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It’s been a little while since we issued a Waves. The year 2020 was a somewhat tumultuous year. However, while some things may have been put on the back burner (like Waves), Carderock still had a very successful year. In this issue of Waves, we highlight some of those accomplishments.

COVID-19 was obviously a big part of our year. We fought through it, and in some cases worked with other Warfare Centers and departments to come up with creative ways to get masks and hand sanitizer to our employees, as well as outside entities. There are several stories in Waves about our people’s tenacity during the pandemic.

Of course, the work must go on. Even in this strange time, our Carderock team stepped up to perform the work necessary to meet the mission. Across all of our departments: Platform Integrity, Significance and Naval Engineering and Hydrodynamics, as well as our detachments, this is a great example of the dedication and resiliency of our folks.

Carderock Division had a number of patents issued, and while many of those had been applied for in previous years, it’s still a great success when an invention is recognized with a patent. There are several examples in this Waves of those successes.

We also changed command last year, welcoming Capt. Todd E. Hutchison as Capt. Cedric McNeal went on to a program office. As your Technical Director, I’m always incredibly proud and humbled to share the Carderock family’s excellence with others. There are some very significant events from last year highlighted, so I sincerely hope you enjoy this issue of Waves as much as I do. Stay tuned for another Rockstar edition that will capture the successes of specific individuals and teams in 2020.

Thank you.
A LOOK BACK

THE LEGACY OF CARDROCK’S DR. YOUNG SHEN

By Benjamin McKnight III, NSWC Carderock Division Public Affairs

hydroplanes were highly popular. The Anheuser-Busch-sponsored Miss Budweiser boat was a dominant competitor since its beginning in 1985, but looked to reach higher speeds as the end of the century approached. Their team reached out to Frank Peterson who at the time was an engineer in the Hydrodynamics Department to take their request to Shen. What Shen discovered was the way the boat operated allowed for a new skid plate design.

In the summer of 1999, the Miss Budweiser boat debuted its new skid plate during the Budweiser Columbia Cup in Tri-Cities, Washington, and set a course record of 633.451 mph according to an email to Shen from Boeing engineer Derrick Rogers. Success continued with another course record at Lake Champlain in British Columbia two weeks later. On Sept. 13, 1999, Miss Budweiser set a world top-speed record in San Diego, California, at 773.365 mph."

I took personal satisfaction to witness that the new concept works as demonstrated by Miss Budweiser," Shen said to Rogers. "We are very happy that we were able to make a contribution to the success of the team."

Shen’s skid plate made the Miss Budweiser boat so competitive that by 2002, racing authorities banned the design from competition. "I think the Miss Budweiser story is a great reflection on his creativity," Gowing said. What might be Shen’s most renowned innovation was the Twisted Rudder, a patented design that reduced noise and erosion damage on rudders of the Arleigh Burke-class guided-missile destroyers (DDG 51). Aligning the rudder section to the inflow was a simple, yet effective concept, and it eventually transitioned to the fleet. Later on, he added a tip plate innovation for delaying tip vortex cavitation and it eventually transitioned to the fleet. Later on, he added a tip plate innovation for delaying tip vortex cavitation and it eventually transitioned to the fleet.

"They had to name this section, so Caltech combined Shen’s initials and some design parameters to call it the TS-1600." Gowing said. One of Shen’s most notable accomplishments came at the turn of the century when he

Known for work on surface ships, he delved into the world of underwater vessels in the back end of his career. That is when Michael Hughes in the Carderock’s Hydrodynamics and Maneuvering Simulation Branch and David Hess in the Submarine Maneuvering and Control Division crossed paths with Shen.

"When I first started working with Shen, I found out that he was a very careful researcher," said Hess, who has known Shen for almost 39 years. "He’s such a nice guy and we just started working together on things."

Early in his career, Shen changed the trajectory of ship technology for the Navy with his work redesigning propeller blades. Innovations on surface ships were running into problems with cavitation, as Gowing recalled. "Standard designs were effectively minimizing the drag to reduce the torque on the propellers, but cavitation created noise and limited the top speed. The solution presented by Shen was to change the design of the cross-section of the propeller blades, and subsequent tests in a water tunnel at the California Institute of Technology (Caltech) proved its advantages."

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WEAPONS, CCAT LOOK AHEAD WITH ELEVATOR PRESERVATION

By Mass Communication Specialist Seaman Anton G. Wendler, USS Stennis (CVN 74)

many departments and teams aboard the aircraft carrier USS John C. Stennis (CVN 74) have assisted in the ship’s pre-Refuelling Complex Overhaul (RCOH) progress.

The ship’s weapons department corrosion team and the Corrosion Control Assistance Team (CCAT) from Naval Surface Warfare Center, Carderock Division’s Corrosion and Coating Engineering Branch worked together to complete the preservation of lower stage weapons elevator (LSWE) 3 on June 22.

“The strength in numbers made this task much more efficient,” said Lt. Bryan Silva, a division officer for the ship’s weapons department. “The goal was to safely preserve the elevator pit and set a new standard for carrier elevator preservation and maintenance.”

With instruction and guidance from CCAT, the weapons department utilized multiple techniques in order to execute a successful preservation of LSWE-3.

“The weapons department conducted removal of rust and damaged coatings using needle guns, deck grinders and abrasive pads as well as applying all coats of paint,” said Silva. “CCAT provided training, oversight, and guidance at each step and ensured that all personnel understood the process to achieve first time quality.”

The corrosion prevention on LSWE-3 will allow weapons department to approach all other weapons elevators with the training and experience provided by this first evolution. Preserving the elevator now will allow it to be used during the RCOH process and ensure that the John C. Stennis gets back into the fight, on budget and on schedule.

“All weapons elevators are important in regards to their functionality, accessibility and usage throughout the ship,” said Lt. Cmdr. Lawrence Schaffer, the ship’s ordnance handling officer. “LSWE-3 was the first elevator pit where the training and understanding of the scope of corrosion prevention started for our team. Completing LSWE-3 pit corrosion prevention saves time and critical man hours that could impact RCOH timelines and delivery schedules.”

CCAT is on track to support a similar level of effort by the fleet in FY20. Ultimately, CCAT improves material readiness, total ownership costs and self-sufficiency.

“CCAT is basically a ship self-help program.”

COVID-19 has not slowed down the support provided by CCAT. While additional measures have been implemented to promote both CCAT and Sailor safety, successful efforts like Stennis have continued to be executed across all of our locations. All members of the CCAT teams wear masks when performing duties, training is conducted topside and in groups of ten or fewer, the CCAT team members maintain social distance when providing over the shoulder training; tools are sanitized prior to lending to the ships and they maintain active communication with ships in order to participate in contact tracing.

In FY19, CCAT serviced 274 ship availabilities supporting ships force efforts and critical man hours that could impact RCOH timelines and delivery schedules.

CCAT is a Naval Sea Systems Command (NAVSEA) Ship Integrity and Performance Engineering Group (SEA 05P) program funded by the Painting Center of Excellence (PCOE) with the tasking to provide corrosion control training, technical assistance and tools, and to facilitate the Transition of new technology to Sailors aboard US Navy ships for corrosion control maintenance projects.

CCAT provides support in nine locations in Virginia, Florida, Washington, California, Hawaii, Spain and Japan.

Jim Wigle has been leading the CCAT program within NSWC Carderock Division’s Corrosion and Coatings Engineering Branch as the in-service engineering agent at Carderock since 2005 and is supported by a project engineer, Brittany Preston-Baker, and a Contracting Officer Representative, Connie Hall.

Wigle said the team’s goal is to train the Sailor to maintain their ship, which obviously is subject to severe weather and ocean environments, and these conditions lead to corrosion and therefore metal loss, if not properly controlled.

“The Sailors are doing the work; our guys are providing the technical assistance, training and support that’s required to do it right, and now technology,” Wigle said. “It’s basically a ship self-help program.”
CARDEROCK HELPS PRESERVE CENTURY OLD ARTIFACTS WITH 3D SCANNING CAPABILITIES

By Edvin Hernandez, NSWC Carderock Division Public Affairs

In a collaborative effort to support the 3D-scanning mission of the gig to commemorate the 150th anniversary of its voyage, Carderock engineers Scott Ziv, Ryan Fisher and Anthony Brock teamed up with Combatant Craft Division engineers Ryan Evanko and Roseller Lim. Combatant Craft Division is a detachment of Carderock located at Little Creek-Fort Story Joint Expeditionary Base, Virginia.

The team used two FARO Focus S70s and one FARO Focus X330 to capture the exterior and interior of the gig. Target spheres were placed around the hull to align and stitch the scans together, and a higher detail FARO Arm was used to record the finer, smaller details on the boat.

"It took us about three hours to scan the 35-foot vessel," Ziv said. "We had a short tour of the warehouse at the beginning, and after NHHC saw how quickly we were scanning the gig, they brought out more artifacts for us to scan."

A pipe given as a gift to Adm. Arleigh Burke, a wooden crocodile, a spyglass and several other small items were selected for the team to scan with the FARO Arm. According to Ziv, however, processing scans is not as easy as it sounds.

"Whenever people think about 3D scanning they think they get an exact copy of the model," Ziv said. "The truth is that it's never really like that because there are some places the scanner cannot get to, like a crevice or cavity. 3D scanners captures features, and there is a lot of approximation that goes into it. Once you take the scans, you get a point cloud of what you can see. Then it goes to another software where you can mesh that data, erase faulty data, patch holes you can't reach, or stitch multiple scans together. As the engineer, you need to be able to understand what is and is not an important feature in the object you're trying to scan."

Ziv said he was surprised to learn that museums showcase only a small fraction of what they actually own. "This was the NHHC's first attempt to digitize some of their artifacts, which will survive longer than their physical presence. Initially, I think one of the command's goals is to establish a 3D web viewer, but there are also other opportunities to share these artifacts with the public. Whether it's a dinosaur or a boat or a missile launcher, you don't really realize how big something is until you stand next to it, and that opens the door - possibly - to virtual reality. What does a museum of the future look like?"

Although 3D scanning capabilities are relatively new to Carderock's Additive Manufacturing Branch, they have been a constant practice for the command's Performance and Evaluation Branch. Brock, who has plenty of experience in 3D scanning, played a pivotal role in supporting space planning efforts at Carderock in a more remote environment.

Brock and Fisher were tasked with scanning Building 9 to capture facilities data and dimensions for future equipment additions and space renovations and support expansion planning for the Manufacturing Knowledge and Education (MAKE) Lab.

"Part of the restructuring at Building 9 was for the Platform Integrity Department," Brock said. "They were looking to acquire new equipment, and they wanted a good idea of the spaces in the facility to plan for the new machines coming in. So, we scanned the area, which took about two days, and stitched all the scans together to create a floor plan and simulation of the available space."

Brock, much like Evanko, Lim and Fisher, is well-versed in 3D scanning. Ziv, on the other hand, is developing his knowledge in the field and said this experience benefited him and the command in several ways.

"One of the biggest benefits to Carderock is that this capability shows and builds on our technical expertise."

USS Saginaw’s surviving gig rests on a steel mount at the Naval History and Heritage Command with a FARO 3D S70 3D scanner. The white spheres surrounding the hull are known, common points that help align separate scans to one another. (U.S. Navy photo by Scott Ziv)

One of the biggest benefits to Carderock is that this capability shows and builds on our technical expertise," he said. "Technical excellence is easy to say, but hard to prove until you go out and do something like this, leverage your skills to make a lasting change, and strengthen our relationship with our partners."

Another benefit for Carderock, according to Brock, has been networking with Combatant Craft Division.

"It is nice to have additional points of contact for scanning resources," he said. "If we have a big project in the future, it is good to know we have people who can help us support the mission."

While the COVID pandemic continues to linger across the United States, it did not prevent Carderock engineers from preserving storied pieces of naval history and helping the public experience them from home.

"We can continue to work with our partners," he said. "Between the command and our partners, we can leverage our skills to make a lasting change, and strengthen our relationship with our partners."
group of engineers from the Naval Architecture and Engineering Department at Naval Surface Warfare Center, Carderock Division drove nearly 3,000 miles to Naval Base San Diego to perform calm-water trials on USS Zumwalt (DDG 1000) in April. The test, which is part of the Performance and Special Trials (P&ST) program for the Zumwalt-class Destroyer Program Office (PMS 100). He was asked to conduct a calm-water trial, which was initially scheduled for later in 2020. A test team was established on short notice including Minnich, naval architect Doug Griggs, electrical engineer Brian Chirozzi and computer engineer Tim Rancourt from NSWC Philadelphia Division. Unlike the 2018 calm-water trial, engineers were now focusing on the ship's high-speed performance.

Since the COVID-19 Pandemic has forced state-wide lockdowns and stay-at-home orders, traveling presents some difficulty. However, Navy personnel are considered essential employees, so the team debated the safest way to get to San Diego. The team concluded that driving a rental vehicle – a 12-passenger van – was the best option to avoid the potential disadvantage of its lee to shield the ship from as much of the prevailing wind and wave environmental conditions with calm seas and low winds,” Senior Trials Director Stephen Minnich said. “San Clemente Island is just offshore from San Diego, and we take advantage of its lee to shield the ship from as much of the prevailing wind and wave environmental conditions as we can.”

On March 27, Minnich received a call from the Zumwalt-class Destroyer Program Office (PMS 100). They were unable to maintain more than six feet of distance between one another. "We were racing against the clock," Minnich said. "We left the following Wednesday morning and we had to be checked into our hotel by Saturday morning. To get there in time, we drove three days straight for about 15 to 16 hours each day and arrived in San Diego late that Friday night.” During their quarantine in the hotel, the team was impacted by the new Navy requirement to wear face-coverings if they were unable to maintain more than six feet of distance between one another. "All of the ship riders and crew were required to wear face-coverings, because when you’re in a shipboard environment, you are in close quarters with many people,” Minnich said. “We were in this challenging situation, because we were in self-isolation, but we also needed to obtain face-masks. Luckily, the wife of one of our team members sewed us some masks and sent them via Priority Mail.”

Carderock and NSWC Philadelphia Division also provided support to the team of engineers by sending hand sanitizer, gloves and face masks, all of which are a luxury during the COVID-19 Pandemic. "Help from both commands was much appreciated," Minnich said. “We were stuck in a situation where we were not supposed to go out in search of that gear - because of our self-quarantine - and of course all of those supplies are limited in general, but we were able to persevere with the help of many folks back home.”

The traveling engineers faced a race against time after it was learned that any test rider from outside the ship’s homeport would have to self-quarantine in San Diego for at least 72 hours before going aboard. "We were racing against the clock," Minnich said. "We left the following Wednesday morning and we had to be checked into our hotel by Saturday morning. To get there in time, we drove three days straight for about 15 to 16 hours each day and arrived in San Diego late that Friday night.”

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After a month’s long journey – including about 6,000 miles of driving - Minnich and his team returned home to West Bethesda, Maryland, on April 28. "We were able to complete all of the planned testing, which was a huge win. The ship was able to support everything we were testing, and it enabled us to finish all the calm-water test conditions for the ship, which is a major milestone,” he said.

Minnich also praised the team's overall preparation, which he believes enabled them to be successful in their mission on the West Coast. “What allowed us to be so successful with this test was the extensive planning and preparation,” he said. “One of the things we did, given all the travel restrictions and changing policy, was to prepare detailed test procedures that the crew could utilize to conduct the trial in case we could not make it out there. Translating our normal procedures into a way that a Sailor, who has no prior experience of our testing, could understand and execute was a nice win that came out of the planning effort.”

After receiving positive feedback from the crew aboard DDG 1000, the test team expects to incorporate similar planning strategies and procedures for future test events. 
Facemask frames are 3D printed in the Additive Manufacturing Lab on April 10, 2020, at Naval Surface Warfare Center, Carderock Division in West Bethesda, Md. The frames were used for face coverings during the COVID-19 pandemic.

(Photo provided)
Since March, Justin Artis, mechanical engineer; Josh Duck, technician; Zach Heinkel, composite materials engineer and Scott Ziv, mechanical engineer, have been using 3D printers to create three separate tools to be used during the worldwide pandemic - facemasks, visors and a flattened, hook-shaped door opener to be used in place of physically touching door handles.

With the majority of the prioritization for health-related supplies being given to hospitals and other medical facilities, these four individuals decided to put their advanced manufacturing talents to use in the best way they know how: “One of the biggest challenges during this pandemic is protecting yourself, and it’s made harder since you can’t effectively buy the supplies needed anymore. We looked to answer the COVID needs very quickly, and determined what we thought to be the most efficient way to help out,” Heinkel said. “We didn’t want to mass produce items, though. We just wanted to step up and do our part and make quality items, and I think that’s really unique.”

The process began in March when they received a request from the Marine Corps for face shields. This locked off their efforts, and it did not go unseen. After the success of the face shields, Larry Tarasek, Carderock’s technical director, requested 3,000 facemasks. Early May, the idea for the door opener had been formed. To date, they have created roughly 1,500 of their door openers, with a goal of 3,000. These door openers, and the facemasks, will be part of a personal protection kit to protect employees working on site.

“The door openers are interesting because the end products we’re making are not actually printed; they’re cast out of urethane, but we use 3D printing as a tool to aid the process.” Ziv said. “We 3D printed the original ‘blank,’ used them to make a silicone mold, then poured urethane in to make the final part. This lets us keep the turn-on-a-dime agility of 3D printing, while having the capacity and consistency of mass production.”

They were assisted by materials and manufacturing subject-matter experts, including Anna Bernal and Joe Korczynski of Carderock’s Non-Metallic Research and Engineering Branch, who produced 125 units and added valuable insight into the urethane casting process.

The door opener, which can be used to open most doors, including handicap accessible doors, is flattened, with a much lower contact area than a person’s hand, and helps reduce transmission and contact exposure when opening a door. They also have a feature for pushing buttons on keypads, elevators or other high-touch locations.

“While it doesn’t eliminate the risk, it considerably lowers it, and every little bit counts.” Ziv said.

The group spent two full weeks working on the door openers, while creating approximately 250 per day. The entire process to make a set took anywhere from 20-30 minutes, while 10-15 of those minutes revolved around waiting for the urethane resin to cure while filling up another set. Each set consists of nine door openers.

They also spent most of April producing, packaging and preparing the facemasks, and collaborating with Carderock’s warehouse for distribution. In June, they created 75 visors in a 72-hour timeframe at Carderock’s Manufacturing Knowledge and Education (MAKE) Lab, to deliver to Naval Sea Systems Command (NAVSEA) headquarters for COVID-related testing. While the four of them are relatively new to Carderock, - Ziv having the most seniority at just over two-and-a-half years - they all come from more than capable backgrounds. Ziv and Artis have bachelor’s degrees in mechanical engineering from Virginia Tech and the University of Maryland, respectively. Artis also worked at the Naval Air Station Patuxent River for nearly four years before transferring to Carderock. Duck has a bachelor’s degree in electrical engineering technology from the State University of New York at Farmingdale, and Heinkel has bachelor’s degrees in physics and composite material engineering from the University of Wisconsin-La Crosse and Winona State University in Minnesota, respectively. Heinkel also served in the Air National Guard for six years.
One of the earliest words of guidance to come from the entities such as the World Health Organization (WHO) and Center for Disease Control (CDC) at the beginning of the COVID-19 pandemic was how important it is for people to keep their hands clean.

As the situation progressed from slightly concerning to severely important, retailers across the nation were not prepared for the mass purchasing of sanitation products. Hand sanitizer was one of the most popular purchases and by the middle of March, many stores and online shops were completely out of stock. Since then, those who have been able to refill their supply have put limits on how many bottles can be purchased at one time, while many listings on websites such as Amazon are still on backorder.

Engineers and scientists at Naval Surface Warfare Center, Carderock Division who are dealing with the impact of sanitizer shortages have been enlisted to help handle demand. With the idea originally stemming from the efforts of Deniz Ferrin and Cody Matheson of Puget Sound Naval Shipyard (PSNS) and Intermediate Maintenance Facility (IMF), Jay Ong of Carderock’s Corrosion and Coatings Engineering Branch is leading an effort to produce hand sanitizer for the command’s use.

The group is following the World Health Organization’s procedures for local production, a guideline that has been out since April 2020. The effort started small with the production of 15, 1-liter bottles and has since grown. After becoming an officially registered Food and Drug Administration (FDA) producer of Ethanol-based hand sanitizer, Carderock can now make the hand sanitizer for the command in 50-milliliter and 1-gallon packaging. Since production began, Ong said they have made over 1000 units.

Although handwashing is definitely the preferred method, one of the things that we also recognize is that handwashing is not always available or practical,” Ong said during the course of the pandemic response, a number of groups at Carderock are finding creative ways to fight the shortage of essential equipment. Some of the materials Ong and his counterparts are using are in a higher demand now, but still easier to come by than sanitizer that has already been made and packaged.

“That was actually one of the first rabbit holes we went down,” Ong said about the challenge of purchasing sanitizer in bulk.

Ong said that industry is catching up, but you have to be cautious as some hand sanitizers aren’t registered with the FDA, are not of the right alcohol content to be effective against COVID-19 or cannot be bought in bulk reliably.

The four ingredients in the solution are ethanol, hydrogen peroxide, glycerol and distilled water, all of which are United States Pharmacopoeia (USP) grade materials to ensure a high quality product is made. Every batch of sanitizer goes through a series of quality control checks right after it is produced and before it is packaged. WHO standards require these sanitizers to have an 80% by volume concentration of ethanol with an acceptable deviation of 5% higher or lower. All of the Carderock-produced batches produced thus far have fallen between 80-84% according to Ong.

Planning the execution of this task began almost immediately after the initial stay-at-home orders were given in mid-March. By April 14, the first batch of sanitizer was complete. The time in between was spent validating the process, procuring the materials and creating a standard operating procedure that would identify the most effective means of completing the process. One of the biggest challenges faced in this task was securing adequate packaging to distribute sanitizer.

A tremendous amount of time was spent trying to identify a container that could be placed in the travel kit, meet TSA restrictions, and effectively dispense the hand sanitizer,” Ong said. “Many of the small fine-mist bottles or pumps were just not available for the same reasons that Germ-X and Purell were not available.”

Now on their third iteration of packaging, Ong said the group has finally hit the mark. Version one’s bottles had a screw top he compared to that on a Sriracha sauce bottle, and the second version used a disc cap one would normally find on a lotion bottle.

“Version three is really where we’re hitting our stride,” he said. “We have these airless sprayers that are working exceedingly well and are refillable which is nice for continuous use. It’s a nice, elegant long bottle that you can put in your pocket while doing daily operations.”

Help with the production effort has come from all parts of the command, as Ong said individuals regularly volunteer to help with labeling and packaging the sanitizer. The hand sanitizer is primarily being used in the travel kits, but it can be always requested through the chain of command.

With the spread of COVID-19 has come a new normal for people across the globe. At Carderock, the “norm” was always to find an innovative solution to a problem, a fact that remains true as this pandemic continues.
IN COVID-19 FIGHT

CARDEROCK LOOKS TO USE R&D ABILITIES IN COVID-19 FIGHT

By Benjamin McKnight III, NSWC Carderock Division Public Affairs

The first case of COVID-19, or the Coronavirus, in the United States was discovered in late January and since then has taken a stronghold on the day-to-day operations of the nation. The number of identified Coronavirus cases in the United States now exceeds all other countries as governments and medical experts race towards a solution.

A handful of engineers at various Navy Labs, including Naval Surface Warfare Center Carderock Division in Bethesda, Maryland, are looking to use their knowledge and creative tools to assist in coronavirus relief efforts in their corners of the country. Medical response organizations are seeing widespread shortages in equipment such as masks, face shields, ventilators and other critical items with the severity of the virus increasing. However, some individuals whose primary objective is to outwit the United States Navy and Marine Corps with high quality tools believe they could leverage their knowledge to help bridge that gap.

“In crises like this, the local response is the most important,” said Dave Newborn of Carderock’s Maritime Aviation and Unmanned Underwater Systems Division. “Being able to understand local needs and problem sets and responding to those in a local fashion.”

Following that line of thinking, Newborn and others decided to turn the NSWC Carderock COVID-19 Additive Manufacturing Rapid Response Team. For almost a month, the group has gathered together every weekday to discuss new ideas and plans of action to support entities within their communities. Other Warfare Centers, such as Indian Head and Crane, have joined the effort to compile concepts and inspire more possibilities among one another. Collaborative efforts are also extending beyond the naval enterprise whose primary objective is to outfit the nationwide defense apparatus, which is to continue to be a degree of coordination that scientists time to adequately test their ideas.

“I have experience with materials and processing technology to help combat shortages in healthcare equipment also inspired the team’s formation,” said Waters, the SSTM for Advanced Manufacturing Materials at Carderock. “If you’re going to put a 3D printed part over your mouth and expect it to filter away viral particles, then we want to make sure that we’re not doing harm by the polymers possibly off gassing deleterious chemicals or compounds to the wearer of the device.”

A series of reports from Italy highlighting the country’s use of additive manufacturing technology to help combat shortages in healthcare equipment also inspired the team’s formation, but Newborn said that contributions are going beyond just additive manufacturing. The idea is not to be restricted to additive manufacturing or some other process, but to leverage what Newborn has been spearheading to provide a solution based on what is available. Right now, though, the goal is to turn those beliefs into affirmations, which means more brainstorming, researching and testing for solutions.

When the solutions phase approaches, Waters said she hopes that Carderock’s response team can provide innovative templates and work with the Food and Drug Administration and Veterans Affairs to help organizations like America Makes, which is a public-private venture that will help innovators to a requirement.

“Those relationships are about understanding what the FDA and VA are seeing as problems and how Carderock’s capabilities can be applied to those problem sets,” Newborn said.

Much of the work to date has been theories, conceptual designs and some experimentation. However, the command’s Additive Manufacturing Branch recently fulfilled a request from the Marine Corps for printed face shields that will be used by a hospital in Colorado in the coming weeks, proving that the capability to provide is there.

However, one of Carderock’s greatest contributions to this COVID-19 fight is through research and development, using its expertise in specific areas. As described by Dr. Cynthia Waters, there will need to continue to be a degree of coordination that includes more players than just Carderock.

A need for those linked relationships is imperative to ensure proper guidance for equipment needs are given and met in the manufacturing process as well as to give the scientists time to adequately test their ideas.

“We have experience with materials and product characterization. We look at the qualifications and then certify parts that have been made by the 3D printing process,” said Waters, the SSTM for Advanced Additive Manufacturing Lab at Carderock. “If you’re going to put a 3D printed part over your mouth and expect it to filter away viral particles, then we want to make sure that we’re not doing harm by the polymers possibly off gassing deleterious chemicals or compounds to the wearer of the device.”

Scientists within the Navy are, like many other industries, starting to turn their focus towards stopping the spread of the virus in hopes that their areas of expertise can address issues that others may not. Waters said, “It’s not against another human adversary, but certainly it’s one that will affect our safety in the United States and the entire world.”
Being a member of the military often requires personnel to be able to adjust to the needs of a new mission on short notice. To some degree, the same is required of its civilian employees, such as Naval Surface Warfare Center Carderock Division’s Milton Perez-Cruz, who went to Spain for one job and ended up doing another.

Perez-Cruz normally works as a mechanical engineer in Carderock’s Ship Structures Branch. As part of an internal rotation with the Additive Manufacturing Branch, he took an assignment supporting the Forward Deployed Regional Maintenance Center (FDRMC) Detachment Rota in Spain to assist in completing the setup of the newly installed advanced manufacturing shop and to support its future Additive Manufacturing (AM) efforts. In fact, upon his arrival in December, he was doing things of a different purpose; utilizing AM tools to produce face shield frames before assembling the face shields in April 2020. As part of their local COVID-19 response efforts, engineers in the Additive Manufacturing Lab at the FDRMC Detachment Rota, Spain, have shifted their focus toward alleviating personal protective equipment shortages for medical professionals in the community.

"I would say our biggest challenge has been navigating a global pandemic was not the conditions under which Perez-Cruz expected to be spending his time overseas. "I knew that there are people back home fighting to take care of them, and I realized that with my contribution, I can help other people’s families and loved ones, as well." said Perez-Cruz. What he is also grateful for is the local community that appreciates and is aware of the sacrifices and efforts his teammates have made.

"Them being far away and not being able to be with them at this moment of crisis really keeps me going," said Perez-Cruz. He regularly talks with his family and friends who are stateside to help keep a high level of motivation.

"I would say our biggest challenge has been adjusting to the needs of a new mission on short notice. To some degree, the same is required of its civilian employees, such as Naval Surface Warfare Center Carderock Division’s Milton Perez-Cruz, who went to Spain for one job and ended up doing another.

Perez-Cruz and his counterparts are not shying away from the challenges. With his knowledge in the AM realm, he has played a key role in preparing their lab into a production facility by creating an efficient system of production, troubleshooting machines and sharing updates on their progress with the local command. It is a clear indication of the shipbuilding process he originally signed up for, and working through the problems presented by the Coronavirus outbreak has pushed the envelope on what Perez-Cruz knows about the AM process.

Day-to-day operations are heavily dependent on Perez-Cruz fostering a positive and productive relationship with his Spanish counterparts, one that he said is flourishing. That mutual understanding helped all parties involved make the necessary shift from vehicle-focused operations to PPE production. The culture of the workplace has shifted to ensure that while he and the others are making equipment to keep the medical professionals safe, they too are remaining safe.

"My contribution, I can help other people’s families and loved ones, as well." said Perez-Cruz. What he is also grateful for is the local community that appreciates and is aware of the sacrifices and efforts his teammates have made.

Special 2020 Edition
Dr. Alexey Titovich, a research scientist at Naval Surface Warfare Center, Carderock Division, saw this as an opportunity to best utilize the piece of equipment.

"The weather aspect to me was absolutely of primary interest for Titovich, who is interested in pursuing this further," Titovich said. "Researchers have attempted measuring infrasound in the atmosphere with a microphone-in-loudspeaker pot sensor. The idea here is to combine the benefit of distributed sensing that fiber optic interferometry gets you with a very large spatial aperture provided by the platform."

In the beginning of his experimental process, Titovich participated in the development of a fiber optic sensor through a Small Business Innovation Research project for structural health monitoring. While analyzing an odd blip in the test data, he realized and proved that it was due to a very small earthquake over 350 miles away, which piqued his interest in discovering new applications of such sensing. Weather monitoring became a primary point of emphasis for Titovich, who noticed that current weather prediction technologies could benefit from infrasonic measurement, which unlike LIDAR captures the vibrational state of the atmosphere. Particularly, infrasound generated by severe weather phenomenon such as tornadoes can be localized earlier than with traditional weather warning systems, which has the potential of saving lives.

"The weather aspects that are absolutely interesting" he said. "Severe weather events that cause infrasound, why would the Navy care about that? Because we either have to sail or fly through it.

Getting the sensor on aircrafts is the next big step for Titovich's invention, and it is a step that is sure to take some considerable time. Following the disclosure for this patent, we worked with our tech transfer office at Carderock's Director of Technology Transfer to participate in the FedTech program, where he met with labs and industry representatives to gauge interest in his idea. Other steps to refine the sensor are taking place, such as working to utilize the structural vibrations of the aircraft and the impact of altitude and temperature on the sensor's accuracy.

"One of the things we identified through the FedTech program was those corporate partners and government labs that were interested in pursuing this further," Titovich said. "It needs development and next level demonstration, so we'll be working on that."
Welding is a highly delicate process that depends on a very specific set of variables for the end product to be effective. A team of engineers that included Naval Surface Warfare Center, Carderock Division engineers Matthew Sinfield and Jeffrey Farren were issued a patent for their work in developing a metal solution that could help meet one of those detailed standards in welding work.

Sinfield and Farren, from Carderock’s Welding Processing and Nondestructive Evaluation Branch, assisted in the research and development of a filler metal system that could be used over a wide range of fabrication conditions. The final product was the “High Strength Welding Consumable Based on a 10% Nickel Steel Metallurgical System” (U.S. Patent 10,384,315), which was awarded on Aug. 25, 2019.

When they began their careers at Carderock, both Sinfield and Farren began welding filler metal research and development almost immediately, working with now-retired Carderock engineer Richard Wong on various prototypes. Like any early stages of an investigation, they found as many problems as they did success points in their work.

“The original 10% Nickel steel filler metal was based on a base metal chemistry that was not optimal and was not as strong,” Sinfield said. “It didn’t have the right proportions of alloying elements such as manganese and silicon, and the carbon too was too high to have good weldability. After early evaluations and techniques were tested, Sinfield, Farren and Wong transitioned from using house technologies to industrial practices and processes to create a more potent, translational solution. A Cooperative Research and Development Agreement was formed with an industry partner, Carpenter Technology Corporation, and the company encouraged the group to file a patent for the work they produced. The group teamed up with eight other engineers from Carpenter Technologies to take their efforts further. William J. Martin, Richard H. Smith, Shane Parra, James E. Heilmann, Paul M. Novotny, Patrick C. Bay, Dan Dukonion and Joe Stravinskas. When the patent was awarded, it was exclusively licensed by Carpenter Technologies.

The team’s main goal was to develop a high-strength steel filler metal that would be cooling rate insensitive with respect to weld metal strength and toughness, and have a low susceptibility to cracking.

“Typically, as strengths in a weldable steel systems increase, the window of operability (i.e., susceptibility to cooling-rate) gets smaller and smaller,” Sinfield said. “By improving filler metal chemistry tolerances become much tighter, which makes it difficult to manufacture consistently.”

According to the patent, achieving both high strength and good toughness in steel welds with a yield strength above 100 kilopounds per square inch (ksi) has been historically difficult. For legacy consumables such as MIL-1205 and MIL-540 type high strength welding electrode, the rate at which metals cool result in a specific microstructure that dictates the material properties. With those types of metals, there is a narrow range for cooling rates that are suitable to achieve the desired microstructure and weld metal properties. By using the 10% Nickel solution, Sinfield said that will have more consistency in their microstructure and properties that are a function of cooling rates and welding parameters.

Metal testing is far from inexpensive and Sinfield said that the decision to get an industry partner for this project was as much about mitigating costs as it was about leveraging accumulated technology to turn the theory into a reality. Having an industry collaborator in the development also lends itself to having a ready made transition partner. Development of the optimized formulation was not an overnight operation either, as the filler metals often took six months to a year to produce, and that is before testing. Sinfield believes that the use of this metal solution could be beneficial in a handful of arenas, from ship building and joining of armor steels, to additive manufacturing factory and whatever uses industry partners like Carpenter Technologies can find.

“In order to get the filler metal into the commercial market, we need to generate relevant data for broad industrial applications,” he said. “There needs to be a vetted database of mechanical and material properties that designers and fabricators can reference to determine whether or not they can use it on their designs.”

In addition to Sinfield, Farren and Wong, other Carderock engineers and technicians made contributions to research of this technology including Daniel Bochetti, James Hayken and Johanne DeLoach, as well as retired employees Gene Prusak and Richard Berndt.

Over the years, the work has been funded by contributions from both Office of Naval Research and Naval Innovative Science and Engineering programs.

"It behoves us (the Navy) to help insert new materials of interest into the commercial market to accelerate risk mitigation and further characterize the material as concurrently work to adopt it for naval applications," Sinfield said. “For the insertion of new materials, we’re always in this bit of the chicken or the egg scenario coupled with an associated aversion to risk. Having more commercial users and having experience with the alloy will only help us in the end to develop these material databases and buy down that early adoption risk.”

The original 10% Nickel steel filler metal was not optimized for welding,” Sinfield said. “It didn’t have the right proportions of oxidizing elements such as manganese and silicon, and the carbon too was too high to have good weldability.”

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The vibrating group at NSWC Philadelphia was able to determine three to take to the flow, Coakley said. “That’s what made me think of the chevron fairing.”

To test the idea, Coakley took cable samples to Carderock’s 36-inch water tunnel and measured the vibration produced from the water running over the cables. About 40 samples were tested and from those, Coakley was able to determine three to take to the 12-inch water tunnel for further evaluation. The vibrating group at Carderock partnered with NSWC Philadelphia assisted Coakley with finding the most effective method to measure the cables’ response to water speeds between 0-20 knots.

The chevron ribbon fairing, according to the patent, is designed to accommodate tow angles between 10 and 90 degrees. If the vertex angle of this fairing is double that of the cable’s towing angle to the flow, the chevron concept can operate at its highest efficiency. A variety of pliable materials can be used to make the fairings, which are woven through the cables as the chevron’s legs are free to move and align with the flow of movement.

By itself, though, the chevron ribbon fairing was not as effective as Coakley hoped it would be. “In a couple cases it turned out to be a little bit better, but in other cases a little bit worse than existing fairings,” he said. What he did discover was that combining the chevron concept with a second type of fairing – a Sandwich Ribbon Fairing – would yield more favorable results for reducing hydrodynamic drag.

“Around the same time, I put in a patent application for the Sandwich Ribbon Fairing,” said Coakley of the second fairing, which is still in pending status. “What this does is come up with a simple means by which one can have a ribbon fairing with a variable stiffness and increased stiffness. If the fairing stiffness is increased the right amount, then you can eliminate the flapping and waving in the flow at realistic speeds.”

Coakley also said that funding for fairing improvements have since ceased as the Navy determines if such will be necessary at a large scale. Should the decision be made to go forward, he is confident that a combination of enhancements including those he investigated can provide positive outcomes for the systems that would benefit.

“It’s always going to be a niche for the Navy because we don’t have that many towed systems,” Coakley said. “In cases where fairings are used, it turns out they’re very important. They can make or break a system.”
Capt. Kristi M. Luttrell, Commander, discusses her topic "A Volcano of Oil at the Bottom of the Gulf," (U.S. Navy photo by Edvin Hernandez)

"We spent a year trying to get our game plan right," Luttrell said. "I was working in the foundry industry for General Motors and suffered third degree burns after equipment malfunction. I stripped my clothes off in the hall, I realized I had third degree burns on my neck. I was treated silver sulfadiazine (Silvadene) to treat his dermal burns and prevent infection and then expected to go back onto the factory floor to continue his normal duty."

"My boss at the time asked me if I knew what I did wrong, and I told him yes, I closed up on overflow' and he said, 'OK, don't do it again and wanted me to get back to work 30 minutes after the incident," Seidle said. "They treated molten aluminum like it was water." In 1995, Seidle accepted a position with a joint venture between Alcoa and Cast Metals Industries, becoming the plant manager of the CMI-Precision Mold casting facility in northern Indiana. It was at Alcoa where Seidle met O'Neil and witnessed positive change in safety protocol at the workplace. O'Neil announced there would be zero tolerance for being injuried on the job, Seidle said. The new safety culture developed a powerful relationship between factory employees and leadership personnel. Seidle recognized the effects of this change and mentioned to Carderock employees that he models his leadership after O'Neil. He highlighted values as an agent of change that can influence an individual's working environment. Seidle emphasized leaders must express their values clearly, be intentional in their behaviors and recommended everyone remain true to themselves.

"I tell people all the time, if you find that you're incongruent between your work-self and personal-self, you ought to pause and reflect," he said. "The things you decide to be about, you need to be about. You need to be who you are."

Other qualities important to leadership, according to Seidle, included unity, authenticity and service. "When we do things for others, it makes us happy," he said. "Looking after their well-being and considering their needs should not be underestimated. I'm here to tell you that if you do those four things, if you model yourself on values based behavior; if you're authentic and comfortable in your own skin, serve others well, and care enough to share, you will impact your culture wherever you are at."

"Engineers Week started Feb. 11 with a presentation from the Commander of Naval Surface Warfare Center New Orleans Commander Capt. Kristi Luttrell and Chief of Emergency Operations Branch at the Coast Guard Sector New Orleans Commander Capt. Kristi Luttrell and Chief of Emergency Division Technical Director Dr. Brett Seidle quizzes NSWC Carderock employees on leadership qualities during his Engineers Week presentation on Feb. 19, 2020. (U.S. Navy photo by Harry Friedman)"
Since March, the United States has been combatting a modern pandemic that has forced major organizations, like Naval Surface Warfare Center (NSWC), Carderock Division, to alter their work habits. Although the global health crisis has canceled many events around the world, the Technical Director’s (TD) Cup proceeded in a new, virtual format.

The TD Cup, which is a cross-Warfare Centers competition, aims to enhance workforce development for employees with less formal technological experien ce in machine learning and artificial intelligence (AI). While the competition has been held in Panama City, Florida, since its inception in 2017, this year’s TD Cup was moved to local venues for each participating team in light of global health concerns.

Team Goose Busters represented Carderock at this year’s competition and featured employees from multiple disciplines across the command. Engineers Stephanie Blaise, Alexandra Lechner, Isaac Downey and Mei Ling McAfee were selected to represent Carderock’s team, and were joined by their team mentor Benjamin Gordon. During Sept. 14-18, team Goose Busters performed trial runs of their unmanned ground vehicle (UGV) at Carderock’s Olney Support Center in Olney, Maryland.

The objective for this year’s TD Cup was to clear an amphibious landing path of Improvised Explosive Devices (IEDs) for Marines. Each team was responsible for developing a method to identify and disarm IEDs using AI and machine learning. The objective for this year’s TD Cup was to clear an amphibious landing path of Improvised Explosive Devices (IEDs) for Marines. Each team was responsible for developing a method to identify and disarm IEDs using AI and machine learning.

“Manning the project, we had to investigate what state the robot was in before September’s competition, which undoubtedly managed to create an opportunity for young engineers to meet and work with other employees outside their branch and gain some exposure to project management,” Gordon said. “I was able to provide some guidance, and I’m very proud of what we accomplished with our project.”

The team had a robot in March that Goose Busters used until their own robot arrived at the end of July. This robot was warmly received by the team, which kept them on schedule to deliver their experimental design. Some of the unique ideas the team added to their robot included a five-axis robotic arm with wire-cutting capability; a small raspberry pi camera; a stereo camera; and a LIDAR system. Each piece of equipment played a critical role in the team’s navigation, classification and neutralization challenges.

Although the team only had a little over a month to incorporate their additive onsite before September’s competition, they undoubtedly managed to create an opportunity for young engineers to meet and work with other employees outside their branch and gain some exposure to project management. “Working with Rod Peterson and Technical Director Larry Tarasek, who has been a key figure in the TD Cup on Sept. 17, 2020.

There was a lot of fabrication work and cable work that was done, as well as CAD (computer-assisted design) modelling to determine the best place to put our sensors.”

One of the most difficult challenges the team faced was the departure of their teammate, Alejandro Lechner.

“We started out as a team of four, but once our team members left government employment for another job opportunity around the beginning of August,” Gordon said. “After her departure, the rest of the team had to pick up the pieces of the project she had been working on, which was mainly the object recognition and classification side of things.”

On Sept. 17, Goose Busters performed their competition run at Carderock’s Olney Support Center with Carderock’s Technical Director Larry Tarasek, who has been a key supporter throughout the year, in attendance. Huddled together by a tent, Downey, McAfee and Blaise operated their robot by using computer monitors and Bluetooth to communicate with it, and manually controlled their device by using a PlayStation 4 controller. With these functions in place, they were able to adjust speed levels and guide their robot through the hay-baled obstacle course.

There were three judges who assessed the team and their robot as it attempted to complete the mission. Each judge was assigned to evaluate a certain part of the trial run, which included obstacles hit, targets neutralized, manual control and time elapsed. Of the 15 targets – 13 of which were eligible for neutralization - the team managed to identify nine, neutralizing seven of them in the process.

Gordon, who managed all administrative components for the team with Marine Corps Vulnerability and Project Lead Rodney Peterson, said he appreciated the hard work of NSWCPanama City, who outlined obstacle course specifications and the scoring rubric for the competition. While Gordon handled the team’s expenditures, communication with other WCs and scheduling, he also served as technical support for the team.

“Although I wasn’t allowed to do any actual work myself, if the team had conceptual questions or needed some ideas on what direction they should be going, I was able to provide that guidance,” he said. “Since the competition was moved locally, I was responsible for setting up the course and organizing the judging. It was quite a unique experience, especially buying 200 bales of hay, but the experience was invaluable because I got to see the project from an organizational point of view rather than a technical one.”

The 2020 TD Cup was Carderock’s first involvement in the competition, and Tarasek is keen to continue participating at the event. “I thought it was a great opportunity to create a team of Carderock engineers from across the command that could put together an unmanned capability and compete against the standards for future Carderock teams. This way we are going to innovate and collaborate in the future.”

While planning for next year’s competition has already begun, Goose Busters have set the standards for future Carderock teams. As Carderock’s TD said, “COVID hit, and it didn’t slow them down, kudos to all of their hard work.”
CARDEROCK MEMBERS RECEIVE EXPERIENCE OF A LIFETIME

By Todd A. Hurley, NSWC Carderock Division Public Affairs

Two Naval Surface Warfare Center, Carderock Division employees recently participated in the experience of a lifetime. Brian Mills, naval architect and test engineer, and Thomas Bruno, electrical engineer, both from Carderock’s Dynamic Measurements and Testing Branch of the Survivability and Weapons Effects Division, were Pacific Fleet (PACFLT) representatives for Exercise Valiant Shield, one of the largest U.S. military war games held in the Pacific Ocean.

Bruno, Mills and a few other individuals initially volunteered to be part of a different exercise back in February, but plans stalled due to the Coronavirus. When PACFLT came back later and asked for help with Exercise Valiant Shield, Bruno and Mills leapt at the opportunity, despite the rigid restriction of movement (ROM) requirements.

The two flew to Japan where they underwent an 18-day quarantine at Naval Station Yokosuka, bound to a single barracks room together.

“We were friends before, but sharing a room for that long definitely bonded us,” Bruno said. “We were there to take notes and make observations - to capture what was going on in the room,” Bruno said. “PACFLT can see the different decisions the ships made, we were there to provide the why.”

Once their quarantine was complete, the two were transported directly to the USS Antietam (CG 54), where they served as data collectors.

“We were there to take notes and make observations - to capture what was going on in the room,” Bruno said. “PACFLT can see the different decisions the ships made, we were there to provide the why.”

Mills went on to add that, “We weren’t assessors; we were there to observe the actions. After each event we would type up our notes and submit them to PACFLT.”

The two did not, however, get to experience Exercise Valiant Shield together. Mills served aboard USS Arizona (CG 54), a Ticonderoga-class guided missile cruiser, and Mills served aboard USS Barry (DDG 52), an Arleigh Burke-class guided missile destroyer.

“Typically there are a team of observers on each ship, and some ships had two or more observers (USS Ronald Reagan and USS Shiloh). Thomas and I were the only solo observers on separate ships,” Mills said. “We had no experience, so we had to learn on the fly.”

While the war game exercises took up the majority of their time, the two of them were still able to get a glimpse into the everyday life of being a Navy Sailor.

“We got to witness two or three live-fire events,” Bruno said. “That was incredible. Aside from that, I really enjoyed meeting the Sailors and listening to their stories. It was interesting to learn what it’s like to be a Sailor during COVID-19 - they are stuck on the ships, they can’t really go anywhere.”

Even when the ship is in port, they are never allowed farther than the pier.

Mills, on the other hand, was already well aware of what it was like to be a Navy Sailor:

“I joined the Navy a few years after High School,” Mills said. “I qualified for the Navy Nuclear Power Program, which seemed like a cool opportunity, so I did that and went to work on submarines, because I wanted to learn more about them.”

Mills was on active duty for six years and served aboard USS Connecticut (SSN 22), a Seawolf-class nuclear powered fast attack submarine.

“Overall, it was a great experience, and I learned a lot,” Bruno said. “It was interesting to be in the ship’s command center and to see what modern naval warfare is all about. It was very rewarding to see how the work we do in our daily jobs affects the fleet and their effectiveness.”

For Mills, his favorite part about not only participating in Exercise Valiant Shield, but also working at Carderock is “the feeling of still being part of the Navy team and being able to provide a service,” he said.
Capt. Todd E. Hutchison relieved Capt. Cedric J. McNeal as commanding officer of Naval Surface Warfare Center (NSWC), Carderock Division in a ceremony July 10, 2020, in West Bethesda, Maryland.

McNeal, who was the 38th commanding officer at Carderock, thanked as many people as he could during the ceremony, focusing on the contributions and talents of each department.

During his time at Carderock, McNeal saw his fair share of both successes and challenges. He commended the people of Carderock for their steadfastness in support of the mission.

"Carderock has the ability to navigate – as demonstrated during this time - through whatever challenges that may be presented and still continue to excel, deliver and be known for the pillar of ship and submarine design," McNeal said.

Capt. Michael Richman, chief of staff for Naval Surface and Undersea Warfare Centers, presented the Legion of Merit Medal to McNeal for his performance as the commanding officer of Carderock Division.

"Capt. McNeal ensured NSWC Carderock’s world-class facilities supported continued delivery of capability, with improved material condition of testing infrastructure, across its various acoustic measurement sites," according to the award citation. "His leadership was crucial in finalizing the acquisition of the Olney Federal Support Center, enabling NSWC Carderock to accept more tasking to address emerging threats in developing ship and submarine training systems, acoustic, electromagnetic and topside signature solutions, and next generation platform designs."

Richman then presented McNeal with a plaque, thanking him on behalf of Rear Adm. Kevin Byrnes, commander of Naval Surface and Undersea Warfare Centers.

"It’s important in this day of great power competition that all the divisions are giving 100% to the mission," Richman said. "Certainly, Carderock is doing that, and that’s a testament to, not just the workforce at Carderock, but also to your leadership."

McNeal’s next assignment was to Naval Sea Systems Command (NAVSEA) as the Amphibious Warfare Program Manager (PMS 377). He had been in a program office before coming to Carderock, and he said, in a sense, he “grew up” there. However, he said that having been the commanding officer of a Warfare Center gave him a renewed perspective going back into program management.

"I have much more appreciation for the Warfare Centers and what they bring in the way of talent, technical expertise and support for the enterprise," McNeal said.

In closing, McNeal again thanked all the Carderock employees for making his experience something he will always remember.

"With some of you – we’ve cried, prayed, laughed and argued - I guess that makes us family," McNeal said. "But, most importantly each of you have inspired me to be better, and while your military leadership changes today, your push to continue to be the best should never change."

Hutchison came to Carderock from NAVSEA, serving as a deputy assistant program manager in the Guided-Missile Frigate (FFG(X)) Program Office (PMS 515), where he worked with McNeal. Earlier in his career, he was the commanding officer of USS Michael Murphy (DDG 112), the culmination of his career as a surface warfare officer.

When taking command, Hutchison thanked the people in his life and said he was honored to become the 39th commanding officer of Carderock.

"From its start over 120 years ago at the Experimental Model Basin at the Navy Yard, with Adm. David Taylor as its first commanding officer, to its move to this location just before World War II, and over the years to the expansions to sites all over the country, the one constant has been the unprecedented contributions the women and men of Carderock have made to our Navy and our country," Hutchison said. "I am thrilled to become a member of this team, and excited to see what the next several years will bring."
Experiencing the severities of a society that I was born and raised in the segregated south and graduated from Howard University in Washington, D.C., instilling in him early in life the importance of perseverance during adversity.

"As I laid down on the ground, I knew something was wrong with me, and I knew it was serious," Gadson said. "I couldn't move. My last thoughts before I lost consciousness were 'God, I don't want to die in this country.' And then I was out."

He survived the explosion, but needed over 100 units of blood and went into cardiac arrest six times within the first six hours of the attack. Four days after he was wounded, Gadson was transferred to Walter Reed National Military Medical Center. The next few weeks were filled with surgery after surgery, ultimately resulting in the amputation of both of his legs above the knees and losing some functionality in his right arm. At times, Gadson could not see a positive outcome to his situation and felt like giving up, but remembering his duty to his family at home and his soldiers still deployed helped him find a renewed sense of purpose.

"That's why we do observances like this, so that we can live up to the best that we can be," Gadson said. "That is our strength, and that is our challenge."
By remembering the past, we can secure our future.

The theme this year for NDEAM was commemorating the 75th Anniversary of World War II. The theme for NDEAM was "Honoring the Past, Securing the Future," and the National Disability Employment Awareness Month (NDEAM) event on Oct. 22 featured Carderock employee Tony Madalena, director of operations for the Center of Innovation in Ship Design (CISD).

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Every year, the United States celebrates National Women’s History Month, a celebration that was not made official until 1981 when Utah Senator Orrin Hatch and Maryland Representative Barbara Mikulski co-sponsored a Congressional resolution. Originally, it was only a Women’s History Week and was created to include March 8, International Women’s Day. It expanded to be the entire month in 1987.

Naval Surface Warfare Center, Carderock Division celebrated Women’s History Month on March 3. Yeager is the first female active duty or National Guard general officer to lead a combat infantry division.

“I’m proud that diversity is working in our armed forces. It’s not just words in my organization. I have been mentored and supported for many years, and it’s the reason I am in the position I am today,” Yeager said.

She is a two-star general who flew combat operations with the California National Guard in 2011, led California’s 40th Combat Aviation Brigade and became the top officer on June 22, 2019. Yeager has served since 1995 and earned her first star in 2015. Earning this star made her only the fourth female general officer in California National Guard history to do so.

In 2013, the Secretary of Defense lifted the restrictions on women serving in combat roles. “This is what led the way for me to be able to serve in the role the way I am now,” Yeager said.

In 2016, two women graduated from Ranger School for the first time. There are now 63 women serving as either generals or admirals across the armed forces according to figures by the Service Women’s Action Network.

The new Marine Corps Commandant Lt. Gen. David Berger told Congress in April 2019 that male and female Marine Corps recruits could be training together sometime this year, ending the service’s standing rules of segregating recruits into separate training units in boot camp.

“Hopefully we’ll get to a point where there are no more firsts,” Yeager said. “Unfortunately, somebody always has to be first, and these women lead the way for people like me. There’s a saying that goes, ‘You have to see it, to be it’ and now there’s a whole generation who can see that they can do it.”

Yeager then talked about women trailblazers, such as Marie Curie, Sally Ride, Clara Barton, Susan B. Anthony, Eleanor Roosevelt and Rosa Parks.

“The former governor of Texas, Ann Richards, once said ‘Ginger Rogers did everything that Fred Astaire did, but moving backwards and in heels,’ and I think that’s true, but I would like to say that we are now doing everything that men do, and we’re doing it in combat boots moving forward,” Yeager said.
NEW NSWC/NUWC COMMANDER VISITS CARDEROCK

James (Jake) Shilling (right) talks to Rear Adm. Kevin Byrne on June 4, 2020, about the capabilities in Naval Surface Warfare Center, Carderock Division’s Deep Submergence Test Facility, which houses pressure tanks of varying capacities and pressure ratings to simulate deep ocean environments for structural test and evaluation. Byrne was at Carderock for his first tour of the West Bethesda, Md., site since becoming commander of the Naval Surface and Undersea Warfare Centers.

(U.S. Navy photo by Nicholas Brezzell)

SECNAV & ALASKA SENATOR TOUR SEAFAC

J enny Kelso (fourth from right), site director for Naval Surface Warfare Center, Carderock Division’s Southeast Alaska Acoustic Measurement Facility, provides a tour of the Ketchikan, Alaska, site on Aug. 31, 2020, to Secretary of the Navy Kenneth Braithwaite (left of Kelso), U.S. Senator Dan Sullivan (third from left), and members of the Alaska state legislature. The Alaskan Senator invited Braithwaite on a tour of Alaska, and Ketchikan was the first stop. Kelso provided a tour of the Back Bay Shore Facility and briefed them about Carderock’s history of full-scale acoustic testing and the unique acoustic environment in Western Bohm Canal that allows them to make critical measurements for the fleet. The SEAFAC Static Site in Bohm Canal is in the background.

(Photo provided)

PEO SUBS VISITS ACOUSTIC RESEARCH DETACHMENT

R ear Adm. David Goggins, Head of the Program Executive Office for Submarines, visited Naval Surface Warfare Center, Carderock Division’s Acoustic Research Detachment in Bayview, Idaho, on Jan. 27. While there, Goggins toured ARD’s large-scale models, facilities and measurement capabilities with a focus on how these facilities and models support important Navy acoustic signature technology initiatives and programs. Carderock Signatures Department Head Dr. Paul Shang briefed Goggins on the overall mission of the Carderock Signatures Department and ARD Director Alan Griffin gave him an overview how ARD is supporting present and future submarine programs. Pictured from left to right: Tom Pfeifer (Carderock), Pat Taylor (Carderock), Kelly Veillette (Carderock), Sherry Carden (ARD), Brian Carter (PEOSS), Goggins (PEOSS), John Vlattas (PEOSS), John Becker (Carderock), Marylou McNamara (Carderock) and Griffiths (Carderock).
A lot of these teachers that have been chosen for the fellowship have stellar leadership skills behind them,” said Charlotte George, Carderock’s STEM and Outreach Program Director. “It is great to see their energy outside of the classroom towards what some might say is the bigger picture of education.”

When the command hosts events such as a robotics competition or the Carderock Math Contest, it naturally draws many local participants. However, as George pointed out, teachers are not beneficial for the students if they do not align with what they are learning in class. While STEM professionals may get passionate about their work, she said that the missing perspective from not formally trained educators, or someone with experience in an established STEM field, can sometimes impact how productive outreach endeavors are. Teachers want their students to be interested in the field, and organizations such as Carderock want the teachers to want to continually bring in fresh faces, making it a must that both sides understand one another’s needs. Spending the year in the AEF allows teachers to address those needs at the highest levels.

“By learning more about the work done at Carderock, I’ll have more first-hand, real-world knowledge to share with my students,” Tuchscherer said. “I hope to translate my experiences in an established STEM office and my interactions with teachers and students in the area to improve the initiatives in my rural Missouri region once I return home.”

Carderock’s involvement with the program began from a working relationship between Tyson Tuchscherer, an alum of the program, and Toby Ratcliffe, Carderock’s former STEM Outreach Coordinator. Tuchscherer left his position as a math and science teacher in Oregon for his fellowship obligation in 2006, and opted to stay in the Washington, D.C., area when his term concluded. His post-fellowship journey led him to working on the National Defense Education Program at the Office of the Secretary of Defense, where he and Ratcliffe initially crossed paths. By 2009, Tuchscherer began to make regular appearances at Carderock and saw the potential that an AEF participant could have with the command.

“Tuchscherer said. “The command had a period without a STEM director for a few years, then Charlotte came on, and I got her interested. This time, the opportunity, funding and interest was there. All the stars aligned to make it happen.”

“By having a larger group of my STEM and Outreach Program staff, it allowed me to provide more effective support for the fellows,” George said. “It shows that the STEM and Outreach Program is expanding its reach and capabilities.”

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Charlotte George (left), STEM and Outreach Program Director at Naval Surface Warfare Center, Carderock Division; Debbie Reynolds, Carderock’s Albert Einstein Distinguished Educator Fellow for 2019-20; and Eric Silberg, an aerospace engineer in Carderock’s Sea-Based Aviation and Aeronautics Branch, attend the 2020 Space Exploration Educators Conference in Houston, Texas, in February. (Photo provided)

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CARDEROCK SIGNS EDUCATION PARTNERSHIP AGREEMENT WITH UDC

By Edvin Hernandez, NSWC Carderock Division Public Affairs

Naval Surface Warfare Center, Carderock Division and the University of the District of Columbia (UDC) signed a five-year Education Partnership Agreement on July 6 in West Bethesda, Maryland.

The agreement, which Commanding Officer Capt. Cedric McNeal and Technical Director Larry Tarasek signed with UDC President Ronald Mason, provides UDC graduate students research opportunities, internships and professional guidance in additive manufacturing, nanotechnology, material science and robotics education at Carderock.

Through this partnership, UDC students will be exposed to the command’s unique facilities, equipment and research relating to surface warfare science and technology.

"This Education Partnership Agreement affords both Carderock and UDC to make headway," UDC Chief Academic Officer Lawrence Potter said. "It is clear in our work - in our deliberations through the EPA - that this fully aligns with our mission as the district’s only public university. The value of UDC in terms of our graduate internships and research opportunities for students at the university will be truly enhanced by the signing of this agreement - we very much welcome the opportunity today."

Carderock offers world-class research in the development of hydrodynamics, structures and material technology, material systems and signature and silencing systems, among more. Carderock has collaborated with several educational institutions, helping establish an encouraging environment in promoting science, technology, engineering and mathematic (STEM) careers for students.

"I cannot tell you how excited we are - as a command - to not only be able to expand our reach, but most importantly partner with UDC in knowledge sharing and collaboration," McNeal said. "There is enormous potential here starting with not only recruitment for hire, professor rotations and internship opportunities, but also the ability to engage with the faculty and staff at UDC. This will help us tackle some of today’s top challenges and support the defense of our nation."

Tarasek spoke about the importance of staying ahead of America’s competition, and highlighted additive manufacturing as a key component.

"Areas like additive manufacturing and digital sciences are critical for Carderock Division to be at the forefront of both of those areas," he said. "We look forward to partnering with UDC - not only in those areas, but in several engineering focuses."

Mason talked about his experience partnering with defense labs and the benefit he has seen in those partnerships.

"We do appreciate this opportunity," Mason said. "I see a lot of potential in it, and I guarantee that, as an institution, the University of the District of Columbia will put everything we can into making it work."

Dr. David Drazen, Carderock’s Chief Technology Officer, will serve as the Partnership Program Manager (PPM) on behalf of Carderock.
CARDEROCK INKS PARTNERSHIP WITH MARYLAND TEDCO
By Benjamin McKnight III, NSWC Carderock Division Public Affairs

Establishing collaborative relationships with non-Department of Navy entities is a key component to the operational success of naval laboratories across the nation.

September marked yet another milestone for Naval Surface Warfare Center, Carderock Division, in the realm of professional collaborations as the command entered a Partnership Intermediary Agreement (PIA) with the Maryland Technology Development Corporation (TEDCO) on the 11th. The signing of the PIA, facilitated by the NavalX Capital Tech Bridge, took place at The Garden in Alexandria, Virginia. On hand for the ceremony was Capt. Todd Hutchison, the commanding officer of Carderock; Troy LeMaile-Stovall, the newly appointed CEO of TEDCO; and Dr. Krista Michalis, director of the Capital Tech Bridge, in addition to other essential leaders within the command.

“This agreement will foster the development of the regional technology ecosystem,” Hutchison said. “It really grows the network between industry, academia and government, as it’s related to maritime technology.”

Although the agreement is between two entities in Maryland, and The Garden is located in Virginia, regional Tech Bridges typically use off-post sites to facilitate cooperative work for accessibility purposes, making The Garden a marquee selection. Hutchison and LeMaile-Stovall were given a tour of the facilities prior to the ceremony to see all of the capabilities and features that Carderock and TEDCO will have at their disposal during this relationship.

“If you ever get the opportunity to come visit The Garden, it is amazing. I’ve seen it on social media, but seeing it in person is definitely next level,” Hutchison said.

When the Navy decided to form regional Tech Bridges, the intent was to enhance collaborations between naval labs, academia, industry and other military branches to accelerate the creation of solutions to the warfighter’s needs. Twelve NavalX Tech Bridges currently operate in all corners of the United States and in between, including the two Carderock is a part of the Capital Tech Bridge which Carderock leads, and the Mid-Atlantic Tech Bridge that the command’s Combatant Craft Division in Norfolk is partnered with.

TEDCO Chief Executive Officer Troy LeMaile-Stovall signs and places a puzzle piece on the visitor wall at The Garden Alexandria following the Partnership Intermediary Agreement signing ceremony on Sept. 11, 2020. This agreement will be a five-year partnership to promote opportunities for cooperative activities between Carderock and small business firms and educational institutions under TEDCO’s purview.

(U.S. Navy photo by Benjamin McKnight III/Released)
Every year, Carderock employees work in conjunction with different universities around the nation on Navy-related projects.

"Initially NEEC was led by the University of Michigan with NAVSEA as the primary partner," Dr. Natasha Chang said, a mechanical engineer in Carderock’s Hydroacoustics and Propulsor Development Branch. "It was created to make sure there is a pipeline of students who would graduate from their universities and want to work for the Navy."

This year, there are seven Carderock-funded NEEC projects being coordinated and facilitated at universities around the nation.
The project itself, which is comprised of Testing and Signal Analysis for Noisy and with the NEEC program since its creation, only care about, but ones that a team of continuously participating in NEEC projects of Michigan. This project – the Acoustic he advertises positions for paid year-long undergraduate students can execute and be successful, Chang said.

"I talk with the applicants and ask each for their resume and transcript," Dowling said. "I then start with the students who have the highest GPA. Though, admittedly, GPA is not always a direct measure of how useful the student will be on the project."

Once the students are chosen - Dowling chooses two per task (for a total of eight), with at least one of the two students on each task being a graduate student or a student with NEEC experience - he and his students then begin working on the project.

"The emphasis of the work has been on acoustic array methods that are not commonly taught, but are interesting to the Navy," Dowling said.

According to Professor Dowling, there are two common problems that the Navy runs into: the Navy has assets that, when put into the water, are used to detect adversaries, and it also has assets that move through the water on their own, which might make them less easily make themselves known to the Navy's adversaries.

"This is something that should happen as infrequently as possible," Dowling said. "What we are trying to do is determine how the Navy can detect their adversaries while also being quiet enough to where they are not detected.

Dowling serves as a mentor and supervisor on the project, while his graduate student provides the majority of day-to-day assistance needed by the undergraduate students.

One current project task revolves around finding simple ways to use accelerometers to quickly locate an unknown sound on a ship.

"We are generally looking at locating the source of sounds and vibrations when they are unknown, while using multiple remote microphones, hydrophones, or accelerometers," Dowling said.

Dowling ensures that when his students are helping on his projects, the experience is vastly different than their normal course work.

"I put emphasis on learning how to do something by physically doing it – ‘learn by doing’. I don’t quiz them, and I don’t give them homework. The students get a lot of experience like this from their regular coursework, but this is 10 times more than what I try to make the NEEC project work different," Dowling said.

Over the years, three of Dowling’s prior students have gone on to work for the Navy. "I find the work fascinating," Dowling said. "I like that I get to spend time with these young, energetic folks. It is very satisfying and ever refreshing."

Furthermore, Chang ensures that at least one student per project is rewarded for their efforts.

"Each student or group of students earns a project at the end of each year we like to bring in a student to Carderock and give them a tour of the base. The end objective is to get the students excited and interested about working with the Navy," Chang said.

University of Michigan
Dr. Natasha Chang, who has been working with the NEEC program since its creation, is part of the FY20 project at the University of Michigan. This project – the Acoustic Testing and Signal Analysis for Noisy and Complicated Environments - is led by Professor David Dowling, a professor of mechanical engineering, who has been continuously participating in NEEC projects since its 2001 creation.

"My job is to work with Professor Dowling to come up with projects that we not only care about, but ones that a team of undergraduate students can execute and be successful," Chang said.

The project itself, which is comprised of four tasks, is performed by Dowling and his students, whom he hand selects, in his laboratory at the University of Michigan.

"Professor Dowling teaches undergraduate acoustic courses, and throughout the year he advertises positions for paid year-long internships, as well as summer internships. He then interviews the candidates, finds out who is truly interested and hires the best fits," Chang said.

The process of finding the perfect fit of students can be quite difficult.

Florida Atlantic University & the University of Tennessee-Knoxville
Charlotte George, NSWC Carderock Division’s STEM and Outreach Program director, has been involved with the Naval Engineering Education Consortium (NEEC) program even before she began working there.

"I was a NEEC researcher at Florida Atlantic University (FAU) on a Carderock project the summer before I started at Carderock," George said. "As the STEM and Outreach Program Director for NSWCDD, I now manage all of the Carderock's NEEC efforts."

Eight years after participating in student research for Carderock NEEC efforts, George is not only director of the STEM and Outreach programs, but she is making significant contributions to augment the NEEC strategy to make naval research more accessible to a broader amount of students.

"Traditionally, Carderock's NEEC projects focus on a single student at a college or university, but Carderock is reshaping their NEEC strategy to make naval research more accessible to a broader amount of students.

"It felt like we could do more with the funding we were given, so I decided to siphon off a very small percentage to hand projects with experiential-learning opportunities focused on student teams tackling real-world naval problems," George said.

"Beyond being a research grant, it is a pipeline for the Navy!

This not only allows Carderock to get more students involved in the projects, but also gives experienced, but Navy-relevant work to a greater amount of people.

The two newest schools to participate in Carderock’s NEEC program are the University of Tennessee-Knoxville and Florida Atlantic University. - George’s alma mater. Both have done NEEC projects with Carderock before, but Carderock will take the old model that focused the bulk of research efforts on only one student.

The majority of Carderock’s NEEC projects have a fairly equal ratio of undergraduate students and graduate students. However, that is not the case with Florida Atlantic University.

"At the end of each year we like to bring in a student to Carderock and give them a tour of the base. The end objective is to get the students excited and interested about working with the Navy," Chang said.

This project title for Florida Atlantic University’s NEEC efforts is the Senior Design Project in Support of Naval Applications.

"The specific topic will be chosen by the students during the first week of the semester, though it will likely deal with the topic of autonomous surface vehicles or underwater vehicles," George said.

"They started experimenting with standard filament, but wondered what would happen if they used something less standard. So, they take water bottles from campus and make their own filament material by sanitizing them, shredding them and melting them,” George said.

The students will be working with their Carderock mentor on test projects, predicting with proper tools what they think the answer is and being able to validate those answers.

"We are trying to be more proactive instead of reactive," George said. "With the COVID-19 pandemic, we are working with the universities to ensure that students can work on these projects virtually and still experience the benefits of participating in NEEC research."

Florida State University
A Sailor applies non-skid to the deck of a ship. The primary objective of this project is to formulate methodology for predicting the mechanical properties of chopped fiber reinforced composites fabricated with a fused filament fabrication. Also, potentially more important is the intention to inform
“Working alongside Pojman on this project working time is exceeded, the batch of Coatings Engineering Branch. Consortium (NEEC) projects at Naval Compounds through Development of Novel due to solvent evaporation, have limited demand non-skid coating that intends to of products. coating is wasted. Pojman’s technology can fail to cure correctly, and if conditions change after application, the process immediately upon application that of dental fillings, is heat triggered. An advantage with the cure-on-time is, though, due to COVID -19 pandemic. While our mechanical engineering program have an easy time choosing the right project that Coyle and his graduate students are working on is a three-year process. The first year comprised of data collection, the second year - where they are currently at – is focused on data fusion, and the final year will consist of deploying their research and putting it to the test. With the help of his graduate students, Coyle has developed a software that synchronizes data that is gathered by unmanned boats and underwater vehicles. The data is collected by taking multiple measurements of objects from different sensors. However, for the data to be valuable, it needs to be condensed into a single format.

“T What I have enjoyed about working on this project is its wide-ranging applicability,” White said. “Almost every paint or coating the Navy uses suffers from similar problems and vulnerabilities. Developing the cure-on-demand technology and demonstrating the potential with non-skid is the first step in incorporating this technology to coatings elsewhere on the ship.”

“T working on this project, in order for the data to be valuable, is to turn the data into actionable intelligence that leverages the advantages of the data source that the Navy can use,” Coyle said. Furthermore, using the collected data, they are able to create multi-domain maps of the surface of the battle ship. They present themselves to accurately detect obstacles and other hazardous objects of interest both above and below the surface. This is a good way to introduce Pojman’s idea – Reduction of Volatile Organic material to that of dental fillings, is heat triggered. An advantage with the cure-on-demand coatings is that of dental fillings, is heat triggered. An advantage with the cure-on-demand coatings is that of dental fillings, is heat triggered. An advantage with the cure-on-demand coatings is that of dental fillings, is heat triggered. An advantage with the cure-on-demand coatings is that of dental fillings, is heat triggered.