Diaz, NSWCCD Public Affairs

When the chance came to work and study abroad with the engineers and scientists at Naval Surface Warfare Center, Carderock Division, in West Bethesda, Maryland, Kane Ivory did not hesitate to say yes.

"I had been thinking about this for several years and had applied once before, but this is when the opportunity opened up," Ivory said. "And when an opportunity like this one opens up, you have to take it when it's there and make it work."

Ivory is an electrical engineer from Melbourne, Australia. He works for his country's Defence Science and Technology (DST) Group, but since March, he's been doing it here in West Bethesda for the Advanced Power and Energy Branch (APEB) under the Engineer and Scientist Exchange Program (ESEP). ESEP is one of the Department of Defense's Defense Exchange Personnel Programs that provides a framework for military and civilian participants to spend one or more years working in the host nation's defense research and development organizations, joint program offices or operational defense establishments on projects directly related to their areas of expertise.

"The ESEP is a memorandum of understanding between America and Australia," Ivory said. "It allows engineers and scientists to go both ways between governments, and there's an existing set of agreements on financial, legal and logistical matters that could make these things take a long time otherwise. I'm here under a year-long fellowship and my home organization is funding everything for me while I'm here."



Kane Ivory, an electrical engineer from Melbourne, Australia, adds thermal couplers and a heating cartridge to a lithium ion cell to run a thermal abuse test on the cell in West Bethesda, Md., Aug. 29, 2016. Ivory is temporarily assigned to Naval Surface Warfare Center, Carderock Division under the Department of Defense's Engineer and Scientist Exchange Program. (U.S. Navy photo by Dustin Q. Diaz/Released)

Ivory, a 2005 graduate of Monash University in Melbourne, was no stranger to Carderock before coming here. He said he has had a working relationship with Julie Simmons and Clint Winchester of APEB for several years, and when one of his colleagues came to Carderock under ESEP, he decided he would attempt to do it, too. He said he wanted to combine his efforts with his counterparts from an allied nation to build on his work on lithium ion battery safety with new facilities and people.

"These guys have been doing it for years, for decades, for some of them. It's great to be able to work with people who are very familiar, and have a lot of lessons learned, so I can get that experience before I go back and operate my own facilities in Australia," Ivory said.

Daphne Fuentevilla, an APEB senior electrochemical researcher and Ivory's

Right: A close up of Kane Ivory, an electrical engineer from Melbourne, Australia, adding thermal couplers and a heating cartridge to a lithium ion cell in West Bethesda, Md., Aug. 29, 2016. (U.S. Navy photo by Dustin Q. Diaz/Released)

colleague at Carderock, said Carderock's role as a designated technical agent for the U.S. Navy's Lithium Battery Safety Program makes it an ideal location for Ivory to be during this exchange.

"Kane is here working with us on understanding how that safety program works and the types of tests and approaches to testing we have to see what is applicable to Australia," Fuentevilla said. "One common area of interest for Australia and the United States is early fault detection for lithium battery failures. Normal battery management systems will detect a fault or failure as it's happening, but not necessarily with sufficient time to prevent system-level hazards. We're looking at technologies that would provide additional early warning so that you can effectively implement hazard mitigation solutions to prevent a small problem from becoming a bigger problem."

Part of Ivory's work here is to evaluate prototypes currently in development to determine whether they are viable for incorporation into U.S. Navy battery systems and battery management systems.

"It's an activity in which Carderock was already engaged, but now I'm here in both a learning capacity and as an additional resource to help," Ivory said. "Part of the reason it's beneficial for me to be here doing this is that I can take back all that knowledge and experience with me, which is relevant to DST's role in Australia as well.

"Another aspect of my work here is a chance to take a break from some of the project management associated with specific programs at home and brush up on my engineering skills with research-type projects that line up with Carderock's interests. I'm actually getting hands-on lab time, running tests and troubleshooting setup and equipment issues, all of which are also essential to understanding how the U.S. battery safety lab and processes work. I'll be able to return home with a broader perspective on battery system safety, but also with a refreshed skill set for the lab."

Another advantage that Ivory said he has already enjoyed during his time abroad under ESEP is the scale of study and number of people working in his field in the U.S., along with his ability to meet those people, talk to them and to work with them. He said with Australia's remote location, he hasn't had as many of these opportunities, but here in the U.S., he has already met many government and industry players through his work at Carderock that he wouldn't have had otherwise, including at a battery safety council two weeks after his arrival.

"That was a really good experience for me just being able to meet the people whose papers I have read, but never met in person," Ivory said. "The lithium-ion battery community is very active in the U.S. I've been taking advantage of the local conferences since arriving here; it's a bit harder to justify airfare to fly here from Australia for a one-week conference. So from my point of view, to have access to and meet some of these people, find out what they're working on, learn about things I wasn't aware of—from my point of view, that's been really good."

Fuentevilla said Ivory is the first engineer she has worked with under ESEP and she felt the collaboration has gone very smoothly between the Australian and his American counterparts.

"He's been integrated completely into the group as an engineer with our team and he's gotten a lot done on the projects," Fuentevilla said. "I think it's been really interesting and a way to form a bond with another organization that has similar goals. It benefits everyone."

Ivory's assignment at Carderock Division is governed by DoD Directive 5230.20 and is set to last for one year.

Carderock Division supports energy innovation with Wave Energy Prize tests

By Dustin Q. Diaz, NSWCCD Public Affairs

Team AquaHarmonics accepts the $1.5-million Wave Energy Prize at Naval Surface Warfare Center, Carderock Division on Nov. 16, 2016 in West Bethesda, Md. Pictured, from left, is Dr. Alison LaBonte, U.S. Department of Energy's (DOE) Marine and Hydrokinetic Technology manager; David Friedman, acting assistant secretary for energy efficiency and renewable energy at DOE; AquaHarmonics teammates Max Levites-Ginsburg and Alex Hagmuller; Jim Ahlgrimm, director of DOE's Water Power Technologies Office; and Dr. Franklin (Lynn) Orr, under secretary for science and energy at DOE. The 2016 Wave Energy Prize is a public prize competition in search of better ways to convert ocean waves into usable energy. The contest is sponsored by DOE and supported by the Office of Naval Research and Carderock. (U.S. Navy photo by Ryan Hanyok/Released)

One team emerged victorious from an initial field of 92 competing in renewable energy development to win $1.5 million during the Wave Energy Prize Innovation Showcase on Nov. 16 at Naval Surface Warfare Center, Carderock Division.

With nine teams in the finals, Alex Hagmuller and Max Levites-Ginsburg of team AquaHarmonics, both civilian engineers and graduates of Oregon State University, took the prize with the most effective and cost-efficient wave energy converter (WEC) design, which they tested and demonstrated at Carderock Division headquarters in West Bethesda, Maryland. Carderock and the Office of Naval Research (ONR) supported the contest, which was sponsored by the Department of Energy (DOE).

"Our goal was to build a device that would extract energy from ocean waves," Levites-Ginsburg said. "Early on, we were working out of a garage, and we didn't have a lot of resources or great facilities. We approached it trying to make the best of what we had, but we didn't really have a lot. It was really surprising what we were able to achieve."

AquaHarmonics won the contest with their WEC concept and model of a point absorber with latching/de-clutching control. Levites-Ginsburg said they built a buoy with a generator inside, anchored to the sea floor. Any relative motion from the point on the sea floor to the elevation of the device caused the generator to spin and produce electricity.

This victory is the culmination of years of

work both on their part, but also the many members of government and private industry involved in the Wave Energy Prize contest. Jim Ahlgrimm, director of DOE's Water Power Technologies Office, spoke at the beginning of the awards ceremony about DOE's vision for the contest and the critical support of Carderock and other partners in the contest, which ran 20 months from beginning to end. He said the goal of the Wave Energy Prize is to encourage the development of more efficient WEC devices that double the energy captured from ocean waves, which in turn will reduce the cost of wave energy, making it more competitive with traditional energy solutions. The winning team actually quintupled the captured energy.

"We put this competition together for you to help in the DOE's quest to drive renewable energy innovation in the U.S.," Ahlgrimm said. "We owe much of the success of this competition to the U.S. Navy, specifically Carderock, ONR and the assistant secretary of the Navy's office (energy, installations and environment). The Navy's commitment of resources and facilities included the best wave-making staff and facilities in the world."

The support of the Carderock staff and facilities was critical to enabling this public prize competition's goal of improving methods of gathering energy from the ocean's waves, according to Dave Newborn, an ocean engineer with Carderock's Maritime Systems Hydromechanics Branch. Newborn has been heavily involved in this contest since its planning began over two years ago.

"There's been a colossal effort by Miguel and I, other Carderock employees and a number of other entities to make all this happen," Newborn said, referring to Miguel Quintero, an ocean engineer with Carderock's Full-Scale Trials Branch. “It's very much a collaborative project. We were part of writing the rules with the prize administration team; I'm one of five judges for the prize. We have served in the role of technical experts for marine hydrokinetic renewable energy technologies as a program identified partner, along with Sandia National Lab in Albuquerque, New Mexico, and National Renewable Energy Lab in Golden, Colorado, and we've served as the lead on the hydrodynamic testing in the final technology gate for the prize."

Carderock established an interagency agreement with DOE in spring of 2014 to support the Wave Energy Prize. Registration opened April 2015 to U.S.-based teams of corporations, small businesses, professional engineers, students and entrepreneurs and closed two months later. The competition continued through design submission and testing, with qualifying teams progressing to testing on 1/50-scale models of their designs. The nine teams who qualified then proceeded to test 1/20-scale models in Carderock's Maneuvering and Seakeeping (MASK) Basin under 10 different wave conditions in a series of tests that could only be conducted in the MASK's 2.5-acre pool, the world's most technologically advanced indoor ocean, according to Capt. Mark Vandroff, Carderock Division's commanding officer.

After the presentation of the prizes in Carderock’s Maritime Technology Information Center, participants and guests moved to the MASK to watch a demonstration of the winning device.

"We have 216 computer-controlled hydraulic paddles that can move in concert to create, at a 1-20 scale, the wave conditions of any ocean anywhere in the world," Vandroff said before the waves started rolling for the demonstration. "You had nine different finalists, each using a variety of different extraction technologies, who needed something they could control that would be variable to what each of the teams needed, but also precise, repeatable and available on demand. That takes a world-class hydrodynamics facility, so that's why DOE chose to come here."

AquaHarmonics team member Alex Hagmuller (left) shakes hands with Naval Surface Warfare Center, Carderock Division Commanding Officer Capt. Mark Vandroff in the Maneuvering and Seakeeping Basin during the Wave Energy Prize Innovation Showcase on Nov. 16, 2016, in West Bethesda, Md. (U.S. Navy photo by Monica McCoy/Released)

Capt. Mark Vandroff (center), commanding officer of Naval Surface Warfare Center, Carderock Division, stands with Dave Newborn (left), an ocean engineer with the Maritime Systems Hydromechanics Branch, and Miguel Quintero, an ocean engineer with Full-Scale Trials Branch in the Maneuvering and Seakeeping basin on Nov. 16, 2016, in West Bethesda, Md. Newborn and Quintero were instrumental in the success of the 2016 Wave Energy Prize, public prize competition in search of better ways to convert ocean waves into usable energy. The contest is sponsored by the U.S. Department of Energy and supported by the Office of Naval Research and Carderock. (U.S. Navy photo by Monica McCoy/Released)

In August, the finalists began transferring their 1/20-scale models to Carderock, unpacking and reassembling them for testing in the MASK with the assistance of Carderock employees. Data analysts from Sandia National Lab and National Renewable Energy Lab verified the finished data and ensured its legitimacy. This process involved a lot more work than standard testing in the MASK since each team required different conditions for testing, according to Quintero.

"We had calls almost every day for about six months before the tests, and once they began, we had four or five teams working every day to make this happen," Quintero said. "They were putting out weights and mooring lines, taking measurements, setting up devices and deploying them using cranes and homemade lifting devices. We had to position the anchors accurately to ensure each team had the correct mooring setup and instrument everything with force gauges, accelerometers and motion tracking. It was a ton of work."

Quintero said he eagerly joined this project at the beginning without knowing many details about it and is glad he did, especially since wave energy is still a developing technology compared with other renewable energy sources like solar and wind.

"It was a sense of completion, of satisfaction, that all the hard work we put in was actually successful and we helped a team achieve what they needed," Quintero said. "This is one of the projects as an ocean engineer you want to see succeed. There's a lot of research and known metrics on solar and wind, but with wave energy, there aren't that many to go by. It's great to have this -- a known data set that's been well collected and well-reviewed by several experts -- to help jump the technology to where it needs to be."

Retired Navy Vice Adm. Dennis McGinn, assistant secretary of the Navy for energy, installations and environment, spoke at the event about this DOE-DON partnership and the logical use of wave energy for the Navy and Marine Corps in the littoral environments it operates in. He also praised Hagmuller and Levites-Ginsburg for doing well and ultimately winning the prize, despite lacking resources to do so at first.

"It says so much about America's innovation, our inventors, that this small team literally operating out of a garage

in Portland, Oregon, has won this $1.5 million prize," McGinn said. "For them, this is just the beginning. It's a wonderful milestone, and they will be moving forward to continue to refine and scale up this technology."

Levites-Ginsburg said he was surprised, awed and grateful to have beaten out those other 91 teams, which he never expected to do. He and Hagmuller said they simply decided to give their best effort at each milestone, from receiving seed funding for their 1/20-scale model to getting to test it at Carderock's advanced facilities. The Wave Energy Prize gave them guidance, structure and motivation, he said.

"If we start at the very beginning, you could say we've been working on this for five years, but our first attempts at this looked very different," Levites-Ginsburg said. "We definitely learned a lot as we went, and the Wave Energy Prize laid out some goals for us to achieve that really pushed us in directions that maybe we wouldn't have pursued on our own, but ultimately led us down a path to enable us to make the right discoveries we had to do and make the right design choices."

Levites-Ginsburg said AquaHarmonics is very eager to follow up on this success and continue to do work in the vein of their team quote: "Clean. Simple. Energy."

"It would absolutely be my goal to continue working on this in some regard," Levites-Ginsburg said. "Our performance in the Wave Energy Prize will open a lot of doors and generate a lot of interest. If there are funding opportunities or testing opportunities, we would both be very excited to do that and keep pursuing our passion, which is what this whole thing has been about for us."

Carderock's support of the Wave Energy Prize also brought unexpected but welcome benefits to the command, such as the development of the underwater optical tracking system used in the tests, Newborn said. The underwater system provides six degrees of freedom motions of rigid bodies and 3-D translations of points on the surface of bodies. The ability to track motions for submerged or surface-piercing bodies is a significant capability enhancement across a wide range of hydrodynamic testing performed at Carderock.

"We reverse engineered the system to work underwater; it has never worked underwater anywhere before," Newborn said. "We formed a CRADA [Cooperative Research and Development Agreement] with the company that develops the hardware. What we've learned about putting it underwater they can learn from, and we can learn from them, as well."

Newborn said the ultimate goal, as the underwater system is tuned and modified for use at Carderock, is to establish a flexible, reconfigurable motion-capture system that could track bodies in the entire MASK basin and sections of the other basins around base.

Newborn added the development of an emerging technology like wave energy fulfills Carderock's congressional charter, which states the command not only supports Navy operations and research and development, but also the maritime industry, as stated in OPNAV Notice 5450, Dec. 23, 1991.

CalWave Power Technologies from Berkeley, California, led by Marcus Lehmann, won the second-place prize of $500,000 for their submerged pressure differential device. The third-place prize of $250,000 went to Waveswing America of Sacramento, California, led by Mirko Previsic, for their sub-sea pressure-differential point-absorber.

For more information on the Wave Energy Prize, visit http://waveenergyprize.org/about/.

The earlier, small-scale model of the winning wave energy converter is on display next to the trophy for the 2016 Wave Energy Prize. A ceremony announcing the winners was held at Naval Surface Warfare Center, Carderock Division on Nov. 16, 2016, in West Bethesda, Md. Carderock hosted the final testing for the Wave Energy Prize contestants in the Maneuvering and Seakeeping basin over the last few months. (U.S. Navy photo by Ryan Hanyok/Released)

Carderock partners with other labs for unprecedented 3-D printed naval asset

By Dustin Q. Diaz, NSWCCD Public Affairs

Representatives from the Naval Surface Warfare Center, Carderock Division's (NSWCCD) Disruptive Technology Lab (DTL) and their Department of the Navy and government partners stand in front of the Big Area Additive Manufacturing test article Nov. 16, 2016, in West Bethesda, Md. Pictured from left to right: Robert Springfield, a contractor for TruDesign; Garry Shields, director for the NSWCCD DTL; Harry Whittaker, deputy director for the NSWCCD DTL; Mike Alban, from NSWCCD's Center for Ship Design (CISD); Simeon Ryan, NSWCCD CISD; Sam Pratt, NSWCCD Welding, Processing and Non-Destructive Evaluation Branch; Brian Kessel, NSWCCD Welding, Processing and Non-Destructive Evaluation Branch; Steven Orciuolo, from Naval Air Systems Command; and Ray Alexander, NSWCCD Materials Division. (U.S. Navy photo by Dustin Diaz/Released)

Representatives from Naval Surface Warfare Center, Carderock Division's Disruptive Technology Lab (DTL) and their DoN and government partners printed the largest-ever additively manufactured (AM) naval asset in collaboration with Oak Ridge National Laboratory (ORNL) July 25-Aug. 5.

The Big Area Additive Manufacturing (BAAM) test article is a 30-foot-long proof-of-concept hull print for the Optionally Manned Technology Demonstrator (OMTD) project using ONRL's BAAM machine, according to Garry Shields, director of the DTL.

"Can we do it a different way and get different results? The impact may be that we change the way we play the game," Shields said.

Shields and other DTL representatives met at ORNL with members of participating organization to begin work on the project with classroom instruction and practical exercises to familiarize members of participating organizations with the nuances of designing for AM. In addition to Carderock and ORNL, some of the participating organizations represented included the Picatinny Arsenal; Navy Special Warfare; Office of Naval Research; Defense Advanced Research Projects Agency; Naval Air Systems Command; the Johns Hopkins University Applied Physics Laboratory; Naval Surface Warfare Centers from Crane, Panama City, and Philadelphia; Naval Undersea Warfare Center Newport; and Portsmouth Naval Shipyard.

These representatives split into three teams, each creating different designs for a prototype using the Mk. 8 Mod 1 SEAL Delivery Vehicle (SDV) as a template and printing the designs at 1/24 scale using a small 3-D printer to verify printability.

"We had each team present their design and went through the pros and cons of each," said Michael Alban, a naval architect with Carderock's Center of Innovation in Ship Design. "Along with the training, that all happened in the first week."

During the first week, the teams began using ORNL's AM systems to produce prototype scaled hulls and sections at 1/24, 1/12 and 1/3 scale. The second week started a full scale print of the hull. This was the first time this system has been used on one of Carderock's projects, according to Harry Whittaker, a team lead in the Technical Information Systems Branch.

The teams then incorporated the lessons learned from these printers to create a single design. One of these lessons involved finding the balance between print resolution and production time.

"This is a collapsing of the design and manufacturing spiral at an incredible iteration rate at very low cost," Shields said.

According to Alban, the BAAM system uses a 3/8-inch bead thickness, compared to some of Carderock's printers that possess beads less than a millimeter thick. This facilitates greater printing speed and size, but results in some gaps and imperfections in printing. These gaps can and will be filled in with self-leveling coating in post-production later, according to Alban, saving time and money in the end.

"If we used a smaller bead like that, the material cost wouldn't rise at all, but it would increase the print time exponentially because of the level of detail," Alban said. "That increases your print time and man hours, making it cost much more, and we had to control costs."

According to Whittaker, using AM to produce these prints can bring a significant cost and time savings over traditional methods. The current SDV the OMTD is modeled after costs $300,000-$500,000 and takes three to five months to manufacture, but producing it in this way may reduce costs of hull production by 90 percent and fabrication can be done in days not weeks or months. Like Alban, he pointed to another example of lessons learned during this project.

"We had issues with certain print heads where screws would loosen between prints, so the calibration would be off, affecting the printed modules," Whittaker said. "By doing this work, we were able to address that and change ORNL procedure, which led to improving ORNL's standard operating procedure for printing large-scale objects. So everybody gained from this effort."

The team's effort resulted in the production of a single design in six 3-D printed sections that then went on to commercial partner TruDesign LLC, who received them for assembly and post-processing Aug. 8. Whittaker said all involved learned a lot about 3-D designing, printing and manufacturability, and the finished hull serves as another important milestone in the Office of Naval Research-sponsored OMTD project.

The OMTD brings together the idea of on-demand vehicles enabled by the emergent AM base.

Carderock engineers designed and printed previous OMTD prototypes, as well as parts used in this one, using Carderock's Manufacturing, Knowledge and Education Lab (MAKE) and other AM resources. They have displayed previous prototypes at events like the National Defense Industrial Association Conference in Groton, Connecticut, in September; the Navy League's Sea Air Space Expo in Oxon Hill, Maryland, in May; and the Navy AM Print-a-thon, sponsored by the Deputy Assistant Secretary of the Navy for Research, Development, Test and Evaluation, at Naval Support Facility Dahlgren, Virginia, in April.

"This test article was created to prove that we can both print and design in this scale to dispel disbelief that we can build in the scale and in even greater sizes. This is one of the larger naval projects that has been printed to date," Whittaker said, adding that information from this test article, as well as further material strength and other testing, will be used to inform future OMTD projects.

Dr. Tim Arcano (left), technical director for Naval Surface Warfare Center, Carderock Division, speaks with Rear Adm. Tom Druggan, commander, Naval Surface Warfare Center, and Garry Shields, director for Carderock's Disruptive Technology Lab, about the Big Area Additive Manufacturing test article during Druggan's visit Nov. 16, 2016, in West Bethesda, Md. (U.S. Navy photo by Ryan Hanyok/Released)

Navy inventions explored during Innovation Discovery Event

By Dustin Q. Diaz, NSWCCD Public Affairs

During the Innovation Discovery Event at Naval Surface Warfare Center, Carderock Divsion in West Bethesda, Md., Aug. 30, 2016, Peter Helfet, an independent business development consultant and one of the panelists, measures the magnetic field value of the large-area magnetic field sensor, a new technology presented by Dr. John Miesner, an engineer in the Structural Acoustics and Target Strength Branch. (U.S. Navy photo by Dustin Q. Diaz, U.S. Navy/Released)

Researchers from Naval Surface Warfare Center, Carderock Division presented their inventions to a "Shark Tank" type panel at the second annual Innovation Discovery Event (IDE), hosted by the Technology Transfer Office (TTO) in West Bethesda, Maryland, Aug. 30. The event explored five developing technological innovations.

"The goal of the 'Shark Tank' was to discover potential commercial applications or other Navy or military applications of the technologies, to expand the reach beyond what was originally disclosed," Carderock's Director of Technology Transfer Dr. Joseph Teter said.

The four inventors presented their inventions, whether it was hardware, software or a process, to panel members representing entrepreneurs, venture capitalists and business development experts, showcasing how the Navy will use the technology. The panel then pitched ideas on how the inventions might be used in other applications.

"The IDE event provided an opportunity for inventors to gain a fresh, child-like perspective on their particular technology. where you might get a brilliantly simple idea from a child about something," said Mike Wade, head of the Ship and Submarine Acquisition Engineering Division. He presented the industrial Human Augmentation Telemetry (iHAT) device, which is a new and novel micro-sensor system integrated into a standard industrial hard hat, providing the user with real-time information pertaining to environmental hazards, work-site conditions and personal biomedical feedback. "Nobody [from the panel] was in the business of what I was explaining, so they were able to take a very objective assessment of it. An honest third party that doesn't have a dog in the fight, so to speak, or a hidden agenda can bring a lot of fresh ideas to the table."

A Department of Defense (DoD) partnership intermediary, TechLink, facilitated the event. The company's primary purpose is to broker license agreements between DoD labs and U.S. industry for manufacture and use of DoD inventions, according to their website. TechLink is funded by the Office of Naval Research (ONR) to facilitate the IDE.

"This is a big networking opportunity here," said Mike Reilly, a Techlink employee who was on site during the

event. "There's a lot of intelligent people here and a lot of good connections to be made. Scientists, engineers and subject-matter experts really enjoy getting out of the lab and talking about their stuff with intelligent people. It raises morale and inspires new ideas."

Wade, who was presenting at his first IDE, said he is looking to establish a Cooperative Research and Development Agreement (CRADA) with a commercial entity to further develop the iHat. He said the IDE format and discussion with panelists and the audience gave an opportunity for a lot of out-of-the-box thinking that someone intimately involved with the invention wouldn't have. The IDE panelists brainstormed and pitched 53 potential ideas that the iHat technology could be used for, such as athletic monitoring, medical alert, driver fatigue monitoring and a "hat of shame" for drivers under the influence.

The ideas are not explored in depth at the IDE, but further investigation may mean adding the ideas to the patent application. If the technology already has an issued patent, the researcher can file for new patents. Teter said all the technologies presented are in one of three stages: either they are invention disclosures, patent applications or issued patents.

The panel members, who were asked to attend by the Maryland Technology Development Corporation (TEDCO) and who do so without compensation, included Peter Helfet, independent business development consultant; Michael David of Capitol City Techlaw, PLLC; Matt Sinfield, a welding engineer in Carderock's Welding, Processing and Nondestructive Examination Branch; Lisa May of Murphian Consulting; Ron Kaese of TEDCO; and Todd Stave of Blue Vigil. Audience members also participating in discussions included employees from ONR, Carderock and other Naval Sea Systems commands. The panel members may be different each year.

Other Carderock inventors were Phil Dudt, an engineer with the Hull Response and Protection Branch, who presented both Surface Enhancement and Compaction Using Glass Failure Generated Pulse and Lightweight Armor with Slide Region For Slidably Redirecting Projectiles; Eric Shields, a mechanical engineer with the Advanced Power and Energy Branch, who presented Hybrid Power Systems Historical Load and Resource Self-Optimization; and Dr. John Miesner, an engineer in the Structural Acoustics and Target Strength Branch, who presented Large Area Magnetic Flux Sensor.

"There was a good mix of technologies presented, and I enjoyed the process," May said. "I thought it was well-facilitated; I learned a lot about brainstorming and actually got to flex some creative muscles I didn't know that I had."

May said she was enjoying a bit of a Navy reunion by coming to Carderock, having started her career in 1984 at Newport News Shipbuilding. After that, she spent years working at NASA, including as lead program executive for the Mars program, and later moved on to start a consulting company specifically to work with tech startups, which she runs today. She said she is particularly interested in what she called the next step for inventors, which is helping them focus on applications that they want to pursue with those inventions, and IDE was a fun and satisfying way to do that.

In all, there were 214 new ideas of applications, target markets and commercialization opportunities for these federally developed inventions, Teter said.

Teter said this year's IDE improved upon last year's by fielding five projects instead of last year's three, and they modified the process allowing more time for brainstorming, which netted an average of 43 new ideas per invention, versus last year's average of 23. He expects this event will result in effective technology transfer for all five projects to academia, industry and local and state governments through CRADAs, Patent License Agreements and Educational Partnership Agreements.

"Events like these will hopefully show our Navy researchers the usefulness of patents," Teter said. "The Navy encourages their people to patent; and if a commercial entity comes along that wants to license the Navy's technology for something other than the limited government use it was invented for, that is a great benefit to us because now someone else will want to actually produce the technology and the Navy has the option to then buy the product from them."

Kelley Stirling, NSWCCD public affairs specialist, contributed to this article.

Phil Dudt, an engineer with the Hull Response and Protection Branch presents his new technology on glass fracture compaction to a panel of entrepreneurs, venture capitalists and business development experts at the Innovation Discovery Event Aug. 30, 2016, at Naval Surface Warfare Center, Carderock Divsion in West Bethesda, Md. (U.S. Navy photo by Dustin Q. Diaz, U.S. Navy/Released)

High-velocity learning: an engine for performance output

By Kelley Stirling, NSWCCD Public Affairs

Just over a year ago, Adm. John Richardson became the Navy's Shortly after Adm. John Richardson became chief of naval operations, he presented the Navy his "Design for Maintaining Maritime Superiority."

According to the plan, the desired outcome is "A Naval force that produces leaders and teams who learn and adapt to achieve maximum possible performance, and who achieve and maintain high standards to be ready for decisive operations and combat."

The Design includes four lines of effort:

1. Strengthen naval power at and from sea
2. Achieve high-velocity learning at every level
3. Strengthen our Navy team for the future
4. Expand and strengthen our network of partners

"The CNO's Design lays out what is needed for the Navy to maintain our advantage in this new environment," said Dr. Tim Arcano, technical director for Naval Surface Warfare Center, Carderock Division. Arcano focused on high-velocity learning (HVL) as an area that can accomplish the performance output of any organization.

In the CNO's Design, the four elements of HVL are:

1. Implement individual, team and organizational best practices to inculcate high-velocity learning as a matter of routine.
2. Expand the use of learning-centered technologies, simulators, online gaming, analytics and other tools as a means to bring in creativity, operational agility and insight.
3. Optimize the Navy intellectual enterprise to maximize combat effectiveness and efficiency. Reinvigorate an assessment culture and processes.
4. Understand the lessons of history so as not to relearn them.

In an interview in June at the Naval Postgraduate School, the CNO likened HVL to the scientific method, which includes the steps of question; hypothesis; experiment; observe and record; analyze; and share results. He also recognized that there are many people who already incorporate these methods in their everyday jobs.

"We have people that know this as part of their day-to-day work; they are experts in it, they have deep knowledge in areas that are really important to our Navy, whether that be cyber warfare or unmanned vehicles," Richardson said.

The Design outlines steps for high-velocity learning:

1. First, define the problem
2. Next, formulate a plan
3. Anticipate the result: define the expected outcome(s)
4. Then, act by operating in the actual environment
5. Execute the plan and obtain the actual results
6. Finally, analyze the gap by comparing the expected outcomes with the actual results (anticipated vs. actual results), and
7. Refine next steps based on that analysis

Since then, the Navy has embraced the concept of HVL, Arcano said, adding that HVL is "about innovation and approaching problems in a specific way that is tailored to yield better, faster and actually more innovative solutions."

Since the CNO's Design was released more than a year ago, the Navy developed the "four S's" to accomplishing HVL, which sum up the CNO's outline: See, Swarm, Share and Sustain. Arcano explained these four S's like this:

See: "See" and detect a problem or issue.

Swarm/Solve: Have all the right people and resources "swarm" to the problem to come up with a solution or a set of solutions.

Share: "Share" new knowledge throughout the organization and embed the knowledge in work processes.

Sustain: "Sustain" the solution by developing previous capabilities and making continuous process improvement part of the daily routine.

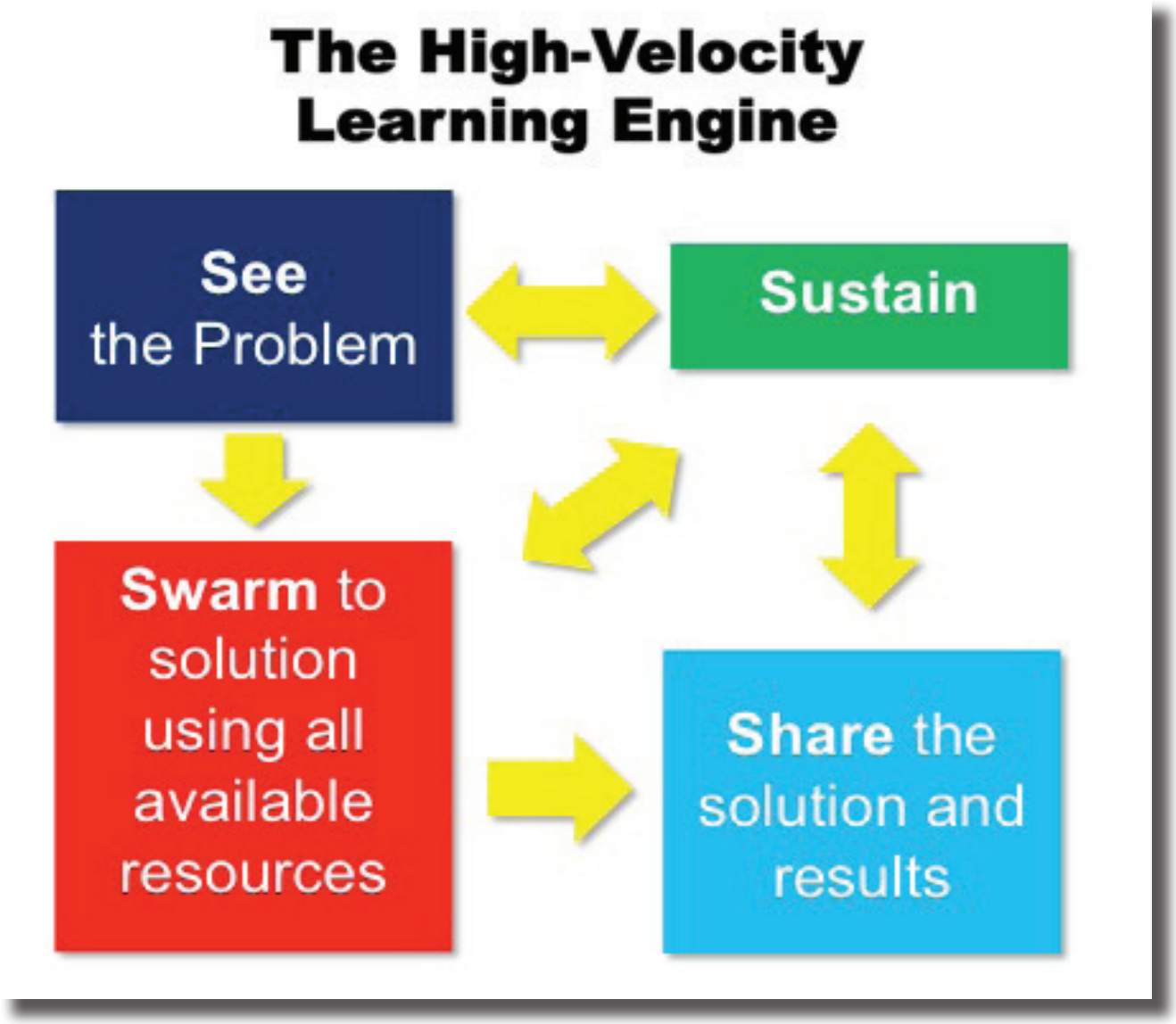
In stressing the "swarm," Arcano said that Carderock's relationships are a key way to expanding and strengthening its network of partners.

"We will be collaborating more and deepening relationships, not only within the Navy, but also across other Services, agencies, industries and allies, as well as across the Naval Research and Development Establishment," he said.

Arcano thinks HVL should be an easy leap for the professionals of Carderock Division.

"For those who are already disciplined in thinking, and I think this applies to folks at Carderock, this will not or should not be an issue," he said. "High-velocity learning is not just for scientists and engineers; it's for everybody. It's for the Comptroller folks, for the Contracts folks and the Operations folks, as well as the scientists, engineers and technicians."

Over the last few months, HVL has been a focus at Carderock, such as the eight Communities of Interest (COIs). Currently there are eight COIs: Acquisition, Branch Head Communication, Communication, Division Financial Management, Materials and Asset Management, Morale, Welfare, Recreation-Quality of Life, Security and Technical Excellence.



"As these COIs meet and work together, we expect to see solutions coming out that will enhance the outcomes of our daily performance at every level," Arcano said.

Another example Arcano gave is how Carderock has specific projects that directly support HVL, like knowledge preservation management and human-centered design.

"While defining knowledge management preservation seems easy, human-centered design takes a little more thought," Arcano said. The Office of Personnel Management defines human-centered design as "creative and strategic approach to solving challenging problems. It blends design, strategy, qualitative research and entrepreneurial thinking."

"In basic terms, it's making sure the 'human' has a say in the problem solving and getting away from doing things the way they've always been done if the way they've always been done isn't working anymore," Arcano said.

Arcano said he will be asking departments within Carderock Division to report on how they are implementing high-velocity learning and provide examples how it has helped to yield better products.

"When folks are presenting the work that they've done, they should always be ready to show how HVL was applied and then how it actually shaped more meaningful outcomes through the deliberate and disciplined way that they thought and acted in the process," Arcano said.

To see the interview with the CNO about high-velocity learning, follow this link: https://www.youtube.com/watch?v=GBOy3DrkuM4

Visiting faculty provide research capabilities at Carderock

By Kelley Stirling, NSWCCD Public Affairs

Visiting professors at Naval Surface Warfare Center, Carderock Division in West Bethesda, Maryland, wrapped up their summer tours and headed back to their universities in August.

Carderock Division's Director of Research Dr. Jack Price said these tours not only give professors an opportunity to provide their expertise and knowledge to different professional areas of Carderock, but also allow them to gain some practical experience in naval problems.

"It helps researchers get in touch with what the Navy does," Price said. "By working at the Navy laboratories, they get to understand a little more what the naval aspects of the problems of the research are and they can focus their research that way."

Two professors, Dr. Vladas Pipiras and Dr. Themistoklis Sapsis, had the opportunity to provide their expertise to projects that help to predict what a ship might do in the most extreme conditions, especially conditions that are not likely to even occur. And working with Dr. Vadim Belenky, a naval architect with Carderock's Simulations and Analysis Branch, the two professors have spent numerous hours analyzing data based on statistics, dynamics and numerical hydrodynamics.

This particular multi-disciplinary research provides input from several different disciplines to try to determine the outcome of something that rarely happens. Belenky explained that it is very difficult to create experiments for these extreme occurrences.

"It would be like trying to figure out how many umbrellas will be sold in London based on the popularity of white shirts in Rio de Janeiro," Belenky said, adding a little humor to the equation.

Pipiras, originally from Lithuania, is the director of the Mathematical Decision Sciences Program with the Department of Statistics and Operations Research at the University of North Carolina at Chapel Hill. This is his fourth summer as a visiting professor at Carderock. Even though he is young compared to other professors of his caliber, his research in the statistics is well-known in the mathematics community, Belenky said.

In basic terms, the three researchers are working together to extrapolate data from the recorded motion of a ship to then come up with the data that might support how the ship would react in a much more extreme situation that has not and will not likely be observed.

"This is a difficult process even though there is statistical methodology and justification," Pipiras said. Pipiras is researching the statistics of the data acquired. But statistics alone is not enough, and that's where Sapsis comes in.

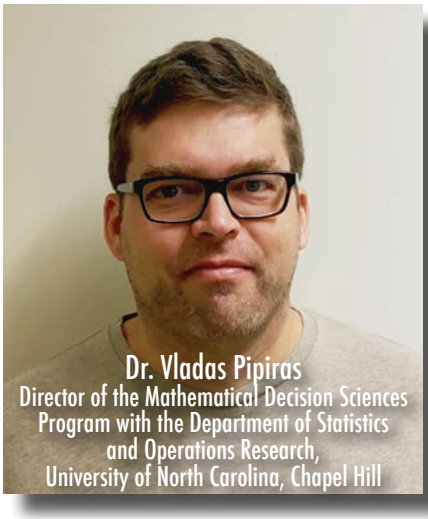
Sapsis is an associate professor of mechanical and ocean engineering at Massachusetts Institute of Technology (MIT) in Cambridge, Massachusetts, and his specialty in this research is dynamics, specifically stochastic dynamics, meaning randomly determined.

"We use statistics to describe a predicted response, and we use dynamics to qualitatively describe what we should see," Belenky said. Together, the research provides a useful prediction for the Navy and the commercial shipping industry.

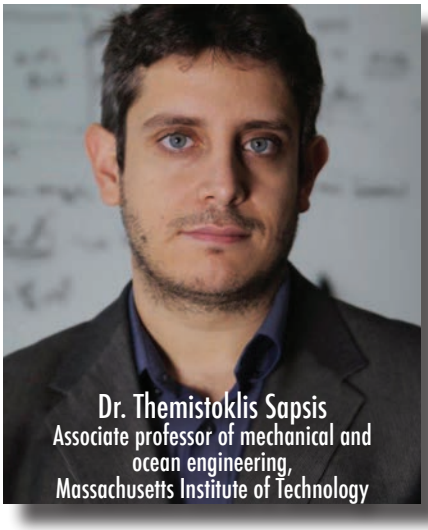
Sapsis' work at MIT has been focusing on the understanding of rare events in complex dynamical systems. He believes that new mathematical methods are essential for the description and understanding of extreme events.

"I feel my work has impact on real Navy challenges," Sapsis said. "Special aspects of my research and work apply directly to what we are doing."

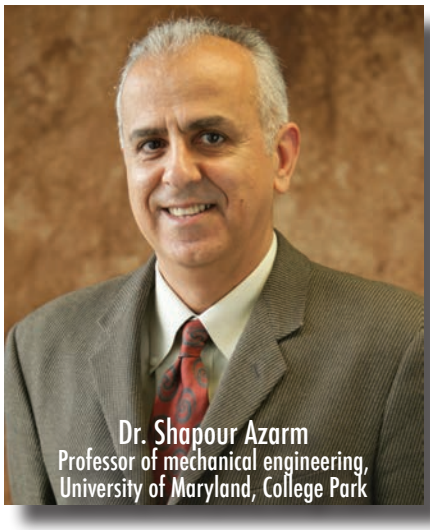
Carderock benefits from the summer faculty as well, according to Price.



Dr. Vladas Pipiras
Director of the Mathematical Decision Sciences Program with the Department of Statistics and Operations Research, University of North Carolina, Chapel Hill



Dr. Themistoklis Sapsis
Associate professor of mechanical and ocean engineering, Massachusetts Institute of Technology



Dr. Shapour Azarm
Professor of mechanical engineering, University of Maryland, College Park

"Having them here helps our researchers get in touch with an academic community, which is getting increasingly difficult to do," Price said. "It's hard to get out into the rest of the world, and this gives them the opportunity to do that, to reach out into the academic community where some exciting research is going on."

Pipiras believes he provides a perspective of statistical methodologies and techniques being used in the lab that the Navy might not have used before or perhaps need to be updated.

Carderock's summer faculty program is sponsored by the Office of Naval Research through their education and outreach department. There are several programs available to professors, as well as high-school, undergraduate and graduate students. ONR also sponsors a sabbatical leave program, which provides science and engineering faculty members fellowship appointments for anywhere between one semester to a year.

Dr. Shapour Azarm, a professor of mechanical engineering at the University of Maryland in College Park, is doing both. Azarm is working with Carderock's Dr. Yu Tai Lee in the Computational Analysis and Design Branch. Although he has just completed a nine-month sabbatical and then a 10-week summer faculty program at Carderock, Azarm and Lee have been working together on their research for several years.

"We met in the ONR-sponsored workshops," Azarm said, referring to the research they have done on certain problems for the Navy.

Lee said he invited Azarm to apply to the faculty programs because Azarm is a renowned expert in the field of optimization, and he felt Azarm could contribute to some of the problems they face in systems designs. And like Pipiras and Sapsis, Azarm is working on his problems from a multi-disciplinary aspect, more so for different types of system optimization than different types of research.

The problem Azarm and Yu Tai are tackling is in computer-aided optimal design, where certain techniques like modeling and simulation are used to optimize the design of a system. And that system can be anything, such as the structure, engines, weapons, etc. But an entire ship can be a complex system, Azarm said.

"Given our current computational power, we only focus on certain aspects of the ship," Azarm said. "My expertise is developing techniques for optimizing that system."

Together, Azarm and Lee are working on optimizing a system where some uncertainty might exist or where all the information is not known. They have published a conference paper, "Multi-Objective Robust Optimization Formulations with Operational Flexibility and Discretized Uncertainty," which was briefed by both Azarm and Lee at different engineering conferences.

"Optimization is gradually becoming a necessary tool in order to get the optimal system design," Lee said.

He also said having Azarm at Carderock for an entire year has been a great experience.

"I appreciate his contributions," Lee said. "We learn things from him every day."

Azarm plans to take what he has learned and developed at Carderock to his University of Maryland classes. He will be teaching a graduate-level class in the spring semester called multi-disciplinary engineering optimization. As part of that, Azarm will discuss the topic of robust optimization and the specific work he did at Carderock with Lee, including some things he learned as a result of that interaction.

"That's the interesting thing about our life as a researcher," Azarm said. "You have to constantly learn something new and update your knowledge base. And that makes our work interesting."

Both Lee and Belenky recognized the support Price provides in the faculty programs at Carderock.

Price wants to see the visiting faculty members to act as recruiters for Carderock when they go back to their universities. Carderock has multiple programs available to college-level students that would not only provide employment to them after graduation, but also give Carderock the new engineers, mathematicians and scientists it needs to replace an aging workforce.

Price is also looking to expand the program. In addition to the 12 visiting faculty members at the West Bethesda location this year, there were two Combatant Craft participants at Joint Expeditionary Base Little Creek-Fort Story in Virginia Beach, Virginia. The goal is to also get faculty members connected to the Carderock facility at Naval Base Kitsap-Bangor, Washington.

"Making these connections moves the field forward," Price said. "It's exciting to see and that's what I love about the program."

"That's the interesting thing about our life as a researcher," Azarm said. "You have to constantly learn something new and update your knowledge base. And that makes our work interesting."

Carderock wants researchers to patent their inventions

By Kelley Stirling, NSWCCD Public Affairs

Dr. John Barkyoumb, director of strategic relations for Naval Surface Warfare Center, Carderock Division, speaks to engineers and scientists who may be interested in filing for a patent at some point in their Carderock careers during the patents and technology transfer training Sept. 20, 2016, in West Bethesda, Md. (U.S. Navy photo by Kelley Stirling/Released)

Potential inventors from Naval Surface Warfare Center, Carderock Division attended a training session on patents and technology transfer in West Bethesda, Maryland, Sept. 20.

Dr. Joe Teter, director of technology transfer, and Dr. John Barkyoumb, director of strategic relations, both working in Carderock's Chief Technology Office, along with Dave Ghatt, Carderock's lead patent attorney, devised this training as a way to reach employees who may be considering filing for a patent and for those who may just be considering inventing something. Barkyoumb is also the chair of the Invention Evaluation Board (IEB).

Brandon Swartz, an operations research analyst for the Cost Effectiveness Branch, attended the training. Although he has been at Carderock for several years, he says when a new employee is getting up to speed on Carderock technical capabilities and business practices, they need to understand the resources available to the organization.

Teter said Carderock receives about 20 patents a year, but he thinks that number should be higher.

"A place this size, where we have essentially more than 1,000 scientists and engineers, we should be generating a lot more than 20 a year," Teter said. "We have the bandwidth to go higher."

Part of the challenge, Barkyoumb said, is that many of the newer employees don't know how to or even why they should file for a patent. Barkyoumb and Ghatt gave in-depth presentations on why and how to file for a patent to the 25 employees who attended the training.

"I really encourage filing for patents," Ghatt said, adding that it protects the government when its inventions are patented. He also went into detail about the legal ramifications the government faces if an invention is not patented, such as lawsuits for infringement.

According to Ghatt, the patent attorney will draft the patent application once the inventor provides an "invention disclosure," where a detailed description of the invention, with illustrations, is given, including what its intended use will be for the government and potentially outside government.

"Most patents are rejected the first time," Ghatt said. But that should just be understood as part of the patenting process, which generally takes about two years. Ghatt encourages employees to file for patents because patents are important to both technical and business operations at Carderock.

"Carderock is 'where the fleet begins,' and patents build on that legacy of innovation we are known for," Swartz said.

Once a government employee invents something and it is patented, the government owns the rights to the invention. From a legal perspective,

an engineer who uses government equipment, money and time to invent something does so on behalf of the government. Likewise, an engineer who works for the government but spends his own time and money to invent something will own the invention.

Ghatt gave an example of this in Richard James, the inventor of the slinky. In 1943, James was a naval engineer in Philadelphia working to develop a way to support or suspend shipboard instruments in rough seas. He was using tension springs when he dropped one and thought it would make a neat toy. James didn't use any government time or materials, and he took the idea home. Working with this wife, Betty, they came up with the slinky. James patented the slinky and sold millions of the toys.

"There are two reasons to get a patent: to be defensive on your product or to make royalty money," Teter said. "With the Navy having a very big patent program compared to other services, most everything we do is defensive."

The hope is that a commercial entity will license a patent and create the product that the government can then buy back, Teter said. That's where technology transfer comes in. At Carderock, that is when the Navy works with a non-Department of Defense (DOD) entity to create or develop a mutually beneficial product, process or application that is consistent with Carderock's and the DOD's mission by entering into a Cooperative Research and Development Agreement (CRADA). Teter gave the third presentation at the training that covered how to develop CRADAs with industry and academia.

Carderock can receive the royalties from a license sold to a commercial entity. Teter said the money goes right back into Navy research and that he thinks Carderock has a responsibility to the American taxpayer to file for patents.

"In the current competitive fiscal environment, we have to be vocal about our technical excellence," Swartz said. "Recognition is a huge part of advancing the Navy's mission and an individual's career. Our warfare center has to display the technical excellence of our workforce."

What is a patent?

A patent is a legal document that protects new, useful and non-obvious inventions for a limited amount of time (usually 20 years) and in exchange, the invention is disclosed to the public.

Why should I patent?

1. It benefits the inventor. An inventor's name is listed on the patent, regardless if the invented item is owned by the government. The inventor can also be recognized within the government with monetary awards and other prestigious awards such as the Vice Adm. Bowen Naval Patent of the Year Patent Award.
2. It benefits the government for two reasons. One is that patents serve to defend the government's work so that a commercial entity cannot sue for infringement rights of a government patented invention; and two, a commercial entity may decide to license and produce the patented invention, which may give the government royalties and which may allow the government to buy the product rather than producing it themselves.
3. It benefits the warfighter. Most of the technology developed at Carderock is military in nature and ultimately benefits Sailors or Marines.

What types of things can be patented?

Machines, manufactured items, composition of matter, software, hardware, processes and business methods.

What do I do if I think I might have an idea for invention?

Write it down, date and time stamp, and have it witnessed by two technically competent people. Continue to write detailed notes and draw illustrations as the idea develops.

What are the steps to filing for a patent?

1. Fill out an invention disclosure. Using the department chain of command, the inventor should present the idea to the department's Invention Evaluation Board (IEB) representative, and that person will assist in filling out the invention disclosure. The IEB will evaluate the invention disclosure to determine if the invention will go forward for patent application.
2. File a patent application. This process is done through Carderock's patent attorneys. With the detailed notes and illustrations, the attorneys should be able to draft the invention description that will be used for the application. The application is filed with the U.S. Patent and Trademark Office. Once a patent application has been filed, the application starts receiving the benefit of patent protection, but it is only when an official patent is issued that full patent protection is realized.
3. Receive an issued patent. This generally takes about two years from the time a patent application is filed.

SEAP intern presentations at Carderock

By Edvin Hernandez,
NSWCCD Public Affairs Intern

High-school interns with the Science and Engineering Apprenticeship Program at Naval Surface Warfare Center, Carderock Division participate in the Additive Manufacturing Challenge, July 28, 2016, in West Bethesda, Md. One team of interns created this speedboat, USS Mongoose, with a 3-D printer and raced it as part of the challenge. (U.S. Navy photo by Dustin Q. Diaz/Released)

High-school interns at Naval Surface Warfare Center, Carderock Division presented their summer projects and experiences at the West Bethesda, Maryland, campus on Aug 9. Center for Innovation and Ship Design (CISD) director Dave Ruley opened the presentations by thanking interns for their contribution this summer.

During their seven-week employment period, interns who are part of the Science and Engineering Apprenticeship Program (SEAP) were given the opportunity to experiment and learn more about science, technology, engineering and math (STEM) fields at Carderock. The students were also able to utilize their knowledge and enhance their skills on how to operate a 3-D printer in the process.

Jacob Blumberg, a SEAP intern and junior at the Field School in the District of Columbia, presented on the importance of 3-D printing in the modern world. Through his PowerPoint presentation, Blumberg demonstrated the many benefits that 3-D printing has to offer. The printer is: quick, low cost, precise, efficient, lightweight and has the ability to create unique shapes. It also has the capability to conveniently design an image by an additive process where layers are laid upon layers of material until the object is created. Fortunately, now there is no "need for an individual to run to different departments for supplies anymore," Blumberg said.

He expanded on the process of 3-D printing by showing the three stages involved. First, there must be a design developed through software. At Carderock, SEAP interns used the Rhino 3-D software program where they were able to create model figures on the computer. After the design was constructed it went through the slice stage, Blumberg said. In this stage, the printer software adjusts the density and measurements of the item being printed for accurate representation. Once the slicing stage was complete, the printer began to produce the design one layer at a time as melted filament was squeezed through a nozzle.

Upon finishing his explanation of how 3-D printers operate, Blumberg applied a real-world example of 3-D printing aiding individuals in the past. In his research he found that prosthetic hands were being created cheaply for young children in need. The prosthetic hand works by connecting with limbs allowing the new hand to function and move. 3-D printing has created an affordable way to supply people in need of prosthetic devices, potentially improving their quality of life. "The hand costs $15 to make and hospitals are beginning to give them to children in need for free," Blumberg said.

During his internship at Carderock, Blumberg was able to use a 3-D printer for his participation in the Additive Manufacturing challenge. He and his team of other SEAP interns modeled a speedboat they named USS Mongoose, which they used in their competition. They tested and raced their vehicle in the David Taylor Model Basin along with other competitors.

"This year we were really aggressive in design teams and the modeling process along with water testing," Ruley said. "It's exciting to see them in the tow tanks, collecting resistance measurements and flow visualization. It's a key tenant of what goes on here at Carderock."

Another SEAP intern, Joshua Flitter, experimented on odor control on Navy vessels during his time at Carderock. His objective was to "find an alternative way to contain garbage for the Navy," Flitter said. He began his experimentation by filling bags with raw chicken and other foods. After adding a variety of different nutrients, Flitter would smell the bag every day to analyze the stench coming from the bags. To more effectively understand the strength of the stench from the trash bags, Flitter designed a zero to three number scale that would measure and assess smell. Zero would represent no odor while a three would indicate the odor is unbearable. He found that after a couple of days the smell of the trash was awful inside, but when sealed the odor could not be smelled. "These bags will continue to help control waste on submarine ships and prevent illness," Flitter said.

As the presentations came to an end, Ruley said there was a good balance between ship design process and scientific design process by interns this summer. "Some people like to work in labs and others like to build," Ruley said. "We would like to give a special thanks to Rachel Luu and mentors involved in the program this year." Luu is the summer intern outreach coordinator for Carderock.

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Naval Surface Warfare Center, Carderock Division
9500 MacArthur Blvd. • West Bethesda, MD 20817-5700