



— 2021 —
IN REVIEW

NAVAL SURFACE WARFARE CENTER

CRANE DIVISION



NSWC CRANE

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Introduction



CAPT Duncan McKay
COMMANDING OFFICER



Dr. Angela Lewis, SES
TECHNICAL DIRECTOR

NAVAL SURFACE WARFARE CENTER

CRANE DIVISION

our mission

...Deliver innovative solutions and readiness to the Nation and its Warfighters through application of our Technical Capabilities. Advance all-domain system of systems within the Mission Areas of Electronic Warfare, Expeditionary Warfare, and Strategic Missions. Conduct science and technology, research, development, test and evaluation, acquisition and in-service engineering across the Defense life-cycles. Execute other responsibilities as assigned by the Commander, Naval Surface Warfare Center.

Reflection & Priorities

Naval Surface Warfare Center, Crane Division (NSWC Crane) is pleased to release the **2021 Annual Year in Review**. NSWC Crane's mission is to deliver innovative solutions and readiness to the Nation and its Warfighters through National Technical Leadership in Expeditionary Warfare, Electronic Warfare, and Strategic Missions.

EXPEDITIONARY WARFARE: *Providing intelligent systems solutions for all domains that enhance detection, decision-making, maneuver, and kinetic and non-kinetic engagement capabilities for the Expeditionary warfighter. We utilize open architecture designs to integrate multi-platform advanced sensors and specialized weapons systems.*

ELECTRONIC WARFARE: *National Leaders in Force Level EW for Department of Defense: Influence EW Operational employment (Doctrine, TTPs, CONOPs, CONEMPs) and create multi-domain and full spectrum electromagnetic warfare solutions to provide the Electromagnetic Spectrum advantage.*

STRATEGIC MISSIONS: *Strategic Missions encompasses the full range of Department of Defense activities that alter an adversary's will and ability to attack the United States and its interests.*

NSWC Crane is a **premier federal laboratory – the only in the state** - and the **third largest employer in southwest Indiana**. We work directly with Warfighters to create comprehensive, innovative solutions at the speed of relevance. NSWC Crane and is more valued and relevant now than in any time in our history. Today, our Nation faces increased global challenges that are shaping a more complex and volatile security environment than ever before. When threats to our Nation and global interests increase, so do demands for our products, expertise, and services.

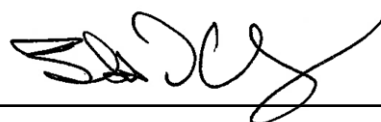
In the past year, we have all navigated the myriad of challenges brought on by the COVID-19 pandemic. NSWC Crane has remained focused on supporting our mission, including the implementation of safety protocols and measures to ensure that we continue to **Preserve and Protect** the health and well-being of each team member of NSWC Crane.

We are proud to share stories of how our culture of **Employee Engagement, Inclusion, and Corporate Citizenship** plays a vital role in the success of our mission. Our prolific workforce exemplifies **National Technical Leadership** and we will continue to invest in attracting, developing, and retaining a high performing, diverse workforce. Our organization is built on finding and retaining the finest intellectual and innovative talent in the country.

Also within this Year in Review, you will find stories of how NSWC Crane's skilled professionals put technical solutions directly into the hands of the Warfighter, ensuring safer missions and providing the advantage over our adversaries.



Dr. Angela Lewis, SES
TECHNICAL DIRECTOR



CAPT Duncan McKay
COMMANDING OFFICER

National Leadership

By the end of 2021, NSWC Crane was flexing its value as a national asset. NSWC Crane's resume includes, but is not limited to supporting more than 150+ major customers spanning the Department of Defense and other government agencies National technical leadership in strategic systems programs, electronic warfare programs, and special warfare and expeditionary systems programs consisting of:

- The Nation's primary organic field activity for Nuclear Deterrent systems
- A key contributor to the Nation's Missile Defense mission
- The Navy's preeminent center for Microelectronics Technology
- Trusted & Assured Microelectronics Program National Leadership
- Microelectronics Innovation for National Security & Economic Competitiveness Program Leadership
- Strategic Radiation Hardened Electronics Council Execution Leadership
- The DoD's largest resource dedicated to power systems
- The DoD's largest concentration of EW expertise
- DoD Executive Agent for Printed Circuit Board Technology

FLEET TOUCHES: Anytime NSWC Crane employees have direct interaction with the fleet, such as performing installations, maintenance, depot work, providing training, and other hands-on support.

\$3B+

Contracts, +Salaries+Incoming Funds+Education

669,965

Fleet Touches/Assignments

50

Technical Direction Agent
Assignments

6

Naval Sea Systems Command
Technical Warrant Holders

11

Software Support Activity Designations

48

Acquisition Engineering Agent Assignments

84

In-Service Engineering Agent Assignments

52

Academic Tech Transfer Partnerships in 24 States

\$362K

K-12 STEM Education Funding

27

Innovation Labs

32

Systems Integration Agent Assignments

7

Design Agent Assignments

870

Maintenance Actions Completed

39% Increase (last 10 yrs)

Doctoral Degrees

26

Patents

77% Increase (last 10 yrs)

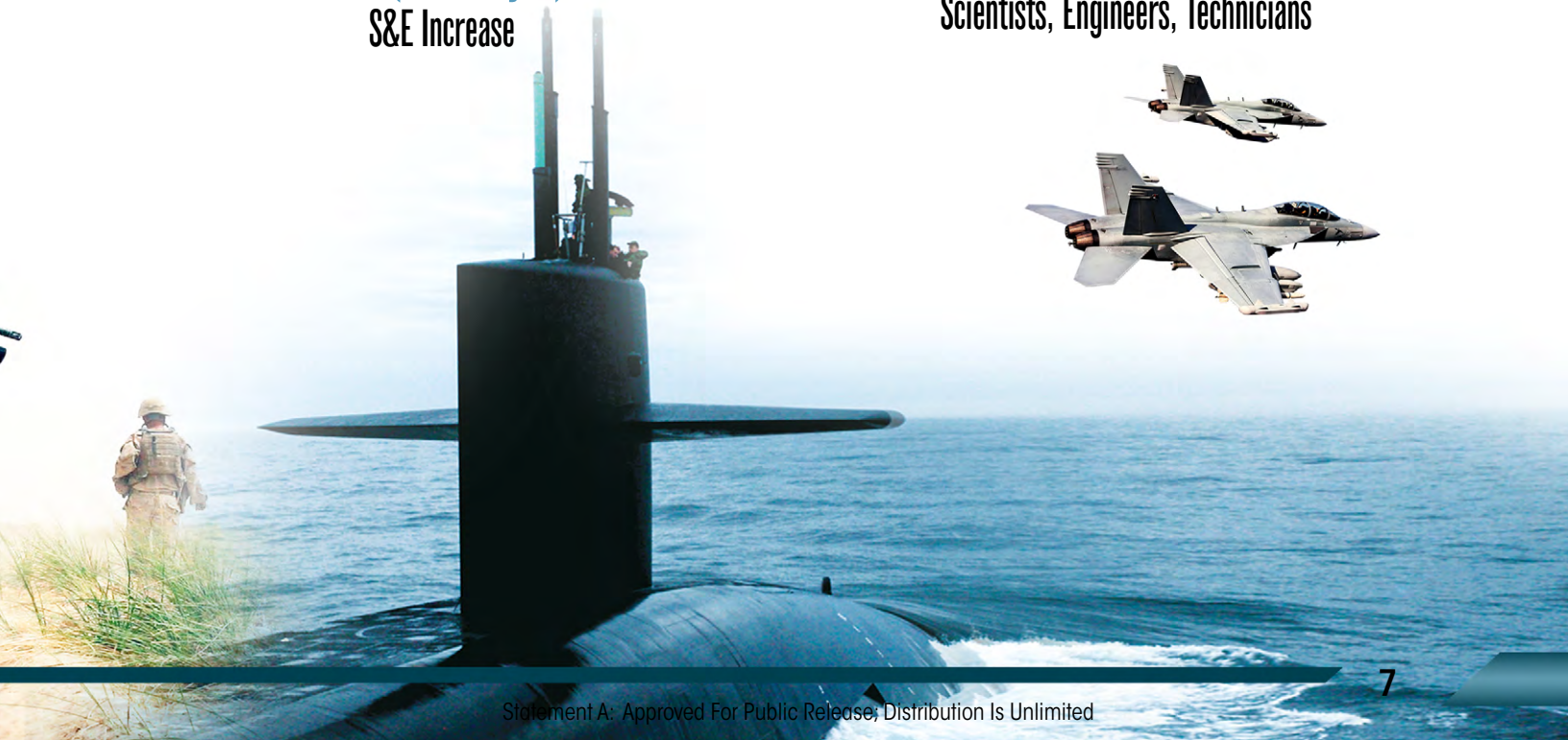
Masters Degrees

31% (last 10 yrs)

S&E Increase

61.5%

Scientists, Engineers, Technicians



Awards

NSWC Crane Employee Receives Second-Highest DON Award for Nine Years Of Dedication to Marine Corps

An NSWC Crane employee received the **Department of the Navy (DoN) Superior Civilian Service Award (SCSA)**, which is the second highest honorary award in the DoN. Alan Matthews, the SCSA recipient, was awarded for his outstanding efforts as Test Manager for Program Manager Infantry Weapons (PM IW), NSWC Crane from November 2011 to August 2020. In particular, his award recognizes his recent extensive effort to execute critical live-fire testing to determine potential issues with the relatively newer configuration of the M2 Heavy Barrel Machine Gun, called the M2A1.



NSWC Crane Nationally Recognized Electronic Warfare Expert Embraces Futurist Mentality

Electronic Warfare (EW) or Electromagnetic Spectrum Operations (EMSO) is military activity that uses electromagnetic (EM) energy to control the electromagnetic spectrum (EMS). Warfighters use this technology to degrade or deny an adversary's combat capability, gather intelligence data and ensure friendly use of the EM spectrum. NSWC Crane's solutions are employed across air, ground, maritime and space domains to ensure safe and effective missions for the joint and coalition forces. The acceleration of technological development and growing threats from adversaries is why NSWC Crane EW Chief Scientist Dr. James Stewart thinks adopting a futurist mentality is important to delivering a decisive advantage to end users.



NSWC Crane Human Resource Specialist Awarded the Department of Navy Civilian HR & EEO Community Award for Excellence

NSWC Crane Human Resource (HR) Specialist Jill Winger was recently awarded the **Department of the Navy (DON) Civilian HR & EEO (CHREEO) Community Award for Excellence** in recognition of her outstanding level of performance and aspiring leadership within the HR & EEO community. Her significant contributions to the NSWC Crane Human Resources Office has earned tremendous amount of credibility and respect from her peers, the union, and command leadership as a subject expert and adviser in employee discipline and the drug free workplace program.



"In just under two years, Jill has exceeded all expectations and has proven to be an outstanding LER specialist within the Human Resources Office (HRO)."

- Brittany Mitchell, LER Branch Manager

NSWC Crane Department Head Awarded for Department Leadership

Benjamin Harkness, the Deputy Technical Director at NSWC Crane, was recognized for his *"outstanding contributions"* in his role as the Department Director for Global Deterrence and Defense Department from June 2009 to May 2021. Global Deterrence and Defense Department at NSWC Crane does full spectrum systems engineering and sustainment of Strategic Programs.



"I really appreciate the recognition from the Program Offices we have supported over the years, it signals the affirmation of the hard work of the team at NSWC Crane. It takes all of us here at Crane to fulfill mission requirements."

- Ben Harkness

Economic Impact

We at NSWC Crane exist to provide the **AMERICAN WARFIGHTER** with solutions to their toughest technical challenges in order to better equip them with a **DECISIVE ADVANTAGE** over our Nation's adversaries!

TOP FIVE CUSTOMERS FY21

\$140.0M



\$114.0M



\$78.1M



\$61.9M



\$57.4M



U.S. AIR FORCE

NEW HIRES FY21

NON SCIENTISTS
& ENGINEERS

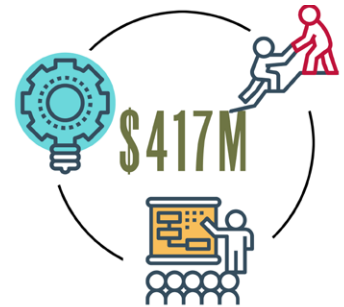
185



SCIENTISTS &
ENGINEERS

151

SMALL BUSINESS FY21



139%
increase in
last 10 years
**DOCTORAL
DEGREES**

77%
increase in
last 10 years
**MASTERS
DEGREES**

EMPLOYEE NUMBERS



FEDERAL CIVILIAN
3,870



MILITARY
16



CONTRACTORS
872

INNOVATION ECOSYSTEM

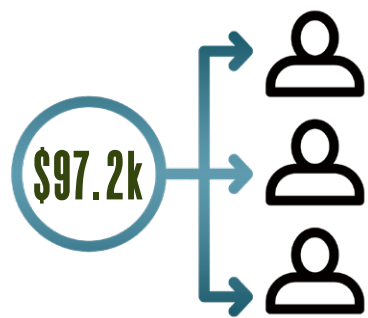


STEM

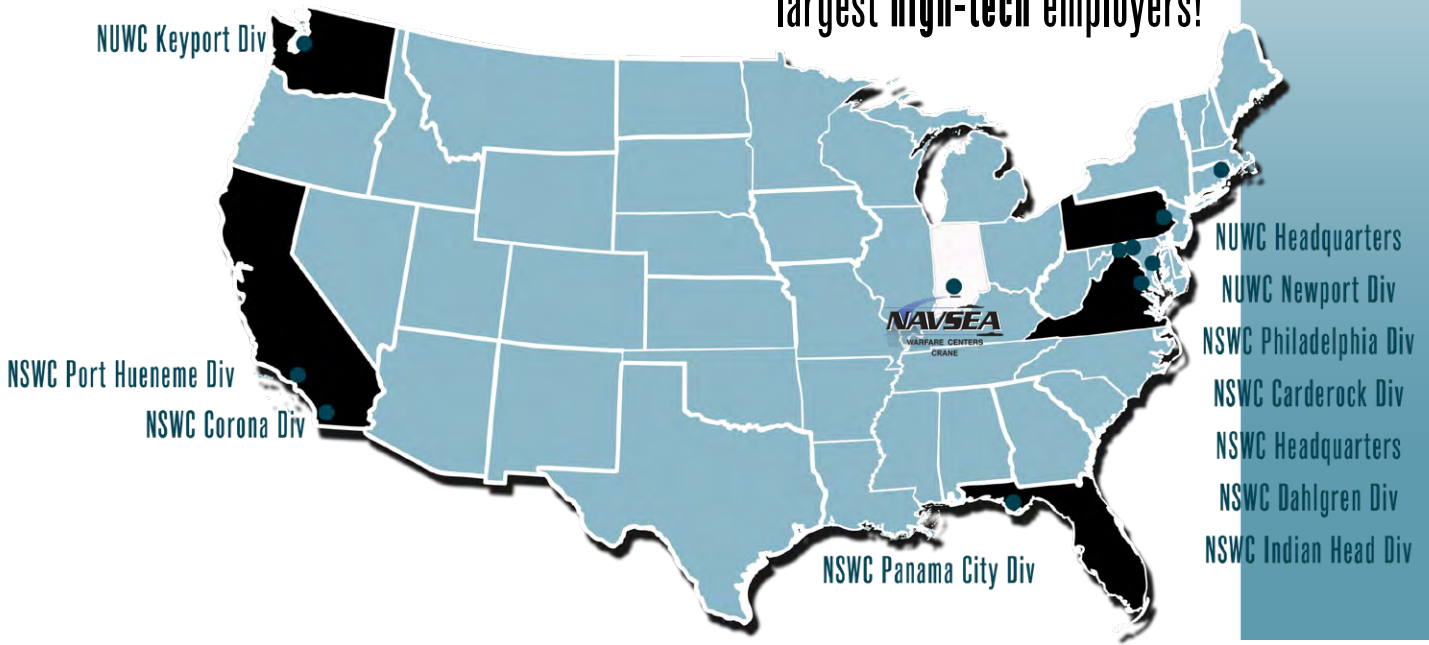
FUNDING **\$362K**

| | |
|---------------------|-------|
| Students Served | 4,995 |
| Teachers Supported | 33 |
| Employee Volunteers | 43 |
| Schools Supported | 25 |

AVERAGE SALARY FY21



Located on the **THIRD** largest Naval installation in the world, **NSWC CRANE** is one of Indiana's largest high-tech employers!



External Collaborations

NSWC Crane Collaborates With Warfare Centers to Bring High-Energy Laser Project to the Fleet

NSWC Crane collaborated with NSWC Dahlgren, NSWC Port Hueneme, Integrated Warfare Systems 2.0, Directed Energy (IWS 2.0, DE), and Lockheed Martin to bring a high energy laser control system to the Navy fleet. The Navy is developing several ship-based weapons that could improve the Navy's surface ships to defend against missiles, unmanned aerial vehicles (UAVs), and surface craft. HELIOS (High Energy Laser with Integrated Optical-Dazzler and Surveillance) is a new system in the Navy Laser Family of Systems (NLFoS) working to deploy capable directed energy solutions to the fleet.

"The HELIOS program merges low and high power and integrates the technology on a ship. Directed energy solutions are significantly cheaper and don't involve the manpower and material that things like missiles require."

- Tyler Fitzsimmons, NSWC Crane Engineer

NSWC Crane and Indiana University Collaborate On \$1.7M Grant to Pilot AI Student Education

NSWC Crane and Indiana University (IU) were awarded \$1.7 million to collaborate on Artificial Intelligence (AI) programming for rural students. The Office of the Secretary of Defense (OSD) funded the AI pilot program, which began the summer of 2021 for middle school students. NSWC Crane teamed up with two IU schools, the School of Education and the Luddy School of Informatics, Computing, and Engineering. NSWC Crane and IU received the National Defense Education Program (NDEP) Award from OSD to pilot the program, ["AI Goes Rural: Middle School Artificial Intelligence Education"](#) to Indiana middle schools.

AI Goes Rural: Middle school Artificial Intelligence Education

- 1.3m award from nationally defense education program for 3 years of AI curriculum
- Curriculum and training scalable nationally
- Program piloted in Indiana schools

Stakeholders & Supporters:

Logos include: NAVSEA Warfare Centers Crane, Indiana University, Indiana Army National Guard, JAIC, National Security Commission on Artificial Intelligence, Indiana Office of Career Connections and Talent, NDEP (National Defense Education Program), Department of Defense, Department of Education, Department of Energy, Department of Health and Human Services, Department of Justice, Department of Labor, Department of State, Department of Transportation, Department of Veterans Affairs, Department of the Interior, Department of the Treasury, Department of the Environment, Department of the Navy, Department of the Air Force, Department of the Army, Department of the Coast Guard, Department of the Marine Corps, Department of the Space Force, Department of the Defense Health Agency, Department of the Defense Health Program, Department of the Defense Health Research, Department of the Defense Health System, Department of the Defense Health Transformation, Department of the Defense Health Innovation, Department of the Defense Health Modernization, Department of the Defense Health Resilience, Department of the Defense Health Security, Department of the Defense Health Sustainability, Department of the Defense Health Wellbeing.

NSWC Crane Increases USNA Midshipmen Internships Over the Summer, Strengthening Partnership



NSWC Crane continues its partnership with the United States Naval Academy (USNA), more than doubling the number of midshipmen in internship positions from its first year. This partnership launched with five USNA midshipmen interns in 2019. Due to COVID-19, the program was on hold in 2020, but this past summer NSWC Crane grew the partnership to host 11 midshipmen in science, technology, engineering, and math (STEM) internships. Each midshipman participated in a three-and-a-half-week program.

"The midshipmen had exposure to a wide variety of technology at Crane and each worked on a project during their internship. This is part of a long-term effort to provide research opportunities and to help future naval officers understand the role Crane has in the larger Navy structure."

- Dr. Bryan Woosley, NSWC Crane University

NSWC Crane, NUWC Newport, and Penn State Applied Research Lab Collaborate to Modernize Navy Sonar Capabilities

NSWC Crane, Naval Undersea Warfare Center, Newport Division (NUWC Newport) and Pennsylvania State University (Penn State) Applied Research Laboratory (ARL) are collaborating to modernize the Navy's sonar capabilities. The combination of these organizations' expertise provides technical oversight and production solutions in the *development, assembly, repair, test, and evaluation of undersea sensors.*



Electronic Warfare (EW)

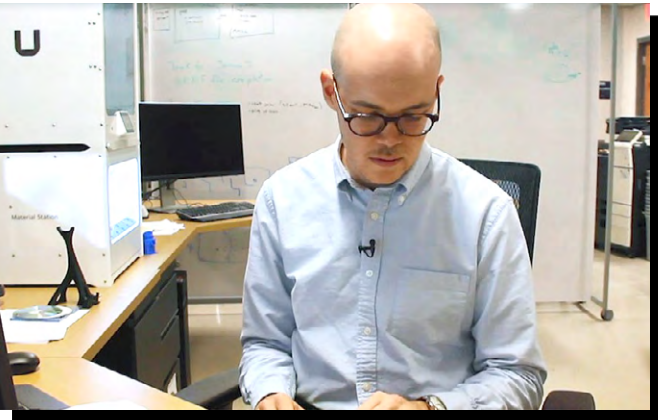
National Leaders in Force Level EW for Department of Defense: Influence EW Operational employment (Doctrine, TTPs, CONOPs, CONEMPs) and create multi-domain and full spectrum electromagnetic warfare solutions to provide the Electromagnetic Spectrum advantage.

| | | |
|--|--|---|
| <p>1948 Ship Installations</p> <p>304 Aircraft Supported Airborne Electronic Attack Team</p> | <p>9 Innovation Labs</p> <p>148 Aircraft Supported Infrared Countermeasures Team</p> | <p>Services Supported</p> <ul style="list-style-type: none"> US Navy USMC US Air Force US Army |
|--|--|---|

NSWC Crane Electronic Warfare SMEs Apply Machine Learning to Radio Frequency Spectrum

NSWC Crane Electronic Warfare (EW) subject matter experts (SMEs) are applying Machine Learning (ML) to the Radio Frequency (RF) spectrum. Machine Learning is a subcategory of Artificial Intelligence (AI) that has been applied to images, audio, and language processing to find patterns or identify objects and words. NSWC Crane is helping develop and modify ML software that adjusts to RF signals automatically to improve EW capabilities.

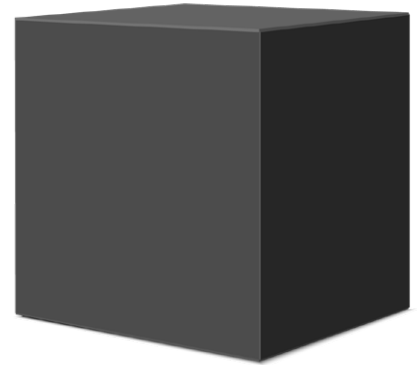
“We want to provide Warfighters with as much information as we can. Our talent, RF knowledge base, and Machine Learning technology puts Crane in a unique position to increase the accuracy and speed that we can do that.”
- Zachary Davis, NSWC Crane Scientist



NSWC Crane Electromagnetic Warfare Experts Reverse-Engineer Critical Technology To Maintain Fleet Readiness

In less than a year, NSWC Crane Maritime Electromagnetic Warfare (EW) experts reverse-engineered a critical technological component of the AN/SLQ-32 (commonly pronounced “Slick-32”) system. An industry organization would no longer be making the Electronic Surveillance Enhancements (ESE) technology component, so NSWC Crane experts reverse-engineered the component.

“A Black Box” for the Navy - unknown how it was constructed, functioned, or how to repair it.



NSWC Crane Electronic Warfare Employees Provide Expertise for Virtual Training System

NSWC Crane Electronic Warfare (EW) experts consulted with Naval Air Warfare Center Training Systems Division to create an all-virtual maintenance training system for the AN/SLQ-32 EW system. The AN/SLQ-32 EW system (commonly referred to as the Slick-32) provides ships with capabilities such as early detection, signal analysis, threat warning, and protection from anti-ship missiles.



NSWC Crane Technical Experts Contribute to Plans To Bolster Radar Industrial Base

A group of NSWC Crane Electronic Warfare (EW) and Radar technical experts were instrumental in plans to bolster the Radar Industrial Base (RIB) for the U.S. Strengthening the U.S. RIB is a Department of Defense (DoD) priority. The industrial base plays a key role in meeting current, developing, and future Fleet capabilities.

Expeditionary Warfare (ExW)

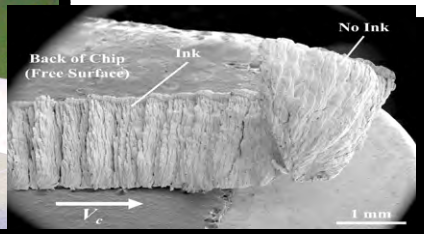
Our mission is to provide intelligent systems solutions for all domains that enhance detection, decision-making, maneuver, and kinetic and non-kinetic engagement capabilities for the Expeditionary warfighter. We utilize open architecture designs to integrate multi-platform advanced sensors and specialized weapons systems.

| | | |
|-----------------------------------|------------------------------------|--|
| 2513 Ship Installations | 6 Innovation Labs | 105 Customers |
| 2513 Ship Installations | 4099 Small Weapons Supported | Largest Customers NAVSEA NAVAIR USSOCOM |
| 1990 Depot Refurbs/IMA Repairs | 883 Weapons Training (Students) | 649644 Transactions Across Registries |



NSWC Crane Engineer Receives International Award for Research In Cutting of a Rare, Superior Metal

An NSWC Crane mechanical engineer, Dr. Jason Davis, received an **International Award For Analyzing The Cutting Of Tantalum**, a rare metal that is highly corrosion-resistant. Dr. Davis led the U.S.-Japanese research team from the Center for Materials Processing and Tribology at Purdue University, IN, USA. The award was announced in September from the Belgium-based Tantalum-Niobium International Study Center (TIC).



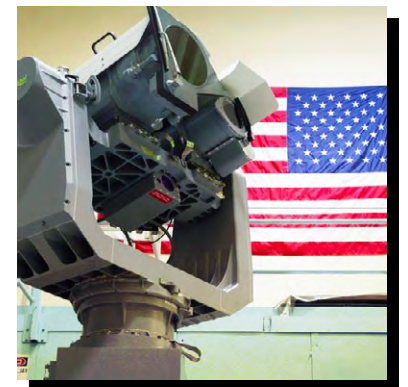
NSWC Crane Chief Engineer Recognized by Rose Hulman as an Honor Alumni 2021

An NSWC Crane Chief Engineer received the **Honor Alumni Award** for 2021 from Rose-Hulman Institute of Technology. Lucius “Gus” Taylor graduated from Rose-Hulman as a Mechanical Engineer with a minor in Psychology and retired from the Army in 1995 as a U.S. Army Special Forces Lieutenant Colonel. Taylor served twenty years in the Army, and more than twenty years at NSWC Crane. As a Chief Engineer, Taylor serves in a division with around 200-people devoted to weapon systems engineering for the US Navy, US Marine Corps, and US Special Operations Command.



NSWC Crane Provides Years of Electro-Optic Support to Critical I-Stalker System

NSWC Crane’s Electro Optics (EO) subject matter experts (SMEs) have supported a critical situational awareness system for Navy ships since its inception in 2017. NSWC Crane serves as the in-service agent to the I-Stalker system, which replaced an older technology. The I-Stalker program is a Rapid Deployment Capability (RDC) for a fleet Urgent Operational Needs (UONs) to support the safety and defense of ship operations and Navy capital assets. The I-Stalker team at Crane also won a **Program Executive Office Integrated Warfare Systems (PEO IWS) Excellence Award** for their efforts in overcoming installation risk and tight deadlines.



NSWC Crane, ONR, NavalX Midwest Tech Bridge Award Winners of Artificial Intelligence Prize Challenge

NSWC Crane, Office of Naval Research (ONR) and the NavalX Midwest Tech Bridge (MTB) recently announced the winners of the **Artificial Intelligence for Small Unit Maneuvers AISUM) Prize Challenge**. The purpose of AISUM technology is to equip warfighters with robotic autonomous systems in critical high-risk missions to keep service members out of harm’s way. EpiSys Science, Inc. (Episci) took first place and Draper, Inc. (Draper) took second place.

Strategic Missions

Strategic Missions encompasses the full range of Department of Defense activities that alter an adversary’s will and ability to attack the United States and its interests.

Long-Serving Customers

1941-1975

Bureau of Ordnance (BUORD)
/Bureau of Weapons (BUWPNS)
/US Army Material Command

1960s

NAVSEA, NAVAIR, USMC, NAVSUP/
NAVICP, US Special Operations Command
(USSOCOM), Est. April 16, 1987

12

Innovation Labs

8436

Fleet Touches

1958

Strategic Systems Command (SSP)

1990

Depot Refurbs/IMA Repairs

Vietnam War 1960s

SEAL Teams

NSWC Crane Supports DoD to Successfully Launch Three Rockets for Hypersonic Research at NASA’s Wallops Flight Facility

NSWC Crane served as the executing agent for the Department of Defense (DoD) flight test campaign known as High Operational Temp for Hypersonics (H4H). The flight test campaign was jointly planned and funded by the Navy Conventional Prompt Strike (CPS) program, the Army Hypersonic Program Office (AHPO), and Missile Defense Agency (MDA). The flight test campaign successfully launched three precision sounding rockets in October from National Aeronautics and Space Administration’s (NASA) launch range at Wallops Flight Facility in Virginia.



NSWC Crane Exceeds Significant 50K Transducer-Delivery Milestone, Boosting Undersea Sonar Capabilities for Navy Fleet

NSWC Crane reached a milestone in its delivery of 50-thousand TR-343 transducers to the US Navy Fleet over the past decade. As an offshoot of the technical lessons learned in this project NSWC Crane, along with Naval Undersea Warfare Center, Newport Division (NUWC Newport) and PMS 401, has initiated a modernization effort to meet the needs of rapidly evolving threats at sea.



NSWC Crane Breaks Ground On New Radiation Modernization Facility, Creating Unique Capability for the Fleet

NSWC Crane leadership, industry, and state government stakeholders broke ground on a new Radiation Modernization facility on the installation in October. NSWC Crane provides radiation testing capability for many prominent domains across the DOD, including the Nuclear Deterrence, Missile Defense, and Space Systems.

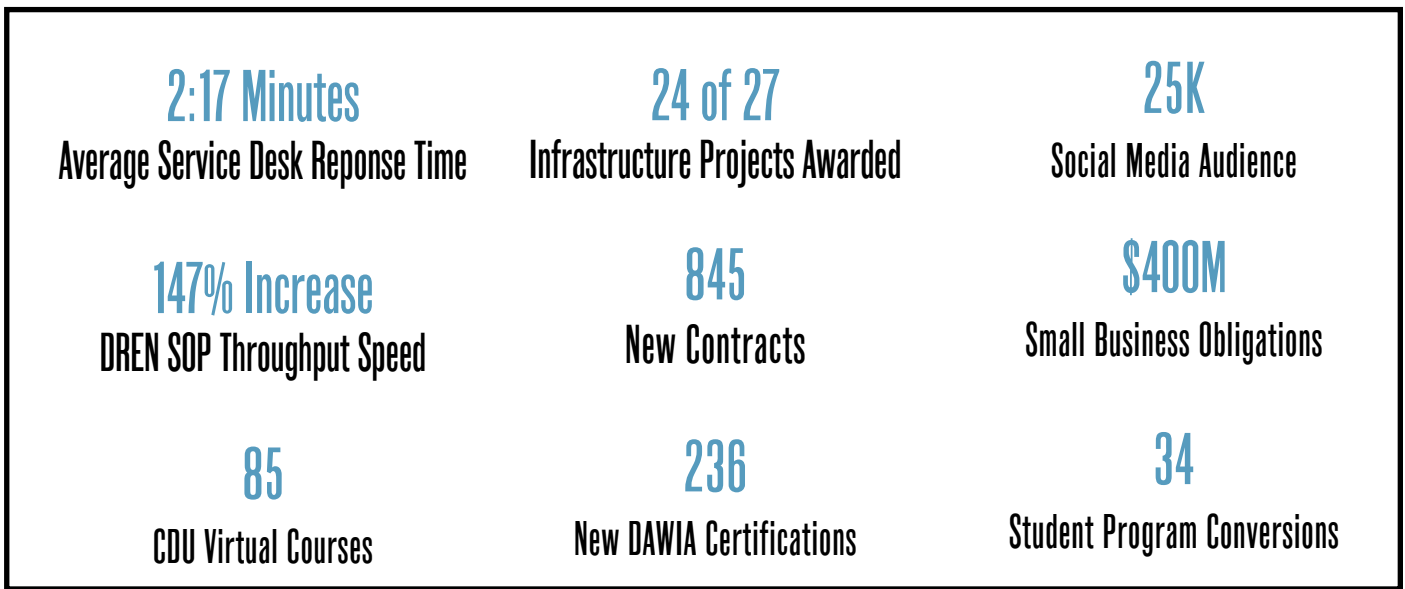


NSWC Crane Trusted Microelectronics Experts Team Up With Washington High School Class for Pilot Program

NSWC Crane Trusted Microelectronics Division partnered with Crane-area Washington High School's computer science and cybersecurity classes for a week-long pilot program in April 2021. During the program, three subject matters experts (SMEs) from NSWC Crane visited the classroom and engaged the students with interactive problem sets.

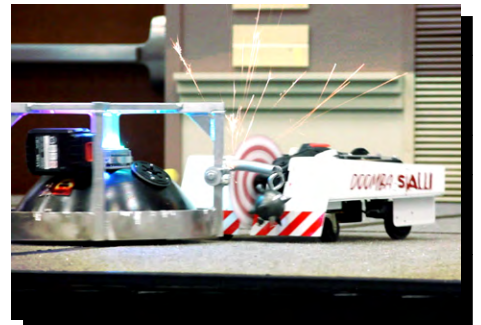
Business Excellence

Comprised of trusted professionals dedicated to world-class customer service, NSWC Crane's Business departments partner with stakeholders to provide innovative business solutions focused on meeting the mission.



NSWC Crane, USI Graduate First Cohort of Tech to Engineer Students

NSWC Crane and the University of Southern Indiana (USI) graduated their first cohort of the **Tech to Engineer (T2E)** students in December. In the program, 10 NSWC Crane employees in technician positions took USI classes part-time while continuing to work full-time. Now, the employees all have a Bachelor of Science in Engineering. The program will continue as bachelor's/bachelor of science to be open to those across career fields.



NSWC Crane Hosts First Virtual Advanced Planning Briefings for Industry

NSWC Crane hosted its first virtual **Advanced Planning Briefings for Industry (APBI)** event from June 2021. The APBI event provided detailed information on industry, academia, future NSWC Crane technology efforts, criteria, possible contract opportunities, as well as how to do business with NSWC Crane. APBI includes presentations and discussions on how NSWC Crane, industry, and academia can collaborate and build thriving partnerships to ensure future Warfighter success.

The APBI series included eight sessions throughout the week from NSWC Crane senior leadership discussing a broad range of topics: Global Deterrence and Defense, Special Warfare and Expeditionary Systems, Spectrum Warfare Systems, Corporate Operations, small businesses, information technology, cybersecurity, Contractor Support Services, Defense Modernization Priorities, Technology Transfer, and the NavalX Midwest Tech Bridge.



NSWC Crane Infrastructure Division Protects and Enhances Crane's Resources

NSWC Crane's Infrastructure Division protects and enhances Crane's resources and ensures the workforce is in safe, comfortable, and mission-capable facilities so they can accomplish their work and create innovative solutions for the warfighter. The Infrastructure Division develops strategic plans in line with future mission needs and corporate goals for personnel expansion, provides mission-focused facilities, and ensures efficient and cost-effective construction of facilities.



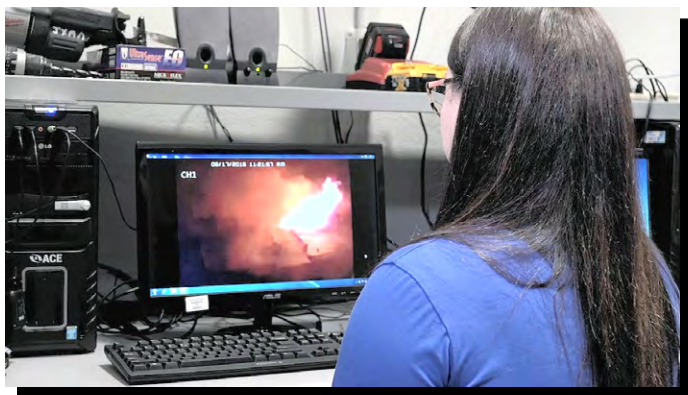
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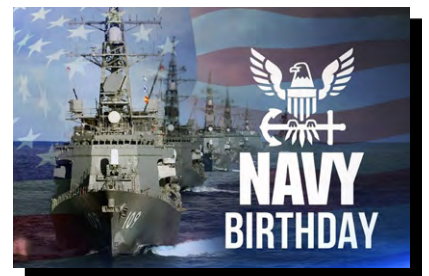


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