Naval Surface Warfare Center Panama City Division

ANNUAL REPORT
FY22

October 2021 - September 2022

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Centers/NSWC-Panama City/

Foreword
from the Commanding Officer

As a full lifecycle field activity for naval warfare in the littorals, our job is clear: Naval Surface Warfare Center Panama City Division (NSWC PCD) develops, delivers, and sustains innovative warfighting capabilities to our nation's warfighters. Our mission is to ensure the technical capabilities we develop here are effective, relevant, safe, and expand our nation's advantages over our adversaries.

The 2022 Annual Report is a compilation of NSWC PCD's accomplishments within the last fiscal year. This report celebrates our command's contributions to the warfighter and reflects on future opportunities. Fiscal year 2022 resulted in tremendous achievements in our core mission areas and provided an opportunity to continue creating a vision for our future.

This report also serves to measure how our command has evolved and captures the great milestones achieved by our talented workforce. Our people are our greatest asset and the foundation for a powerful and capable Navy.

The technical director and I are committed to improving our workforce, organization, products and services in the coming year. I am honored to serve as the commanding officer and look forward to serving in the next year.

Thank you for your dedication,

Capt. David N. Back, USN
Commanding Officer
NSWC PCD

ABOUT

Panama City Division

Located on St. Andrew Bay in Panama City, Fla., Naval Surface Warfare Center, Panama City Division (NSWC PCD) is the U.S. Navy's principal organization responsible for Research, Development, Test, and Evaluation (RDT&E), in its core mission areas and other missions that take place in the coastal region. By virtue of its geographical location on the Gulf of Mexico and the Department of Defense's Joint Gulf Test Range, and coupled with its recognized mission areas and technical expertise, the Division is a leading contributor in developing, fielding, and testing joint expeditionary, and coastal operations systems in the littoral environment. This report documents accomplishments achieved in fiscal year 2022.

Mission

The mission of NSWC PCD is to conduct research, pursue development, perform tests, and evaluate processes to ensure warfighting dominance in the littoral battlespace. This is done in support of mine warfare systems, mines, special naval warfare systems, diving and life support systems, amphibious/expeditionary warfare systems, and missions that occur primarily in coastal regions.

Vision

Ensuring Warfighting Dominance in the Littoral Battlespace

Technical Capabilities

Personal Protective Systems for Extreme Environments

Expeditionary Coastal and Maritime Security System Engineering and Integration

Air Cushion Vehicle Systems

Expeditionary Maneuver Warfare Systems Engineering and Integration

Special Warfare Maritime Mobility Mission Systems and Mission Support Equipment

Mine Countermeasures Detect and Engage Systems, Modular Mission Packaging, and Platform Integration and Handling

Littoral Mission Systems Integration and Modular Mission Packages Certification

Unmanned Systems Engineering & Integration, Autonomous Operations, Joint Interoperability, and Common Control

Mine Sensor and Target Detection Technology, Mine Delivery Platform Integration, and Minefield Architecture

Diving and Life Support Systems

Surface Life Support Systems for Extreme Environments

Subsea and Seabed Systems (Panama City Missions)

WORKFORCE IN NUMBERS

1,628 EMPLOYEES

178 NEW HIRES — **57** RETIREES

795 BACHELOR'S DEGREES

435 MASTER'S DEGREES

72 DOCTORATE DEGREES

Unique Capabilities

Full Spectrum Mine Warfare to include Tactics

Expeditionary Maneuver Warfare

Ship to Shore Maneuver to include Air Cushion Vehicles

Full Spectrum Diving and Life Support Systems

Special Warfare Maritime Mobility

Littoral Mission Systems Integration to include UxS

Joint Gulf Test Range: open ocean, bays, estuaries, rivers, and harbors
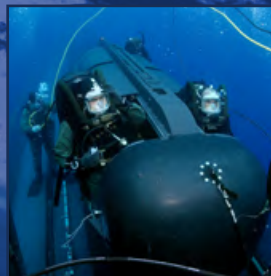

Coastal Battlefield Reconnaissance and Analysis

SMCM UUV Knifefish

MK-16 Underwater Breathing Apparatus

Air Cushion Vehicle

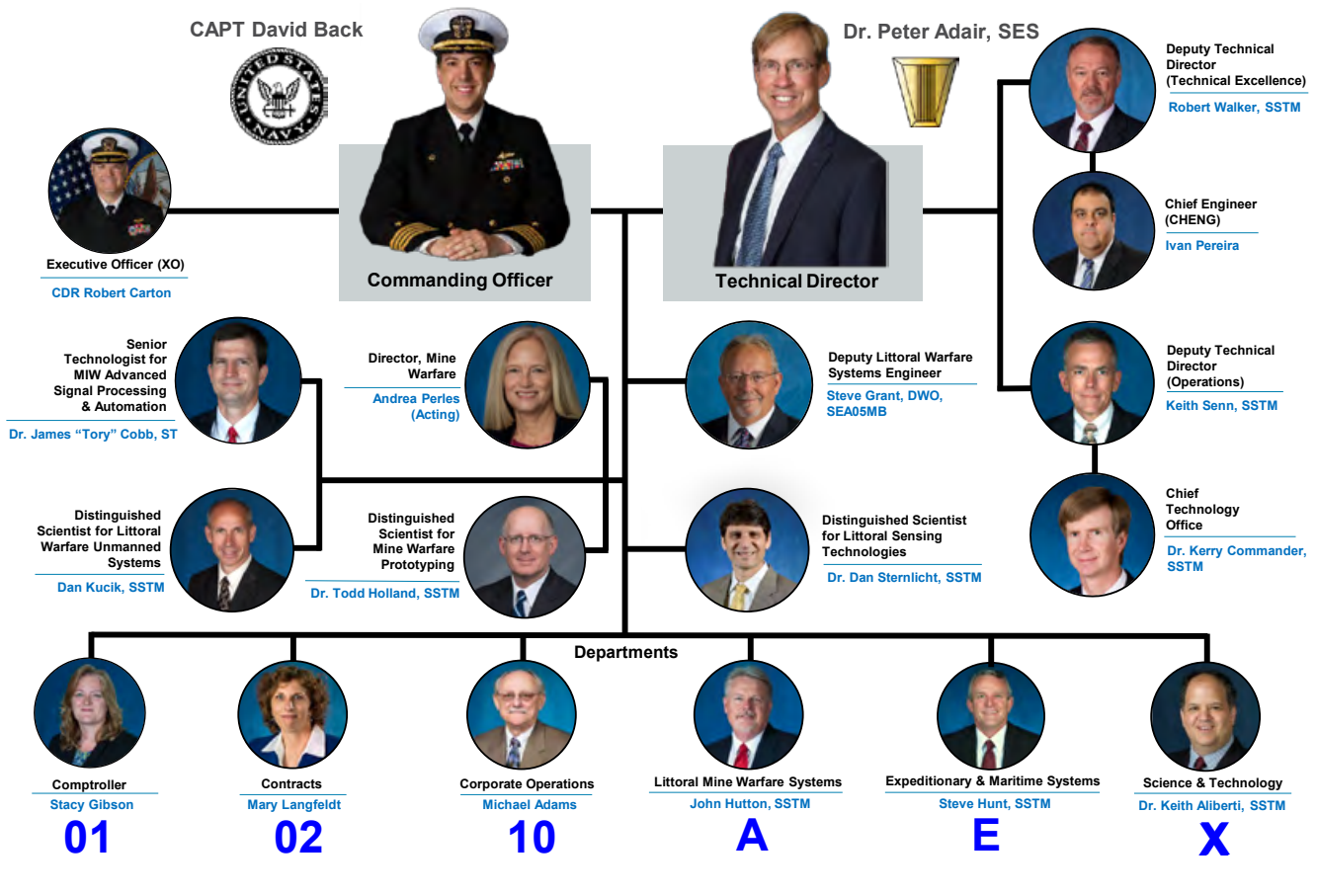SEAL Delivery Vehicle

Autonomous Vehicle

Leadership

Forum

The Leadership Forum is the primary leadership and decision-making body for NSWC PCD. These senior leaders work together to cross organizational boundaries to achieve solutions that will move the organization forward toward achieving its strategic vision. The Leadership Forum ensures Panama City Division operates in the most effective, efficient, and safe manor in support of current and future Naval, Joint, and National Objectives both internal and across the Warfare Center enterprise.

NSWC PCD Leadership

CAPT David Back

Dr. Peter Adair, SES

Deputy Technical Director (Technical Excellence)
Robert Walker, SSTM

Executive Officer (XO)
CDR Robert Carton

Commanding Officer

Technical Director

Chief Engineer (CHENG)
Ivan Pereira

Senior Technologist for MIW Advanced Signal Processing & Automation
Dr. James "Tory" Cobb, ST

Director, Mine Warfare
Andrea Perles (Acting)

Deputy Littoral Warfare Systems Engineer
Steve Grant, DWO, SEA05MB

Deputy Technical Director (Operations)
Keith Senn, SSTM

Distinguished Scientist for Littoral Warfare Unmanned Systems
Dan Kucik, SSTM

Distinguished Scientist for Mine Warfare Prototyping
Dr. Todd Holland, SSTM

Distinguished Scientist for Littoral Sensing Technologies
Dr. Dan Sternlicht, SSTM

Chief Technology Office
Dr. Kerry Commander, SSTM

Departments

Comptroller	Contracts	Corporate Operations	Littoral Mine Warfare Systems	Expeditionary & Maritime Systems	Science & Technology
Stacy Gibson	Mary Langfeldt	Michael Adams	John Hutton, SSTM	Steve Hunt, SSTM	Dr. Keith Aliberti, SSTM
01	02	10	A	E	X

October 2021

Position Legend:

SES — Senior Executive Service

SSTM — Senior Scientific Technical Manager

ST — Senior Technologist

NSWC PANAMA CITY DIVISION LEADERSHIP

September 2022

New Leadership in FY22

NAME	CODE	TITLE	
LCDR Michael Krestos	XO	Executive Officer	XO
Mike Adams	COS	Chief of Staff	COS
Andrea Perles	TDM	Mine Warfare Directorate	TDM
Steve Grant	TDB	Deputy Technical Director Technical Excellence	TDB
Heidi Serrano Vargas	00Q	Quality Management	00Q
Amanda Davis	011	Budget Division	01
Gregg Fulks	012	Accounting Division	
Ken Bennett	013	Employee Services Division	
Jenetta Langston	02B	Deputy, Contracts Department	02
Vaughn Lasater	021	Acquisition Policy & Oversight Division	
Nicole Stevens	024	Small Purchases Division	
Kim Lawler	101B	Deputy, Human Resources Division	10
Roland Deale	1016	Workforce Development Branch	
Gregory Brotherton	102	Infrastructure Division	
David Hawes	104	Activity Command Information Officer/ Information Technology Division	
Stacy Faison	1042	Information Technology Operations Branch	
Matthew Strickland	1043	Cyber Security Branch	
Wynne Bischoff	1044	Enterprise Services Branch	
Kevin Barron	A45	Fleet Software Support Branch	A
Wayne Vickers	E23	Command & Control In-Service Engineering Branch	E
Nicole Waters	E40	Test & Evaluation & Prototype Fabrication Division	
Jesse Walton	E42	Range & Facilities Branch	
Richard Bodine	E55	Logistics Technical Data Branch	
George Johnson Jr.	E56	Training Systems Branch	
Jermaine Kennedy	X10	Sensing Sciences & Systems Division	X

Veterans Among Us

THANK YOU VETERANS

2022 Awards

External Awards

National Defense Industrial Association Bronze Medal
Dr. K. Todd Holland, SSTM

National Defense Industrial Association VADM Charles B. Martell - David Bushnell Award
Dr. Kerry Commander

Dr. Delores M. Etter Top Navy Scientists and Engineers for the Year Awards
Andrew Bouchard

Black Engineer of the Year Awards Modern-Day Technology Leaders
Ashley Williams

Warfare Center Awards
Air Cushion Vehicle Foreign Military Sales Team

Barracuda Team

Clyde Brown

Joint Expeditionary Command and Control Team

Precise Integrated Navigation System In-Service Engineering Agent Team

Rapid Prototyping & Experimentation with Unmanned Systems Team

Research Commons Team

Surface-to-Surface Mission Module Cross-Deck Team

Naval Sea Systems Command Excellence Award
Angela Taylor

Littoral Combat Ship Mine Countermeasures Mission Package Tactic & Analysis Team

Naval Sea Systems Command Tester in the Spotlight
Amanda Elkins

Office of Secretary Defense Patriotic Employer Award
Katherine Mapp

FIRST LEGO Volunteer of the Year Award
Mary Mouro

Department of Navy Medals

Meritorious Civilian Service Award
Wanda Cutchin

Stephen Weathers

Commendation Medal
Lisa Arrieta
Donald Bickford
Joseph Bray
Jaime Bunczek

John Holloway
Clinton Iles
Eric Kosmoski
Vincent Tomasi

Achievement Medal
Donn Brown
Halie Cameron
Michael Kirke
Cynthia Ratliff
Carlos Rubio

Charles Self
Lorri Tucker
Jesse Walton
Nicole Waters

NSWC PCD Quarterly Awards

Award	Quarter 1-2	Quarter 3	Quarter 4
Civilian of the Quarter	Carla Stanton	Maria Chapman	Eric Queen
New Employee of the Quarter	Fiamma Fernandez	Jason Wilson	Erick Garcia-Alvarez
Spearhead Award	Clyde Brown	Dr. Michelle Kincer	David Walls
Team of the Quarter	Ship to Shore Connector Ship Interface Test 1 Team	High Volume Long Range Precision Team	Acquisition Management System Deployment & Load Team

2022 ANNUAL Awards

NSWC PANAMA CITY DIVISION

Individual Awards

Amanda Elkins
COLLABORATION EXCELLENCE

Cory Bruckschen
BUSINESS EXCELLENCE

Anna Anderson
EXCEPTIONAL TECHNICAL SUPPORT

Dr. Michelle Kincer
EXEMPLARY LEADERSHIP

Dr. Richard Tatum
DR. DAVID P. SKINNER OUTSTANDING
SCIENTIFIC & ENGINEERING AWARD

Ronel Murillo Pagan
NEW EMPLOYEE
EXCEPTIONAL ACHIEVEMENT

Christopher Doyle
CAREER ACHIEVEMENT

Evan McCaw
OUTSTANDING INNOVATION

Clyde Brown
TECHNICAL EXCELLENCE

Kirk Dye
HALL OF FAME AWARD

Patents

Agent Conflict Resolution

Dr. Matthew Bays

Not pictured: Demetrious Kutzke

Caustic Expander and Local Waveguide to Improve Acoustic Communications

Michael Kobold

Team Awards

Outstanding Fleet Support

Special Operations Forces Combat Diving Rapid Engineering Division Team

From left to right:
Chris Voorheis, Daniel Lopez-Gavilan, James McGinley, Jonathan Outlaw, Brandon Bascetta, Jason Scott, Michael Kirke, and David Davila

Not Pictured: Michael Hodges, Stan Swiess, Melissa Walbridge, and Doug Copsey

Outstanding Organizational Support

Equal Employment Opportunity, Diversity & Inclusion Office

From left to right:
Mary Kim, Lauren Sikes, and Katelyn Arnold (virtually)

Technical Excellence

AN/SQQ-32 (V)4 ISEA Team

From left to right:
Dennis Shelton, Issac Guettler, Tyler Tierney, Daniel Greenlee, Andrew Fonzi, Robert Stetson, John Best, and David Brown

Not pictured: Joshua Jordan, Lee Dittman, Richard Sama, Joseph TImbang, Billy Courson, Charles Martin, and Matt Mullin

Outstanding Program Success

Mine Countermeasure Mission Package Tactics & Analysis Project Team

From left to right:
Timothy Currie, Evan Stafford, Shelby Scotese, Justin Deherder, Christine Ingram, Dr. Jean-Francois Kamath, Jennifer Conner, Regina Kettering, Sunny Barton, Daniel Noble, Dr. Emily Dempsey, and Jennifer Powell

Not pictured: Jennifer Jackson

MINE COUNTERMEASURES MISSION PACKAGE TEST TEAM

Amy Abbott, Diana Abee, Alexis Acevedo Sanchez, Leo Acker, Corey Alderman, Ratha An, Stephanie Anderson , Evan Applegate, Dominic Araujo, Emily Astrom, Brandon Barner, David Barnett, Kevin Barron, Sunny Barton, Paula Beauchene, Jason Bennett, Zachary Billingham, Nicole Bishop, Mackenzie Blair, Jeffrey Blankenship, Daniel Bockstege, Mallory Bond, Joseph Boza, James Brackett, Katherine Brackett, John Brady, Casey Brennan, Sarah Bride, Reginald Bright, Tina Buddi, Christopher Buglino, Anthony Bush, John Bush, Miguel Camacho, Oana Castle, Ronald Ceballos, Dan Chandler, Myranda Chapman, Muhibus Chaudhury, Brandi Chestang, Ryan Close, Bradley Collie, Michael Conley, Michael Conn, Jennifer Conner, Chika Cosmas, Dr. Erin Cotton, Alexandra Crisostomo, Marcus Cruzvelez, Timothy Currie,

Patrick Curry, Michael Dawson, James Deason, Derek Decker, Justin Deherder, Emily Dempsey, Howard Doane, Patrick Donovan, Scott Dorsch, Kelly Dunn, Lindsey Dupriest, Rosa Eby, Amanda Elkins, Kelly Elrod, Mike Elrod, David Emery, Eduardo Fenollal-Gines, Roscelin Figueroa, Tiffany Finch, Jody Forcha, Alex Fournier, Lisa Frye, Thomas Fuqua, David Galindo, Erick Garcia-Alvarez, Katherine Garner, Edward Gregg, Rohin Gupta, Jessica Haig, Eric Haight, Angela Hall, Christopher Harrington, James Hayes, Douglas Heath, Michelle Henderson, Lauren Howell, Adam Humble, Penelope Hutt, Jason Hyndman, Tinsley Ihaksi, Christine Ingram, Jennifer Jackson, Lauren Jarlenski, Steen Jensen, Colin Jones, Dr. Jean-Francois Kamath, Ilish Kane, Harry Kantor, Terri Kesler Aldridge, Regina Kettering, Jarred Kinder, Martin Knapp, Daryl Kunkel,

Alexander Kushma, Barbara Kuzan, Jeremiah LaFountain, Michael Langford, Rachael Langford, Diego Langoni, Timothy Lawler, Heather Lewis, Natalia Linares, Katherine Lor, Katherine Maglio, Randall Main, Patrick Malvoso, Howard Marshall, Logan McCall, Amanda McFarlin, Joseph McMonigal, Richard McNaron, Alesia McNutt, Ronald Miller, Benjamin Mitchell, Kyla Mitchell, Tyler Moak, Joshua Moehring, Margaret Morejon, Jason Newton, Tri Ngo, Anh-Vo Nguyen, Thu Nguyen, Daniel Noble, Kevin Oakes, Kristine Olive, Hannah Olson, Nicole Pagan-Montanez, Dwayne Palmer, Lacy Parker, Stephen Peffers, Christopher Pennington, Gabriel Perez-Figuerola, William Pinkerton, William Porter, Richard Potemken, Jennifer Powell, Anthony Powers, Jaime Raya, Gordon Reece, Tanner Reynolds, Morgan Ridler, Luke Ridley,

Adrian Rodriguez Morales, Edwin Rodriguez, Debora Roy, Steven Rutledge, John Sanderson, Josephine Schamle, Stephen Schelfhout, Jason Schrieffer, Shelby Scotese, Robert Scullion, Amanda Shaw, Michael Shepherd, Wade Sigstedt, Calen Sims, Honor Six, Delaney Slaton, David Slusser, Haydlee Slutzky, Michael Small, Darius Smedley, Lederick Smedley, Cody Smith, Emily Smith, John Smith, Michael St. Pierre, Evan Stafford, Christopher Stanley, Joshua Strickland, Andrew Stubblefield, Cody Subject, Michael Sullivan, Brett Thach, George Thomas, Bryon Timbs, Thuy Tran, Tien Tran, Jeffrey Tweedie, Shin-Miin Tzuoo, William Vandiver, Rayfield Velazquez, Johnny Vue, Nathaniel Waldstein, Jared Wampler, Stephen Weathers, Randy Williams, Demetricus Woodard, Susanna Yau

DEPART
& Mission Areas

Chief Engineer (CHENG) Office

The purpose of the CHENG Office is to provide Navy technical expertise in the areas of research, development, test and evaluation (RDT&E), and lifecycle sustainment of Littoral Warfare Systems for NSWC PCD. The office oversees engineering investigations, analyses, and technical program developments at the Command level across the full lifecycle of the Division's assigned mission areas and responsibilities. Additionally, the office is responsible for directing the implementation of engineering policies, instructions, and agreements to ensure that policy is consistently implemented and that quality products are developed in a consistent and repeatable manner. The CHENG Office includes the Chief Engineer and the Competency Leads for key technical competency domains.

Code A: Littoral & Mine Warfare Systems Department

NSWC PCD is the Navy's designated full-spectrum Mine Warfare RDT&E laboratory with over 75 years of in-house knowledge and expertise. The Littoral & Mine Warfare Systems Department capabilities include the development and implementation of new technologies, mission systems integration, and applied system engineering to conduct mining and mine countermeasures. Mine counter-measures include detecting, localizing, identifying, and neutralizing mine threats from deep water through the beach zone. Detection and identification may use magnetics, acoustics, and electro-optics, as well as other technologies. Neutral-ization uses systems ranging from minesweeping to explosive clearance.

Code E: Expeditionary & Maritime Systems Department

The Expeditionary & Maritime Systems Department conducts and manages research, technology transitions, systems development, integration, test and evaluation, and sustainment programs for Naval Special Warfare, Diving & Life Support, Amphibious & Expeditionary Warfare, and other missions in support of homeland defense and force protection. The Department's activities span the full spectrum of acquisition lifecycle support required to enable Navy, Marine Corps, Special Operation Forces (SOF), Joint Forces, and other related Federal agencies to successfully conduct their mission and to operate globally. In support of the above missions, the Department maintains the health of seven Technical Capabil-ities and the associated personnel, equipment, facilities, and related processes.

MENTS

Code X: *Science & Technology Department*

Science and Technology (S&T) Department performs basic and applied research supporting Navy and Marine Corps missions in Mine Warfare, Expeditionary Warfare, Special Operations, Diving and Life Support, and other applications for Littoral Warfare and Coastal Defense. Maturing technology are integrated into advanced technology demonstrations to provide visibility to the fleet and to support the transitions. The S&T Department maintains the health of eight Technical Capabilities and the associated personnel, equipment, facilities, and related processes.

Code 01: *Comptroller Department*

The Comptroller Department is responsible for all financial management functions, including fiscal policy and regulations, budget, accounting, and financial services. In addition, the Comptroller provides command management with technical advice and guidance in the areas of budget formulation and execution, managerial accounting, financial review and management analysis, program analysis, internal control systems, and integrated financial systems. The Department is also responsible for administering all laws, policies, regulations, and directives pertaining to financial management. The Comptroller reports directly to the Commanding Officer, serves as the Chief Financial Advisor to the Division, and is delegated fiduciary authority under Title 31 USC 1517.

Code 02: *Contracts Department*

The Contracts Department is responsible for the end-to-end management and execution of the contract process from solicitation, proposal, evaluation, and award through contract closeout. Code 02 manages and directs the contract functions, which support the Warfare Center Division's technical programs and missions. Contracting is the process by which NSWC PCD acquires supplies and services. Code 02 is organized around four divisions and an Engineering Liaison Office. The four divisions are composed of the Acquisition Policy and Oversight Division, Littoral and Mine Systems Division, Expeditionary and Maritime Systems Division, and Small Purchases Division.

Code 10: *Corporate Operations Department*

Corporate Operations Department manages and directs the business functions, which support the Warfare Center Division's technical programs and missions. Key functions include Equal Employment Opportunity, Diversity and Inclusion (ED&I), Human Resources Management, Infrastructure, Corporate Communication, Information Technology, Security, Corporate Business Office, and Property Management.

PCD RELA

The Impact

Worldwide Reach
NSWC PCD directly supports Navy fleets and warfighters throughout the world

Diverse Customer Base
Work spans from basic research to in-service engineering (ISEA)

Sponsor Summary

FUNDED PROGRAMS
$574M

CONTRACTS ISSUED
$250.1M

Percent of total funding

91% Navy   2% DoD

3% USMC   1% Army

2% USAF   1% Non-DoD

Top 5 Sponsors

PEO USC   PEO SHIPS   PEO C4I   NAVSUP NAVAL SUPPLY SYSTEMS COMMAND   Office of Naval Research Science & Technology

TIONSHIPS

Innovation Ecosystem

DoD

Other Government

Fleet

Industry

Academia

7 Active Cooperative Research and Development Agreements (CRADAs)

13 Active Educational Partnership Agreements (EPAs)

Regional Partners

BAY COUNTY CHAMBER OF COMMERCE Est. 1913

MSET

GULF COAST TECH BRIDGE POWERED BY NAVWAR

NATIONAL INVENTION CONVENTION

seaperch

FIRST LEGO LEAGUE

STEM OUTREACH

GULF COAST STATE COLLEGE SINCE 1957

FLORIDA STATE UNIVERSITY 1851

BAY DISTRICT SCHOOLS FLORIDA

Areas of Excellence

Mine Warfare	Subsea & Seabed Warfare	Naval Special Warfare
Expeditionary & Amphibious Warfare	Unmanned Systems	Science & Technology
	Diving & Life Support	Other Coastal Missions

Division Technology Focus Areas

Developing and fielding unmanned systems and associated technologies to reduce the operational timeline and remove humans from hazardous environments.

Unmanned Systems

Developing and analyzing automated machine technology and applications that can take the place of humans, or result in more efficient operations, in dangerous Naval and maritime environments.

Robotics

Researching ocean phenomena and biological behaviors to enable novel solutions for undersea sensing, communications and control.

Ocean Sciences & Sensing

Applying a multi-tiered, multi-disciplinary approach to M&S and to assess new technology development and optimization of system performance.

Modeling & Simulation/ LVC

Material Science

Exploring advanced material and design solutions unique to the marine environment, including additive manufacturing.

Fully Networked Command, Control & Communications (FNC3)

Developing fully networked command, control, and communications (C3) technologies capable of acquiring, processing and disseminating information across force elements.

Mission & System Analys

Advancing techniques for analysis and assessment of littoral systems.

Acoustics, Signals & Signal Processing

Exploring novel acoustic sensing concepts and signal processing techniques for unmanned platforms to expand our advantage in the littorals.

Artificial Intelligence & Machine Learning

Developing and applying AI/ML techniques to problems in the littorals in order to provide warfighting decision aids and optimized autonomous mission planning and execution.

Autonomy

Studying autonomous and human behaviors and their interaction to optimize mission planning, training, system command and control, and mission execution of littoral systems.

Bio-Technology

Developing technology that utilizes biological systems, living organisms or biological behaviors to address problems in the marine environment.

Cybersecurity

Pursuing R&D efforts that influence cyber resilience at all phases of systems life cycle engineering including design, construction, deployment and execution.

Electro-Optics

Exploring specialized electro-optical (EO) sensors to support detection, classification and identification (DCI) of threats and other targets at actionable distances within a broad range of operating environments.

Electro-magnetics

Exploring the full electromagnetic spectrum to develop advanced imaging and electronic warfare capabilities.

NSEA
CENTERS
a City
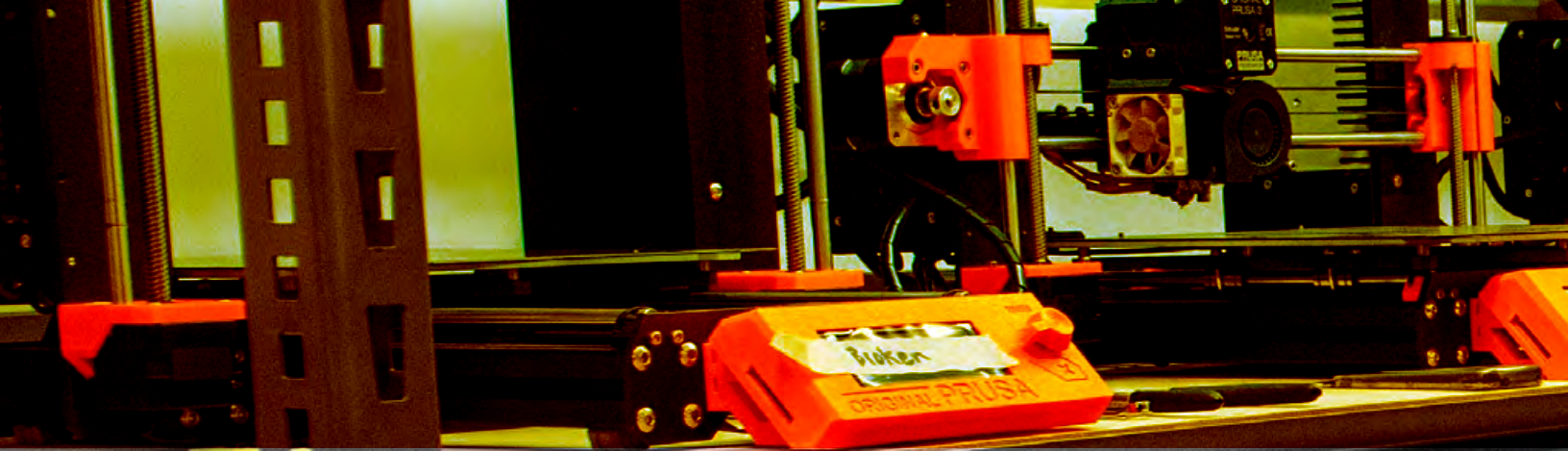
Technology Transfer

Several NSWC PCD professionals shared their time and talents judging the Bay District Invention Convention and Entrepreneurship Fair at Gulf Coast State College in Panama City, Fla.

Autonomous vehicles save time and money during dry-dock inspections.

Education Partnerships

At NSWC PCD, the Education Partnership Agreements (EPA) are mostly used for STEM outreach and recruiting. The three most significant EPAs we have are with Bay District Schools, Florida State University Panama City, and Gulf Coast State College. NSWC PCD partners with these academic institutions to hold STEM camps during the summer and support all of NSWC PCD's STEM outreach programs in the community, including STEM-in-a-Box, Scientist@School, SeaPerch, Invention Convention, Science Fair, and FIRST Robotics. Through the academic partnerships, NSWC PCD has been able to reach thousands of students in Bay County and surrounding counties.

Autonomous Dry Dock Survey System

Another significant partnership was a three-way Cooperative Research and Development Agreement (CRADA) with NSWC PCD, Portsmouth Naval Shipyard (PNSY), and Radiation Safety and Control Services. In 2019, NSWC PCD developed an unmanned ground vehicle to support the Autonomous Dry Dock Survey System (ADDS) under a Director's Cup competition at the lab. Under the current CRADA, Panama City engineers will integrate a Surface Contamination Monitor sensor onto the vehicle to perform demonstration and testing at PNSY. This robotic system will reduce the cost and man hours associated with dry-dock surveys, evaluate wide-area envi-ronmental sensor solutions and introduce artificial intelligence capabilities into naval shipyard environments.

Pharos receives final preparation before launching into the water to test its ballasted and de-ballasted loaded configurations.

A crane prepares to lift the HII Pharos launch and recovery system from a trailer before launching it down the boat ramp.

Huntington Ingalls Industries Pharos

A significant test event took place in Panama City that was the result of a collaboration between NSWC PCD, Huntington Ingalls Industries unmanned underwater vehicle, Inc. (HII UxS) and Naval Undersea Warfare Center Newport. Under a CRADA, NSWC PCD and HII UxS worked together to develop and execute a test of the Pharos UUV launch and recovery system. The Pharos was then shipped to Newport for further testing with UUVs. This testing supported both Newport and Panama City's work with Unmanned Underwater Vehicles (UUVs) and successfully demonstrated the possibility of being able to launch and recover UUVs, which will have a significant impact on future Navy programs.

Quality Management (00Q)

Accomplishments

1. In an effort of continued Command Quality Management System maturation, the first fiscal year audit schedule was developed to assess the current quality health throughout the Command.

00Q successfully met the schedule and completed four Technical Assists of four tier four projects including; Multiple Vehicle Communications System, Knifefish Surface Mine Countermeasures Unmanned Underwater Vehicle, Air Cushion Vehicle Landing Craft, Air Cushion, and Net-Centric Sensor Analysis for Mine Warfare.

2. March, 00Q collaborated with Code 1063 on the analysis of NSWC PCD's procurement process, resulting in the Code 1063 Procurement Process Conjoint Analysis Report. The purpose of the white paper was to establish baseline data to evaluate, create and analyze the procurement process conjoint analysis survey, and the objective of the survey is to evaluate the preference of these four metrics: Purchase Request Cycle Time, Consistency, Rejection Rate, and Assistance. While analyzing the proposed metrics, via baseline data and the survey, barriers and areas for improvement were discovered for the procurement process, which was discussed through the paper and concluded with recommendations.

3. October, NSWC PCD reported to NAVSEA HQ, $1.78M in cost avoidance for FY22 in support of the Culture of Affordability initiative. The cost avoidances are submitted to 00Q from all technical and support codes as reduction in total ownership costs. Additionally, the follow on years of these cost avoidances are expected to yield approximately $1M in FY23 and $400K in FY24.

Core Values

Integrity
To be trusted to do the right thing even when no one is watching.

Commitment
To our nation, to our Navy, and to each other; to have passion for our work, to be focused on the warfighter; and to bring, every day, a determination to get the job done.

Courage
To be technically assertive; to be a responsible risk taker; to speak truth to power even when the message is unpopular; to remain steadfast to overcome the challenges that lie ahead.

Respect
To create a safe and supportive environment to all; to embrace diversity and teamwork; to treat others as they would like to be treated.

Strategic Campaign Plan Fiscal Year 19–23

Rapidly Deliver Solutions to Ensure Warfighting Dominance

Decrease Time to Deliver Products/Services

- Accelerate Acquisition
- Employ Digital Engineering
- Create a culture of responsible risk taking
- Mainstream high velocity learning throughout the division

Increase Agility to Meet Emerging Needs

- Accelerate S&T (incubation to transition)
- Strengthen external partnerships
- Cultivate a culture of innovation and experimentation

Expand Naval Superiority

- Enhance warfighting familiarity among the workforce
- Strengthen relationships with the warfighter

Be the Undisputed Technical Expert Throughout the Littoral Battlespace

Establish a Deep Technical Bench

- Shape the workforce for the future
- Optimize and balance technical support across the organization

Shape Future Littoral Battlespace Operations

- Drive Littoral Battlespace Mission Area Analysis
- Shape the long term vision for the Littoral Battlespace
- Develop credible technical solutions for the Littoral Battlespace

Be recognized internationally as the Technical Leader

- Expand recognition as the Technical Leaders in the Littoral Battlespace
- Strengthen and expand influence across the Naval Research and Development Enterprise and fleet

Be Recognized as a Model Organization

Be the Employer of Choice

- Recruit, develop, and retain talented personnel
- Equip our workforce with world class facilities and tools
- Ensure a culture of inclusion and engagement exists in all parts of our organization
- expand networking and interaction across the Command
- Deliver business solutions that meet our employees' needs

Be the Partner of Choice

- Establish enduring reputation for ground truth, technical assertiveness, and quality
- Enable a culture of affordability and demonstrate value to our customers
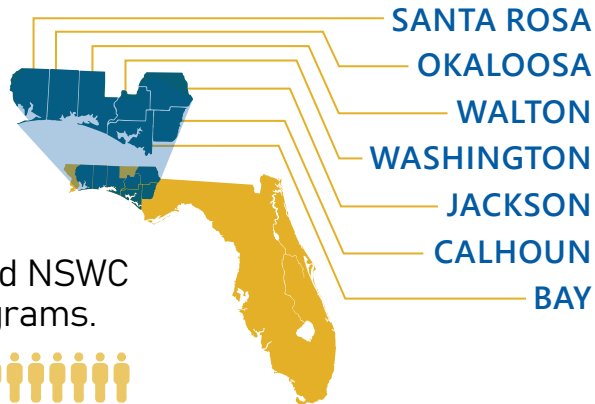- Strengthen relationships and stakeholders

Be the Collaborator of Choice

- Foster a culture of collaboration both internally and externally
- Grow and sustain our network of collaborators

STEM OUTREACH

3,500+ STUDENTS

reached via STEM Camps and NSWC PCD Scientist at School programs.

SANTA ROSA
OKALOOSA
WALTON
WASHINGTON
JACKSON
CALHOUN
BAY

PARTICIPANTS

	Students	Educators	Volunteers
Enrichment	1917	66	112
Competition	1590	222	43
SEAP Intern & Apprenticeships	16	1	5

Grades K–5: 1,789	Grades 6–8: 986	Grades 9–12: 650	College: 98

ENGAGEMENT HOURS

Enrichment: 670.80

Competition: 829.00

Coordination: 1,266.00

High school Science and Engineering Apprenticeship Program (SEAP) summer interns 2022.

CHENG

The CHENG Office introduced data visualization into the Mid-Year Execution Reviews (MERs). Three projects (one in each technical department) were chosen to go through a pilot data visualization MER. The pilot program transitioned data presentation to command leadership from PowerPoint to Tableau created visualizations. The data visualizations allow data to be extracted from the existing authoritative data source and easily displayed in various views for data analysis and display. The goal is to continue to expand data visualizations to other project reviews as well as provide the visualizations to stakeholders throughout the command to aid in project execution as part of NSWC PCD's digital transformation.

Due to the Defense Intelligence Information Enterprise (DI2E) platform removing access to several NSWC PCD projects, the Software Engineering (SWE) Competency Lead (CL) led an effort (in conjunction with Code 10) to replicate the Atlassian environment in a local instantiation at NSWC PCD. Multiple projects use the Atlassian tool set hosted on DI2E to manage their software development activities. With the removal of access to DI2E a need was identified for another solution. Working with the software leads throughout the command and code 10, the SWE CL was able to stand up a local Atlassian environment and contracted support for data transfer and training to ensure there was no loss to data to projects. Transition to the local Atlassian environment commenced in FY22 and will continue into FY23.

Continued executing the Competency Proficiency Program (CPP) by adding Project Managers and Project Lead System Engineers as critical positions in the program. Additionally, Mechanical Engineering (ME) and Electrical Engineering (EE) Competency Leads were established. These two CLs are responsible for standing up the elements of the ME and EE competencies, to include defining the CPP standards for their competency areas.

CURRENT OPEN CMD RISKS

52
Total Current Risks

48
Current Risks with Active Mitigation Plans

2
Current Risks with Impact Date < 6 months

Current QTY of Risks by Level and Status

Legend:
- Active
- Accepted

	Division	Branch	Department
(bar values)	~37	~9	~3

(y-axis: 0, 10, 20, 30, 40)

Risks Identified Over Time

- Risks Realized
- Risks Closed

2016 2017 2018 2019 2020 2021 2022
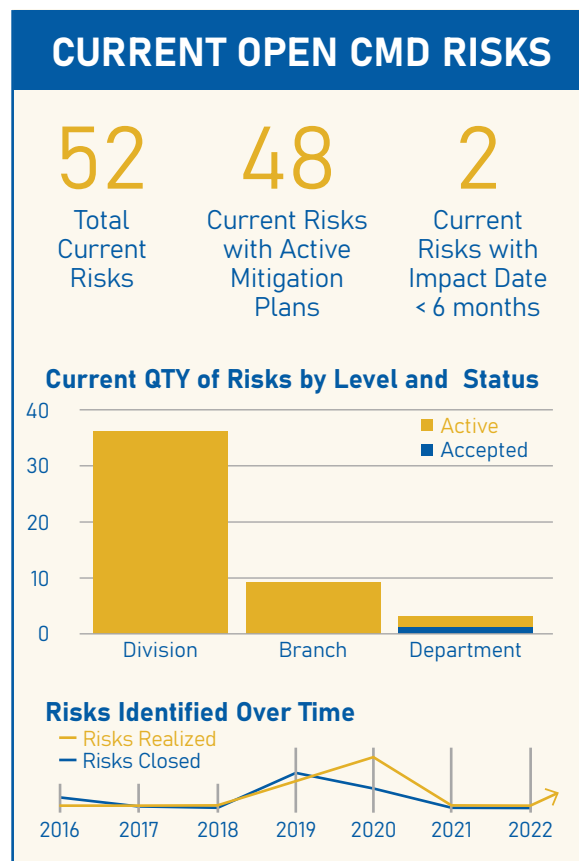
CODE A

LITTORAL&MINE WARFARE SYSTEMS DEPARTMENT

A10: Mine Countermeasures Unmanned Surface Vehicle Unmanned Influence Sweep System (MCM USV UISS)

The Office of the Chief of Naval Operations (OPNAV) declared UISS Initial Operating Capability (IOC) July 22, 2022. Notably, this was the first IOC of an unmanned surface platform by the U.S. Navy, marking an important milestone in the evolution toward a hybrid fleet of manned and unmanned systems. The MCM USV UISS program completed formal testing and delivered a system with logistics and training material with appropriately trained Fleet personnel to execute minesweeping as part of the Mine Countermeasures (MCM) Mission Package (MP). Capable of being operated from littoral combat ships (LCS), shore, or vessels of opportunity, UISS provides acoustic and magnetic minesweeping coupled with the semi-autonomous, Diesel-powered, aluminum-hulled MCM USV. The project

was awarded Milestone C in January 2020 and the Low Rate Production (LRIP) contract was awarded shortly after. Since then, the MCM USV UISS team has completed Developmental Testing to include integration of the AN/AQS-20 sonar into the USV mine hunting configuration with sonar integration testing accomplished in the Gulf of Mexico. The project also successfully completed dual USV testing in the Gulf of Mexico with one MCM USV minesweeping configuration and one mine hunting configuration operating simultaneously. The MCM USV UISS team developed solutions to correct deficiencies identified during UISS Operational Testing and is currently supporting production of LRIP units to support system-wide IOC for the MCM MP.

A20: Fleet Support

AN/SQQ-32 Minehunting Sonar Set

In FY22, the AN/SQQ-32 Minehunting Sonar Set team improved Fleet Readiness through material support and provided corrective actions for 18 casualty reports (CASREP), provided 56 distance support and technical assistance events, and completed 14 CARE events. Through proactive distance support, the SQQ-32 team was able to correct 11 CASREPS and avoid eight CASREPS on forward-deployed MCM 1 Class ships. The SQQ-32 Depot repaired overhauled and reconditioned three classify array assemblies to improve sparing and Fleet Readiness for the AN/SQQ-32 (V)4 sonar, and restored two unit 1A3 classify carousels aboard the MCM 1 platforms. Operational availability (Ao) for the AN/SQQ-32 sonar remained above 95%, and closed out FY22 CASREP Free.

AN/SLQ-48 Mine Neutralization System

In FY22, the AN/SLQ-48 Mine Neutralization System team completed Overhaul and Reconditioning (O&R) and product delivery of three Mine Neutralization Vehicles (MNVs) to COMCMRON SEVEN (U.S. 7th Fleet; Sasebo Japan) and one MNV for the Taiwan Navy. The Team improved Fleet Readiness through material support and provided corrective actions for 11 CASREPs aboard U.S. 7th Fleet MCM Platforms, provided 47 technical assistance events, and performed three 48CARE events. These efforts culminated to improve the Ao above 95% and achieve CASREP-free status to close out FY22.

Sweep Systems

In FY22, the Sweep Systems team completed replacement of one Magnetic Sweep (MAG) cables in-theater at U.S. 5th Fleet, performed one in-theater MAG Cable repairs in 7th Fleet, and performed numerous S-cable repairs and fabrications in theater. The team provided on-site overhauls of the Influence and Acoustic sweep generator system in both U.S. 5th Fleet and U.S. 7th Fleet. The Team improved Fleet Readiness through material support and provided corrective actions for five CASREPs, provided 11 technical assistance events, and performed six CARE events.

A30: MCM Mission Package Testing (E2E Workups, TECHEVAL & IOT&E)

The Mine Countermeasures Mission Package End-to-End Workups and Technical Evaluation events were conducted aboard USS Cincinnati (LCS 20) at Naval Base San Diego and southern California operational area. The E2E Workups and TECHEVAL events took place on May 12-26 and June 16 to July 6, 2022, respectively. Five MCM Mission Modules (MMs) were embarked on the USS Cincinnati as the Systems Under Test (SUT): Near-Surface Detection, Airborne Mine Neutralization, Buried Minehunting, Remote Minehunting, and Unmanned Minesweeping. Additional elements under test included the Mission Package Computing Environment, Mission Package Application Software, Multi-Vehicle Communication System, MH-60S helicopter, and support containers. The Aviation Detachment and MCM-Focused LCS Crew were also considered part of the SUT. The main goal was to assess the performance, effectiveness, and suitability of these MCM Mission Systems during operations and support risk mitigation for the upcoming MCM MP Initial Operational Test and Evaluation.

TECHEVAL demonstrated launch and recovery of mission systems, data flow and management, Command and Control of off-board systems, and occurrence of simultaneous mission planning and PMA among multiple systems. TECHEVAL also demonstrated the utilization of the integrated MCM Tactics. Data was also captured to evaluate train-to-certify, measures of effectiveness/measures of performance, and operational availability/material availability requirements. A major highlight from this event included demonstrating the simultaneous use of the MH-60/Airborne Laser Mine Detection System (ALMDS), Knifefish unmanned underwater vehicle, and MCM USV mission systems operated and controlled from LCS.

MCM Mission Package Initial Operating Test & Evaluation (IOTE) event was conducted in August 2022 aboard USS Cincinnati at the Naval Base San Diego. All test objectives and required data collection were completed ahead of schedule. Additionally, unplanned missions were accomplish to support Mine Hunt performance data assessment and buy down risk for Mine Hunt IOTE in September 2022.

Accomplishments

1. Full Detect-To-Engage sequence for moored targets

2. Multiple Airborne Mine Neutralization System neutralizations and completion of ALMDS missions

3. All mine hunt modes demonstrated including Electro-Optic Identification during dual USV operations

4. Mine hunt Near Surface Volume runs for Overlap assessment

A40: Analysis, Tactics, & Simulation Division

Highlight

In FY22, A Department's A40 Division, the Analysis, Tactics, and Simulation Division, provided critical Fleet MCM tactical training and testing support, as well as Fleet tactical data collection.

Description

The Integrated Tactics team executed several MCM Staff continuums and/or wargames with Mine Countermeasures Group (MCMGRU) 3, Naval Surface and Mine Warfighting Development Center (NSWMDC), Commander Task Force (CTF) 52, and Commander Task Group (CTG) 68.3. In addition, the team provided in-theater Fleet support during several major exercises, such as Arctic Edge, Baltic Operations (BALTOPS), and Rim of the Pacific (RIMPAC). The Underwater Mine Countermeasures Fleet Tactics team executed eleven Operational MINEnet Tactical and Real Aperture Sonar Post Mission Analysis courses, three MCM Commander Continuum courses in support of Explosive Ordnance Disposal forces, as well as supporting in-theater three certification exercises and one Fleet exercise. The Airborne Mine Countermeasures (AMCM) team conducted the Helicopter Advanced Readiness Program (HARP) 22-1 exercise as well as an Airborne MCM Tactics Continuum class. The Mine Warfare Readiness and Effectiveness Program conducted four separate data collection events with the Fleet in support of NSMWDC. The Division also staffed a Shore-Based Command Center (SBCC) for direct support of the LCS MCM MP testing aboard USS Cincinnati. The SBCC entailed 24/7 operations providing MCM Commander functionality and support, tactical planning and plan approval for the Fleet, and extensive data collection over three major at-sea test events.
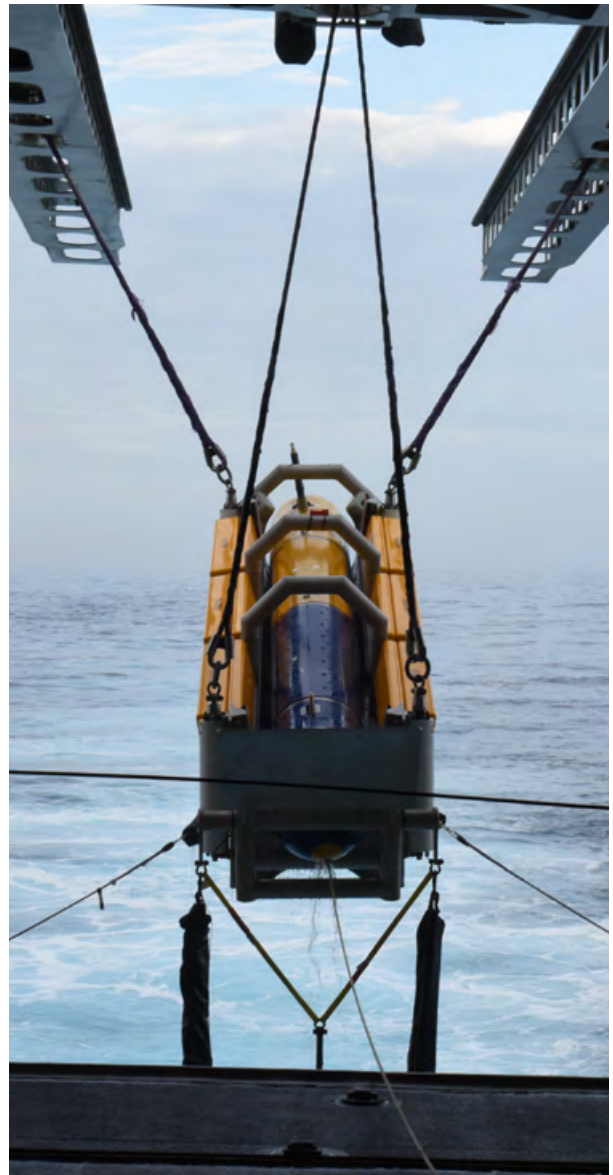
CODE E

EXPEDITIONARY & MARITIME SYSTEMS DEPARTMENT

E10: E Department's Chemical Biological Individual Protection Equipment (CBD-IPE) Project Helps Navy Determine How Often to Fit Test Chemical Protective Masks

The Chemical Biological Individual Protection Equipment project completed a critical study on the mask size and fit periodicity of U.S. Navy sailors for chemical protective masks in 2022. The Mask Fit Test Study team collected demographic and anthropometric data on 194 Sailors and Marines at multiple U.S. Navy, Marine Corps, and Naval Reserve sites over an approximate three year period. The data analysis and test report may influence mask fit test requirements beyond the Navy, as study data collection over individuals over such a time frame had not been accomplished prior to this study.

The objective of this study was to determine if the current Navy five year test for mask size and fit for the M50 Mask fit is satisfactory or if standard size and fit checks should be performed more frequently. This study began in 2018 in response to an update to a DoD instruction requiring DoD components to apply OSHA and/or other regulatory safety and health standards to military-unique situations as practicable; where this is infeasible or inappropriate, DoD components must apply risk management procedures and communicate results to all affected personnel.

Occupational Safety and Health Administration (OSHA) standard 29 CFR 1910.134 requires annual fit verifications for respiratory protective masks. However, for the Navy, annual fit testing is not practicable due to deployment requirements and cost impacts. As a result, the team assessed the current Navy five year periodicity to inform the Office of the Chief of Naval Operations (OPNAV) and the Fleet.

The study was conducted using the M50 Joint Service General Purpose Mask, the currently fielded military-unique ground and ship chemical protective mask. Participants were sized using the face measuring tool, fit using quantitative methods, and measured anthropometrically with traditional anthropometry tools and 3D measurements. Participants were measured initially and then every six months for a period of at least two years afterward.

The results from the study supported the Navy policy that mask size and fit assessment is sufficient at the 5-year periodicity, and should be refit only for large changes in weight (33 lbs.), pregnancy, or an event that would change the facial structure such as maxillofacial surgery or injury. Therefore, the current periodicity of five years is deemed sufficient and low risk.

As a result of the Mask Fit Test Study Team's technical expertise, dedication to the Fleet, and determination to rise to the challenge, the Navy was provided with data to support the continuation of the current Navy five year mask size and fit periodicity. The current five year periodicity affords a significant reduction in logistical burden to the Fleet and an annual cost savings of approximately $11M for the Navy compared to an annual size and fit requirement.

E20: Adaptive Persistent Awareness System (APAS) Team has String of Successes in Real-World Testbeds

E Department's Adaptive Persistent Awareness System (APAS) team had a stellar year of accomplishment and growth in 2022. The APAS project, which has been supporting the Department of Homeland Security and Transportation Security Administration (DHS/TSA) Critical Infrastructure Protection (CIP) programs since 2005, is now TSA's premier Systems Integrator for security technologies.

APAS supports counter-terrorism efforts by using sensor data to detect, track, and classify potential threats within protected areas to safeguard the traveling public. APAS provides security technology recommendations and solutions for Counter-Unmanned Aerial Systems (C-UAS), Critical Infrastructure, Mass Transit Public Areas, and Air Cargo by evaluating existing technologies and developing requirements for new security technologies. APAS has played a pivotal role in providing technology solutions and testing & evaluation support of these technologies in active testbeds across the U.S.

Since FY20, the APAS project has increased in funding from $2.6M per year to more than $16.7M per year, and has grown its portfolio from one functional area to five. Since FY20, APAS has grown from supporting rail bridges and pipelines to now also assessing security infrastructure for Bay Area Rapid Transit, New York/New Jersey Transit Authority, Port of Miami, and Norwegian Cruise Lines. It has supported security at the Army Navy game, the National Hockey League, and the National Basketball Association. APAS has also established CIP test beds at Miami International and Los Angeles International airports. APAS has added Air Cargo transportation security equipment, Air Cargo infrastructure protection and surveillance, Airport Infrastructure protection, Unmanned Aerial Systems (UAS), and Threat Tracker, which added an additional sponsor to the program. Threat Tracker was a NSWC PCD-developed Counter-Unmanned System that was transitioned to a High Powered Microwave system at NSWC Dahlgren Division.

APAS executed a C-UAS flight test event in August 2022 at MIA, ranked in the top 15 busiest US airports in 2022. The event evaluated the Detect, Track, and Identification (DTI) capabilities of four selected C-UAS systems. The flight test provided TSA with a venue for assessing the current state of various technologies in the complex conditions of an operational airport that included a dense urban setting and numerous nearby Radio Frequency (RF) emitters on a variety of frequencies. The event provided an opportunity for government and industry partners to challenge their capabilities in a rigorous and realistic setting, and provided a chance to observe the DTI capabilities against realistic flight profiles of a variety of small UAS platforms. The MIA test event exemplifies the type of outstanding task execution under complex conditions that has gained the APAS team the confidence of sponsors and garnered a quadrupling of funding in just two years.

Executing the flight test required significant collaboration between the APAS team and DHS Science and Technology (S&T), Federal Aviation Administration (FAA) Air Traffic Controllers, Miami-Dade Aviation Division (MDAD), Miami-Dade Police Department (MDPD), and the MIA airport. The APAS team coordinated with more than 40 personnel from Federal, State, and Contractor organizations involved in event execution. The entire test event was successfully completed ahead of schedule due to the meticulous efforts of the APAS team.

E40: E Department's Unmanned Systems Test & Evaluation Team Executes Complex Demonstration Test Event for New Launch and Recovery System

E Department's Unmanned Systems Test & Evaluation Team successfully conducted a complex demonstration test event in 2022 which helped the Navy get one step closer to being able to launch and recover a Large Displacement Unmanned Undersea Vehicle (LDUUV).

The demonstration test event was conducted under a Cooperative Research and Development Agreement (CRADA) between NSWC PCD and a company named Huntington Ingalls Industries. The agreement was entitled Unmanned Underwater Vehicles (UUV) Launch and Recovery (LAR) Testing and involved a system called Pharos, a new HII LAR system which was built to operate with large unmanned underwater vehicles like Naval Undersea Warfare Center (NUWC) Division Newport's Snakehead LDUUV.

Prior to shipping Pharos to NUWC Newport, HII needed to ensure the system could accommodate Snakehead, was capable of ballasting/de-ballasting, and could be recovered in a loaded condition. As a result, the NSWC PCD Unmanned Systems Test and Evaluation Team expeditiously engaged to support its CRADA partner HII and sister Warfare Center Division NUWC Newport by developing and executing the complex demonstration test event in very short order.

"NSWC PCD has a dedicated unmanned system (UxS) test and evaluation branch with the ability to apply expertise with rapid response to provide agile, effective solutions to meet mission objectives," said Hal Rhea III, NSWC PCD Unmanned Systems Test & Evaluation Branch head. "Couple that with our ability to quickly coordinate CRADA approval and our 185,000 square miles of ranges which can support all classes of vehicles with everything from cross-domain UxS operations to live-fire events or, in this case, launch and recovery testing. We were proud to deliver problem-solving capability to our fellow warfare centers and industry partners with vital technical services needed to support national defense strategies."

Beyond CRADA partnerships, other entities were instrumental in this successful demonstration. Security teams from NSWC PCD and its host installation, Naval Support Activity Panama City, also coordinated to play a critical role in support of successful testing. U.S. Coast Guard Station Panama City also provided security services and on-site support during the effort both pier-side and at their boat launch.

"We are very proud to be working with the U.S. Navy on advancing the capability to deploy unmanned vehicles on amphibious ships," said Randy Johnson, Sr. Director of Research, Development, and Process Technology within HII's Ingalls Shipbuilding division. "Continuing to collaborate with the Navy early in this process, and successfully conducting these two additional demonstration tests, enables us to move forward expeditiously with further testing to mature the Pharos capabilities."

Through the accomplishments of this CRADA, HII can continue to demonstrate Pharos capabilities to the fleet, apply lessons-learned to further mature and advance autonomy concepts, and continue to develop innovative national security solutions.

"This test is truly the best form of collaboration between U.S. Navy labs and CRADA partner HII. We are collaborating as One Team to perform a service that will provide incredible returns to the U.S. Navy as a whole," said NSWC PCD Technology Transfer Manager Paige George. "Without NSWC PCD support, there would be delays in shipment to NUWC which could negatively impact the program. This is a BIG win all around!"

CODE X

SCIENCE&TECHNOLOGY

X10: Underwater Terrain-Aided Navigation (UTAN)

Highlight

X Department's X10 Division, the Sensing Sciences and Systems Division, has made progress in developing advanced navigation techniques that can augment inertial navigation systems in satellite-denied environments:

- Automated processing of interferometric forward look sonar (FLS) data
- Developed and tested Monte Carlo based Bayesian filter techniques for pose estimation when presented with an a priori map
- Integrated hardware components and conducted multiple in-water tests
- Documented and presented conference paper at Institute of Electrical and Electronics Engineers OCEANS 2022

Description

Underwater Terrain-Aided Navigation (UTAN) provides a method for drift mitigation in Global Navigation Satellite System-denied environments and can assist with a vehicle's inertial navigation processes via reference with a stored map. By iteratively re-sampling from an estimated distribution of possible Unmanned Underwater Vehicle (UUV) orientations, the probability density of the vehicle pose is determined. Improved localization of the estimated pose is achieved by using three dimensional bathymetric data from the FLS in addition to the estimated pose (roll, pitch, and yaw state) from the vehicle's inertial navigation system. This mitigates accumulation of Inertial Navigation System (INS) error, and allows for more accurate and reliable autonomous vehicle navigation. With this intent, a vehicle state-estimation particle filter that

incorporates use of this aiding information has been developed. An interferometric phase unwrapping process enables the observation estimate, and the integrated system has been evaluated with a combination test trials conducted in simulation and at the NSWC PCD Underwater Multi-Sensor (UMS) Test Pool.

To facilitate prototyping of the particle filter, a three dimensional MATLAB-based UTAN simulator was created that leverages National Oceanic and Atmospheric Administration (NOAA) bathymetric grid files. These publicly available hydrographic data products have various resolutions and, in total, cover significant portions of ocean in and around the United States. The loosely coupled augmentation framework was eventually selected so as to provide modularity.

To advance the concepts developed in simulation and to iterate towards real-time operational capability of the UTAN system, FLS hardware and a C++ UTAN code base were integrated with a GreanSea INS and a Remotely Operated Vehicle (ROV) for in-water testing. The FLS unit selected for this effort is the dual frequency Teledyne Reson SeaBat F30-S. The vehicle is a multi-thrust ROV that can operate in autonomous mode and is equipped with a power and data tether. This configuration allows for top-side monitoring and trouble shooting. During tests in January and June 2022 a variety of runs were conducted in the UMS Test Pool; the latter event ran C++ UTAN test code on the ROV in parallel to the ROS based vehicle control and INS software.

Impact

Initial results are encouraging; showing an increase in navigational accuracy. For example, shown in Figure 1 is a simulated test run conducted off of the coast of Del Mar in Southern California, where the path follows the contour of the underwater ridge. During the initial portions of the traverse the UTAN solution offers negligible improvement, but as the INS errors accumulate over time and distance, the utility of the UTAN processing becomes apparent. In this example the accumulated error (using the mean of the last 10 positions) as expressed as a percentage of distance traveled for the UTAN solution is 0.06% – compared to 0.1% for the INS-only solution. UTAN performance improvements of this order were observed in multiple runs. Analysis of data from in-water events shows that the UTAN particle filter and map association processes converged efficiently to the known location. Additional testing and longer range missions will be conducted to verify development of UTAN system. Success will enable longer stand off ranges and more accurate underwater navigation.
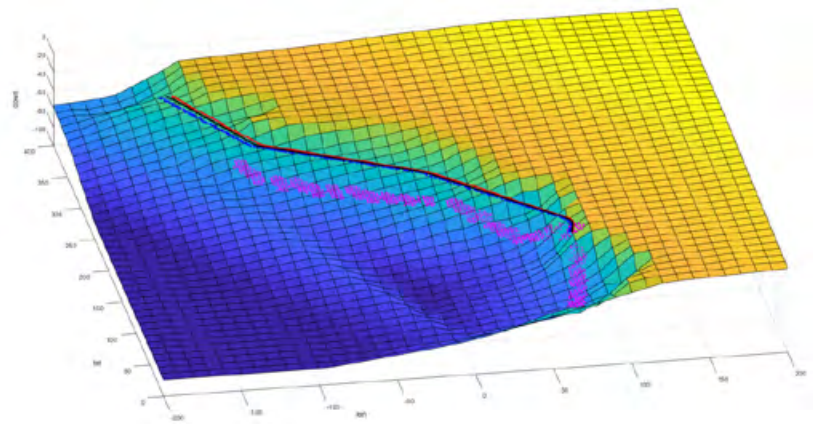

Figure 1. Simulated UTAN results; Blue line represents INS data without UTAN augmentation; Black line represents planned trajectory; Red line represents UTAN solution; Magenta shows select FLS observations.

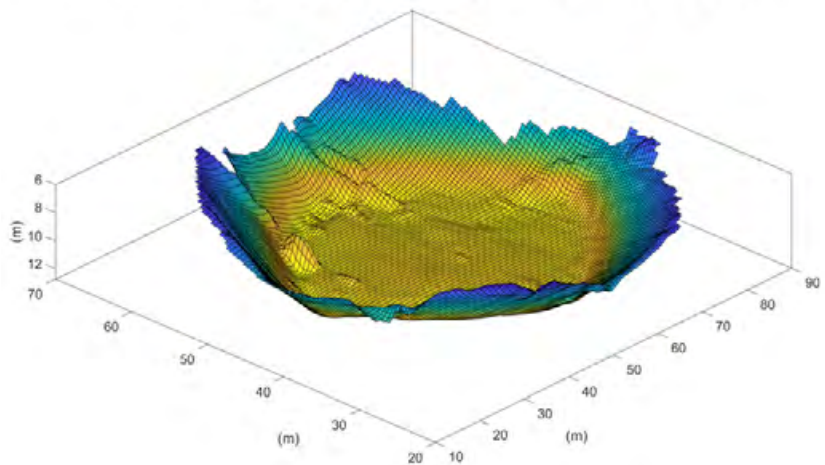### Interferometric Hydrographic Survey Results UMS Test Pool

Figure 2. A priori map compilation acquired from integrated vehicle/FLS system in UMS Test Pool

X20: Ground-Based Magnetic Anomaly Termination and Localization for GPS Denied Environments (MATLOC)

Highlight

X Department's X20 Division, the Unmanned Systems, Automation & Processing Division, made significant progress in the effort to improve effectiveness of unmanned ground-based assets participating in clandestine missions:

- Developed a novel solution for navigation in Global Positioning System (GPS) denied environments
- Implemented software to support navigation behaviors for GPS denied environments
- Developed a prototype system for testing methodology and techniques developed for improved navigation
- Developed ground-based vehicles

Description

Modern military applications often involve deployment of unmanned ground-based vehicles for survey, inspection, and reconnaissance missions, among others. A common requirement for these types of missions is maintaining persistent and reliable navigation in contested environments, especially in cases with limited operator supervision. In order to achieve this, the agent needs to have high confidence in its own position relative to some global or local datum. In situations with restricted access to information from a traditional GPS, this can be quite challenging. The MATLOC project addresses the need for an increase in navigational capability by leveraging past research in

magnetics and associated processing techniques as well as recent advancements in high-sensitivity magnetometers. The goal of the project is to develop a toolkit composed of modular software and hardware components that can augment current navigation capabilities.

Optimal state estimation algorithms have shown effectiveness across a variety of sensor modalities. The primary state estimator is a particle filter showing generic magnetic survey maps (Figure 1). In this case, the particle filter relies on some a-priori knowledge of the measured magnetic field, such as a magnetic survey map.

A Tolles-Lawson based processing approach is used to perform motion compensation for sensors moving in the earth's field. Removing motion effects is critical for producing enough spatial resolution to distinguish between unique locations within a greater area. A python implementation of Tolles-Lawson, capable of embedded on-line processing, was developed under this program.

In order to collect data, an array of highly sensitive optically-pumped atomic magnetometers were integrated onto a small research robotic ground platform, a Clearpath Jackal with towed magnetometer cart (Figure 2). Autonomy software developed at NSWC PCD facilitated path following in predefined patterns for collecting sample map data.

Impact

Throughout FY20 and FY21, the MATLOC team conducted several internally organized data collection experiments to build diverse datasets that will be used for tuning processing and state estimation software. In FY22, parts of the MATLOC project were transitioned into LACEX (Large Area Clearance Exercise), which is a part of the Joint Concept Technology Demonstration (JCTD) Rapid Large Area Clearance (RLAC). The solutions developed by the MATLOC team are expected to assist with the problem of navigation in GPS–denied environments, thereby improving the overall effectiveness of the Navy's unmanned fleet assets to accomplish long–duration, clandestine missions.

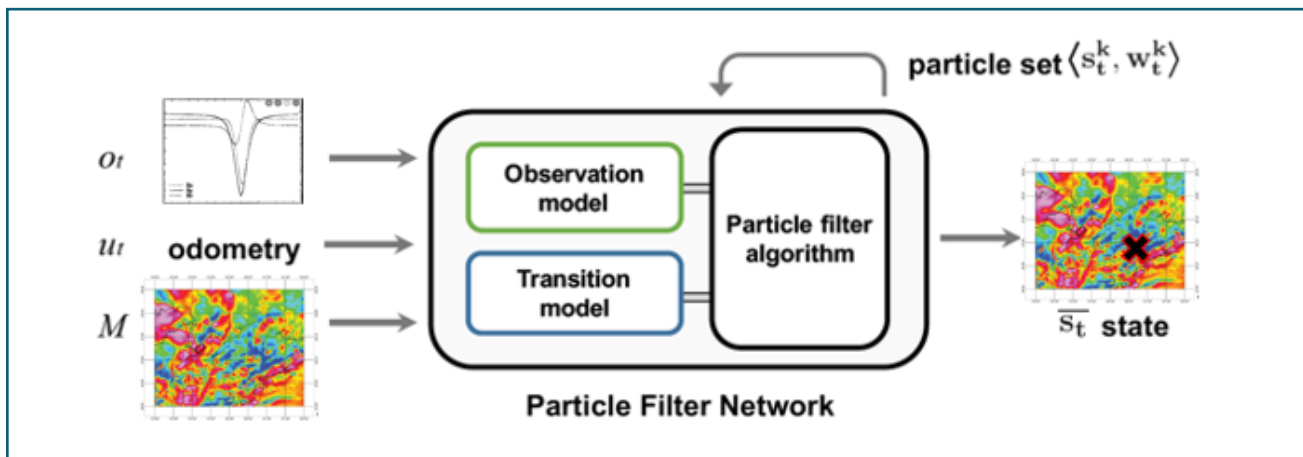Figure 2: Jackal with Magnetometers

Figure 1: Particle Filter Network

X20: Unmanned Systems, Automation & Processing

Highlight

X Department's X20 Division, the Unmanned Systems, Automation & Processing Division, made significant progress in the effort to characterize underwater sound speed profiles (SSPs):

- Developed novel SSP distance metrics based on elastic registration and elastic partial matching
- Developed software toolkit to cluster SSPs using various distance metrics and unsupervised machine learning (ML) methods; Toolkit validates cluster quality using transmission loss diagram images
- Published one journal paper in Institute of Electrical and Electronics Engineers TPAMI, the world's top ML journal, and one conference paper at IEEE OCEANS 2022

Description

Grouping together similar sets of underwater sound speed profiles (SSPs) yields an environmental characterization according to acoustic transmission properties, which can serve as a useful tactical decision aid in detect, classify, localize, and track (DCLT) applications. Since there are many different metrics for similarity one could use for pairwise comparison of SSPs, a challenge arises to determine which metric yields the most sensible SSP characterization. In this research, we have investigated the use of novel elastic metrics – which allow for nonlinear depth-warping for optimal function matching – in clustering SSPs compared to more standard non-elastic metrics such as Euclidean.

To further address the challenge of comparing SSPs defined on different depth domains, we have developed a novel metric based on elastic partial matching and published our methodology in IEEE's flagship journal, Transactions on Pattern Analysis and Machine Intelligence (IEEE TPAMI). We then executed a full comparison of SSP clustering metrics and methods on publicly available SSP data in our IEEE OCEANS 2022 conference paper. Additionally in this paper, we address the challenging problem of how to determine if a clustering is "good" or "not good" by designing a novel validation procedure that uses the 2D Transmission Loss (TL) diagram images simulated from their respective SSPs. TL diagrams capture more information on acoustic transmission properties than do SSPs, hence the reason for validating on this higher dimensional data. The validation procedure is such that we cluster SSPs using a particular metric and method, then we assign these labels to Euclidean dimension reduced TL diagrams, and finally we evaluate the resulting TL clustering using various well-known quality measures.

During this effort, we uncovered a clear trend that when shallow sound sources were used to generate the TL images, clustering SSPs with the novel elastic distance metric yielded more sensible clusters in the TL space compared to standard non-elastic metrics. Contrarily, when deeper sound sources were used, SSP clustering via non-elastic metrics yielded more sensible groupings of the associated TL diagrams. We can use this information to inform our metric selection when generating SSP characterizations for different DCLT scenarios.

Impact

The ability to extract/infer environmental parameters key to optimizing manned/off-board system performance will impact the missions of undersea surveillance, reconnaissance, mining, and subsea/seabed warfare and will be used to ensure optimal performance of systems in the critical areas of sensing, navigation, communications, and undersea systems maneuvering. This research will help inform operators of the most appropriate and effective SSP characterization to aid in tactical decisions according to their particular DCLT application or scenario. In particular, geographic region parsing according to SSP characterization can help inform machine learning based geo-acoustic inversion methods for estimating sound source location.

SSP CLUSTER VALIDATION USING DIMENSION REDUCED TL DIAGRAMS.
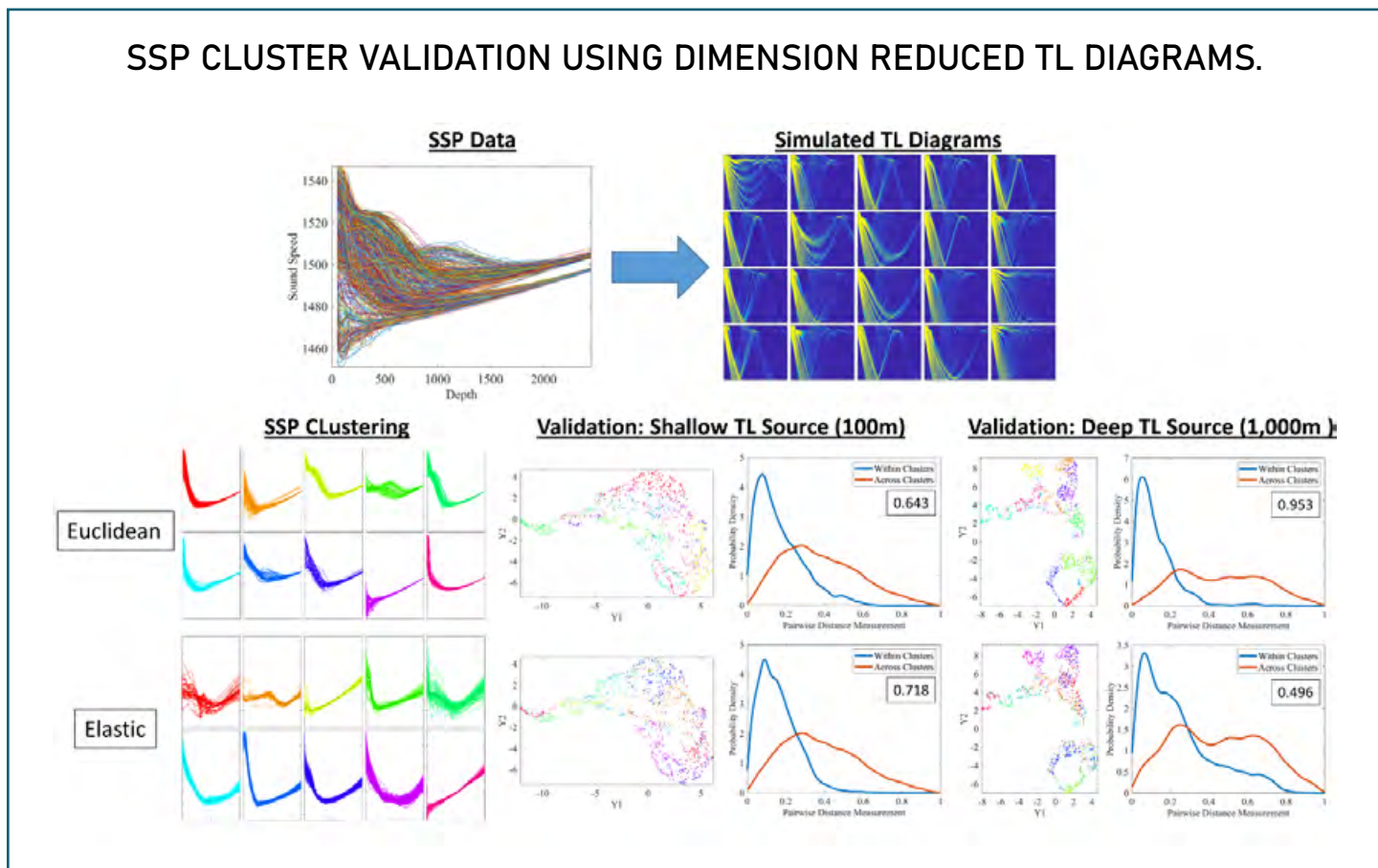
Top Left: 1,000 SSPs taken from public CCHDO dataset. Top Right: Subset of respective TL diagram images simulated from each SSP. Bottom Left: SSP clustering result for K=10 clusters for both the Euclidean and elastic metrics. Bottom Center: TL diagram validation results for shallow sound source of 100m. The colored point clouds are the dimension reduced TL diagrams colorized according to the SSP clustering labels. Here, the elastic metric validates better than the Euclidean metric with an improved cluster separability score. Bottom Right: TL diagram validation results for deeper sound source of 1,000m. Here, the Euclidean metric validates better than the elastic metric.

BUSINESS DEPARTMENTS

Code 01: *Comptroller*

Responsible for all financial management functions
- Fiscal policy & regulations
- Budget
- Accounting
- Financial Services

Provide command management with technical advice and guidance in:
- budget formulation & execution
- managerial accounting
- financial review & management analysis
- Program analysis
- Internal control systems
- Integrated Financial Systems

The Comptroller:
- Reports directly to Commanding Officer
- Serves as the Chief Financial Advisor to the Division
- Is delegated fiduciary authority under Title 31 USC 1517

Code 02: *Contracts*

Responsible for the end-to-end management and execution of the procurement process
- Solicitation
- Proposal
- Evaluation
- Award through contract closeout

Manages and directs the procurement functions, which support the Warfare Center Division's technical programs and missions.

Organized around four Divisions and an Engineering Liaison Office:
- Littoral and Mine Systems Division
- Expeditionary and Maritime Systems Division
- Small Purchases Division
- Acquisition Policy and Oversight Division

Code 10: *Corporate Operations*

10E: Equal Employment Opportunity, Diversity & Inclusion

101: Human Resources Division

102: Infrastructure Division

103: Corporate Communication Division

104: Information Technology Division

105: Security Division

106: Corporate Business Office Division

107: Property Management Division
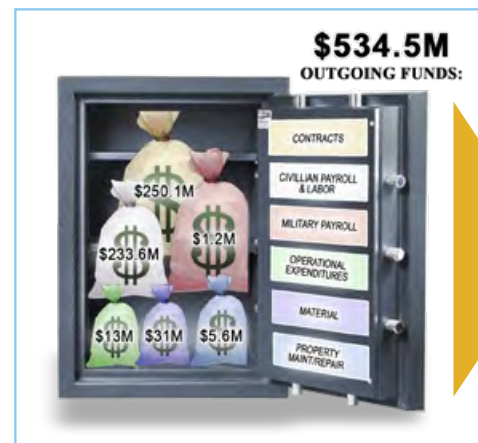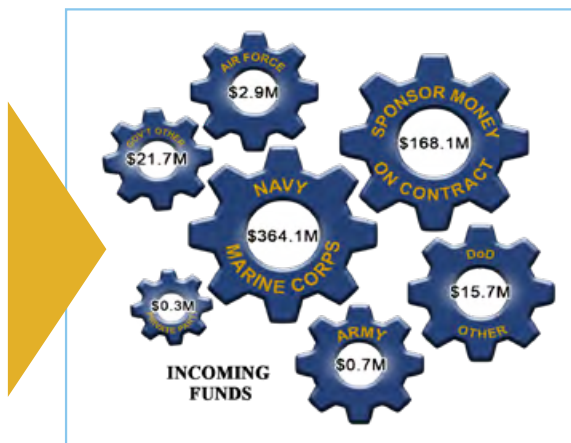
CODE 01

COMPTROLLER DEPARTMENT

Description

The Comptroller Department (Code 01) works annually to improve the financial management competency of the Command, both internally and externally to the Department. Code 01 provides financial management expertise to our customers through collaboration on fiscal policy development, execution guidance, over–sight on financial internal controls. Since starting in 2017, the Department of the Navy (DON) continues to work toward an unmodified opinion from the yearly Department of Defense financial statement audit as required by Congress. Our staff's efforts are integral to DON's success through the improvement of busi-ness and financial processes and working closely with the independent auditors and other stakeholders. While Panama City Comptroller's Department is the smallest of all the Naval Surface Warfare Center Divisions, Code 01 takes pride in being recognized as subject matter experts in several areas within our Department, such as Capital Improvement Program management, Delegation of Authority tracking, Execution Plan phasing.

FY22 Accomplishments

· 97% DEOCs Participation
· Processed 4600 Incoming Funding Documents and 1100 Ongoing Funding Documents
· Successfully cleaned up 99.9% of FY23 Lapsing sales orders
· Payroll processed and reimbursed 188 OF1164's resulting in total payments made of $60,454.56
· Total travel dollars spent $8.4M on 8,832 trips, a 152% increase from FY21
· Dormant Records cleared 6,765 (Unliquidated Obligations)

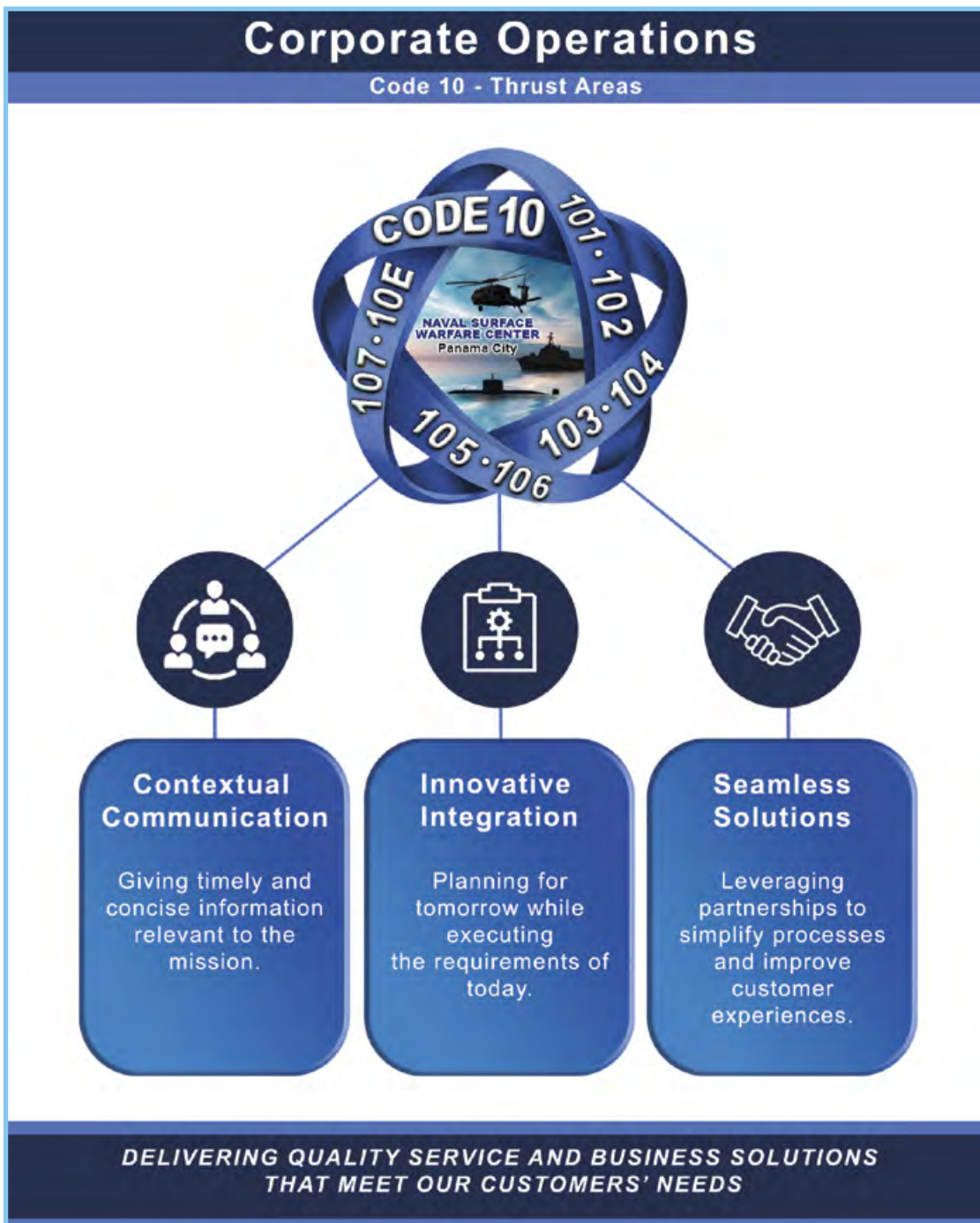|	Target	Result
Net Operating Results	$12.2M	$10.8M
Reimbursable Authority	$428M	$406M
Carryover	$159M	$149M

CODE 02

CONTRACTS DEPARTMENT

Working closely with legal counsel and technical partners, Code 02 has done a fabulous job executing the Command's FY22 procurements! Of particular note are the following:

1. Awarded NSWC PCD's first Architect-Engineer Contract.

2. Awarded NSWC PCD's first construction indefinite delivery indefinite quantity.

3. The Small Purchases Division awarded 10 NUWC Keyport Simplified Acquisition Procedures helping out another Warfare Center Division.

4. Obligated $250M in contract actions - an 18% increase from FY21.

5. Reduced the number of actions from 1638 in FY21 to 1593 in FY22, a 3% decrease, even though dollars increased by 18%.

6. Implemented Acquisition Management System and uploaded electronic files allowing the Department to become paperless from a contract file perspective. This will reduce costs (supplies, shred runs, storage) and improve the Department's efficiency.

7. Awarded the 11 FY22 scheduled Seaports and three FY23 Seaports ahead of schedule.

8. Awarded numerous Procurement Desktop Defense stand-alone contracts (e.g. Q20s, Q24s, Mine-Neutralization System) that will take us to FY27.

9. Awarded all FY22 CIP funded projects in September.

CODE 10

CORPORATE OPERATIONS DEPARTMENT

Corporate Operations
Code 10 - Thrust Areas

CODE 10
101·102
103·104
105·106
107·10E
NAVAL SURFACE WARFARE CENTER
Panama City

Contextual Communication

Giving timely and concise information relevant to the mission.

Innovative Integration

Planning for tomorrow while executing the requirements of today.

Seamless Solutions

Leveraging partnerships to simplify processes and improve customer experiences.

DELIVERING QUALITY SERVICE AND BUSINESS SOLUTIONS THAT MEET OUR CUSTOMERS' NEEDS

Equal Employment Opportunity, Diversity & Inclusion

Highlight
The Corporate Operations Department's ED&I Office, hosted the INSPIRE: Igniting a Culture of Leadership and Innovation Event in August 2022. Attendance exceeded 80 individuals in person and over 300 people online.

Description
The INSPIRE Planning Committee at NSWC PCD ignited the flame to creating a culture of lead-ership and innovation at the command through the first INSPIRE event held at Gulf Coast State College. The team worked diligently to host an impactful event with dynamic guest speakers that educated the audience on the importance of being an active leader, embracing diversity, and invest-ing in the strengths of their teams to further grow the command.

Impact
The impact from the work of this team and the event they produced will be evident in the fabric of NSWC PCD for years to come.

Human Resources Division

Highlight
The Human Resources Division, created the First Friday Foundations to educate management throughout the command on all areas of Human Resources.

Description
The First Friday Foundations allows for knowledge sharing and communication of processes, proce-dures, and regulations, ensuring that all employees benefit from the enhanced understanding of the center's flexibilities and solid management efforts.

Impact
The impact from this program is a solid leadership foundation for the organization to foster organiza-tional improvements within Human Resources that supports retention and morale for the command.

Infrastructure Division

Highlight
The Infrastructure Division, obligated over $21 million dollars of construction awards and executed over $11 million dollars of construction work for damaged facilities from Hurricane Michael.

Description
In cooperation with Naval Facilities Command (NAVFAC) and authorities under the 2017 National Defense Authorization Act Section 233, Code 102 continues to work to rebuild NSWC PCD facilities after the devastation caused by Hurricane Michael.

Impact
To date, approximately $67 million dollars of construction work has been executed on 27 significant structures.

Corporate Communication Division

Highlight
The Corporate Communication Division coordinated and hosted the Fiscal Year 2022 Director's Cup May 17, 2022 with the technical codes competing for the title of Director's Cup Champions.

Description
The competition challenges Departments A – Littoral and Mine Warfare, E – Expeditionary and Maritime Systems and X – Science and Technology, to manufacture an autonomous vehicle to overcome the specific challenges that accompany the respective course. This year, the major challenge was to design a "robot" that could traverse from water to land in order to locate specific areas on the navigation course with speed and precision.

Impact
Code 103 provided event planning, coordination, support, public affairs, protocol, photography, videography, graphic design, printing, and hosting of the competition. The themed event attracted several hundred NSWC PCD personnel, community leaders, and Congressman Neal Dunn, representing Florida's 2nd Congressional District. The competition provides teams with the opportunity to enhance critical thinking and learn skillsets to further research, develop, test and evaluation efforts for the Department of the Navy. One of the purposes of this event is workforce development. It gives every competitor the opportunity to learn the skills they can use on future projects.

Information Technology Division

Highlight
The Information Technology Division, conducted a technical refresh of command-wide computers.

Description
The Technical Refresh Team at Naval Surface Warfare Center Panama City Division saved over $500K and 2,500+ personnel-hours ensuring employees had the necessary tools to perform their assigned duties.

Impact
The impact from the work of this team is significant on the warfighter, the mission, and the budget. NSWC PCD was the first Warfare Center Division to complete their Technical Refresh. Our personnel were able to get back to work with all of the data and software they needed faster than any other Technical Refresh in NSWC PCD history.

Property Management Division

Highlight
The Property Management Division, successfully completed several audits this year and inventory testing with substantial achievements.

Description
The Highest score ever on NAVSEA WFC HQ Property Audit 86% (Code 1073 – Passed NAVSEA WFC HQ Property Audit with a perfect score (1st in the history of the audit). This is an assessment of all Property Management performance areas.

Passed OPNAV/KPMG Audit with ZERO findings. This was a physical inventory of Operating Material & Supplies Remainder material testing inventory accuracy and processes.

Completed the PEO USC Inventory Testing of program material resulting in a 99% inventory accuracy rate.

Impact
The impact from the work of this team is significant on the warfighter, the mission, and the budget. The Department of the Navy contracted Ernst & Young to audit the Navy in property management. The above statements reflect audits and testings that are geared toward Ernst & Young audit expectations to specific areas such as Purchasing, Operating Material & Supplies, Navy Working Capital Fund – Supply Management, and General Equipment. NSWC PCD Property Management Team Code 107 has maintained these expectations and are compliant with all policies.
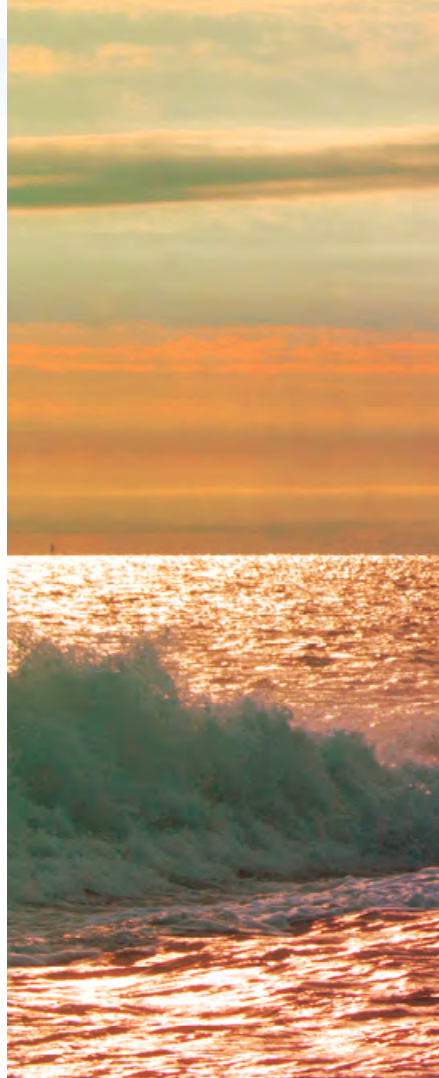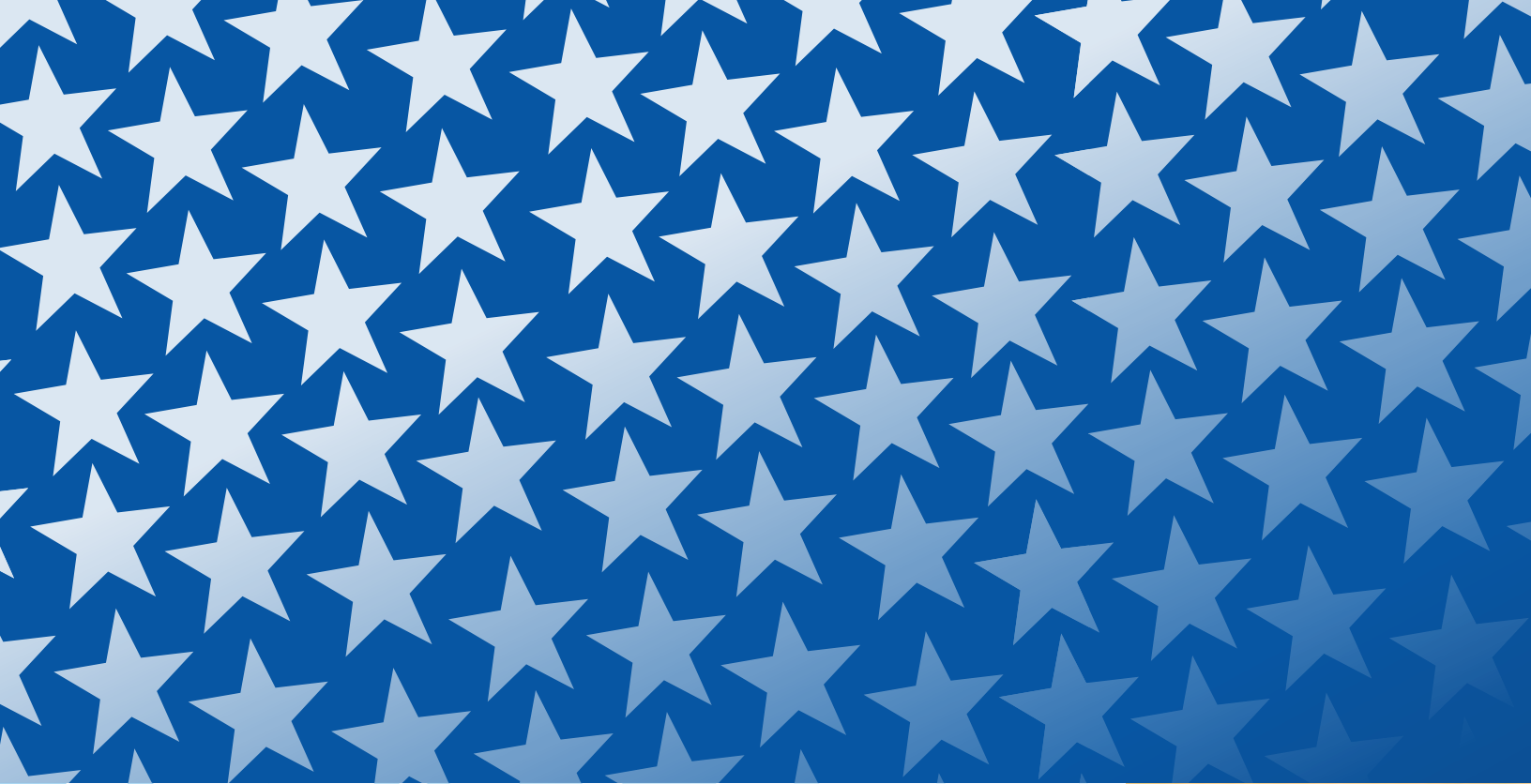
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