

# Navy Explores the Future of 3D Printing

## CDSA Dam Neck, CNSL & NAVAIR Host Workshops for Deckplate Sailors & Industry Partners

**THE U.S. NAVY** hosted a series of “Print the Fleet” workshops to introduce three-dimensional (3D) printing and additive manufacturing to Sailors and other stakeholders.

The Navy’s events took place on the heels of the first White House Maker Faire that was held on June 18, 2014. The White House event showcased the work of entrepreneurs and forward thinkers from around the country, as well as students exploring Science, Technology, Engineering and Math (STEM) related skills.

“When you consider the cost and vulnerabilities of our existing Navy logistics and supply chains as well as the resource constraints we face, it quickly becomes clear that we have to reimagine how we do business,” said Vice Admiral Phil Cullom, deputy chief of naval operations for Fleet Readiness and Logistics, during a brief on June 23, 2014. “When additive manufacturing and 3D printing become widely available, we envision a global network of advanced fabrication shops supported by Sailors with the skills and

training to identify problems and make products.”

Admiral Cullom also welcomed (via pre-recorded video) participants to the Navy’s first “Print the Fleet 3D Printing Workshop” held at the Combat Direction Systems Activity (CDSA) in Dam Neck, VA. (Visit <http://youtu.be/dkZl6X9ucBg> to view the entire video.)

The Office of the Chief of Naval Operations, Director of Logistics Programs and Business Operations (OPNAV N41) has supported all workshops held to date. “Educating Sailors on the

increased readiness, savings and efficiencies afforded through additive manufacturing is one of our primary objectives,” said Dave Barrett, OPNAV 41. “One of the greatest benefits of introducing this technology to Sailors is the creativity it affords them in an otherwise very structured and standardized environment. Additive manufacturing can liberate the Sailor and empower them to get the job done without being overly dependent on others to resolve their problems. We are confident that Sailors will experience an increase in job satisfaction by empowering them with these new capabilities.”



The amphibious assault ship USS Essex (LHD 2) was successful at installing and using a 3D printer and also provided training to its Sailors on computer-aided design software.

*MC3 Raul Moreno Jr.*

The terms additive manufacturing and 3D printing are often used synonymously in mainstream media. However, 3D printing is technically a subset of additive manufacturing processes that refer to material buildup through a nozzle or other printing technology. Traditional subtractive manufacturing entails the removal of material (often by lathing, cutting, chipping or grinding) to create a final product. In contrast, 3D printing joins (adds) materials to make objects using 3D model data, usually layer by layer.

The traditional method is often time consuming, wasteful and costly. 3D printing, however, negates these issues while also affording the design of complex shapes that could not be created through traditional manufacturing techniques.

The Navy aims to train Sailors with this expertise in the future, according to Cullom. Adopting the 3D printer and other additive manufacturing capabilities could drastically reduce the wait for replacement parts, improve

readiness, decrease costs and avoid shipping parts around the world.

### CDSA Dam Neck Hosts First “Print to Fleet” Event

Personnel from OPNAV N41, Navy Warfare Development Center (NWDC), and CDSA Dam Neck co-sponsored the first Maker Faire—a two-day event on June 24 and 26, 2014—titled “Print the Fleet 3D Printing Workshop.” Each event was attended by about 60 individuals, both civilian and military, who learned more about additive manufacturing and discussed potential future uses of the technology across the Navy.

“Think of it as another tool in the toolbox,” said Jim Lambeth, additive manufacturing lead at CDSA Dam Neck. “If there is a part needed and it doesn’t exist in the inventory, not only can we cut costs, but we can design the part on demand. That’s what additive manufacturing is going to solve.”

## The Basics About Combat Direction Systems Activity Dam Neck

CDSA DAM NECK provides force-level integrated and interoperable engineering solutions, mission critical control systems, and associated testing and training technologies to meet maritime, joint, special warfare and information operation requirements related to surface warfare in the following four areas of expertise:

### 1. Integrated Training Capabilities for Maritime, Joint, Coalition, Interagency and Inter-Service Domains

CDSA Dam Neck currently provides key leadership and products for The Joint National Training Center (JNTC) located in Suffolk, VA.; The Joint Knowledge Development and Distribution Capability (JKDDC); and The Maritime Integrated Training Capabilities Laboratory Complex at Dam Neck which delivers Battle Force Tactical and Total Ship Training Systems to the fleet.

### 2. Force Integration & Interoperability Taskings for the Maritime, Joint, and Coalition Warfighter

The Multi-functional Land Based Test Site (LBTS) and Joint Test and Training Facility (JTTF) are two assets within CDSA’s Integration and Interoperability Laboratory Complex that enables them to serve the fleet and the warfighters from the Hampton Roads area while collaborating with other Department of Defense (DoD) commands, organizations, or agencies.

### 3. Engineering Expertise for the Acquisition and Delivery of Modern Integrated Combat Control Systems

The knowledge of CDSA Dam Neck engineers is leveraged daily for Advanced Sensor Distribution Systems (ASDS) and Ship’s Self Defense System (SSDS) MK II, Combat Systems Integration and the Carrier Modernization Program.

### 4. Modernization of Information Operations and Rapid Response Engineering Focused on Global Maritime Security Operations

CDSA engineers collaborate within the Naval Sea Systems Command and other DoD commands to deliver the right capabilities at the right cost to the warfighters who need specialized tools to complete unique missions every day.

For more information, visit [www.navsea.navy.mil/nswc/damneck](http://www.navsea.navy.mil/nswc/damneck).





ABOVE LEFT: Carolyn Lambeth, a mechanical engineer at CDSA Dam Neck, right, explains the process on additive manufacturing and 3D printing to Sailors during the U.S. Navy's first "Print the Fleet" workshop. The event showcased additive manufacturing techniques for Sailors and other stakeholders attending the two-day event.

*MC Seaman Jonathan B. Trejo*

ABOVE RIGHT: LT Chris Baxter, division officer at Fleet Readiness Center Norfolk, examines products created with 3D printing during the U.S. Navy's first Maker Faire titled "Print the Fleet."

*MC Seaman Jonathan B. Trejo*

RIGHT: LT Ben Kohlmann, U.S. Fleet Forces Command (left) discusses 3D printing with Dr. Marty Irvine, Head, Maritime and Joint Systems Department, Naval Surface Warfare Center Dahlgren/Dam Neck (center) and Ms. Karen R. Jackson, Secretary of Technology for the State of Virginia (right) at the "Print the Fleet" workshop.



LEFT: Chief of Naval Operations Admiral Jonathan Greenert reviews parts manufactured using 3D printing technology at NAVAIR's AVMI laboratory during his visit to NAS Patuxent River.

*Chief MC Peter D. Lawlor*

BELOW LEFT: CAPT Eric Tapp from CDSA Dam Neck addressing "Print the Fleet" workshop participants.

*Kenneth Hess*

BELOW RIGHT: LT Ben Kohlmann (center) and Carolyn Lambeth (far left) discuss additive manufacturing and 3D printing with Lance Bacon, *Navy Times* Reporter (far right), and Mike Gooding, WVEC ABC13 Reporter (bottom left) at the "Print the Fleet" workshop.

*Kenneth Hess*



Within days or hours of identifying a needed part on a ship, a 3D model can be designed and uploaded to a printer for production, allowing for a more rapid response to the ship's needs.

Earlier this year, the amphibious assault ship USS Essex (LHD 2) installed a 3D printer on board. Essex was successful in using the printer as well as training its Sailors on computer-aided design software.

3D printing is effectively done at a number of shops on land, but being able to utilize a 3D printer within the dynamic environment of a carrier or destroyer is the Navy's biggest test.

"It's the biggest thing happening on the deck plate," said CAPT Jim Loper, concepts and innovations department head at NWDC. "We put the printer on Essex specifically to get it in Sailors' hands so they could play with the technology and so we could learn the best way to use the printer."

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*—Vice Admiral Phil Cullom*

CDSA Dam Neck partnered with the Naval Supply Systems Command and NWDC to identify printable parts and create a suitable infrastructure in hopes of bringing these parts to the fleet.

"The future of logistics is 3D printing," said Loper. "The amount of supplies that we carry on board the ship can be reduced significantly if we can 3D print those products on the ship itself. There really are no limits to the advantages of 3D printing."

Items printed by CDSA Dam Neck's 3D printer were on display and include Ouija Board pieces (modeled by USS Essex), a buoy replica, and an F-18 replica. (Not shown is a bracket for phone jack boxes.)

*Kenneth Hess*

### **Naval Air Systems Command Embraces 3D Printing Technology**

The Naval Air Systems Command (NAVAIR) has also embraced 3D printing technology to deliver capabilities to the warfighter at a rapid pace and a lower cost.

Together, the NAVAIR team and industry providers focused on developing a roadmap for the future as they discussed the current opportunities and challenges associated with 3D printing at the NAVAIR Additive Manufacturing Industry Day held on July 24, 2014.

Vice Admiral David Dunaway, NAVAIR's commander, laid out the

goals and the reasons why additive manufacturing (3D printing) will play a part in the command's future.

"Naval aviation is well capitalized. If you look at our production curve, it is going to tremendously decrease by 2018 or 2019," Dunaway said.

"We're in the sustainment phase. We're going to have to think about how we apply the limited resources we have. I think additive manufacturing will allow us to optimally use those resources."



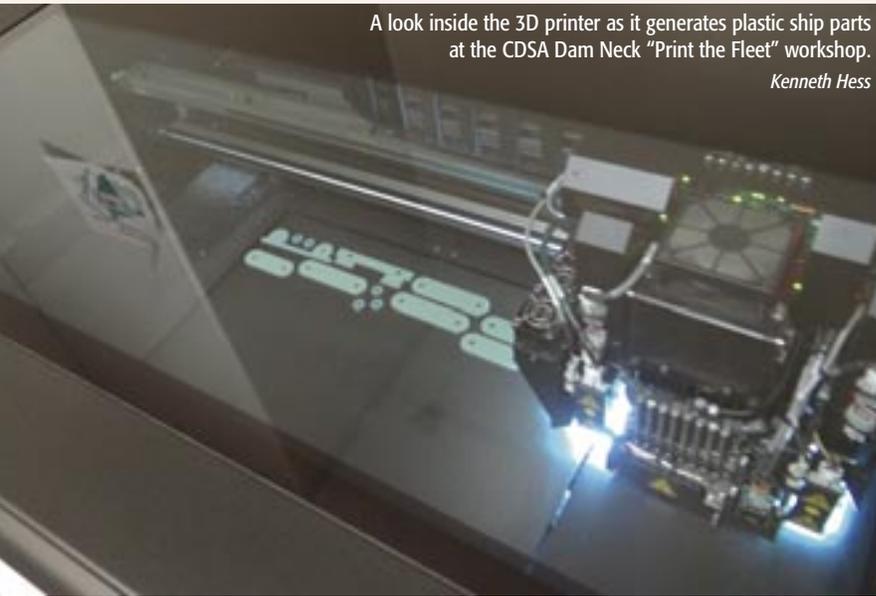
Currently, the Air Vehicle Modification and Instrumentation (AVMI) group is using 3D printing to support naval aircraft flight testing and prototyping projects at Naval Air Station Patuxent River, Maryland.

Using their two 3D printers, AVMI engineers have fabricated components such as antenna covers, environmental cooling system ducts and mechanical spacers, as well as geometrically-representative models for form and fit checks.

### **Commander, Naval Surface Force Atlantic Hosts Two 3D Printing Symposia**

Commander, Naval Surface Force Atlantic (CNSL) also hosted its first 3D printing symposium directed at waterfront warfighters on August 6, 2014 at Naval Station Norfolk. OPNAV N41, NWDC, and CDSA Dam Neck supported the event as well.

CNSL held this symposium to reinforce command priorities of



A look inside the 3D printer as it generates plastic ship parts at the CDSA Dam Neck "Print the Fleet" workshop.

*Kenneth Hess*



"Print the Fleet" workshop participants listen to pre-recorded remarks from Vice Admiral Phil Cullom, Deputy Chief of Naval Operations for Fleet Readiness and Logistics, at the first Maker Faire at CDSA Dam Neck in June 2014.

*Kenneth Hess*

improving surface warrior tactical and technical competence, delivering combat-ready warships and synchronizing lines of effort.

"At its very core, this technology further enhances the leadership opportunities of our Sailors," noted symposium coordinator LT Matthew Hipple, a CNSL action officer.

About a dozen Sailors and civilians attended the symposium on 3D printing, also known as additive manufacturing, rapid prototyping and direct digital manufacturing.

"For challenges in your engineering plant, at your console, or on the bridge—additive manufacturing (like 3D printing) could one day allow Sailors to create their own novel solutions, or overcome pauses from logistical delays," Hipple continued. "That's ownership, and an important part of cultivating new generations of leaders and experts."

These workshops were created to push junior deckplate leadership—the guys who are doing the technical work, the maintainers who are

encountering the day-to-day problems—to harness 3D printing technology for their uses," Hipple explained. "It's a great opportunity for them, not to just decrease their man-hours spent working on equipment, but also to increase the amount of leadership and input they have into this new technology."

During the CNSL symposium, those in attendance learned that 3D printing has the capability to bring parts to the warfighter quickly and cheaply. By printing parts on nearby military installations or eventually on ships at sea, inventory can be reduced and shipping costs can be nearly eliminated for many items. Within days or hours of identifying a needed part, a model can be designed and uploaded to a database for printing, allowing for a more rapid response to warfighters' needs.

"This is about helping Sailors overcome acquisition problems," he pointed out. "And it's about using taxpayers' dollars well. 3D printing is a new process that can streamline our logistics and give the Sailor new problem-solving tools.

"You and I have been given these resources by the American people and it is our job to use them wisely; 3D printing looks like it's going to be one way to do so. We're investigating if this can give the Navy, our Sailors, and the people the best bang for our buck," Hipple concluded.

CNSL sponsored a second 3D printing symposium aboard Naval Station Norfolk on August 20, 2014. [📍](#)

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