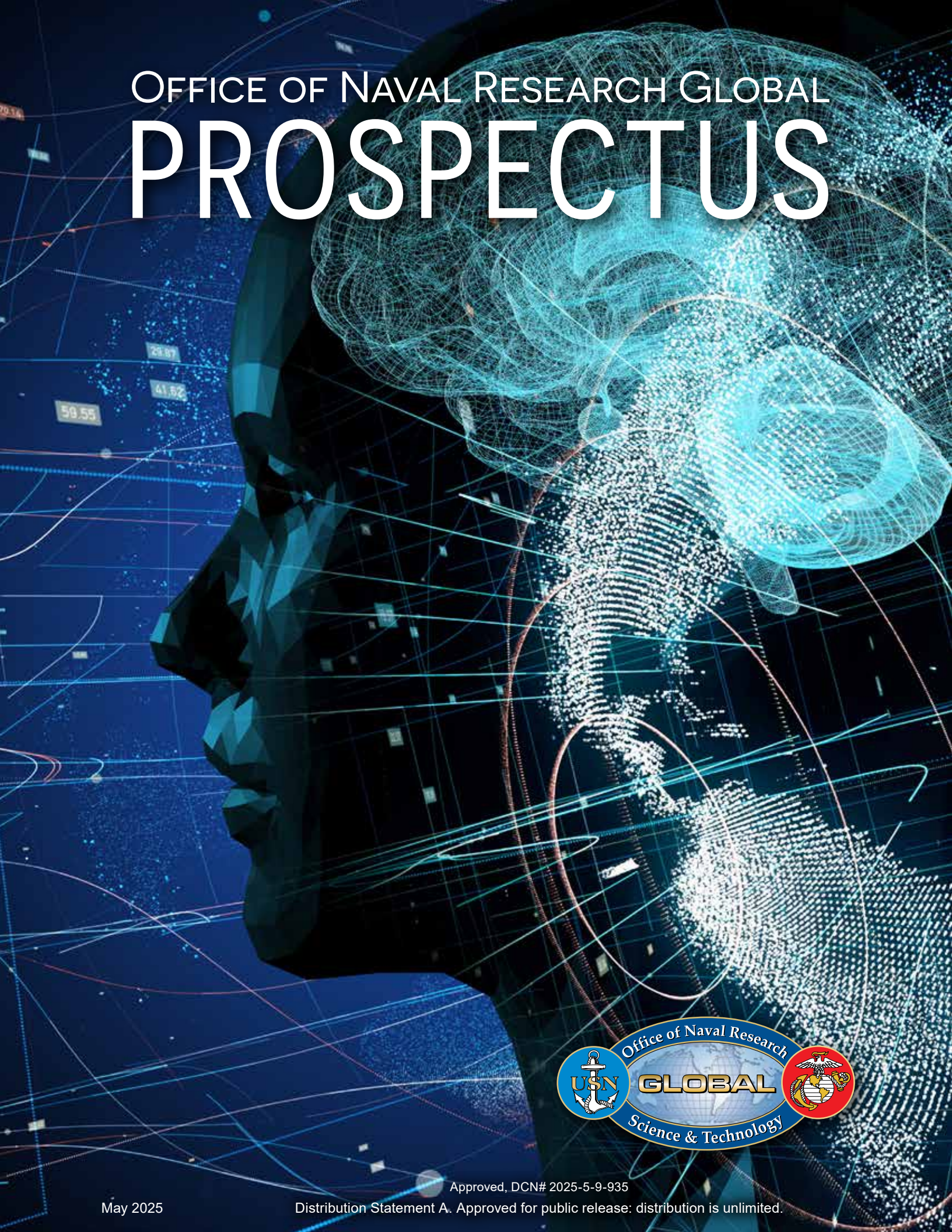
Office of Naval Research Global

PROSPECTUS



Office of Naval Research GLOBAL Science & Technology

Approved, DCN# 2025-5-9-935

May 2025

ONR GLOBAL COMMANDING OFFICER Opening Thoughts

As we reflect on the accomplishments of 2024 and look ahead to the opportunities and challenges of 2025, it is my pleasure to present the next iteration for the Office of Naval Research Global (ONR GLOBAL). This publication highlights the significant advancements and breakthroughs achieved by our office in the past year, while it also outlines our strategic priorities and initiatives for the coming year.

At ONR GLOBAL, our mission is "Obtain, coordinate, and make available world-wide scientific information." We foster innovation through partnerships — and we envision ourselves as THE partner of choice for science and technology leaders around the globe. Technological dominance will come out of these partnerships — sponsoring research and working with the best minds around the world will give our Sailors and Marines the warfignting edge. We accelerate the discovery and development of new technologies that will enable the U.S. Navy and Marine Corps to maintain their lethality, readiness and warfighting competitive edge in an increasingly complex and dynamic global environment. We accomplish this mission by connecting global researchers to the Office of Naval Research in Arlington, Virginia. We also accomplish this mission with a threefold philosophy that puts warfighters first in everything we do, seeks constant improvements, and is committed to fostering a family atmosphere throughout our organization.

Throughout 2024, our team worked tirelessly to build partnerships, leverage international collaborations, and sponsor cutting-edge research that addresses the most pressing challenges facing our naval forces.

As you review this Prospectus, you will see the breadth and depth of our efforts across our seven technical departments which are fueled by our incredible business operations team. Indeed, I think of ONR GLOBAL as an "Unstoppable Team" as described by Alden Mills in his book of the same name. This means that ONR GLOBAL "invites all gifts to bear on the team's goals through a shared sense of purpose and a deep commitment to each other." More specifically, our team is constantly leading Technology Operational Experimentation Events, Science Advisor Fleet/Force engagements, Science Director global technology awareness efforts, International Engagement Office agreement interactions, Foreign Comparative Tests, TechSolutions prototypes, and London Tech Bridge Tea and Tech events. These events come together to advance everything from autonomy, artificial intelligence, and areas of quantum physics, to developing new materials, manufacturing techniques, and new ways to leverage synthetic biology. You will also learn about our initiatives to enhance naval capabilities in areas such as cybersecurity, power and energy, and even virtual reality. These achievements are a testament to the dedication and expertise of our staff, as well as the strong relationships we have built with our international partners, academia, and industry.

As we press forward into 2025, we will continue to explore new frontiers in science and technology through the "business" of creating partnerships, all around the world. This will continue to be guided

by our Global Engagement Plan (GEP). The GEP sets the foundation for our efforts and encapsulates everything that we do as an organization. It helps us prioritize our efforts in a resource-constrained environment through a rubric that leverages metrics such as the global innovation index. In 2025, we will work towards a GEP that pulls in international efforts across the Office of Naval Research as a whole and sets us up to pull in the international efforts of the entire Naval Research and Development Establishment (NR&DE) — so that our Navy/USMC can operate as effectively and efficiently as possible. This effort will help prioritize global research and development in areas that will have the greatest impact on the readiness of our naval operations, such as integrated sensing, microelectronics, fluid dynamics, communications, and unmanned autonomous systems. Through this plan, we will also strengthen our partnerships and collaborations to leverage the best ideas and expertise from around the world.

As I get closer to the end of my tenure in the command, I continue to be amazed by everything that our professionals do each day to connect the United States Navy and Marine Corps to the rest of the world's science and technology leaders. I have come to realize that our mission could not be more important than it is today. It truly is my honor to be a part of this organization. I am extremely proud of what we have accomplished in 2024, and I couldn't be more excited about everything that ONR GLOBAL will accomplish in 2025.

Thank you for your partnership with ONR GLOBAL. We look forward to your feedback and engagement in the coming year!

Most Sincerely,

CAPT Andy "Big Tuna" Berner
Commanding Officer
Office of Naval Research GLOBAL

Office of Naval Research Global staff from around the world gathered in Arlington, Virginia in December 2024 for their annual Global Technology Meeting. (U.S. Navy photo by Michael Walls)

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ONR GLOBAL MISSION

Obtain, coordinate, and make available world-wide scientific information.

The Office of Naval Research Global is not just an organization; it's the cornerstone of science diplomacy, uniting the expertise of dedicated scientists, technologists and engineers across five continents. With a robust network, ONR GLOBAL is committed to ensuring that the United States of America and its allies remain the most lethal, ready and formidable warfighting force in the world.

Founded in its current form more than two decades ago, ONR GLOBAL's origins date back to World War II with the London branch of the Office of Scientific Research and Development. Helping to create and maintain the war-winning scientific partnership between the United States and the United Kingdom, the office would become ONR's first international location in 1946.

Today, ONR GLOBAL's reach extends far and wide, with additional offices in Arlington, Virginia; Tokyo, Japan; Singapore; Santiago, Chile; Prague, Czech Republic; São Paulo, Brazil; Melbourne, Australia; and Delhi, India.

By actively engaging with the expansive global technical community and the operational Fleet/Force, ONR GLOBAL cultivates essential partnerships in areas of shared interest. This collaboration is vital for swiftly deploying cutting-edge technologies to the battlefield, enhancing our strategic advantage for America, its allies and international science partners.

ONR GLOBAL has seven Technical departments supporting the Naval Science and Technology (S&T) strategy.

Experimentation and Analysis (E&A): serves to bridge the gap between the Naval Research and Development Establishment (NR&DE) and the operational fleet by using E&A to rapidly field, iterate, and improve experimental prototypes and to produce decision-quality information to help shape Naval S&T partnerships.

Science Advisor Program (SA): hosts civilian scientists, engineers and technologists to serve as the critical link between Joint, Navy and Marine Corps Commanders worldwide and ONR. Serving in one-to-three-year career development tours, these professionals help shape Naval science and technology (S&T) partnerships.

TechSolutions (TS): links warfighters to the Science and Technology community and addresses challenges identified by Sailors and Marines by rapidly developing science and technology-driven prototype solutions within 12 months of requests.

The International Engagement Office (IEO): initiates and fosters bilateral and multilateral military relationships that promote research, development, testing and evaluation (RDT&E) collaborations.

Navy Foreign Comparative Testing (FCT): is tasked with finding, assessing and fielding world-class products with a high technology readiness level, in order to satisfy valid defense requirements quickly and economically.

The London Tech Bridge (LTB): is a collaboration between the U.S. Navy (USN) and Royal Navy (RN) to foster connectivity, agility, and innovation under the broader ambition of delivering combined sea power.

International Science Program (ISP): leverages various tools — including liaison visits, collaborative science programs, visiting scientist programs, and research grants — to enhance the U.S. Navy and Marine Corps' international S&T engagement and increase awareness of global technology advancements.

Together, we are not just shaping the future of defense; we are ensuring the safety and security of the world.

OFFICE OF NAVAL R

ONR GLOBAL CO-LOCATED WITH OTHER DOD S&T COMPONENTS

London (USA/USAF) | Melbourne (USA/USAF) | Santiago (USA/USAF) | São Paulo (USA) | Singapore (USA) | Tokyo (USA/USAF)

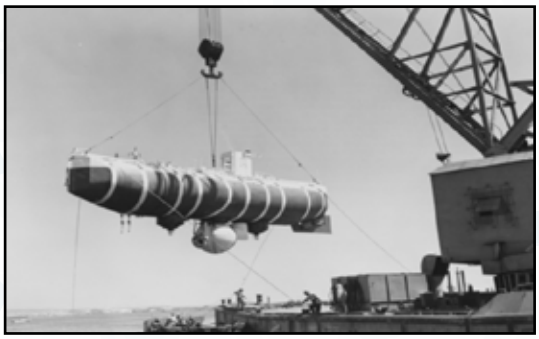
RESEARCH GLOBAL

ONR GLOBAL
SEVEN DECADES OF

The first ONR London Office was opened in 1946 with director Holbrooke Mann MacNeill at the helm and a small support staff. (Photo courtesy of ONR GLOBAL)

ONR London was instrumental in development and deployment of airborne microwave radar technology. (Photo courtesy of ONR GLOBAL)

The Trieste bathyscaphe was the first crewed vessel to reach the bottom of Challenger Deep in the Mariana Trench, the deepest point in Earth's seabedseabed,which was purchased for the U.S. Navy by the ONR London Office. (Photo courtesy of ONR GLOBAL)



ONR London (1952-1973) Keysign House, 1st Floor (where sign says “Shop Office & Showroom”) 429 Oxford Street, London. (Photo courtesy of ONR GLOBAL)

HISTORY
SCIENCE & TECHNOLOGY

CAPT Juston Kuch, Training Air Wing One commodore, operates a simulated T-45 Goshawk in the ONR GLOBAL TechSolutions-sponsored Operational Flight Trainer. (U.S. Navy photo by Petty Officer 2nd Class Molly Tice)

A U.S. Marine tests the latest advancement in surf observation (SUROB) technology. The ONR GLOBAL TechSolutions-sponsored SUROB was demonstrated at the Technical Concept Experiment (TCE) 24.2 at Marine Corps Base Camp Pendleton, California. (U.S. Navy Photo by Michael Walls)

CAPT Andy Berner presenting a plague to Dr. Tripti Johri inaugurating the opening the ONR GLOBAL office at the U.S. Embassy in New Delhi. From left to right, Lt Col Hughes (DCAS), Will Henry (Country Director, ONR GLOBAL), Berner, Johri and Joel Goodman. (Photo courtesy of ONR GLOBAL)

Nobel Laureate John B. Goodenough (an ONR GLOBAL principal investigator), along with two other scientists, identified the cathode material enabling the development of the rechargeable lithium ion battery. Because of this breakthrough, they received the Nobel Prize in Chemistry in 2019. (Photo: Department of Energy)

EXPERIMENTATION AND ANALYSIS

An aerial view of two High Speed Maneuvering Sea Targets (HSMSTs) used while conducting operations in support of the ONR GLOBAL-sponsored Integrated Battle Problem (IBP) 24.2 experiment at Port Hueneme, California. (Photo courtesy of ONR GLOBAL)

The Office of Naval Research Global Experimentation and Analysis (E&A) department serves to bridge the gap between the Naval Research and Development Establishment (NR&DE) and the operational fleet by using experimentation and analysis to rapidly field, iterate, and improve experimental prototypes and to produce decision-quality information to shape Naval science and technology (S&T) partnerships. Through collaboration with the Office of the Chief of Naval Operations (OPNAV) and Fleet/Force stakeholders, E&A identifies critical opportunities for technology experimentation, in order to enhance warfighter lethality and readiness.

E&A leverages these opportunities in its core portfolio by sponsoring customized Technology Operational Experimentation Events (TOEE), conducting operational analysis studies to inform future experimentation concepts, and linking S&T program officers to experimentation opportunities during fleet and international exercises. TOEEs provide a dedicated experimentation environment with realistic operational conditions focused on current naval concepts. They provide S&T initiatives of varying technology readiness levels an opportunity to get out of the lab environment and into the field, gain exposure to real environmental conditions, and be employed by current warfighters to enhance both readiness and lethality. TOEEs are technology-centric but warfighter focused to enable experimentation, rapid learning, and early warfighter integration with technology.

Marines recover the Hydronalix Reckless unmanned surface vessel (USV) after conducting a mission during the ONR GLOBAL-sponsored TOEE 24.1 at Camp Pendleton, California on June 3-14, 2024. (Photo courtesy of ONR GLOBAL)

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Results and Achievements

The graphic below captures the all the events and projects sponsored by the Experimentation and Anylasis team during the 2024 calendar year.

E&A 2024 by the Numbers

- **212** Technology proposals reviewed
- **56** Technologies participated in limited technical assessments
- **34** Technologies participated in limited objective experiments
- **22** Technologies participated in advanced capability experiments
- **40** Days of live experimentation with operational forces
- **7** Technologies inserted into fleet exercises
- **3** E&A designed and executed TOEEs

Events and Projects

TOEE 24.1 Small Boat Payloads in support of Littoral Maneuver

E&A sponsored TOEE 24.1 Small Boat Payloads in support of Littoral Maneuver, which executed throughout the first half of 2024 with the Advanced Capability Experiment (ACE) at Camp Pendleton, California on June 3-14, 2024. The team experimented with 16 technologies in the following technology areas:

Marines conducting small boat operations off the coast of Camp Pendleton, California as part of the ONR GLOBAL-sponsored TOEE 24.1 (Photo courtesy of ONR Global)

- Sensors (active radar, infrared, and electro-optical) with automated detection of surface, subsurface, and air tracks
- Unmanned systems to include unmanned surface vessels (USV), unmanned aircraft systems (UAS), and unmanned undersea vehicles (UUV) with various levels of autonomy
- Federation of information in the littoral space in support of a common operational picture (COP) and decision aids.

Technology Operational Experimentation Event (TOEE) 24.2 Frozen Flyer Group Unmanned Aerial System Experimentation

E&A conducted TOEE 24.2 Frozen Flyer at Pituffik Space Base, Greenland from February 15-29, 2024. Operations in Arctic and extreme cold conditions are uniquely challenging for personnel because of harsh and rapidly changing weather and austere infrastructure. The objective of the experiment was to determine how an unmanned aeriel system could contribute to maritime mission sets while operating in Arctic winter conditions.

During the two-week period of operations, flights were conducted in darkness and low light conditions with operating temperatures ranged from –21˚F to +5.7˚F.

The operational environment weather data included feeds from the on-base weather towers, hourly airfield weather reports, and handheld anemometers. The TOEE 24.2 team included the Naval Surface Warfare Center Panama City, Florida and IT Mentor Group with support from the

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Members of the ONR GLOBAL-sponsored Technology Operational Experimentation Event (TOEE) 24.2 Frozen Flyer team at Pituffik Space Base, Greenland. (Photo courtesy of ONR GLOBAL)

821 Support Squadron, the office of the Danish Liaison Officer (DLO), and Inussuk (a Greenlandic company of base maintenance contractors). The Frozen Flyer ACE welcomed observers from U.S. Fleet/Forces (USFF), Naval Postgraduate School (NPS), DLO, Danish Police Inspector (DPI) and 821 Support Squadron.

E&A will be supporting additional Arctic UAS experimentation in partnership with the ONR GLOBAL International Engagement Office (IEO) in 2025.

An unmanned aerial system manufactured by Pegasus Aeronautics conducting night operations during the ONR GLOBAL-sponsored Technology Operational Experimentation Event (TOEE) 24.2 at Pitiffuk Space Base, Greenland. (Photos courtesy of ONR GLOBAL)

Integrated Battle Problem (IBP) 24.2

E&A sponsored Integrated Battle Problem 24.2 focusing on enhancing capabilities for small Unmanned Surface Vehicles (sUSV). The team conducted an Advanced Capability Experiment July 15-26, 2024 at Port Hueneme, California. To experiment with remote operations and control of autonomous systems, E&A partnered with the Ventura Tech Bridge to operate an Unmanned Operations Center (UOC) at a building located on Naval Base Ventura County, California.

Technologies were mounted onto multiple High Speed Maneuvering Sea Targets (HSMSTs) and were then subjected to varying ocean conditions to test their ability to find airborne and seaborne targets. In-house pilots flew two Velos V3 vertical takeoff and landing Group 2 UAS as targets for the computer vision and radar systems. The results of the experiment were promising and follow on experiments are planned for 2025.

Two High Speed Maneuvering Sea Targets (HSMSTs) conducting operations in support of the ONR GLOBAL-sponsored Integrated Battle Problem (IBP) 24.2 experiment at Port Hueneme, California. (Photos courtesy of ONR GLOBAL)

(Above) Helicopters and USV conduct operations during the ONR GLOBAL-sponsored IBP 24.2 experiment at Port Hueneme, California. (Inset) UAS launched off the HOS Dominator during the IBP 24.2 experiment at Port Hueneme. (Photos courtesy of ONR GLOBAL)

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Additional Events

E&A also sponsored technologies to participate in Fleet and International Experimentation events as well as analysis studies in support of its overall mission to use experimentation and analysis to inform future S&T partnerships. Some highlights from these additional projects include:

Combined Electro-optic Infrared Surveillance and Response System (CESARS)
E&A sponsored the CESARS Naval Research Laboratory (NRL) team to conduct experimentation with three systems during the Technical Cooperation Program Anti-Ship Threat Project Arrangement (TAPA) 24 exercises held at Rim of the Pacific Exercise (RIMPAC) 24.

ONR GLOBAL sponsored NRL's CESAR team to conduct experimentation on New Zealand oiler Aotearoa at RIMPAC 24. (Photo courtesy of ONR GLOBAL)

Maritime On-the-Move Troposcatter Radio (MoTR)
E&A sponsored a series of experimentation opportunities for MoTR, which leveraged three Low Power Troposcatter Radio (LPTR) prototypes to demonstrate a long range troposcatter link for resilient command, control and communications (RC3) during Coastal Trident 24.

ONR GLOBAL sponsored experimentation for MoTR during Coastal Trident 24. (Photo courtesy of ONR GLOBAL)

Vision and Plans for 2025

E&A will conduct three Technology Operational Experimentation Events (TOEE) in 2025:

- **25.1 Expeditionary Medicine (ExMed)**
- **25.2 Subsea and Seabed Warfare (SSW)**
- **25.3 Daisho (Manned Unmanned Teaming in Highly Contested Environments)**

In addition, E&A will support additional efforts such as a collaboration with the International Engagement Office (IEO) on Arctic experimentation, participation in fleet experimentation such as the Robotic Experimentation and Prototyping with Maritime Unmanned Systems (REPMUS) NATO exercise, and operational analysis to inform experimentation efforts for 2025 and beyond.

TOEE 25.1 Expeditionary Medicine

E&A is conducting TOEE 25.1 Expeditionary Medicine (ExMed) in partnership with the Marine Corps Warfighting Lab (MCWL) and II Marine Expeditionary Force (II MEF) to explore technologies related to tactical triage, casualty care, enroute care, casualty evacuation, and prolonged holding and stabilization of patients. The initial planning conference was held in December 2024 with representatives from ONR, MCWL, II MEF, Fleet/Forces Command (FFC), and U.S. Special Operations Command (SOCOM) along with 17 technology teams to introduce teams to the ExMed problem space and begin experiment design. The team conducted live events in February 2025 and will conduct events in May 2025 at Camp Lejeune, North Carolina.

TOEE 25.2 Seabed and Subsea Warfare

E&A is conducting TOEE 25.2 Seabed and Subsea Warfare (SSW), which is scheduled to take place throughout 2025. E&A hosted a Concept Development Conference in September 2024 with representatives from Submarine Force (SUBFOR), Surface Force (SURFOR), Naval Special Warfare (NSW) and Navy Expeditionary Combatant Command (NECC) in attendance. The operational forces showcased challenges associated with SSW, and ONR's Ocean Battlespace Sensing Department (Code 32) and Warfighter Performance Department (Code 34) briefed the participants on current technology developments in the SSW domain. Working groups further refined the experimentation focus areas: communications, long range navigation, visualizations tools, and sensing. The team will conduct live events in Panama City, Florida in early 2025 and the Naval Underwater Warfare Center Newport, Rhode Island in the summer and fall of 2025.

TOEE 25.3 Daisho

E&A is conducting TOEE 25.1 Daisho focusing on manned-unmanned teaming (MUM-T) in contested environments. For this event, E&A is fielding three teams in force on force experimentation, each with different objectives. Each team's objectives explore several focus areas to include manned-unmanned teaming, contested logistics, autonomous systems, and advanced sensing. The teams will conduct live events throughout 2025 with the Advanced Capability Experiment planned for this summer.

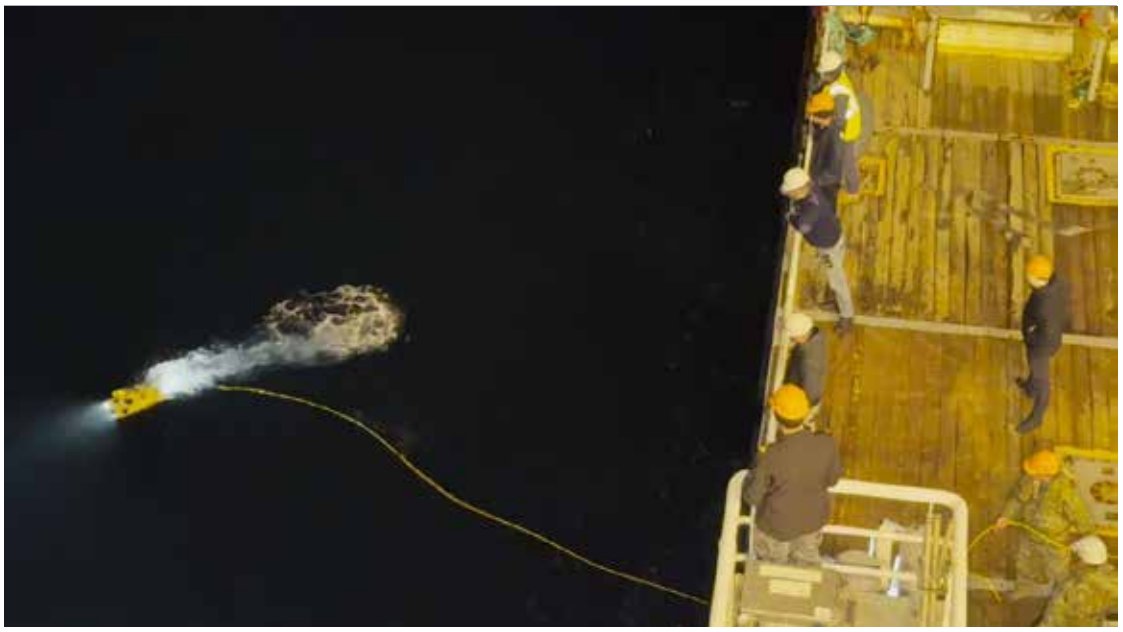
SCIENCE ADVISORS

The ONR GLOBAL Science Advisor team at the Office of Naval Research in Arlington, Virginia. (U.S. Navy photo by Michael Walls)

Office of Naval Research Global Science Advisors (SAs) are U.S. government civilian scientists, engineers and technologists selected for three-year temporary assignment tours. SA positions are competed nationally. SAs report to Navy and Marine Corps operational commands worldwide, covering a broad range of naval warfare Science and Technology (S&T) disciplines.

SAs serve as the Fleet/Force operational commands' senior S&T nodes who discover and develop technology solutions that address high-priority military capability requirements that enhance warfighting effectiveness, improve Fleet/Force readiness and increase lethality across naval operations. They accomplish this by partnering with government, academia, and industry. While embedded within Fleet/Force commands, SAs prioritize S&T requirements, provide capability solutions, lead experimentation events, and connect warfighters to technologically advanced and emerging capabilities. Overall, SAs help shape S&T partnerships in support of high-priority Fleet/Force needs.

All SA efforts are aligned with the Naval S&T Strategy, Chief of Naval Operations' Navigation Plan, Chief of Naval Research Commander's Intent, Department of Navy (DON) Distributed Maritime Operations concept, and Commandant of the Marine Corps' Expeditionary Advanced Base Operations concept.



Nighttime, remotely operated vehicle operations during the ONR GLOBAL-supported Australia, United Kingdom and U.S. Subsea and Seabed Warfare (AUKUS) Two event. (Photo courtesy of ONR GLOBAL)

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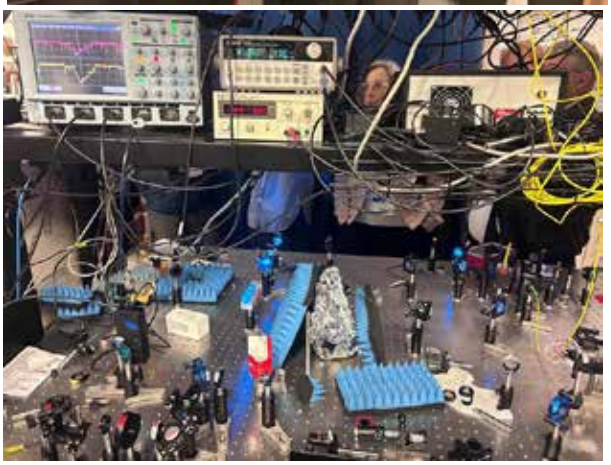
Results and Achievements

In 2024, SAs were essential in socializing, resourcing, or providing their expertise to at least 30 of ONR's active S&T projects to include Future Naval Capabilities, Innovative Naval Prototypes, and Technology Candidates as follows:

Dreamcatcher
Poison Apple
Stand-off Radar Imaging Detection System
Precision Fire Control
Super Swarm
Ubiquitous Edge
Advanced Autonomous Air-to-Air Refueling System
Chimera
Cognitive Router
Coordinated Advanced Distributed Radio Frequency Effects
Data Framework for the Maritime Operations Centers of the Future
Deployment and Employment of Autonomous Long-Range Systems
Four Leaf Clovers
Full Spectrum Undersea Warfare
Gravity-Aided Inertial Navigation System
Innovative Naval Prototype Applied Research Refresh
Innovative Naval Prototype Operational Analysis, Support and Experimentation Activity
MAGICO
MK-48 Acoustic Modifications
Multi-Material Propeller Prototype
MyNavy Foresight: Decision Support Tools for Future Naval Power
Next Generation Stern Area System
Own Ship Acoustic Monitoring
Physical and Networking Layer Prototype
Rough Neptune
Rough Patch Phase Three
Talent Management Nexus
Undersea Advantage Block Upgrade
Untethered Goat
VIRGINIA Improved Propulsor Bearing

ONR GLOBAL SAs Industry Tour 2024: Advancing Naval S&T

To address emerging naval capability needs — ranging from expeditionary warfare and missile defense to decision superiority and unmanned systems — ONR Global Science Advisors (SAs) conducted their annual Industry Tour (IT) in Colorado from April 21–27, 2024. This tour served as a bridge between ONR GLOBAL and leaders in government, academia, and industry, ensuring SAs remain informed about cutting-edge science and technology to better support the Fleet/Force.



(Top photo, left to right) ONR GLOBAL Science Advisors Layna Nelson, Charles Humphrey and Michelle Treadway at the National Institute of Standards and Technology Tour, April 2024. (Photo courtesy of ONR GLOBAL)

Focus Areas & Key Visits

With a focus on U.S. space initiatives, C5ISR-T, and counter-C5ISR-T, the IT included 18 site visits across Denver and Colorado Springs. Highlights included:

U.S. Space Command (USSPACECOM) – Discussions with USSPACECOM J8, J81, and Marine Corps and Navy Space Command Liaisons on naval roles in space, S&T priorities and interoperability challenges affecting Fleet/Forces.

North American Aerospace Defense Command (NORAD) – High-level briefings on aerospace warning, homeland defense, and air sovereignty at Peterson Space Force Base, including a Homeland Defense Design overview and a tour of the Operations Center/Watch Floor.

Aerospace Data Facility-Colorado (ADF-C/Space Delta 20) – In-depth look at space-based intelligence collection and reconnaissance satellite operations at Buckley Space Force Base, in Aurora, Colorado. This facility is responsible for the command and control of reconnaissance satellites involved in the collection of intelligence information and for the dissemination of that intelligence to other U.S. government agencies.

These engagements provided SAs with crucial insights into national space capabilities and operational gaps, helping shape future naval S&T partnerships to maintain technological superiority in an evolving defense landscape.

ONR GLOBAL Science Advisors Michelle Treadway, Tony Bausas and Chad Gardner at the demo of the Co-Wrapped High Strain Composite Boom Deployer for Sonobuoy Structure by Opterus Research, an ONR-sponsored small business, April 2024. (Photo courtesy of ONR GLOBAL)

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Events and Projects

In 2024, SAs were laser focused on supporting the Navy's operational plan and specifically one key target — scaling robotic and autonomous systems to integrate more platforms at speed. A few specific opportunities for demonstration included the Australia, United Kingdom and U.S. (AUKUS) Subsea and Seabed Warfare Event Two, Manned-Unmanned Teaming (MUM-T) Exercise hosted by U.S. Fourth Fleet, and the Robotic Experimentation and Prototyping for Maritime Unmanned Systems, or REPMUS, hosted by NATO in Portugal.

ONR GLOBAL Science Advisor to the Commander, Submarine Forces, Layna Nelson stands next to an autonomous-underwater vehicle during the Australia, United Kingdom and U.S. (AUKUS) Subsea and Seabed Warfare Event Two, December 2024. (Photo courtesy of ONR GLOBAL)

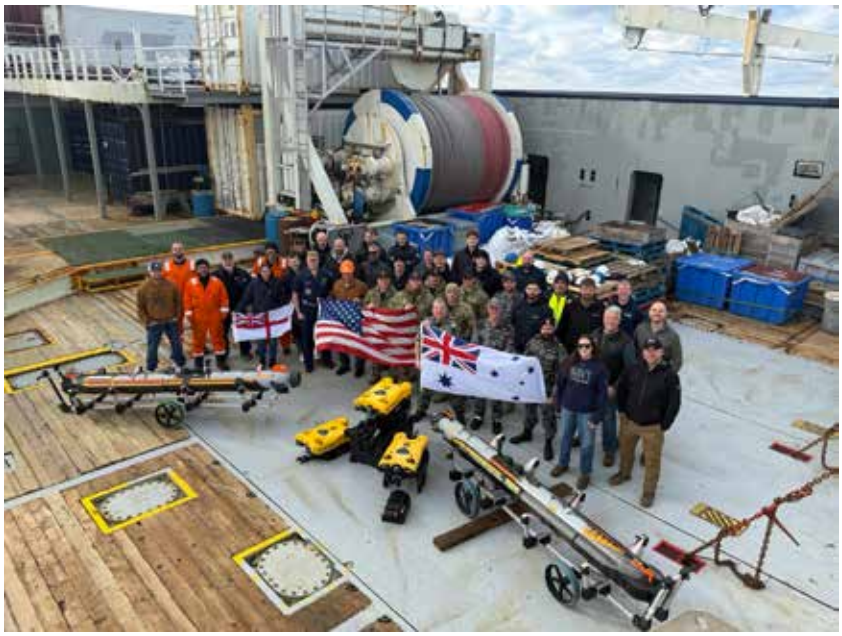
The Australia, United Kingdom and U.S. (AUKUS) Subsea and Seabed Warfare Event Two

From December 3-16, 2024, the AUKUS defense alliance executed a second Subsea and Seabed Warfare (SSW) exercise employing a variety of unmanned and hybrid undersea systems. The team utilized a commercial vessel for AUKUS Subsea and Seabed Warfare Event 2, and successfully mobilized the vessel in less than 38 hours. Time is a key part of the effort because it demonstrates the capability to mobilize the vessels quickly. ONR GLOBAL Science Advisor to the Commander, Submarine Forces, Layna Nelson, and Cmdr. Dan Stock, U.S. Country Lead for AUKUS SSW, Commander of Submarine Force Atlantic, gathered operators and equipment from 14 military and five commercial entities in under 30 days. Below are the key objectives achieved at the event:

- Deploy and trilaterally operate Unmanned Undersea Vehicle (UUV) and Autonomous Undersea Vehicle (AUV) and Remotely Operated Vehicle (ROV) assets to conduct offensive and defensive SSW with target fix and finish demonstration at depth;
- Engage with a global maritime leader in AUV/ROV operations to inform civil-military data exchange requirements; and,
- Integrate with and provide support to AUKUS SSW as part of the AUKUS Pillar 2 Advanced Capabilities Undersea Warfare Working Group.

Layna Nelson (left), ONR GLOBAL science advisor to the Commander, Submarine Forces, and Cmdr. Dan Stock, U.S. Country Lead for AUKUS Subsea and Seabed Warfare event and Commander of Submarine Force Atlantic, in the bridge of the MV Island Pride during an AUKUS SSW event. (Photo courtesy of ONR GLOBAL)

The most important goal of this event was to achieve trilateral interoperability in the SSW domain. This exercise demonstrated offensive and defensive SSW with target find, fix and finish (i.e., kill chain) capabilities. Each



U.S. Navy, Royal Navy and Royal Australian Navy personnel pose for a picture with Mission Specialist Defender Mark IV remotely operated vehicles (ROV) and an IVER4 900 autonomous-underwater vehicles aboard the Norwegian f lagged seabed construction vessel MV Island Pride during the ONR GLOBAL-supported Australia, United Kingdom and U.S. (AUKUS) Pillar II Subsea and Seabed Warfare Event Two/Integrated Battle Problem 25.1. (Photo courtesy of ONR GLOBAL)

country operated their own Defender observation class remotely operated vehicle (ROV). Other technologies used were United States Rat Trap IVER 4 900 unmanned underwater vehicle (UUV), Ocean Infinity's Hugin 6000 autonomous underwater vehicle, and Schilling work class ROV. A targeting cell from the Undersea Warfighting Development Center in San Diego, California selected locations to place targets, effectors, and training shapes. The team also demonstrated the ability to quickly transfer larger data sets from the ship to a cloud environment to develop SSW data pipelines and management.

The third AUKUS SSW exercise will take place in the summer of 2025. It will focus on continued progression of the subsea and seabed warfare kill chain with the objectives to employ interoperable, combined command and control, the use of live, virtual, and constructive simulation, and further development of the subsea and seabed warfare data pipeline. In conclusion, the AUKUS SSW effort provides a valuable setting to strengthen trilateral interoperability between Australia, United Kingdom and the U.S. By working together as one joint team and conducting subsea and seabed warfare experiments using advanced commercially available technologies, the AUKUS alliance continues to help secure collective subsea and seabed warfare dominance for the U.S. Navy and our partners.

Manned-Unmanned Teaming (MUM-T)

Manned-Unmanned Teaming (MUM-T) is a revolutionary strategy in the military domain that synchronizes the manned and unmanned platforms to support naval operations. MUM-T gives the amalgamated features of both platforms, with enhanced awareness of battle scenes, enhanced lethality, and better chances of survival.

In 2024, the MUM-T's purpose was to evaluate enhanced maritime domain awareness by demonstrating an improved search area by augmenting manned aircraft with unmanned aircraft system, or UAS.

Dr. Michael Pollock, ONR Command, Control, Computing, Communications, Cyber, Intelligence, Surveillance, Reconnaissance and Targeting (Code 31) department head, and Dr. Christopher Heagney, ONR GLOBAL's science advisor to C4F, built a strategic partnership between ONR and U.S. Southern Command (SOUTHCOM) to conduct experimental operations using King

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Air aircraft transferred from the U.S. Army to Naval Air Warfare Center Aircraft Division (NAWCAD). Together, they successfully combined sponsorship from SOUTHCOM (SC) J3, SC J84, U.S. Naval Forces Southern Command (USNAVSOUTH) and ONR. This deployment will begin a measured plan to accelerate Unmanned Aerial System (UAS) operations in the area of responsibility (AOR) by leveraging the new DODI 4540.01 Due Regard Policy update for Geographic Combatant Commands to determine acceptable risk. MUM-T will allow the King Air to maintain broad area search, then vector the unmanned aircraft closer for positive identification and overwatch during Counter Narcotics (CN) interdictions. ONR will refine sensors with long-term data in operational environments.

Dr. Christopher Heagney, ONR GLOBAL's science advisor to C4F, gives a briefing on the MUM-T at the Hybrid Fleet Campaign 2024 event. (Photo courtesy of ONR GLOBAL)

El Salvador is one of U.S.' most prolific CN partners, but they need air support to achieve more interdictions. This MUM-T operation will deliver 600 hours of manned-unmanned air support and meet the CCDR's intent to make the SOUTHCOM AOR a "testbed for innovation." MUM-T will mitigate risk as operations begin within updated DODI 4540.01 Due Regard policy authorities delegated from OUSD(P) to SOUTHCOM and NAVAIR Airworthiness Director for unmanned aircraft operation. This arrangement continues to build on the relationship ONR has had with SOUTHCOM since 2022. Additionally, it may prove a path to future capabilities while augmenting immediate intelligence, surveillance and reconnaissance (ISR) needs in the AOR.

From 19-26 September, MUM-T risk reduction flights were conducted at Key West, Florida using King Air. Additionally, on 21 September, Scientists-to-Sea toured the ONR King Air at Naval Air Station (NAS) Key West. Sensor data fed to the NAVSOUTH and JIATF-S watch floors via Minotaur. NAS Key West has had good results with the ONR King Air detecting surface targets, providing due regard for the Integrator UAS, and pushing data feeds into Minotaur. This was followed by the November operations with King Air in Naval Station (NS) Guantanamo Bay, Cuba. From February to July 2025, operational deployment from CSL Comalapa with King Air in collaboration with UAS operations will include: (1) CN support to JIATF-S and El Salvador Navy, (2) J3 OPS support for MDA and (3) ONR support for new sensor validation.

Robotic Experimentation and Prototyping using Maritime Unmanned Systems (REPMUS)
Robotic Experimentation and Prototyping using Maritime Unmanned Systems (REPMUS) is an annual exercise focused on advancing unmanned maritime systems. Hosted by the Portuguese

Navy, the event gathers NATO and international partners to test and develop the interoperability and capabilities of unmanned aerial, surface and underwater vehicles. It involves military forces, universities, and technology companies, making it one of the largest events dedicated to unmanned systems in maritime operations.

REPMUS 24 took place from September 9-26, 2024, in Troia and Sesimbra, Portugal, with 2,000 participants from 23 nations, 20 ships and around 700 events across various operational areas. These included above water warfare, maritime safety and security, naval mine warfare, rapid environmental analysis and underwater warfare operations.

ONR GLOBAL Science Advisors Tony Bausas (USFFC), LaKeisha Williams (NECC) and Chad Gardner (C5F) in front of Commander Task Unit (CTU) Washington during REPMUS 2024. (Photo courtesty of ONR GLOBAL)

ONR GLOBAL Science Advisors — Chad Gardner (C5F), Anthony Bausas (USFFC), LaKeisha Williams (NECC) and Charles Humphrey (C6F) — attended the exercise to observe operations and engage with technology partners. Charles Humphrey played a central role in coordinating U.S. participation, supporting initiatives such as the U.S. Naval Research Laboratory's (NRL) Unmanned Aerial System (UAS)-based spectral imaging sensors for mine detection, as well as the integration of Mine Countermeasure (MCM) Unmanned Underwater Vehicles (UUVs) with British and Dutch systems. These efforts were aimed at enhancing mine detection and collaborative autonomy. NRL's Dr. Andrei Abelev demonstrated cutting-edge multispectral and hyperspectral sensors integrated on a Vapor 55 UAV, which were used to detect drifting mines and collect data for surf-zone bathymetry. These sensors also helped gather shore slope and soil type data, essential for planning marine and amphibious operations.

The U.S. MCM team continued building on the previous year's progress, demonstrating dynamic re-tasking of UUVs with British and Dutch partners. They showcased collaborative autonomy by running different autonomy solutions for reacquiring and identifying mine shapes with advanced sensors. A significant achievement was using NATO's STANAG 4817 Collaborative Autonomy Tasking Layer (CATL) to send a tasking request to a Spanish Sparus II UUV, reducing the time needed to reacquire a mine-like object from two days to under 30 minutes. In addition, ONR GLOBAL Science Advisors engaged with Kongsberg Hugin on undersea cable mapping capabilities, which were demonstrated at REPMUS with the Hugin Superior system. REPMUS 24 highlighted the continued evolution of unmanned systems, promoting multinational cooperation and advancing the use of autonomous technologies in maritime operations.

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U.S. Fleet/Forces Command (USFFC) Meet the Fleet

The ONR GLOBAL Science Advisor to U.S. Fleet/Forces Command along with ONR's Navy Reservists scheduled and coordinated a Meet-the-Fleet event for ONR GLOBAL personnel, December 10-12, 2024.

Attendees of the ONR GLOBAL-sponsored Meet the Fleet event stand in front of the USS Gonzalez. They are (from left to right) Cmdr. Jeff Parks, Tripti Johri, Will Hou, Troy Hendricks, Ashley Molinaro, Kristen Mitchell, Nick Falcone, Anthony Bausas, Dillard Patton, Justin Massey, Scott Walper, Marketa Papezova, Paul Sundaram, Shajuana Williams, Alina Banasyak, Martina Siwek, Seth Schroeder, Russ Wilson. (Photo courtesy of ONR GLOBAL)

The event gave ONR GLOBAL personnel the opportunity to visit U.S. Navy ships such as: USS Iwo Jima (LHD-7), USS Pasadena (SSN-752) and USS Gonzalez (DDG 66). ONR GLOBAL personnel also toured the Fleet Logistics Multi-Mission Squadron (VRM) 40 the "Mighty Bison" in Norfolk, Virgina. Lastly, they interacted with cutting edge technologies and discussed operational challenges at Naval Surface Warfare Center Dahlgren Division Dam Neck Activity headquartered in Virginia Beach, Virginia.

Highlights included:
Science Advisor Program hosted a tour at the Fleet Logistics Multi-Mission Squadron (VRM) 40 the "Mighty Bison" in Norfolk, Virginia. During this tour, attendees were able to go aboard an operational V-22 Osprey and interact with pilots. Attendees also visited the Osprey simulator facility. This simulator featured an actual Osprey cockpit with photo-realistic scenery. Attendees were able to board an Osprey, transition from vertical to standard flight, fly to an aircraft carrier and land.

VRM-40 is a V-22 Osprey Fleet Logistics Multi-Mission Squadron of the United States Navy. During this tour attendees were able to go aboard an operational V-22 Osprey and interact with pilots. Attendees also visited the Opsrey simulator facility. This simulator featured an actual Osprey cockpit with photo-realistic scenery. (Photo courtesy of ONR GLOBAL)

U.S.S. Iwo Jima (LHD-7) is a Wasp-class amphibious assault ship. The ship is designed to support a variety of military operations including launching and recovering helicopters, landing Marines and providing humanitarian assistance. During the tour, attendees visited a multitude of locations within the ship including the well-deck. The well-deck is

well suited for the launch of unmanned vehicles. However, it would require Iwo Jima to operate at risk during the many hours needed to complete the launches.

Unmanned Undersea Vehicle Group ONE (UUVGRU-1) detachment in Little Creek, Virgina. During this visit attendees were able to see a variety of small and medium unmanned undersea vehicles (UUV). This visit featured a detailed discussion with unmanned undersea vehicles operators on current operational challenges and how to make UUVs more operationally viable. ONR GLOBAL Science Advisor to U.S. Fleet/Forces Command will work with UUVGRU-1 to identify a potential TechSolutions proposals.

USS Pasadena (SSN-752) is a Los Angeles-class nuclear-powered attack submarine. Attendees were able to experience the conditions under which submariners operate for months at a time. During discussions with the Torpedo Chief, attendees were able to get detailed information about the submarine's capability to deliver unique effects. USS Pasadena is scheduled to be decommissioned next year. While awaiting decommissioning, the USS Pasadena will be required to remain in port. This may present a unique opportunity for pier-side experimentation.

Scientists and Engineers Spend Eight Nights Underway on USS CARL VINSON

Nine riders from the Naval Research and Development Establishment (NR&DE) participated in a Scientists-to-Sea underway for nine days and eight nights aboard the USS Carl Vinson (CVN 70) in October 2024. This was a rare Scientists-to-Sea opportunity aboard an aircraft carrier, and the riders said it was an experience of a lifetime. They had unlimited access to most of the ship and were able to spend significant amounts of time in nearly every department. Highlights included: observing F/A-18 Super Hornet take-offs and landings while standing on the flight deck, observing drills and training evolutions and discussions with the Executive Officer.

NR&DE participants in the ONR GLOBAL-hosted Scientists-to-Sea opportunity aboard the USS Carl Vinson (CVN 70). (Photo courtesy of ONR GLOBAL)

ONR GLOBAL Science Director Will Hou aboard the Wasp-class amphibious assault ship USS Iwo Jima (LHD-7). (Photo courtesy of ONR GLOBAL)

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Recognition Summary

On 4 June 2024, Vice Adm. Brendan McLane, Commander, Naval Surface Force, U.S. Pacific Fleet presented Ms. Rebecca Boxerman, ONR Global Science Advisor to Commander, Naval Surface Forces with a DON Meritorious Civilian Service Award stating: "... Ms. Boxerman led multiple asymmetric experimentation efforts on staff during her tenure, to include acting as the Programmatic Lead for Vanishing Act and Vanishing Act Reloaded, resulting in increased lethality and survivability of Independence Class Littoral Combat Ships.

Vice Adm. Brendan McLane presents Rebecca Boxerman, ONR Global science advisor, with a DON Meritorious Civilian Service Award. (Photo courtesy of ONR GLOBAL)

"Her efforts saved more than $30 million and provided the Surface Force with organic capabilities that made manning, training, and equipping for Maritime Intelligence Surveillance, Reconnaissance, and Targeting easier and more affordable. Tenacious and gregarious, she made inroads with many organizations that will carry forward an increased productivity and capability delivery to the sailors for years to come..." -Vice Admiral Brendan McLane

On August 28, 2024, Rear Adm. Michael R. Vanpoots, Commander, Undersea Warfighting Development Center (UWDC) presented a DON Meritorious Civilian Service Award to Mr. Colin Murphy, ONR Global Science Advisor to UWDC. The award citation states the following: "... [Mr. Murphy's] advocacy of DON sponsored studies directly led to vast improvements in the Navy's Undersea Warfare (USW) capability. His unique technical abilities in USW directly led to mature technologies in support of sub-systems applicable to current and/or future kinetic weapons systems as well as advancement in propulsion; seekers; guidance, navigation and control; warheads; and related targeting, networking and command and control systems.

Rear Adm. Michael R. Vanpoots, Commander, UWDC presented a Navy Meritorious Civilian Service Award to Colin Murphy, ONR Global science advisor to UWDC. (Photo courtesy of ONR GLOBAL)

"Finally, his cross-domain collaboration with fellow Science Advisors and within the Office of Naval Research was key to the successful delivery of multiple technologies to resolve warfighting capability gaps in the undersea domain and provided significant and long-lasting benefits to the United States Submarine Force and several allied countries..." -EOCS Piotr Diugolecki, U.S. Navy

Vision and Plans for 2025

The future of the Science Advisor Program and its Science Advisors (SAs) in 2025 and beyond is directly influenced by the Science and Technology (S&T) needs and capability gaps of the U.S. Navy and Marine Corps. SA efforts are determined and driven by strength and lethality priorities of the U.S. military's operational commands, where they are embedded. With that reality in mind, SAs have their pulse on the most pressing S&T problems of our Fleet/Force and will continue to design solutions that significantly impact U.S. national security. SAs are instrumental members of their commands' staffs providing expertise in engineering, acquisition, and technology transition charged with a mission to rapidly field emerging capabilities. Their innovative thinking and tenacity contribute to deterring U.S. adversaries by making sure that our Navy and Marine Corps have the technological edge to outperform, outpace and outsmart our opponents.

In 2025, the program's vision is for SAs to advance the development and de-risking of the hybrid Fleet/Force through experimentation with a wide variety of Artificial Intelligence (AI)-powered autonomous systems and platforms (i.e., remotely operated vehicles, unmanned undersea vehicles, unmanned surface vehicles, unmanned aerial systems, etc.), as the future fight will rely heavily on the safety, efficacy, and payload capacity of such systems in all domains of warfare. The U.S. is home to tremendous S&T talent and sophisticated systems within the government and private industries; however, the U.S. Navy and Marine Corps must have absolute confidence that these systems will perform as advertised. Differences in environmental conditions in specific areas of operations, hardware/software integration with command and control systems, and human factors (e.g., operator training) all present challenges to our Sailors and Marines as we collectively face the changing world order and heightened hostilities, especially in the Indo-Pacific. ONR GLOBAL SAs will be integral to ensuring that the Fleet/Force is equipped with the C5ISR-T tools and lethal firepower of the future while minimizing the potential loss of life. Whether it is designing new systems or re-purposing legacy ones on time and on budget, SAs have the access and know-how to work alongside their Commanders and operators to achieve these essential goals and vision.

In the coming year, SAs will focus on rapidly fielding emerging technologies, with commitment to equipping our Sailors and Marines with tools and capabilities to outmatch our adversaries. They will utilize their access to world-wide scientific information to identify S&T initiatives that fill operational gaps and propel efforts forward into rapid experimentation and into the hands of the warfighter. Our SAs are highly motivated individuals whose goals are to keep our forces lethal.

TECHSOLUTIONS

Chief of Naval Research (CNR) Rear Adm. Kurt Rothenhaus (right) celebrates the 1,000th request sent to TechSolutions — along with the Director of TechSolutions, Jason Payne (center right); ONR GLOBAL Commander CAPT Andy Berner (center); John Coffey (center left), TechSolutions; and Command Master Chief Andrew Chupashko (left) — at ONR headquarters in Arlington, Virginia. (Photo by U.S. Navy Photographer Michael Walls)

TechSolutions addresses challenges identified by Sailors and Marines by rapidly developing science and technology-driven prototype solutions. By linking warfighters to the science and technology community, TechSolutions initiates development of solutions as quickly as possible.

The goal is to have a prototype in the hands of the requesting Sailor or Marine within 12 months to emphasize warfighter focus, accelerated readiness, lethality and agile development in partnership with the Naval Research and Development Establishment (NR&DE).

TechSolutions accepts requests from anyone in the Fleet/Force, regardless of rank, rate or military occupation specialty (MOS). Once a technology request or new idea is received, the team works closely with the submitter and subject-matter experts to ensure that the problem is clear and the required solution capabilities are well-defined. TechSolutions then turns to the NR&DE network of labs, warfare centers and affiliated university research centers for proposed solutions. The submitter can be involved throughout the process starting with recommending the best proposal for sponsorship, all the way through design iterations with end-users and program reviews. If available, the submitter guides the development team and participates in the prototype demonstration and assessment.

Once a prototype is developed, TechSolutions works with transition sponsors, the submitter and their command to identify paths for adoption and support — possibly through an existing program of record, Government Services Administration (GSA) catalogue, Navy Type Command (TYCOM) supply, etc.

TechSolutions responds to needs and requirements from the Fleet/Force

- TechSolutions wants to hear from Sailors on the deck plate and Marines at ground level about their operational challenges.
- NR&DE members are selected to quickly develop solutions, potentially in partnership with industry or academia. Advanced technology prototypes with high-impact capabilities are delivered to the Navy and Marine Corps within 12 months.

Our website provides additional program and contact information to warfighters and stakeholders around the globe: **https://www. onr.navy.mil/techsolutions**.

U.S. Marines test the latest advancement in surf observation (SUROB) technology. The ONR GLOBAL TechSolutions-sponsored SUROB was among many innovations demonstrated at the Technical Concept Experiment (TCE) 24.2 at Marine Corps Base Camp Pendleton, California. (U.S. Navy Photo by Michael Walls)

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Results and Achievements

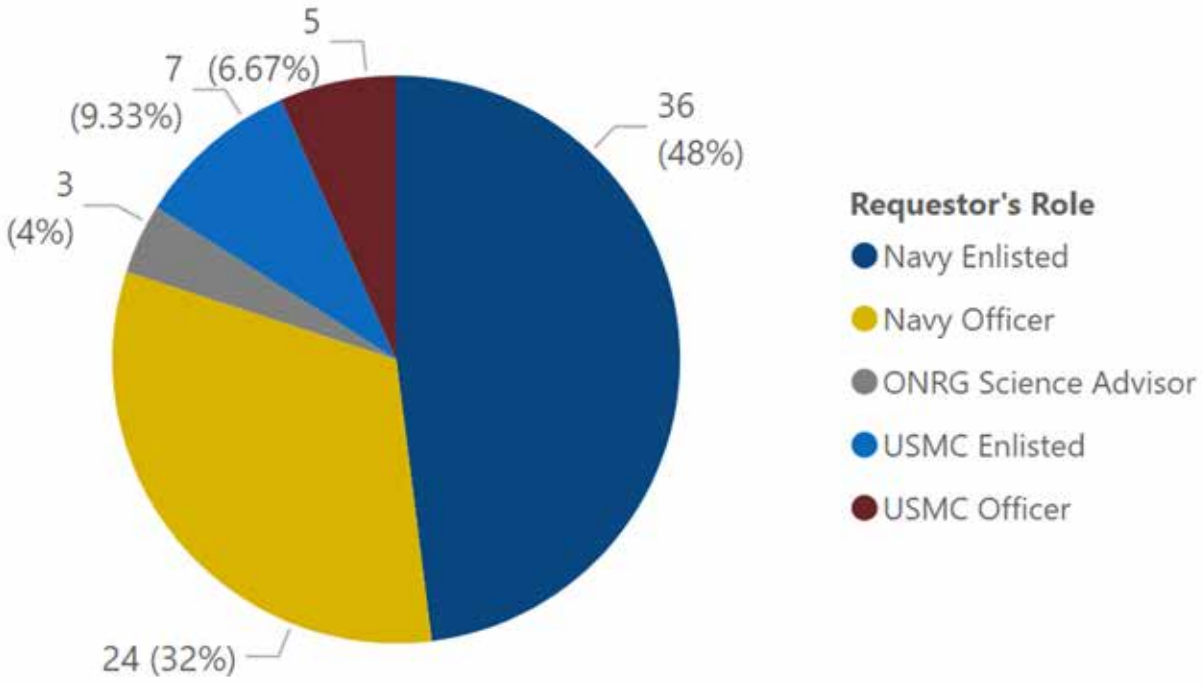
In 2024, TechSolutions responded to warfighter technology needs by delivering solutions ranging from expeditionary structures — such as temporary hangars and piers — to mission planning tools and training aids. Nine new development projects were initiated, 10 prototypes were delivered to warfighters, and the team managed a total of 19 active projects over the course of the year, while continuing to transition completed projects into the field and to acquisition partners.

TechSolutions received a record 75 requests for solutions from warfighters in 2024. This was the year that TechSolutions simplified the request process with instructions to warfighters to reach out to team members directly via email or phone, rather than having to register for access to an online portal. Additionally, TechSolutions is now featured on the newly released ONR mobile app with a "Warfighter Ideas" link on the main page to guide warfighters through making a request. The "quicklink" buttons for "prototypes" on MyNavy Portal — and as of November 2024 Marine On-Line — continue to be a driver for connecting warfighters with ideas to TechSolutions. The TechSolutions team maintained direct outreach efforts with Sailors and Marines with virtual and in-person events nationally and internationally, using ONR Active Duty and Reserve Components and connections with ONR GLOBAL's Science Advisors.

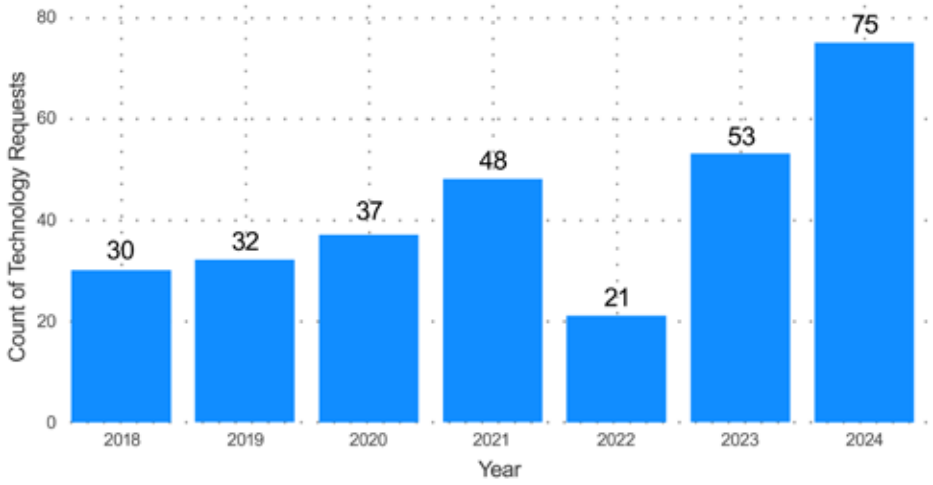
Key 2024 Program Results and Achievements:

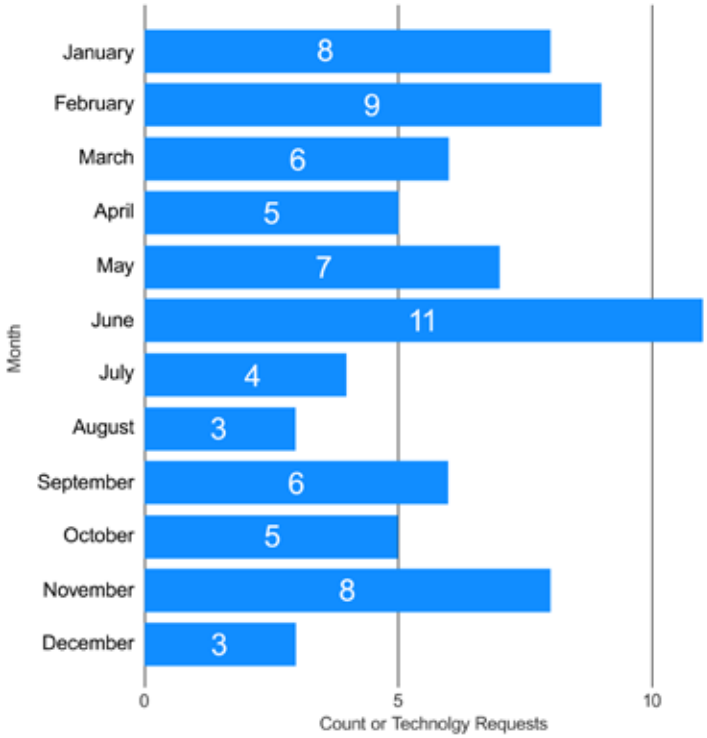
- 75 tech requests in 2024 (over 100% above average number of 36)
- 72 requests received from Marines and Sailors
- 3 requests received from ONR GLOBAL Science Advisors on behalf of warfighters at their commands
- Cost-sharing with TechSolutions projects from partner organizations

Navy enlisted lead requests at 48%, followed by officers at 32%. USMC and ONR GLOBAL requests total 20%, highlighting a Navy focus.



This bar chart displays the count of technology requests by year from 2018 to 2024. Except for a dip in 2022, the chart shows a steady increase from 30 in 2018 to 75 in 2024.





This chart tracks 2024 requests by month. Requests are typically highest mid-year, as this chart shows, with requests peaking in June (11), while December has the fewest (1).

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2024 Fleet/Force Tech Requests

As listed below, TechSolutions received a record 75 tech requests from the Fleet/Force for broad and diverse capabilities from multiple commands:

Request Title	Solution Request Title	Organization	Rank
TS-00998	Sub Cleat Boots	SSN 771	PO1
TS-00999	Sub Array Neoprene Sleeve	SSN 771	PO1
TS-01000	Fleet Data Science at Sea (DS@S)	CVN-70	CDR
TS-01001	AI Enabled SUAS - C-UAS	USMC TTECG	CAPT
TS-01002	Food Service Inventory Control	UAA Pelalau	PO1
TS-01003	RFID Inventory System	CVN 76	CPO
TS-01004	Secured Comms Radio		LT
TS-01005	Barrage Balloon - Low cost, C-UAS aerial hazard system	Task Group Shore Battle Space, UAE	CDR
TS-01006	SCADA Intrusion Prevention Systems	NAVIFOR	SCPO
TS-01007	Weaponized UAS/C-UAS	SURFDEVRON ONE	LCDR
TS-01008	Autonomous UAS Refueling	SURFDEVRON ONE	LCDR
TS-01009	Autonomous UAS Tractor	SURFDEVRON ONE	LCDR
TS-01010	Storage of UAS on UXS	SURFDEVRON ONE	LCDR
TS-01011	Gas Turbine and Aviation Internal Inspection	SRF Sasebo	SCPO
TS-01012	SentinelGuard	USS New Orleans (LPD 18)	PO3
TS-01013	H-60 Engine Output Shaft	Helicopter Sea Combat Squadron TWO	PO1
TS-01014	NALCOMIS Logsets Improvement	HSM-72	PO2

Request Title	Solution Request Title	Organization	Rank
TS-01015	Improved Camelbak	Strike Fighter Weapons School Pacific	CWO3
TS-01016	Counter UAS technology - Shake Rattle and Roll	NR USSTRATCOM HQ	LCDR
TS-01017	Cover in a Box (CIB) - Armored Ship Defense	USS San Antonio (LPD 17)	PO2
TS-01018	Javian Tiger	NAWDC	CDR
TS-01019	CONEX Box TechSolution for Siren's Song	Navy Expeditionary Combat Command	GS
TS-01020	Landing Signal Officer (LSO) Communication Equipment	VFA-106	CDR
TS-01021	AI Work Package Generator (AIWPG)	UWDC/ONR GLOBAL	GS-15
TS-01022	Compartmental Sorting Algorithm	NB San Diego	Ensign
TS-01023	Social Media Boosting	USN	Ensign
TS-01024	Digital Inventory System for Ships Technical Publications Libraries	USS William P. Lawrence (DDG 110)	Ensign
TS-01025	Automated Cable Tester	USS Sampson (DDG 102)	ET2/PO2
TS-01026	Sub Scope	USS Columbia (SSN 771)	CPO
TS-01027	High-tech Assistant for Naval Analysis aka HANA	MARMC	CPO
TS-01028	Navy Tech Manual Automatic Updates	USS Savannah (LCS 28)	PO1
TS-01029	Engineering Oil Sampling Efficiency	USN	PO1
TS-01030	Project Proteus	EODMU11	SCPO
TS-01031	Innovation in FA-18EFG 68 Door Removal and Installation Process	VFA-81	PO1

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Request Title	Solution Request Title	Organization	Rank
TS-01032	Cooling Vest for NAVCENT MAs and NSAII saliors	5th Fleet	GS-15
TS-01033	GARC Support	U.S. Fleet/Forces Command	LT
TS-01034	Invisible Small Team Recon Drone	USS Nimitz (CVN 68)	SN
TS-01035	Helpdesk Inventory and TroubleTicket Resolution System (HITTRS)	USS George Washington (CVN73)	LT
TS-01036	Rapid Measurement Accruing Device (RMAD)	USS Sterett	CDR
TS-01037	Next Generation Landing Gear	New London Sub Base	SA
TS-01038	Universal coax adapters	Army	SPC/PO2
TS-01039	Standardized Equipment Across DOD	160th SOAR U.S. Army	PO2
TS-01040	Navy Man Overboard	USN	PO2/Navy Reserve
TS-01041	MPU and Wifi	Army	Sgt
TS-01042	S6 Non Commissioned Officer in Charge (NCOIC)	1/160 SOAR	SFC/CPO
TS-01043	Advanced Insert Plates for Military Gear	NSF	MA3
TS-01044	Ops Planner's Plotting Board	Commander, Second Fleet	CDR
TS-01045	Helicopter Airbags	USN	PO2
TS-01046	DRAKE	Submarine Training Facility San Diego	PO1
TS-01047	Evaporative Cooling	MALS-11	Cpl
TS-01048	Aural Drone Recognition and Targeting	COMSUBPAC N8	LT

Request Title	Solution Request Title	Organization	Rank
TS-01049	Harbor Maritime Safety Harness	U.S. Navy Harbor Patrol	MASA
TS-01050	RFID for Real-Time Tracking of Personnel In/Out of Perimeters	Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility (PHNSY&IMF)	CDR(s)
TS-01051	Dynamic Inventory of Adversary Naval Arsenal (DIANA)	Special Reconnaissance Team ONE, Naval Special Warfare Group EIGHT	LCDR
TS-01052	Drop Tank Storage Adapter	VFA-41 embarked on CVN-72	AT1/PO1
TS-01053	Permanently Mounted Drake JCREW ANPLQ-12(V)1	USS Green Bay (LPD20)	GM1
TS-01054	MAMVerifier (MAM-V) or SMART (System Maintenance and Assessment Rapid Test)	USS Sampson (DDG 102)	CPO
TS-01055	WebWave II Automation Initiative	Bureau of Medicine and Surgery, Special Duty Waivers	HM1/PO1
TS-01056	Better Maintenance Software for Modern Sailors	USS Gabbrielle Giffords (LCS 10)	PO1
TS-01057	Technical Manual Conversion to Conversational Podcasts via AI (Google Notebook LM)	COMNAVAIRPAC	EMNCM/ MCPO
TS-01058	CAC Certificates Incompatible with RADM OMMS	USS Higgins (DDG 76)	LCDR
TS-01059	Hybrid Search and GenAI Q&A System	VAQ-135	CDR
TS-01060	ACTAS- Active Towed Array Sonar (Towed Variable Depth Sonar)	NCTS Hampton Roads	ET1
TS-01061	GCCS-M over HF	Commander Sixth Fleet	ET1/CDR

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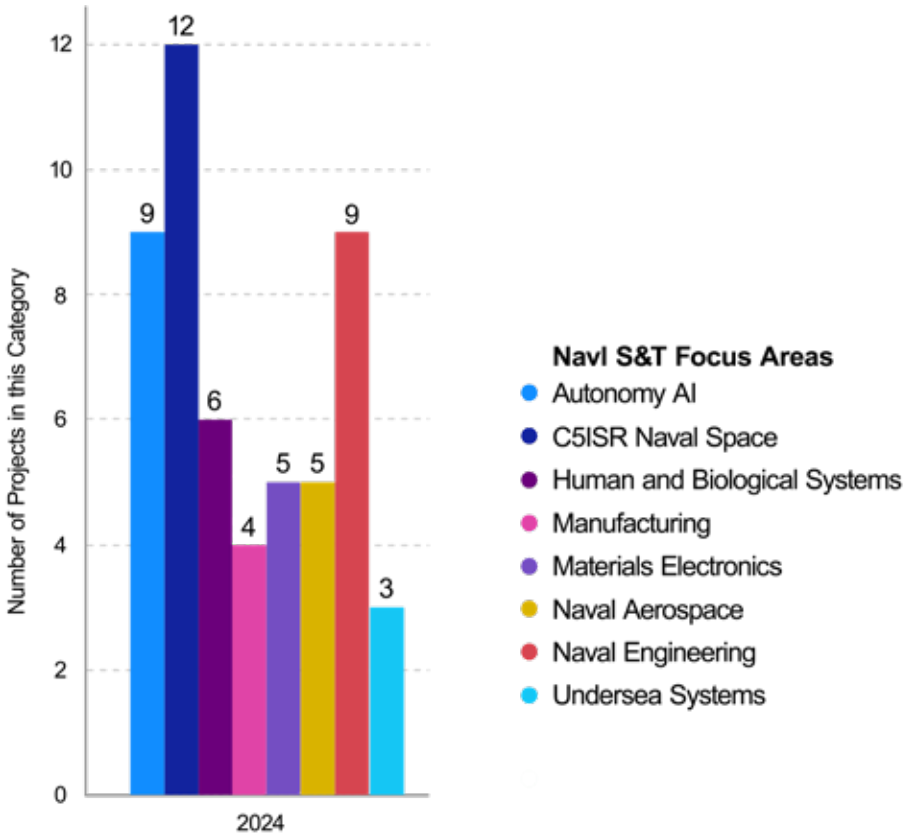
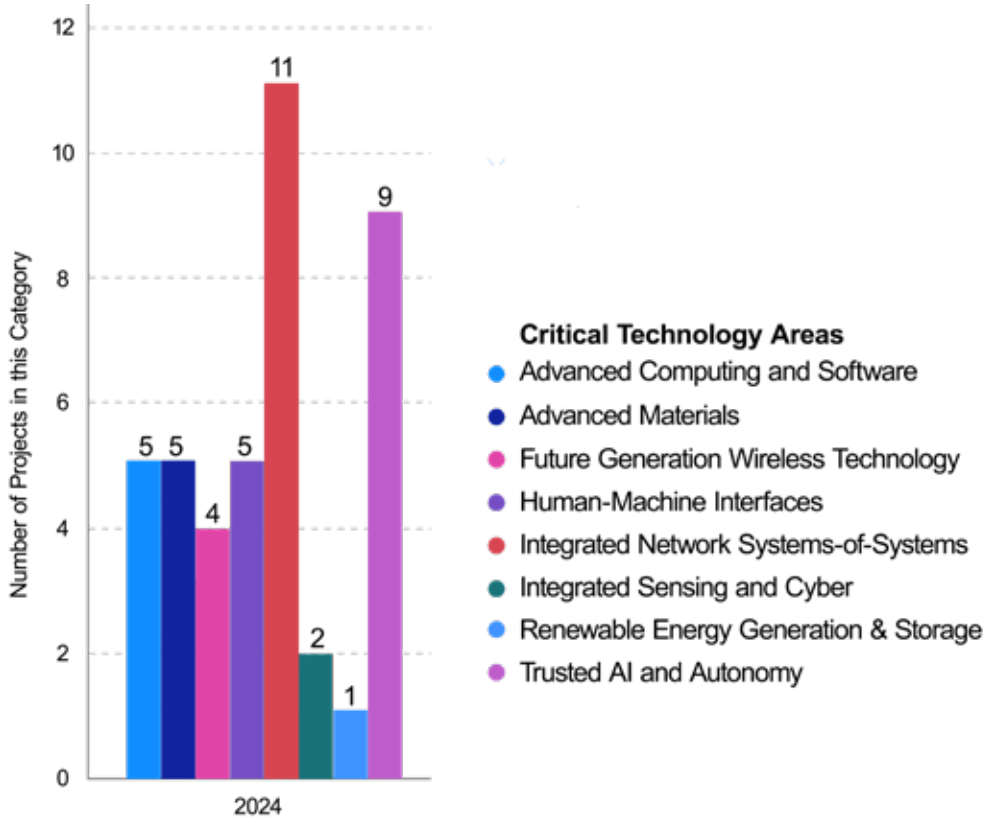
Request Title	Solution Request Title	Organization	Rank
TS-01062	Zodiac Upgrade Project	Marine Corps Warfighting Laboratory/Futures Directorate	SgtMaj
TS-01063	Targeted USMC Reserve Communication	CLR-4	LtCol
TS-01064	Encrypted Satellite Communications Operations Application	Marine Wing Communications Squadron 38 | 3D Marine Aircraft Wing	LCpl
TS-01065	PMO Digital Registrations	Provost Marshal Office, Marine Corps Base Quantico	Maj
TS-01066	UMSR Redefined: Driving Efficiency Compliance and Readiness Through Integration	MALS 16/MAG 16/3rd Marine Aircraft Wing	1stLt
TS-01067	Anti-Submarine Warfare Periscope Saturation	Trident Training Facility Bangor	FTC/CPO
TS-01068	Light Airborne Multi-purpose Unmanned Combat Aerial Vehicles (UCAVs)	NCTS Hampton Roads	ET1/PO1
TS-01069	Family of Mesh Networking Systems	II Marine Expeditionary Force	CAPT
TS-01070	Tactical Radio Audio Solution	MARSOC	SSgt
TS-01071	Formal Training Center e-Surveys	(Current) Marine Corps Systems Command (Previous: member of Training and Education Command)	GySgt
TS-01072	WEC Capability Enhancements	COMSUBPAC	CAPT

The TS Naval S&T requests for 2024 were: Autonomy AI (9), C5ISR & Naval Space (12), Human & Biological Systems (6), Manufacturing (4), Materials & Electronics (5), Naval Aerospace (5), Naval Engineering (9) and Undersea Systems (3). The focus areas without requests were: Ocean, Atmosphere and Space, Power and Energy and Directed Energy & Kinetic Systems.



In alignment with the Critical Technology Areas, for 2024 TS received requests in eight of the 14 areas. They were: Integrated Network Systems-of-Systems, leading with 11 requests, followed by Integrated Sensing and Cyber with nine. Advanced Computing, Materials, and Biotechnology had five each; Directed Energy had four; Human-Machine Interfaces had two; and Future Generation Wireless Technology had one. Biotechnology, Directed Energy, Hypersonics, Microelectronics, Quantum Science and Space Technology didn't align with any of the TS requests.



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Events and Projects

ONR GLOBAL's warfighter focus, led to numerous engagements with TechSolutions, successful solutions and transition of technologies to the warfighter.

TechSolutions TS-934 Virtual Bridge and Nautical Trainer ("VIBRaNT") has been developed by Naval Information Warfare Center Pacific (NIWC-PAC) in a partnership with industry and in a collaboration with London TechBridge for a Virtual Reality (VR) bridge trainer for Surface Warfare Officers in a simulated environment to build confidence and proficiency as an Officer of the Deck and as ship handlers. The VIBRaNT technology was introduced to the Fleet at Interservice/Industry Training, Simulation and Education Conference (I/ITSEC) 2024 in Orlando, Florida the first week of December. VIBRaNT allows Surface Warfare Officers and bridge crews of up to 12 individuals to use an Extended Reality (XR) training system to maintain proficiency in a virtual environment when the ship is not at sea, Navigation, Shiphandling and Seamanship Trainers (NSSTs) are not available, or when preparing to enter a new port for the first time. The simulated experience allows them to build confidence and proficiency as a team and also provides Officers of the Deck, Navigators, Commanders and Executive Officers the ability to tailor training as needed. This new training system could, if acquired, be made available to Officers and Sailors to augment their skills as they train to become better watch standers and excel in ship-handling.

ONR GLOBAL's Tech Solutions sponsored the development of the VIBRaNT technology on display at the I/ITSEC conference in December 2024 and tested by Vice Chairman of the Joint Chief of Staff Adm. Christopher Grady, U.S. Navy (top). Warfighter tests the same VIBRaNT technology (right). (Photos Courtesy of ONR GLOBAL)

TS-935/938 Transmission Emission Device (TED)/C5ISRT are two projects that are force protection systems that can be deployed in an expeditionary advanced base operations (EABO) scenario. The projects have had several meetings and workshops and the Marine Corps Tactical Systems Support Activity, U.S. Marine Corps and Disruptive Capability Office (DCO) have taken an interest in transitioning these for follow-on activities.

TS-766 Patent: Track Drive with Spring-Biased Feet issued. TechSolutions supported a program, which received a patent for its innovation with engineers at Naval Surface Warfare Center Panama City (NSWC-PCD) in Florida. The TechSolutions program worked with scientists and engineers from NSWC-PCD to address critical challenges associated with traction and steerability of track-driven manned and unmanned vehicles and equipment. The patent was specifically awarded for a program entitled, Track Drive with Spring-Biased Feet (US 11,981,377). Dr. Tye Langston, chief engineer and Dane Maglich, senior mechanical engineer at NSWC-PCD, led the development and patent for their invention that provides no-slip endless track traction and steerability.

TS-878 Government Ready Advanced Institutional Secure Online Network (GRAISON) successes have expanded to capture of two other requests: **TS-978 eRecord of Religious Needs Assessments (RNA),** which will develop a government owned Religious Needs Assessments (RNA) for Sailors' e-Records for tracking and updating, and **TS-984 Force Network Command Communication Platform,** which will develop a government owned and approved social media application to be used for official communication. It will also have the ability to send notifications to a "communication received" displayed on the Quarter Deck of various barracks or onboard a ship.

TS-1000 Data Science at Sea (DS@S) initiative has organically developed analytic capabilities to support U.S. Pacific Fleet warfighting directives with sailor-developed prototypes used by carrier strike groups (CSGs) to automate the workflow and optimize operational capabilities. TechSolutions with Naval Information Warfare Center Pacific is developing a solution to incorporate the applications into a software container, ensure cyber compliance, provide configuration management, and establish a continuous integration and deployment (CI/CD) pipeline to support installs.

TS-1001 AI Enabled small unmanned air Systems (sUAS) is designed to counter unmanned aircraft systems (C-UAS) and will be developed by NSWC Dahlgren. It will have an Artificial Intelligence enabled sUAS with computer vision that is able to autonomously identify, track and engage targets, including C-UAS.

TS-1029 Engineering Oil Sampling Efficiency will be developed by the U.S. Naval Research Laboratory as a Navy Marine Diesel Engine sampling line loop back to the sump. With a sampling valve in the line, this would reduce the man-hours required for "flushing" and sampling oil before engine starts while reducing lube oil waste.

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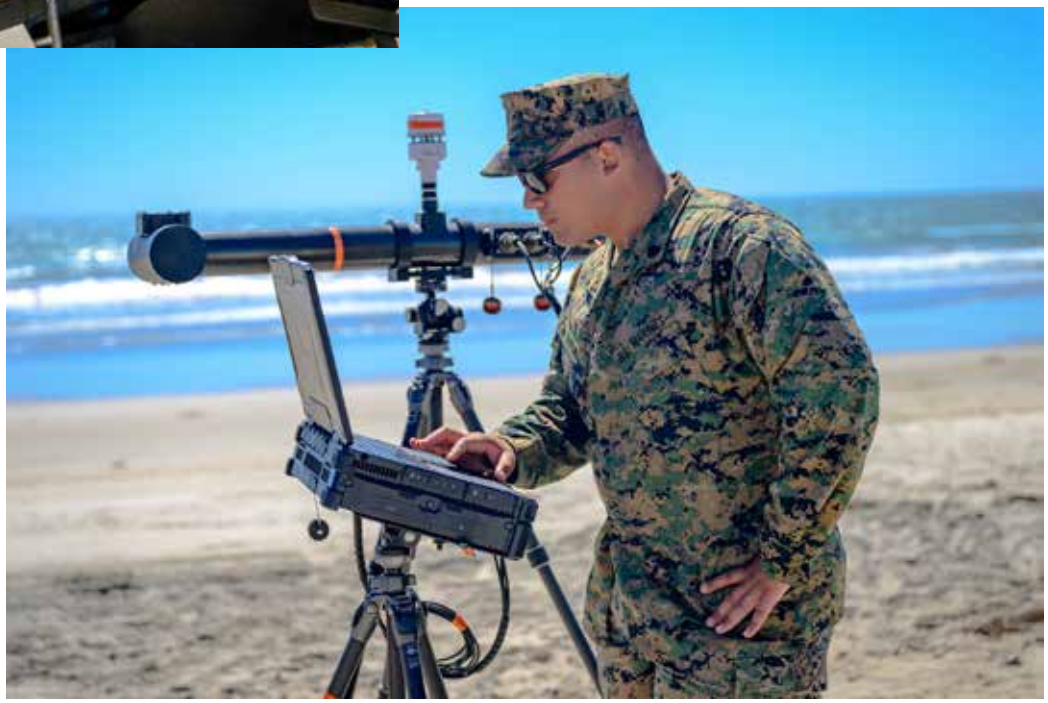
After a demonstration of the TechSolutions-sponsored surf observation (SUROB) technology, Marines and scientists gathered for a Warfighter Workshop in Duck, North Carolina to provide insight into the design and features of the tools demonstrated. (Photo courtesy of ONR GLOBAL)



SUROB was demonstrated at the Technical Concept Experiment (TCE) 24.2 held at Marine Corps Base Camp Pendleton, California, where U.S. Marines tested the latest advancement in the SUROB technology ONR GLOBAL's Tech Solutions sponsored the development the surf observation technology on display. (U.S. Navy Photo by Michael Walls.)

Recognition Summary

Sailors and Marines Driving Twenty Years of Innovation through TechSolutions
2024 began with TechSolutions recording technology request TS-1000, which was the 1,000th request from warfighters in the 20+ year history of TechSolutions. In 2001, then-Chief of Naval Research, Rear Adm. Jay M. Cohen, USN (Ret.), stood up TechSolutions at ONR as a pilot program.

To honor the milestone, TechSolutions hosted a Council of Elders reunion and the celebration included a ceremony during a command-wide meeting with the current CNR, Rear Adm. Kurt Rothenhaus, and ONR GLOBAL's Commander, CAPT Andy Berner (See photo and caption on page 32).

Navy and Marine Corps Achievement Medal
The Office of Naval Research (ONR) Global recently awarded the Navy and Marine Corps Achievement Medal to Senior Chief Piotr Dlugolecki, who submitted Technology Request TS-996 requesting an Unmanned Aerial System (UAS) Payload with Firing Device for United States Navy (USN) Explosive Ordnance Disposal (EOD) community. This system will provide an affordable, simple, scalable, lightweight, remote-operated payload release and recovery mechanism with downward facing camera and firing device and firing controller. The approach will consist of two main elements; the payload/placement system to be developed by NIWC-PAC, and the remote firing system developed by Naval Surface Warfare Center Indian Head.

Senior Chief (United States Navy) Piotr Dlugolecki receives the Navy and Marine Corps Achievement Medal (Gold Star in Lieu of Third ward) and Certificate from the CNR. (U.S. Navy photo by Michael Walls)

"The TechSolutions program accelerates capabilities to Warfighters by coupling real-world battlespace experiences with the Naval Research and Development Enterprise to secure cutting-edge technical superiority for the fleet. Completely warfighter inspired." -EOCS Piotr Diugolecki, U.S. Navy

Vision and Plans for 2025

As TechSolutions welcomes a new Enlisted Outreach Coordinator as a member of the team in early 2025, we approach tech request # TS-1100, which will be the 1,100th request from warfighters in the 20+ year history of TechSolutions. ONR's new Command Master Chief and MCWL's new Sergeant Major have represented our program in visits to the Fleet/Force and will continue to be force multipliers for ONR GLOBAL.

In fact, SgtMaj Singley coordinated the submitted TS-1062 for an Autonomous Combat Rubber Reconnaissance Craft (CRRC) with a rugged, low-cost, quick-installation and attritable kit to fit onto current engines that allow autonomous delivery of supplies in denied and hostile areas of operation. The CRRC are organic to Active and Reserve Marine Reconnaissance Battalions, Force Reconnaissance Companies, and Marine Raider Regiments and Battalions (as well as U.S. Navy and SOCOM Units), so this capability would scale quickly.

Finally, we continuously improve our knowledge management systems to optimize our program and project management, coordination and communications with the ONR GLOBAL Family!

INTERNATIONAL ENGAGEMENT OFFICE

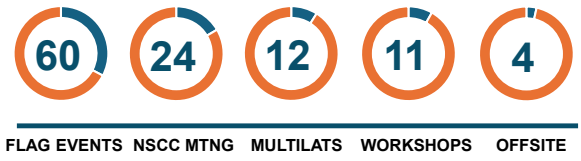
ONR's Chief of Naval Research Rear Adm. Kurt Rothenhaus speaks with personnel at the Information Fusion Centre in Singapore. (Photo courtesy of ONR GLOBAL)

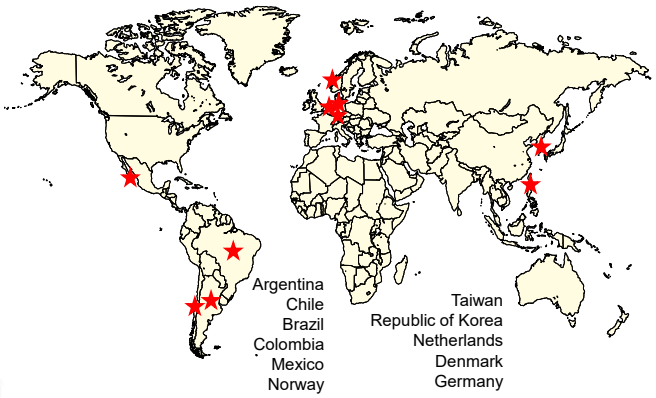
The International Engagement Office (IEO) is a dedicated team of engineers, technical experts, and analysts that work across the Office of Naval Research Global, Office of the Chief of Naval Operations, and Office of the Director, Innovation, Technology Requirements, and Test and Evaluation to build lasting partnerships with our global naval allies — strengthening collaboration that enhances the warfighting capability, lethality and readiness of the Fleet/Force. Our team of 10 includes a director, deputy director, six country directors, a program support analyst and a foreign disclosure analyst. As a team our goals are to serve, engage, interface, gain and connect. We accomplish those goals by:

- Developing and supporting military to military, bilateral and multilateral relationships and activities that promote Research Development Test and Evaluation (RDT&E) collaboration, expanding Navy capability, increasing capacity and ensuring U.S. and Partner interoperability through international cooperation.
- Promoting opportunities for shared collaboration in research and development to support the delivery of innovative warfighting technology.
- Ensuring that our international partners have the capacity and the experience to address an ever-changing environment, both in tandem with the U.S. Government and on their own.

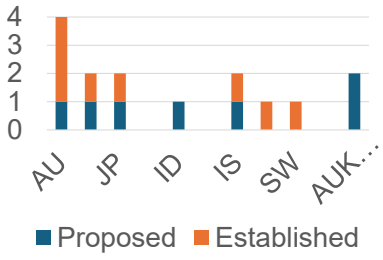
IEO 2024 in Review - Driving Outcomes

111 Engagements





PROJECT AGREEMENTS ACCOMPLISHED IN 2024



	$ US CONTRIBUTION
AU	$ 1,193,000.00
UK	$ 16,200,000.00
JP	$ 9,387,000.00
FR	$ -
ID	$ -
CA	$ -
IS	$ 23,850,000.00
SG	$ 55,677,000.00
SW	$ 1,033,000.00
FN	$ -
AUKUS	$ -

ACCOMPLISHMENTS

- Successfully accomplished 9/10 of our mil-mil engagements
- Led 10 Country Engagements in support to ONRG
- Coordinate and Support the development of over 13 Projects Agreements (7 Proposed | 6 Established (SIGNED))
- Promoted the establishment of a new S&T engagement with ROK
- Led the first ever US Naval Engagement Summit

Over the year, IEO led 111 engagements and interacted with 16 different countries bilaterally and many more through multilateral forums under NATO and the International Cooperative Engagement Program for Polar Research (ICE-PPR). IEO promoted the establishment of a new S&T engagement with the Republic of Korea (ROK). Furthermore, IEO coordinated and supported Navy International Program Office (NIPO) on the development of over 13 Projects Agreements across IEO countries.

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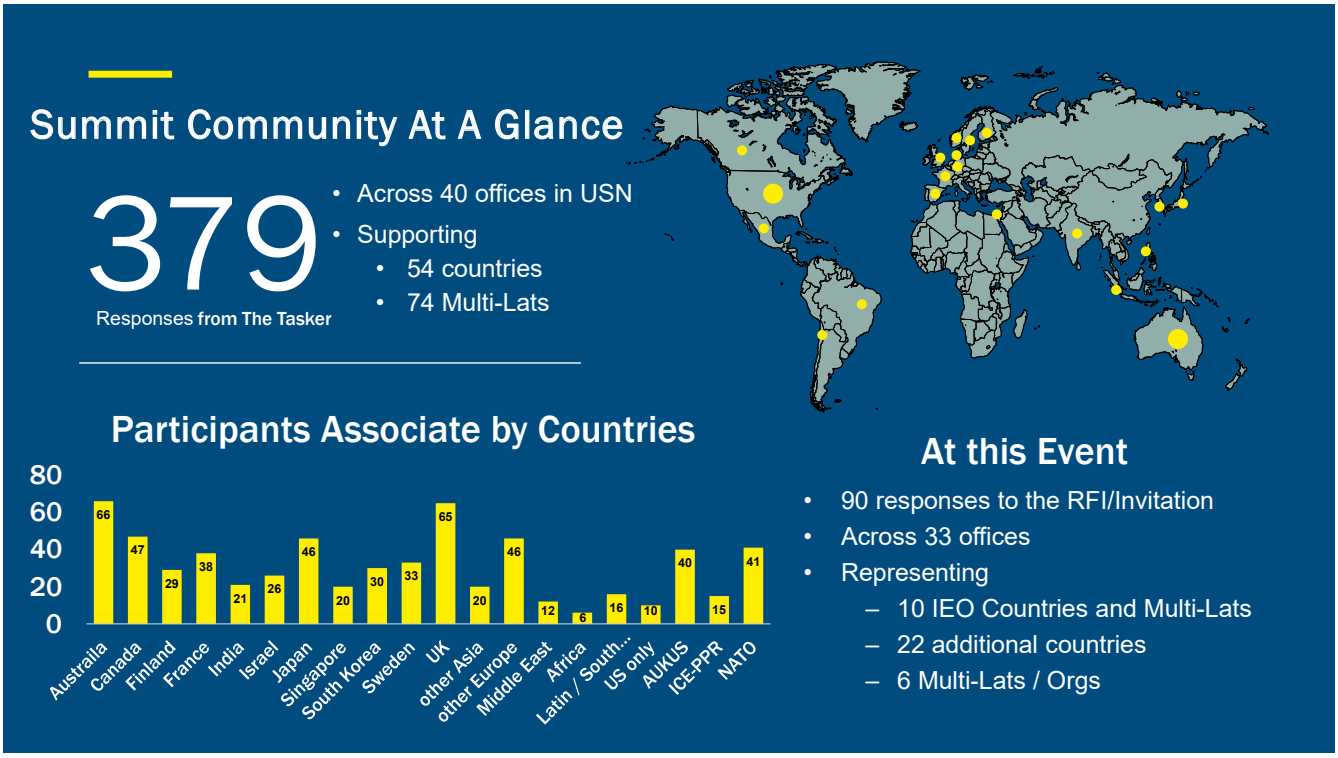
Results and Achievements

One of the biggest achievements for the IEO office was the execution of the first ever U.S. Naval International Engagement Summit held on October 9-10. This event, hosted at the Naval Surface Warfare Center (NSWC) Carderock Division, brought together personnel from multiple Navy commands engaged in international collaboration for discussions and planning. The summit produced the first ever U.S. Navy International Engagement rolodex to identify individuals engaged in international collaboration and ultimately strengthen teamwork across the Department of the Navy. Furthermore, roundtables and breakout sessions provided opportunities to discover areas for collaboration and coordination of activities. IEO looks forward to hosting this event again in the coming years.



Events and Projects

Canada

In January 2024, International Engagement Office traveled with the Chief of Naval Research Rear Adm. Kurt Rothenhaus to Halifax, Canada for the annual U.S.–Canada Senior National Naval Representative (SNNR) engagement. The Canadian Navy hosted the event at the Defense Research and Development Canada (DRDC) Atlantic Research Center (ARC). The first day of the engagement kicked off with tours of Royal Canadian Navy HMCS Harry DeWolf, an ocean patrol vessel, and HMCS St John, a Halifax-class frigate. Day two of the event included briefings on Canadian Integrated Undersea Surveillance technology and sensors, a discussion of the U.S. Navy's artificial intelligence (AI) strategy, fuel cell technology for uncrewed undersea vehicles (UUVs) and Canadian Navy research efforts for the new Canadian Surface Combatant.

In June, International Engagement Office staff represented Rear Adm. Rothenhaus at the 2nd Annual U.S.–Canada Defense Science and Technology Executive (DSTX) Meeting hosted by the Honorable Heidi Shyu, the undersecretary of Defense for Research and Engineering (USD(R&E)) and Dr. Jaspinder Komal, assistant deputy minister, Defense Research and Development Canada (ADM(DRDC)). IEO briefed this group of defense officials on the many areas of science and technology (S&T) collaboration between the Canadian and American Navies, including undersea surveillance, sustainability of naval platforms and interoperability of maritime patrol aircrafts (MPA) assets.

Republic of Korea (RoK)

The International Engagement Office (IEO) had a busy year collaborating with the Republic of Korea (RoK) on defense science and technology (S&T) initiatives. In February, IEO represented the Navy at the annual RoK–U.S. Technology Cooperation Subcommittee (TCSC) meeting in Daejon, Korea. The meeting covered topics such as space, AI, autonomy, future communications and advanced materials. IEO also helped update four Information Exchange Agreements (IEAs) that support these areas of collaboration.

In February, IEO represented the Navy at the annual U.S.–RoK Technology Cooperation Subcommittee (TCSC) meeting in Daejon, Korea. (Photo courtesy of ONR GLOBAL)

In May, IEO coordinated a trip to the RoK with the CNR. During the visit, Rear Adm. Rothenhaus met with key officials from the Agency for Defense Development (ADD) and the RoK Navy, including laboratory tours and briefings on joint research efforts. The trip also included a visit to the Hanwa Ocean shipyard and the company LIG Nex1, which is working on a foreign comparative test proposal with the Navy.

In June, International Engagement Office facilitated the U.S.–RoK Services and Agencies Exploratory Group (SAEG) meeting at the Naval Postgraduate School. The three-day meeting brought together representatives from ADD and multiple U.S. defense research agencies to discuss potential collaboration areas, including chemical-biological technology, rocket propulsion, directed energy, and AI/autonomy. The meeting identified several project topics for future proposal development.

A major milestone was achieved on October 31, 2024, with the inaugural U.S.–RoK Maritime Science, Technology, and Capabilities Steering Group (MSTCSG) meeting. This historic event marked the first bilateral forum for S&T collaboration between the U.S. and RoK navies. The meeting, hosted at the Office of Naval Research (ONR), featured key representatives from both countries, including Rear Adm. Kwang-Sub Kwak and Dr. Hee Seon Seo. The RoK Navy presented its key initiatives, such as the Navy Sea Ghost and Maritime Galaxy, and proposed joint research initiatives with the U.S. The meeting established four working groups: Future Technologies,

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Information Warfare, Multi-Domain Warfare, and Platform and Weapons. Co-chairs from each country were assigned, and plans were made to hold the first working group meeting in May 2025 in Busan, Republic of Korea. The meeting concluded with the ceremonial signing of the MSTCSG Statement of Intent, solidifying the partnership between the two nations.

ONR GLOBAL hosted the inaugural USA–RoK Maritime Science, Technology, and Capabilities Steering Group (MSTCSG) meeting. This historic event marked the first bilateral forum for S&T collaboration between the U.S. and RoK navies. (U.S. Navy Photo by Michael Walls)

Israel

The International Engagement Office supported a trip by ONR's expeditionary portfolio manager in July. The delegation provided program managers from ONR and NRL the opportunity to see Israeli research facilities and engage with their Israeli counterparts. Trip highlights included discussions on counter UAS technology, human performance, subterranean warfare, and lessons learned from current conflicts.

France

International Engagement Office supports two major U.S. Navy–French S&T efforts: the Senior National Naval Representative (SNNR) meeting and the Senior Acquisition Review (SAR). A successful joint SNNR/SAR meeting hosted by the French Navy took place in Paris from February 12-14. The SNNR/SAR stressed the importance of interoperability between the U.S. and French navies and the need for long-term security through further collaborative S&T effort. A new term of reference document signed during the U.S./SNNR meeting paves the way for enhanced dialogue moving forward.

The Office of Naval Research (ONR) hosted Admiral Nicolas Vaujour (right), the Chief of Staff of the French Navy. Adm. Rothenhaus (left) provided an overview of the USN S&T Strategy, followed by overviews of ONR, ONR GLOBAL, Naval X and a roundtable discussion with all participants. (Photo courtesy of ONR GLOBAL)

In September, IEO arranged a visit by Adm. Nicolas Vaujour, the Chief of Staff of the French Navy, to Office of Naval Research Headquarters. The CNR hosted Vaujour for an office call. Follow on events included a briefing on the U.S. Navy's S&T Strategy, presentations from ONR GLOBAL and NavalX, and a roundtable on the future of U.S.–French naval research.

Closing 2024, U.S.–France Senior Acquisitions Review (SAR) and Senior Naval National Representative (SNNR) principals meeting was held at the U.S. Fleet/Forces Command, Hefti Global Live, Virtual and Constructive (LVC) Operations Center at the Dam Neck Annex, December 11-12.

Principals and staff attended the U.S.–France Senior Acquisitions Review (SAR) and Senior Naval National Representative (SNNR) meeting at U.S. Fleet/Forces Command in support of ONR GLOBAL's engagement strategy, at the Dam Neck Annex, Virginia, December 2024. (Photo courtesy of ONR GLOBAL)

U.S. Navy–France principals included Rear Adm. Michael Donnelly, OPNAV N98, Aaron Ammerman, Navy International Programs Office were joined by French counterparts Rear Adm. David Desfougères, Deputy Chief of Plans and Programs and Col. Rodolphe Veillard, Acquisition, Head of Naval Systems Technical Authority, General Armaments Directorate. The principals gathered at this annual engagement to discuss strategic alignment, improve security cooperation and increase interoperability between our Naval Forces. Highlights of the meeting included reflections on USS Eisenhower Strike Group's Red Sea deployment presented by Rear Adm. Kavon Hakimzadeh Commander, Carrier Strike Group Two. The discussion focused on the partnership between the U.S. and French Navies in the region. The meeting venue of the Hefti Global LVC Operations Center allowed for the French to witness firsthand the game-changing capabilities that the facility has to offer. Other topics included updates on Surface Force Interoperability, Under Sea Warfare, Maritime Aviation and Communications.

The next Principals meeting will be hosted by France in approximately 12 months. However, the working groups will be fully engaged in the upcoming Strategic Interoperability Framework (N3/5/7 Lead) prior to summer 2025.

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India

The past year has seen significant engagement with various entities of the Indian government. A major highlight was the Indo–U.S. Artificial Intelligence for Multi-Environment Situational Awareness (AI-MESA) Project Arrangement Workshop, led by the International Engagement Office (IEO) in February. Held in Bangalore, India, in collaboration with India's Center for AI and Robotics (CAIR), the workshop culminated in the signing of a new AI project arrangement between the U.S. and India.

Will Henry (fifth from the right), IEO, represented the U.S. as the Advance Capabilities lead at the U.S.–India Underwater Domain Awareness (UDA) Forum during Malabar MPC in Visakhapatnam, India, in July 2024. (Photo courtesy of ONR GLOBAL)

In addition to this milestone, IEO supported several other key interactions with India throughout the year. These included a meeting between the CNR and Dr. Muthalagu Ravichandran, Secretary of the Ministry of Earth Science (MoES) of India to explore potential oceanographic research collaboration. IEO staff also participated in a U.S.–India Human Machine Team meeting in April, the annual U.S.–India Joint Technology Group (JTG) meeting, and the U.S. Navy–Indian Navy Maritime Technology Working Group.

Throughout these engagements, International Engagement Office staff briefed Navy and Indian officials on various science and technology (S&T) research agreements, including those related to laser propagation, human machine teaming, and data analytics for shipboard maintenance. These briefings helped to advance cooperation and identify new opportunities for collaboration between the U.S. and India in these areas.

Singapore

Throughout 2024, International Engagement Office staff supported multiple meetings and workshops to develop an Artificial Intelligence Grand Challenge jointly administered by the U.S. and Singapore. This technology challenge would seek industry and academic solutions to solve a problem using artificial intelligence (AI). Proposed focus areas include conditions-based maintenance and training efficacy.

During August, International Engagement Office organized working group meetings between ONR and Singapore's Defense Science Technology Agency to discuss unmanned surface vessel technology proposals that could be executed in the coming years. IEO also hosted the U.S.–Singapore SNNR where AI and autonomy were topics of interest.

In November, the IEO participated in a series of strategic collaboration meetings with the Singapore Ministry of Defense, focusing on the cutting-edge technologies of AI and Unmanned Surface Vessels (USVs). The meetings reached a pinnacle with the Senior National Naval

Representative Meeting, where Mr. Tan, Chief Scientist of the Ministry of Defense, and Rear Adm. Kurt Rothenhaus, chief of naval research, engaged in high-level discussions to explore opportunities for mutual cooperation. Following these productive talks, both parties reaffirmed their commitment to continue and expand their collaborative efforts in AI and USV research and development, laying the groundwork for innovative advancements and strengthened partnership between the IEO and the Singapore Ministry of Defense.

United Kingdom

The International Engagement Office engages with the United Kingdom through two bilateral engagements: The Maritime Technology Working Group (MTWG) and Future Integrated Warfighting Staff Talks (FIWST). Both support Line of Effort (LOE) 4 under the U.S.–U.K. Delivering Combined Seapower (DCS) framework. Additionally, the MTWG reports up to OSD's S&T Stocktake initiative, bringing together a wider group of defense research entities across the Services.

The International Engagement Office led a successful U.S.–U.K. Maritime Technology Working Group (MTWG) and Future Integrated Warfighting Staff Talks (FIWST) engagements in Portsmouth, U.K. this past April. The CNR co-chaired the MTWG with Dr. Andrew Bell from Defense Science Technology Lab (DSTL). Topics of discussion included directed energy weapons, anti-submarine warfare, naval power and energy, and, force threat evaluation/weapon assignment. The meeting also included laboratory tours and demonstrations from DSTL staff and researchers. The following day Rear Admiral Paul Schlise of Office of the Chief of Naval Operations (OPNAV N9I) co-chaired the FIWST with Rear Admiral James Parkin, Director Develop, RN. Force Development, Wargaming, Experimentation, Project Overmatch, and Above Water Working Group (AWWG) updates in support of LOE 4 were all major topics. The trip to the United Kingdom also included tours to defense companies SubSea Craft and QinetiQ, NAVSEA Warfare Center Chief Technology Officers (CTO) visit to DSTL Portsdown West and working level technical meetings.

The Future Integrated Warfighting Staff Talks (FIWST) took place in Portsmouth, U.K., April 2024. (Photo courtesy of ONR GLOBAL)

The International Engagement Office supported LOE4 updates to the DCS 3* Annual Staff Talks (AST) in May and the 4* Azimuth Check in October. The OSD S&T Stocktake in August provided an opportunity to highlight ongoing S&T collaboration between the United Kingdom and U.S.

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navies to a wider defense audience. IEO supported the Navy update provided to senior leaders. The meeting also included technical briefings and tours at DSTL's Porton Down laboratory.

Lastly, U.S.–U.K. Future Integrated Warfighting (FIW) Principals held a touchpoint call via secure video teleconference (SVTC) in December. Rear Adm. Sweeney (N9I) and RAdm Parkin (Director Develop, Royal Navy) discussed the status of FIW, plans to stand up a new Robotics & Autonomous Systems (RAS) working group, and plans to host two-star U.S.–U.K.–AUS Trilateral Capability Talks in Washington, D.C. in April 2024. The next FIW Touchpoint was held in January 2025 at WEST25 in San Diego, California.

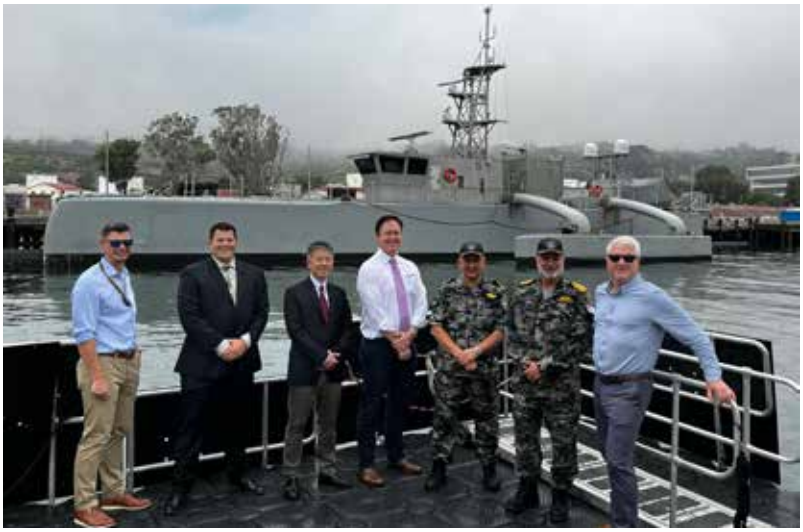
Japan

In May, the International Engagement Office conducted multiple engagements with the Japanese Maritime Self Defense Force (JMSDF) on a trip to Japan. Working level meetings held between the U.S. and Japan discussed underwater and systems technology. IEO also participated in the U.S.–Japan Maritime Science, Technology, and Capabilities Steering Group Meeting co-chaired by Rear Adm. Rothenhaus and Rear Adm. Hoshi from the JMSDF. IEO organized follow-on visits for Rothenhaus to Japanese research institutions and office calls with U.S. 7th Fleet staff.

Later in the summer, International Engagement Office represented the Navy at the 2nd United States-Japan OSD Defense Science and Technology Cooperation Group Meeting (DSTCG). The DSTCG is the senior bilateral forum between the U.S. and Japanese defense forces. This year's meeting identified the need for new U.S.–Japan working groups focused on advanced materials and directed energy.

Australia

The International Engagement Office staff engaged the Royal Navy across a range of S&T activities this year. In March, the IEO team hosted a virtual U.S.–AUS Concepts and Requirements Steering Group (CRSG) and Science and Technology Steering Group (STSG) executives meeting to provide updates on working group activities. During March, IEO staff also virtually participated in the AUKUS Pillar 2 Tabletop Exercise



Wayne Liu (third from left) CDRE Turner (RAN) and Mr. Brendon Anderson (DSTG) visited the Naval Information Warfare Center Pacific (NIWC PAC), which included an onboard tour of Sea Hunter, as part of ONR GLOBAL's engagement strategy. (Photo courtesy of ONR GLOBAL)

During the summer, IEO staff organized and facilitated events for Commodore Turner from the Royal Australian Navy and Mr. Brendon Anderson from Defense Science Technology Group (DSTG) Australia during a trip to the United States. Commodore Turner and Mr. Anderson visited ONR, the Pentagon, NSWC Carderock, NUWC Newport, and NIWC PAC to explore collaboration opportunities.

During the last week of September, IEO traveled to Canberra for a week of working group meetings for the STSG and CRSG. The seven working groups focused on cross-collaboration and addressing strategic context by enhancing lethality, promoting multi-mission capabilities, and rapidly developing technology.

Finally, a representative from the IEO team attended Australia's Autonomous Warrior exercise in October. This week-long exercise evaluated U.S. and Australian navy capabilities both individually and jointly. Technologies included persistent remote UUVs, interoperable acoustic communications, and submerged logistics expeditionary payloads.

Brazil

One of the Navy's newer S&T collaboration was with Brazil. In June, IEO directed the third Maritime Technical Exchange Meeting (MTEM) at the Navy Technology Center in Rio de Janeiro. The MTEM explored potential areas of collaboration between the U.S. and Brazilian Navy and included a workshop on a prospective project agreement in soundscapes for Harbor Defense. The meeting also scoped a potential project agreement concerning autonomous systems and a new information exchange annex in ship design.

This August IEO helped make history when the U.S. and Brazilian navies signed their first ever project agreement during the annual U.S.–BR Science, Technology and Logistics working group meeting. This agreement will verify and validate potential devices for testing biological contamination in ballast water.

Representatives of the Director, International Cooperation (OUSD), ONR GLOBAL, the Brazilian Navy and Air Force and other agencies were present at the Pentagon on August 22, 2024, for the signing of the first Project Agreement between the Brazilian Navy and the U.S. Navy. The creation of the project agreement was finalized through the efforts of Naval Surface Warfare Center Carderock Division, Naval Research Laboratory and the Office of Naval Research Global. (DOD photo by U.S. Air Force Senior Airman Madelyn Keech)

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Denmark

The International Engagement Office coordinated a visit by Danish defense officials to ONR in April this year. The group included members of the Danish Acquisitions and Logistics Organization, Danish Defense Command, and Danish Defense Attache Staff. Highlights included an office call with Rear Adm. Kurt Rothenhaus and a series of briefs on the Naval Research Enterprise.

Sweden

The International Engagement Office (IEO) represented the U.S. Navy at the Office of the Secretary of Defense (OSD) U.S.-Sweden Declaration of Principals (DOP) meeting in June. During the meeting IEO and NIPO provided updates on activities between the U.S. and Swedish navies to include project agreements, information exchanges, and foreign comparative tests. Areas of collaboration include underwater unmanned systems, electromagnetic warfare, and mine warfare.

The Chief of Naval Research Rear Adm. Kurt Rothenhaus and IEO staff tour of the Naval Staff Headquarters Muskö, Sweeden. (Photo courtesy of ONR GLOBAL)

In August, the International Engagement Office staff executed a trip to Sweden in support of the U.S.-SWE SNNR Principals engagement, led by the Chief of Naval Research Rear Adm. Kurt Rothenhaus. The week included meetings with U.S. Embassy Office of Defense Cooperation (ODC), a visit to Sweden's Total Defence Research Institute (FOI), meeting the Chief of Royal Swedish Navy and a tour of the Naval Staff Headquarters Muskö, visit to Swedish defense contractor Saab, and the annual U.S.–Sweden SNNR Principals meeting hosted at Swedish Defence Materiel Administration (FMV). Additional working level meetings with Technical Project Officers (TPO) were conducted during the week on the topics of Undersea Warfare (USW), Unmanned Maritime Systems (UMS)/Mine Warfare (MIW), and Naval Command, Control, Communications, Computers (C4), and our Marine Corps Warfighting Lab (MCWL) colleagues participated in the Archipelago Endeavor 24 exercise.

With Sweden's recent membership in NATO, the IEO continues to strengthen its relationship with Swedish partners. New projects are being developed in the areas of Undersea Electromagnetic Signatures and Ranges (UERS) and Undersea Array Signal Processing and Communications. Two foreign comparative test (FCT) projects on the Stirling engine and Torpedo 47 are conducting testing in 2024. The next SNNR Principals engagement was a touchpoint call in January 2025. The U.S. will host the next in-person SNNR in 2025.

Taiwan

The International Engagement Office (IEO) and Naval International Programs Office (NIPO) co-chair the U.S.–Taiwan Maritime Technologies Steering Group (MTSG), which holds semi-monthly meetings. These meetings bring together representatives from ONR, Naval Sea Systems Command (NAVSEA), the National Chung-Shan Institute of Science and Technology (NCSIST), the Naval Ship Design Center (NSDC) of the Taiwanese Navy, and the Naval Information Warfare Center Pacific (NIWC PAC). The goal of these meetings is to discuss potential information exchanges and project agreements between the two nations.

During the meetings, participants explored various topics, including two potential agreements: a project agreement on catamaran structural fatigue strength and stress, and an information exchange agreement on shock isolation mounts for equipment and pinging technology. The IEO also presented a draft organizational structure for the MTSG and proposed additional technology topics for future discussion. The involvement of NIWC PAC brings additional expertise in information warfare and cybersecurity, further enhancing the potential for cooperation and innovation between the U.S. and Taiwan.

The primary objective of the U.S.–Taiwan collaboration is to establish information exchanges and partnerships in Asymmetric Warfare Capabilities. By working together, the two nations aim to advance their shared interests and strengthen their maritime technologies.

Chile

The U.S. and Chilean Navies continued to work toward enhanced collaboration during the past year. The Chilean Navy in March hosted a grand opening of the Centro de Innovacion Tecnologica de la Armada (CiTA). CiTA will direct Chilean naval research efforts moving forward. IEO attended the grand opening of the center and participated in several days of discussion on potential research activities. Topics of focus included shipbuilding, maritime domain awareness, unmanned systems, electronic warfare, cryptography, and scientist exchange programs.

Left to right: In a collaborative event with the Chilean Navy, ONR GLOBAL attended the grand opening of CiTA. (From left to right) CiTA Director, CAPT Francisco Mackay; ONR GLOBAL ISP Director, Dillard Patton, ONR GLOBAL Director of Operations, Shalareena Malone, Chilean Navy CNO, Admiral Juan Andres de la Mazza, ONR GLOBAL Regional Director West, CDR Taurus Chatman, ONR GLOBAL Santiago Associate Science Director, Sonia Wolff, ONR GLOBAL Santiago Science Director Chris Konek, ONR GLOBAL Comms Lead, Alexis Reyes. (Photo courtesy of ONR GLOBAL)

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Mexico

The 8th Annual Maritime Staff Talks between the U.S. and Mexican Navies took place in July this year and represented significant progress toward producing a collaborative S&T effort between our two nations. IEO attended the event and identified collaboration opportunities to pursue once the first ever information exchange agreement (IEA) between the U.S. and Mexican navies is executed. The IEA will focus on communication, command, control, and computer technology.

Norway

In June, IEO planned and support a visit to ONR by Norway Defense Research Establishment (FFI). FFI officials met with Chief of Naval Research Rear Adm. Kurt Rothenhaus, briefed ONR staff on topics related to remote sensing in the polar regions and highlighted the upcoming ICE-PPR workshop in Norway. Topics included an office call with Rothenhaus, briefs on remote sensing in the polar regions, and the ICE-PPR workshop that Norway was preparing to host in October.

ICE-PPR

The International Cooperative Engagement Program for Polar Research (ICE-PPR) serves as a key platform for collaboration among the defense departments and government agencies of seven partner nations, advancing polar science and technology under the coordination of ONR.

Following the successful development of a Department of Defense (DOD) Memorandum of Understanding (MOU), the U.S., Canada, Denmark, Sweden, Norway, Finland, and New Zealand formally signed the agreement to enhance defense and security capabilities in the Arctic.

In March, the International Engagement Office (IEO) represented the Chief of Naval Research at the ICE-PPR Executive Steering Committee meeting. Discussions covered working group updates, coordination with NATO and collaboration with the Ted Stevens Center for Arctic Security Studies.

Throughout 2024, IEO staff actively supported multiple ICE-PPR workshops and key events. Notable highlights included research buoy deployments in the Arctic and high-latitude Unmanned Aerial Vehicle (UAV) experiments at Pituffik Space Base in Greenland.

NATO

The International Engagement Office staff represented the U.S. Navy at multiple NATO forums this year to include the NATO Naval Armaments Group (NNAG), Quarterly NATO Science and Technology Board meetings and Defense Innovation Accelerator for the North Atlantic (DIANA) events. A highlight of the year was the digital ocean symposium included in April's NATO NNAG meeting. This symposium brought together military and industry representatives to discuss challenges and opportunities in the undersea domain.

The other major NATO event IEO supported this year was the annual Robotic Experimentation and Prototyping using Maritime Uncrewed Systems (REPMUS)

exercise hosted by the Portuguese Navy. IEO supported planning for the exercise and facilitated participation from the U.S. Naval Research Enterprise. This year continued the REPMUS exercise's long track record of driving toward an interoperable NATO force that seamlessly integrates manned and unmanned systems to meet NATO defense goals.

Vision and Plans for 2025

2025 marks a defining year for the International Engagement Office, with ambitious goals set to strengthen international partnerships and revolutionize internal data management. A cornerstone objective early this year is the execution of the groundbreaking U.S.–U.K.–Australia trilateral engagement, a historic initiative poised to unify our maritime domain and fortify our collective strength.

Building upon our foundation, we will actively pursue multiple bilateral engagements, fostering deeper, more collaborative relationships with key allies. Simultaneously, participation in multilateral initiatives such as ICE-PPR and NNAG will amplify our influence on a global scale, positioning the office as a thought leader and driving force within the international naval community. This collaborative spirit will culminate in hosting the second International Engagement Summit, supported by NAVSEA/NUWC Newport, solidifying our commitment to building a robust and interconnected global network within the Navy.

Internally, we will embrace data-driven decision making through the implementation of powerful Power BI tools. Beginning with an Agreements Dashboard, this initiative will streamline processes and enhance transparency for both Long Duration Large Scale (LSLD) and Single Project Agreements, fostering greater efficiency and enabling more informed strategic choices.

ONR GLOBAL hosted the U.S. Naval International Engagement Summit 2024. (Photo courtesy of ONR GLOBAL)

NAVY FOREIGN COMPARATIVE TESTING

The team of Calvin Reddick (left) and Director Steve Duong (right) manage the Navy Foreign Comparative Testing program for ONR GLOBAL. (U.S. Navy Photo by Michael Walls)

The mission of the Navy Foreign Comparative Testing (FCT) Program, under ONR GLOBAL, is to find, assess and field world-class products with a high technology readiness level in order to satisfy valid defense requirements quickly and economically. Authorized by United States Code 2350a(g), the FCT Program provides the Department of Defense (DOD) with a unique acquisition tool that allows testing and evaluation of mature, foreign-developed technology to determine usefulness and feasibility of procurement for current and emerging requirements.

FCT is an important program for building relationships with our partner nations, leveraging research and technology and enhancing our competitive edge. We conduct regular engagements with 20 different partner nations. Through these engagements, the team annually reviews over 25 technology proposals of potential interest to the DOD.

Focus areas include:

- Autonomy/AI
- C5ISR/Naval Space
- Directed Energy and Kinetic Systems
- Human and Biological Systems
- Manufacturing
- Materials/Electronics
- Naval Aerospace
- Naval Engineering
- Ocean, Atmosphere and Space
- Power and Energy
- Undersea Systems

The FCT cross-disciplinary research team engineered a T-45C Goshawk mixed reality flight trainer. This trainer integrated a fully fabricated cockpit with mixed reality and head-mounted display technologies. (Photo courtesy of ONR GLOBAL)

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Results and Achievements

Of the more than 875 Foreign Comparative Testing projects that successfully completed testing since 1980, nearly 80% transitioned to Department of Defense acquisition Programs of Record thus far:

- Reducing life cycle of procurement costs
- Eliminating unnecessary duplication of research, test, and evaluation
- Rapidly fielding quality military equipment
- Enhancing standardization and interoperability
- Promoting competition by qualifying alternative sources
- Improving the United States military industrial base

Foreign Comparative Testing endorses technology proposals that align with one of the Department of Defense's 14 critical technology areas or meets one of the Navy's targeted areas to address recurring challenges and ensure the right partnerships are made for the warfighting capabilities, lethality and readiness now and for the future.

Events and Projects

Marine Corps Systems Command - Active Protection System - Follow On

Active Protection Systems (APSs) are being fitted onto Israeli Defense Force and U.S. Army medium and heavy land combat vehicles. The Iron Fist APS technology from Elbit Systems of Israel is being utilized to provide a robust anti-armor threat protection capability. This technology allows varying levels of armored vehicles to autonomously detect, track, and engage incoming threats by launching a hard-kill counter munition. The project, led by Marine Corps System Command.

A VIP Day was held on July 23, 2024; where several scenarios were tested with an Amphibious Combat Vehicle (ACV) as the test stand. The test team executed over 20 engagement scenarios against various threats such as Rocket Propelled Grenades, using countermeasures made by both Elbit Systems and in the U.S. by General Dynamics. The transition to Amphibious Combat Vehicle Integration, Engineering and Manufacturing Development (EMD) testing, and ECP development is planned for fiscal year 2026 and fiscal year 2027.

Naval Air Systems Command - Airfield Foreign Object Debris (FOD) Barrier

The F-35 Lightning II Joint Program Office (JPO) requires a solution to resolve engine damage due to Foreign Object Debris (FOD) which causes $140 million in engine repair costs per year to the U.S. Navy and Marine Corps. The project successfully completed the testing (Pre-Barrier Installation, Post-Barrier Installation, and Comparative Analysis) in May/June 2024 at Marine Corps Air Station Yuma. The FCT effort aimed to evaluate the effectiveness of the Airvix (Israel)

Foreign Object Debris Barrier in reducing debris on the airfield. The project achieved over a 90% reduction in FOD, indicating a successful outcome. The Foreign Object Debris Barrier's effectiveness in preventing foreign object debris-related engine removals for the F-35B aircraft could result in significant cost savings. Preventing just one engine removal due to debris could save $2.8 million. The barrier aims to reduce the $140 million current annual cost to the Naval Air Enterprise (NAE) due to debris.

Naval Air Systems Command - Portable High Power Directed Energy Systems for Aviation Support

Traditional methods of paint removal, such as abrasive blasting or chemical stripping, often pose environmental and health hazards, as well as operational inefficiencies. Laser paint removal presents a promising alternative, offering precision and efficiency. This FCT project, led by Commander, Fleet Readiness Centers Headquarters, Naval Air Warfare Center Aircraft Division Lakehurst and German vendor CleanLaser, utilized portable high powered directed energy systems to increase the readiness of aviation support equipment, shelters, and ancillary equipment necessary to maintain and deploy a quick reaction fighting force. High powered directed energy LASER technology was evaluated, tested, and qualified to perform corrosion control and coatings maintenance on military assets. This project successfully completed testing during the forth quarter of fiscal year 2024 at the Fleet Readiness Center Aircraft Support Equipment (FRC-ASE) located in Solomons, Maryland, Fleet Readiness Center Mid Atlantic (FRC-MA), Oceana, Virginia and Marine Air Logistics (MALS) 16, Marine Corps Air Station (MCAS) Miramar, California, FRC-NW Whidbey Island, Washington and is currently at FRC WestPAC Okinawa, Japan (MALS 36). Each test period comprised three months. Two sites procured systems during 2024, Marine Air Logistics Squadron 16 and 24.

Naval Air Systems Command - Extended Reality Head-Mounted Display (HMD) Evaluation

Recent advancements in extended reality (XR) head-mounted display (HMD) technologies have created unique opportunities for immersive simulation training. To explore their potential for enhancing flight training, NAVAIR required an investigation into the capabilities of mixed reality headsets. The goal for the FCT effort was to evaluate mixed reality capabilities via development and testing of a prototype mixed reality trainer testbed. Led by Navy Aerospace Experimental Psychologists from NAVAIR PMA-205 and Naval Air Warfare Center Training Systems Division (NAWCTSD), the FCT cross-disciplinary research team engineered a T-45C Goshawk mixed reality flight trainer, an ONR GLOBAL TechSolutions project. This trainer integrated a fully fabricated cockpit with mixed reality and head-mounted display technologies sourced from Finland (Varjo), the Czech Republic (VRgineers), and Japan (JVC), enabling the user to interact with cockpit controls while viewing 360-degree virtual imagery outside the cockpit. The project uses a combination of commercial off-the-shelf (COTS) headsets and software with a custom-built T-45C cockpit. The research team conducted an evaluation of the technology across three main areas:

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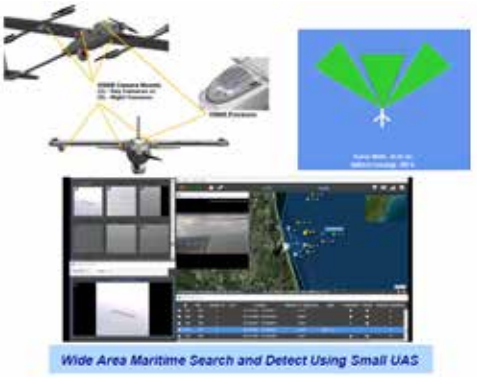
1. Assessing how display characteristics align with pilot training requirements by comparing the different commercial headsets, industry specifications and traditional dome simulator projectors.
2. Engineering a functional prototype T-45C MR testbed trainer capable of executing basic flight controls and functions.
3. Evaluating the mixed reality testbed trainer's ability to meet training requirements.

The iterative development and testing process not only showcased the technology's capabilities across various metrics but also resulted in a new mixed reality flight simulator capable of fulfilling training requirements.

This success led to the procurement of 24 T-45C mixed reality simulators through the Department of Defense's Accelerate the Procurement and Fielding of Innovative Technologies (APFIT) program in support of Naval Aviation strike training. The first four systems were installed at Training Wing One (TW-1) at Naval Air Station (NAS) Meridian, Mississippi, in July 2024, with additional deliveries scheduled over the following year via a contract awarded to Bowhead Professional & Technical Solutions, LLC. By the end of the rollout, both TW-1 and TW-2 (NAS Kingsville, Texas) will each be equipped with twelve T-45C MR trainers, representing a total savings of $21 million dollars in research, development, and procurement for the Department of Defense.

NAVAIR - Visual Detection and Ranging (ViDAR) Wide Area Motion Imagery Sensor

In support of the U.S. Marine Corps' Strategic Plan to utilize Group 2 unmanned aircraft systems to aid in the detection and tracking of maritime traffic from shore-based locations. The goal of this NAVAIR lead FCT project is to utilize the ViDAR sensor package to provide wide area maritime detection coverage by enabling the existing turret camera to cue to the detected targets automatically. Initial testing was completed at Dam Neck, Virginia and, after evaluation of the data, it was determined the ViDAR met initial development goals and could provide Wide-Area Motion Imagery (WAMI) detection capabilities from the Group 2 VXE30. Follow-on engineering/testing was required to correct defects and limitations identified during that testing, as well as further enhance payload optimization, software upgrades and development of future kitting options.

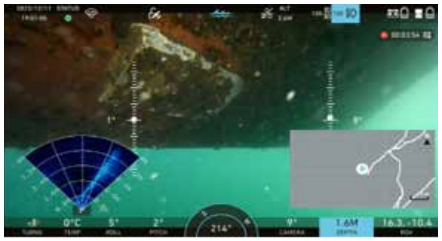


Wide Area Maritime Search and Detect Using Small UAS

The Program Management Administration has sponsored both Phase II and Phase III development efforts, which include containerization of the processing software to run on an existing on-board edge processor, thus enabling removal of the ViDAR processor to reduce space, weight and power requirements of the payload. In addition, PMA-263 has sponsored an objective to interface the ViDAR payload with an adjacent Automatic Target Recognition (ATR) software capability called Dead Center (JHU).

Naval Information Warfare Center (NAVWAR) - Micro-ROV for Rapid Response to Underwater Incidents and Asymmetric Threats

Naval Information Warfare Center (NIWC) Pacific required a rugged, portable micro-ROVs for explosive ordnance disposal (EOD) in underwater environments. The objective of this FCT project is to perform test and evaluation and prototype integration of rugged, low-cost, low-size, weight and power, single-person portable micro-remotely operated vehicle (ROV) systems as an off-the-shelf solution to improve situational awareness for underwater incident/mission and asymmetric threat response teams. This project successfully completed testing at NIWC Pacific which showed these Micro-ROVs are useful, with the Army 7th Transportation Brigade finding the Deep Trekker Pivot (Canada) suitable for their missions. PMS 408 endorses this technology and sponsored multiple Blueye X3 (Norway) and Deep Trekker Pivot smart vehicles for a Navy EOD demo in February 2025.



Naval Information Warfare Center (NAVWAR) - Precision VTUAS Recovery (PVUR)

Naval Information Warfare Center (NIWC) Pacific had a requirement to provide the warfighter the capability to autonomously land an Unmanned Aircraft System (UAS) on a moving platform. The landing phase of UAS operations is inherently complex and often necessitates a skilled pilot with extensive flight experience. The Foreign Comparative Testing program utilized the French company Internest to lead this effort. The PVUR project successfully completed testing. This testing consisted of multiple phases with the first phase being performed at Bellows Airforce Station (BAFS) on a Group 1 S900 Hexacopter UAS. Phase II was conducted at Marine Corps Training Area Bellows (MCTAB) and Naval Information Warfare Center Pacific (NIWC PAC) Center's lab in Pearl City, Hawaii. The test results show that LoLaS sensors can achieve an accuracy of 50mm. This accuracy is mainly due to sensor noise that is common with Ultrawide Band (UWB) and ultrasound sensors. This technology will allow the warfighter to land a UAS on a moving watercraft or ground vehicle in a contested environment.

Naval Information Warfare Center (NAVWAR) - Software-Defined Acoustic Modem (SAME)

NIWC Pacific has a requirement to assess the communications and networking capabilities of consumer off-the-shelf software-defined acoustic modems (SDAMs) developed by foreign companies from Germany and Singapore to meet operational needs of the Navy, with focus on unmanned vehicles and undersea infrastructure. Testing was successfully completed in laboratory setting, in controlled environment (TRANSDEC facility at NIWC Pacific), and in open waters near San Diego, California. The technology evaluated from the SAME project, transitioned to different projects under the program called Undersea Constellation, particularly UnetStack software, which can be licensed from the vendor: Subnero Pte Ltd., Singapore will be integrated into the government owned multi-modal modem.

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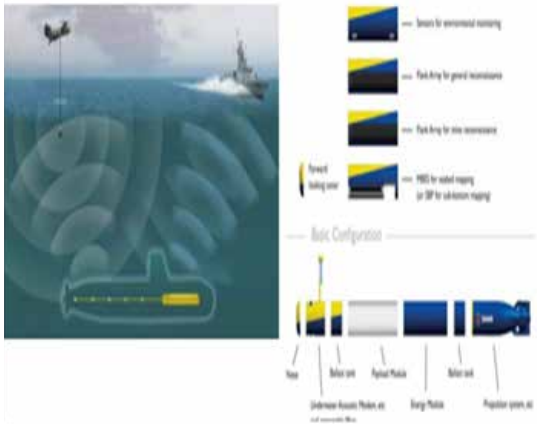
Naval Sea Systems Command (NAVSEA) - Autonomous ASW Training Target

The Undersea Weapons Program Office (PMS404) has tasked the Naval Undersea Warfare Center Division, Newport (NUWCDIVNPT) to procure a new 21-inch diameter, recoverable Antisubmarine Warfare (ASW) Training Target. Antisubmarine Warfare Training Targets provide the Fleet with a realistic ASW target for open ocean and instrumented range use. ASW Training Targets simulate the acoustic and dynamic characteristics of a submarine threat. This allows all the Navy Antisubmarine Warfare, surface, air and subsurface communities to practice their detection, tracking and weapon employment skills against a threat representative target. The test objective for this FCT is to demonstrate the Saab AUV62-AT operation and ability to replace the MK30 Mod 1, the current ASW training target of this size and function used by the Navy.



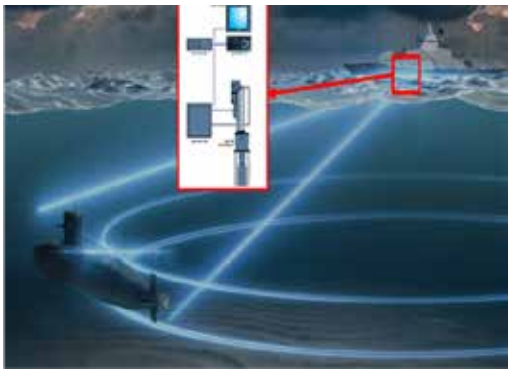
Final testing was conducted on July 16-17 at the Jacksonville Shallow Water Test Range executed by Saab Inc. with coordination of the NUWCDIVNPT and with the support of Saab AB (Sweden). The AUV62-AT FCT successfully met all testing objectives and performed as expected, leading to its procurement as the MK66 Heavyweight Undersea Training Target (HUTT) by OPNAV N94. Saab Inc. was expected to receive a contract in March 2025. PMS 404 will use the Middle Tier of Acquisition Rapid Fielding pathway to develop operational capability within five years.

Naval Sea Systems Command (NAVSEA) - Fast Inshore Attack Craft Poniard

Building on the success of 2023, when the NAVSEA team successfully demonstrated Fast Shore Attack Craft - Asymmetric Force Engagement, the Phase II team, including the U.S. Navy, Republic of Korea Navy, and contractors (Textron, LIG), were tasked to evaluate the capabilities of a fire and forget 2.75-inch rocket with an imaging infrared seeker launched from an unmanned surface vehicle (USV). This technology provides an effective asymmetric capability against FIAC swarms. The testing consisted of four phases, with the results demonstrating that the Poniard system could successfully be employed from a small UAV. Overall, the

FCT demonstrated that Poniard system can be integrated with U.S. Navy systems and employed for high value unit (HVU) escort and defense. Additionally, the Poniard system demonstrated beyond line of sight (BLOS) employment when integrated with U.S. Navy's Multiple Vehicle Communications System (MVCS) via unmanned aircraft vehicle radio and targeting or via satellite-based communication links. Currently there are five live Poniard missile test articles that were not expended during FCT event 2C. All missiles are currently in storage and planned to be used in the follow-on fiscal year 2025 Coalition Warfare Program (CWP) project for modelling and analysis (M&A) to further assess Poniard system suitability. Additionally, the CWP will begin collecting data to support an ordnance qualification with the Weapon Systems Explosives Safety Review Board (WSESRB) for concurrence to store the Poniard missiles in U.S. inventory. The PMS 420 Program Office is covering the storage costs of the ordnance until the execution of the CWP plan to schedule live fire tests with the remaining Poniard missiles that will be used to collect data for WSESRB and for verification of M&A results.

NAVSEA: Anti-Submarine Warfare Capability on unmanned surface vehicles



The NAVSEA Anti-Submarine Warfare Capability on unmanned surface vehicles FCT Project team and Kongsberg, a Norwegian company, conducted a test event near Horten, Norway, on November 12-13, 2024. The team tested the SS2030 hull-mounted sonar and the ST2400 variable depth towed-body sonar. The demonstration was successful, as the sonars were tested against combinations of stationary and mobile passive and active targets under complex environmental conditions.

NAVSEA - Maritime Underwater Threat Attachable Neutralizer (MUTAN)

The Foreign Comparative Test project Maritime Underwater Threat Attachable Neutralizer (MUTAN), successfully conducted in-water testing on December 10-11, 2024, with two U.K. systems at Navy Information Warfare Center–Pacific. The Viper Mine Disposal System was tested on December 10, 2024, successfully attaching to moored and stationary targets six out of six times. The Integrated Pluton Attachment System was tested on December 11, 2024, successfully attaching to moored and stationary targets five out of eight times.

Naval Sea Systems Command: Autonomous Vessel Weapon Launch & Recovery; Lightweight Torpedo (Sweden)

This FCT project, Autonomous Vessel Weapon Launch, successfully executed a demonstration at Motala, Sweden on December 18, 2024. The Saab Lightweight Torpedo in an exercise configuration was successfully launched remotely from the remotely operated Martac T24 USV vessel, accomplishing the main objective of the demo. The torpedo successfully executed a search in the assigned attack volume via a target echo sounder.

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Vision and Plans for 2025

Naval Sea Systems Command: Anti-Ship Missile Countermeasure Test (Germany)
The FCT project will conduct a demonstration of Multi-Ammunition Softkill System (MASS) performance aimed at reducing ship susceptibility to new and emerging anti-ship missile capability.

In July of 2024, the U.S. Naval Research Laboratory (NRL) and the Defense Research and Development Canada (DRDC) collaborated during Rim of the Pacific (RIMPAC) exercises off the coast of Hawaii. Specifically, DRDC launched multiple salvos of decoy rounds from a Multi-Ammunition Softkill System (MASS) integrated onto His Majesty's Canadian Service (HMCS) Vancouver, while NRL flew electro-optic/infrared (EO/IR) imagers mounted in pods below a Lear jet. The purpose of the testing was to record electronic warfare (EW) effects introduced by employment of different MASS tactics. MASS is developed and sold by Rheinmetall, AG, a German arms company, and is a potential electronic warfare solution that the U.S. could invest in to address EO/IR threats.

Marine Corps System Command: Novel Cannula Device with Unambiguous Visual Indication (New Zealand)
This project will test the usefulness and usability of the Cannulight device in successfully peripheral intravenous cannulating/catharizing (PIVC) casualties for military medics and service personnel.

Marine Corps System Command: Rapid Molten Metal Deposition (Belgium)
This is a project to evaluate additive manufacturing technology that allows rapid manufacturing of near-net shape metal parts at the tactical point of need without the use of powder material or use of de-binding or sintering support equipment.

Naval Air Systems Command Qualification of Low-Pressure Cold Spray (Netherlands, Australia)
This project is to qualify a low-pressure cold spray technology to give the U.S. Navy, other Services and our allies two choices, rather than the one they are currently restricted to. The system will be procured and tested for similar performance to the current qualified system (Centerline Inc) via mechanical tests, and then validated in a fleet exercise for forward deployed capability, such as RIMPAC.

Naval Sea System Command - Vertical Launching System (VLS) Rearm – Forward (Australia)

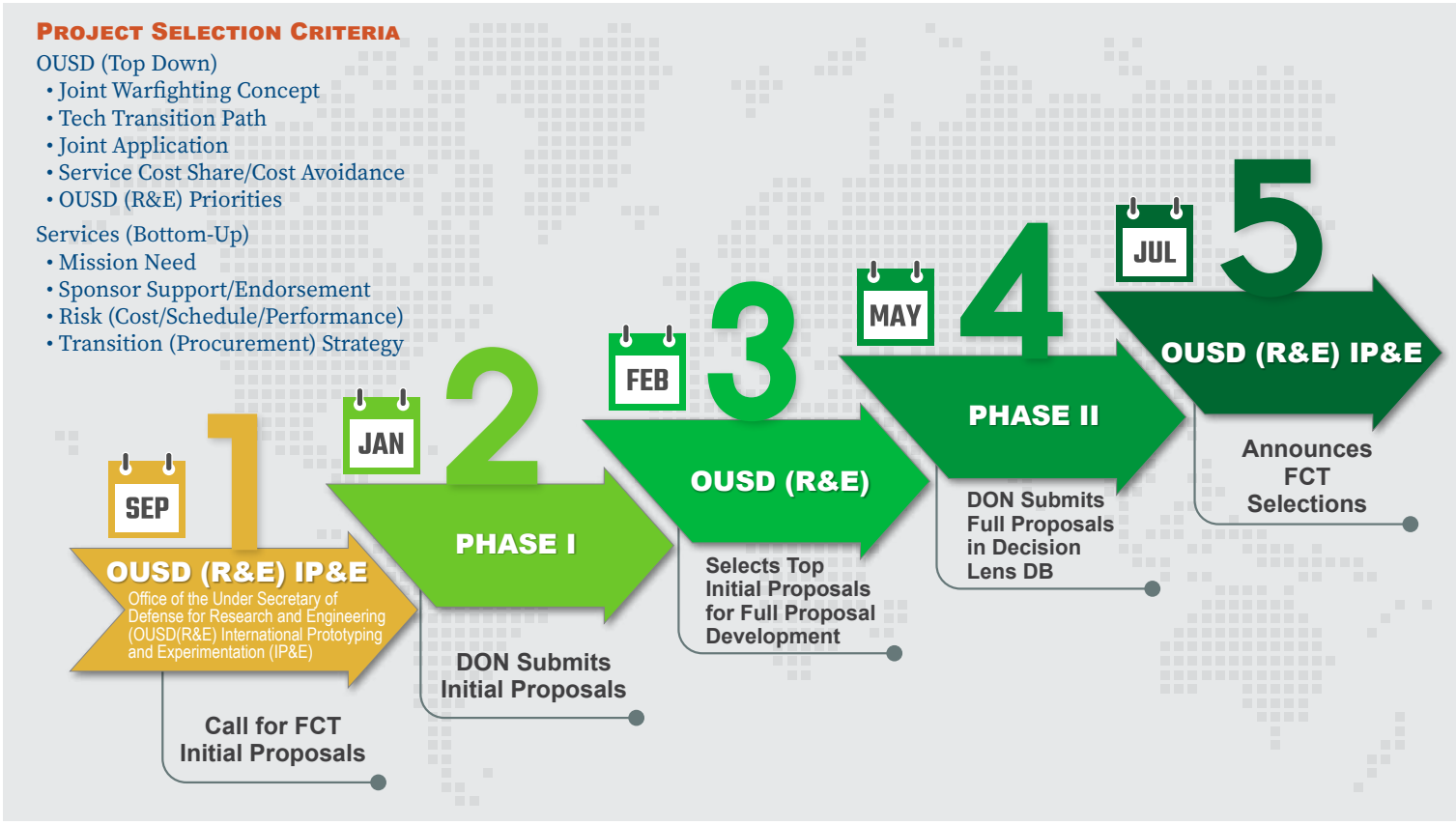
The project will evaluate the Missile Canister Loading Equipment (MCLE) prototype ability to enable VLS reloading capability in forward bases and austere piers and ports in higher wind and sea conditions than current reloading methods using the MK23 tilt fixture.

Navel Sea Systems Command Mining Advanced Development for Diverse Operational Gains (Spain)
The Navy will utilize extant training mines to develop, simulate, and implement mine sensor algorithms, assess lethality, and quantify the safety posture needed for operational use.

Naval Information Warfare Systems Command Deep Purple Compact Optical Communications (Switzerland)
The Navy will test and evaluate an optical communication technology that offers high bandwidths (10 Mb/s and higher), low SWaP, low latency (e.g. speed of light Vs. speed of sound) and a low probability of intercept/detection, significantly improving ability to conduct subsea warfare.

INTERESTED IN MAKING A PROPOSAL?

The OUSD(R&E) program, with its unique acquisition authorities, provides DOD engineers, scientists, and Program Managers an avenue to access mature foreign developed technologies and capabilities that may advance or complement current modernization efforts. The FCT proposal process starts with the identification of an item or an innovative technology that may have potential to provide a solution for an identified need or to satisfy a documented requirement.



FCT proposal submissions should address an OUSD(R&E) Critical Technology areas, add value to the Joint force and/or meet a service-specific need. For more information, contact Steve Duong, Director, DON Foreign Comparative Testing: steve.duong@usmc.mil.

LONDON TECH BRIDGE

Members of the London Tech Bridge visit the Alan Turing Institute. Left to right: Royal Navy Cmdr. Dan Weil, Sierra Yost, Juliet Swinea, Faith Oluwaremi and Jeff Brewer. The Alan Turing Institute is the U.K. national institute for data science and artificial intelligence, with headquarters at the British Library in London, U.K. (Photo courtesy of ONR GLOBAL)

The London Tech Bridge (LTB) is a collaboration between the U.S. Navy (USN) and Royal Navy (RN) to foster connectivity, agility, and innovation under the broader ambition of Delivering Combined Seapower. Our vision supports dialogue, joint partnership, and cooperative development between two navies as they endeavor to advance from Interoperability to Interchangeability. Set in Central London's booming technology ecosystem spanning academia, industry, and government, it is ideally positioned to harness technology faster for Sailors and Marines.

Mission

Delivering Combined Seapower (DCS) signed by the Chief of Naval Operations, the Commandant of the Marine Corps and the RN First Sealord in October of 2023 is the charter that underpins the closeness of the transatlantic relationship between the Royal Navy and U.S. Navy/ Marine Corps. Through ever closer interaction as partners and allies underwater, through carrier operations and in the littoral, we enhance maritime power for the benefit of both nations. The LTB's activities ultimately drive the commitment in the DCS to move from interoperability to interchangeability.

The 2024 LTB SMART Scholars at an unmanned aerial vehicle (UAV) demonstration. The LTB SMART Scholars are (left to right) Aaron Wildenborg, Sierra Yost and Faith Oluwaremi. (Photo courtesy of ONR GLOBAL)

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Results and achievements

In its third year of operation, the London Tech Bridge graduated from its "startup" phase and entered its full operational capability. Building on a solid foundation, it continued to grow the network, engage senior leadership on both sides of the Atlantic, and pursue technology transition via the Innovation Pipeline.

Building the Network

- The LTB attended the Farnborough International Airshow, one of Europe's largest events for the aviation and defense industry. The LTB used this opportunity to reinforce and grow its technology network, engaging small businesses and non-traditional partners at a U.K. Ministry of Trade "Meet the Buyers" session. Going forward the LTB will be connecting the most promising technologies with stakeholders on both sides of the Atlantic.

The London Tech Bridge team at the Farnborough International Airshow. Left to right: Sierra Yost, Jeff Brewer, Aaron Wildenborg, Marc Christino and Faith Oluwaremi. (Photo courtesy of ONR GLOBAL)

- The LTB met with the Office of the Under Secretary of Defense for Acquisition and Sustainment (OUSD (A&S) regarding the Defense Production Act and sourcing strategic materials. The LTB engaged U.K. industry regarding rare earth elements in the past and this is an interest area for A&S staff. They plan to conduct a U.K. visit next year, and the LTB will be their host and guide as they tour the country. We intend that this engagement will lead to strategic partnerships that ultimately supports vital USN production supply chains.
- Overall, the Tech Bridge continued to grow its network, seeing year-to-year increases of engagements with industry, academia, and industry. We engaged 53 Academic institutions (+18%), 302 Government programs (+115%), and 433 Companies (+27%).

Key Leader Engagement at the London Tech Bridge

This year, the London Tech Bridge hosted the following key leaders and VIPs:

- Royal Navy Second Sea Lord, Vice Admiral Sir Martin John Connell, CBE
- U.K. Chief of Defence Logistics and Support, Vice Admiral Andy Kyte, CB

- Under Secretary of Defense for Research and Engineering, Hon. Heidi Shyu
- Under Secretary of the Navy, Hon. Erik Raven
- Former Under Secretary of the Navy, Hon. James "Hondo" Geurts
- RN Director of Naval Staff, Major General Mark Totten
- Commander of MARCORSYCOM, Brig. Gen. Tamara Campbell
- ...and many more!

Events and Projects

Innovation Pipeline and Handoffs to Naval Programs

- The VASCO Virtual Reality (VR) Bridge training system was transitioned to the Royal Navy! VASCO is a commercially available training tool used by cruise line and yacht crews to conduct Bridge Resource and Collision Regulations (COLREGS) training. After discovering the technology in 2022, the LTB conducted end user demonstrations on two ships last year (HMS Diamond and USS Bush). Based on those results, the Royal Navy Fleet Navigator determined that VASCO should be deployed. The Royal Navy tested the system at their fleet training center and have placed the first set on an operational ship. This project demonstrated the value of the Tech Bridge as it discovered, curated, incubated and transitioned new technology to warfighters in just 24 months.

ONR GLOBAL's Jeff Brewer, co-director of LTB, met with a Counter-drone company at the Farnborough International Airshow. (Photo courtesy of ONR GLOBAL)

- VIBRaNT progresses toward delivering VR training to U.S. Navy sailors. Based on warfighter feedback the LTB received on VASCO, the U.S. Navy is developing an untethered VR Bridge trainer based on the commercial product. This portable, self-contained, and closed-loop solution is stored in a pelican case with a laptop, router, and five VR headsets. The resulting system called VIBRaNT, is being developed at NIWC PAC and sponsored by ONR GLOBAL TechSolutions. Using the VASCO backbone, VIBRaNT has been militarized with the visuals and handling of a U.S. destroyer and several U.S. ports. VIBRaNT will increase the availability and flexibility for sailors to conduct ship's bridge training. By leveraging a commercial product, NIWC PAC and TechSolutions have greatly accelerated the pace of development and delivery of this critical training product.

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- The LTB led a sailor engagement event on HMS Prince of Wales, one of the U.K.'s Queen Elizabeth Class aircraft carriers. The team ran problem sourcing sessions with 10 departments, engaging mid-career enlisted sailors to discuss operational problems and potential technology solutions. The LTB will engage technology providers to identify solutions and improve operations aboard the ship.
- The LTB concluded its Energy Framework effort this year, an end-to-end assessment of how our navies can improve energy-related outcomes for sailors and marines. This included technology scouting from Hydrogen-powered systems for HMNB Devonport to technology that would allow expeditionary units to generate energy from waste products. Based on these engagements, the LTB has handed off numerous connections and options to U.S. and U.K. programs seeking energy solutions.

The 2024 LTB SMART Scholars (from left to right) Juliet Swinea, Sierra Yost and Aaron Wildenborg at LTB headquarters in London, U.K. (Photo courtesy of ONR GLOBAL)

- Working with the RN Servicewomen's Network, the LTB sourced problem statements dealing with the full integration and participation of women in uniform. These included health and fitness training and feedback using AI, issues related to equipment and clothing, and how bio-sensors can support improved outcomes for servicewomen. The Royal Navy Servicewomen's Network led the session with industry, and we heard several technology approaches to solve these problems.

People in Focus

This year, the LTB hosted three summer interns from the Science, Mathematics and Research for Transformation (SMART) Scholar Program, a Department of Defense STEM program focused on growing the next generation of Department of Defense scientists and engineers.

These summer interns gained a unique and valuable experience they will be able to leverage when they embark upon their Department of Defense civilian careers. The LTB benefited as they greatly increased our capacity to engage industry and academia. They also brought a feeling of energy and enthusiasm that invigorated the office.

In August, they went back to school and will be joining the Department of Defense full time when they graduate next year. This was a big win for us this year, and we can't wait to do it again! Based on this year's success, we have documented lessons learned and best practices to repeat in future years.

Vision and Plans for 2025

The LTB will continue to grow its presence as a matchmaker and valued node in the U.K. technological ecosystem. It will produce connections that lead to solutions for Sailors and Marines while working on a number of franchise style efforts within its Immersive Technologies Portfolio. Additionally, here are some of the places you'll find us in 2025:

- Subsea Expo 2025 (Aberdeen, U.K.) in February
- Portsmouth, U.K. in June for the first Tech Bridge Interoperability to Interchangeability Event. This hybrid event will link the Philadelphia, Norfolk and London Tech Bridges together to discuss and promote motion amplification technology, a type of machine vision to enable condition-based maintenance and monitoring.
- London Tech Week in June
- Global Underwater Hub Newcastle in July
- Defence & Securities Equipment International (DSEI) 2025 (London) in September.

Marc Christino of the LTB and SMART Scholar Aaron Wildenborg pose with a Royal Navy Merlin helicopter during a problem sourcing event. (Photo courtesy of ONR GLOBAL)

Links

Follow us on LinkedIn!
Learn more about our program and our recent activities.

London Tech Bridge site:

INTERNATIONAL SCIENCE PROGRAM

ONR GLOBAL CO and Prague SDs visit New Technologies Research Center (NTC) and other parts of West Bohemia University in Plzen, Czech Republic. (Photo courtesy of ONR GLOBAL)

The Office of Naval Research Global's vision is to become the partner of choice for science and technology leaders worldwide, and in doing so, to support the overall ONR mission of discovering, developing and delivering new technology and capability to the U.S. Navy and Marine Corps.

In support of that vision, the ONR GLOBAL International Science Program (ISP) employs technically skilled scientists and engineers to enhance the international science and technology (S&T) engagements of the U.S. Navy and Marine Corps, and to increase awareness of global technology. ISP has 24 scientists spread across five continents to build and foster connections and to locate truly outstanding and unique scientific discoveries taking place across the globe.

The international science team leverages several tools including international networking through conference attendance and in-person liaison visits; collaborations within the naval research enterprise; supporting technology focused conferences and workshops; and granting fundamental research grants for international partners.

In 2024, ONR GLOBAL's ISP continued building on established and long-standing partnerships with international researchers and worked to expand partnerships in several countries such as: Estonia, The Gambia, Uruguay, Panama and Rwanda. ONR GLOBAL Science Directors (SDs) engaged in supporting research grants, the hosting of conferences and meetings, as well as the visits of several scientists to Naval research laboratories, including Warfare Centers. During the 2024 calendar year, ONR GLOBAL SDs supported approximately 137 research initiatives, including 73 Collaborative Science Programs, 64 Research Grants — of which seven were Partnership Agreements — and hosted 25 Visiting Scientists from around the world. The sponsored activities covered all 11 ONR focus areas, including Materials/Electronics; C5ISR/Naval Space; Human and Biological Systems; Ocean, Atmosphere and Space; Autonomy/AI; Naval Engineering; Naval Aerospace; Directed Energy and Kinetic Systems; Undersea Systems; Power and Energy; and Manufacturing.

ONR GLOBAL was represented at the Global Space Technology Convention in Singapore by Dr. Will Hou (left) and CAPT Andy Berner (right) attempting to "fix" a satellite (January 2024). (Photo courtesy of ONR GLOBAL)

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Liaison Visits

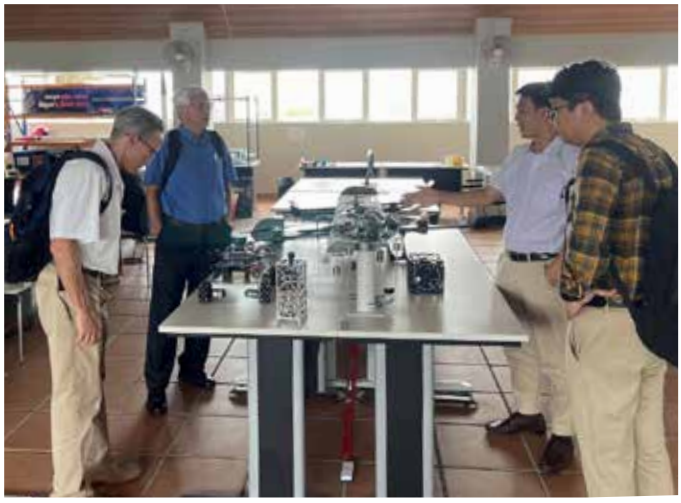
Liaison Visits — where science directors attend international events and visit international institutions to develop, access and discover emerging technologies.

- **The International Science Program supported key engagements in science and technology by facilitating the Chief of Naval Research (CNR) Rear Adm. Kurt Rothenhaus' visits to Vietnam, Australia, Japan, Singapore, and the Vice Chief of Naval Research Brigadier General Simon M. Doran's visit to Australia. Some priorities addressed during the visits included: ONR's ocean research priorities through engaging the Ministries of Science and Technology, Natural Resources, Defense and Public Security. During a three-day visit to Singapore, Rothenhaus and the team expanded S&T engagement across multiple agencies and universities of Singapore and delineated a path for an Artificial Intelligence Grand Challenge, as part of the Senior Naval National Representative dialog.**

CNR Rear Adm. Kurt Rothenhaus and the International Science team (Dillard Patton, Will Hou, Hoa Nguyen) thanked the U.S. Ambassador (Marc Knapper, middle) and his team for the support in engaging Vietnamese scientists in basic research during his visit in November 2024. (Photo courtesy of ONR GLOBAL)

ST Engineering of Singapore showcased the AUTOMAST system to CNR Rear Adm. Kurt Rothenhaus during his visit in November 2024 as part of the SNNR visit. ONR GLOBAL ISP had assisted the system demonstration during a previous RIMPAC. (Photo courtesy of ONR GLOBAL)

- The International Science Program facilitated its inaugural engagement with Cambodia when Science Directors Drs. Joel Goodman and Will Hou visited the Research and Innovation Center at the Institute of Technology Cambodia in Phnom Penh, in August 2024. The team received four presentations from faculty and staff on the following topics: data science, artificial intelligence, dynamic control in aerospace and robotics and fabrication and prototyping. A key focus area of this visit included discussion of an impending 180km-canal and to understand the potential impacts to the coastal ocean and nearby sea-ports. Following the visit, Cambodian scientists are exploring relevant research topics and looking to ONR GLOBAL as a trusted partner to potentially support such research projects.



As part of ONR GLOBAL's ISP liaison visits program, Dr. Joel Goodman and Dr. Will Hou spent time at the Research and Innovation Center at the Institute of Technology Cambodia (ITC). Prof. Sarot Srang showcased their Robotics Lab and UAVs under development. (Photo courtesy of ONR GLOBAL)

- ONR GLOBAL Science Directors also took the opportunity to conduct liaison visits to universities and scientific organizations while supporting conferences and partnership opportunity delegations in several nations in Africa, including the Republics of Kenya and Cabo Verde. Some of the universities visited in Kenya included: Mount Kenya University, Kenya National University, and Kenyatta University, and the University of Cabo Verde in the Republic of Cabo Verde. As a result of the visit to Kenya, ONR GLOBAL received five white papers, one of which is currently being considered for a pull proposal. Drs. Scott Walper and Martina Siwek have also had subsequent meetings with representatives from Tanzania, Kenya and Nigeria, which they are hoping will lead to subsequent liaison visits. Of note, Walper was planning a visit to Nigeria in March of 2025.

Dr. Dawn Wright, Chief Scientist at Esri in the U.S., and Elena McCarthy meet with Dr. Sonia Semedo, the Vice-Rector, and other faculty at the University of Cabo Verde, as part of ONR GLOBAL's ISP liaison visit program. (Photos courtesy of ONR GLOBAL)

- While visiting the largest university in Cape Verde, Dr. Elena McCarthy invited researchers to participate in the upcoming ONR-sponsored Gulf of Guinea initiative focused on oceanography in the Gulf of Guinea off West Africa.

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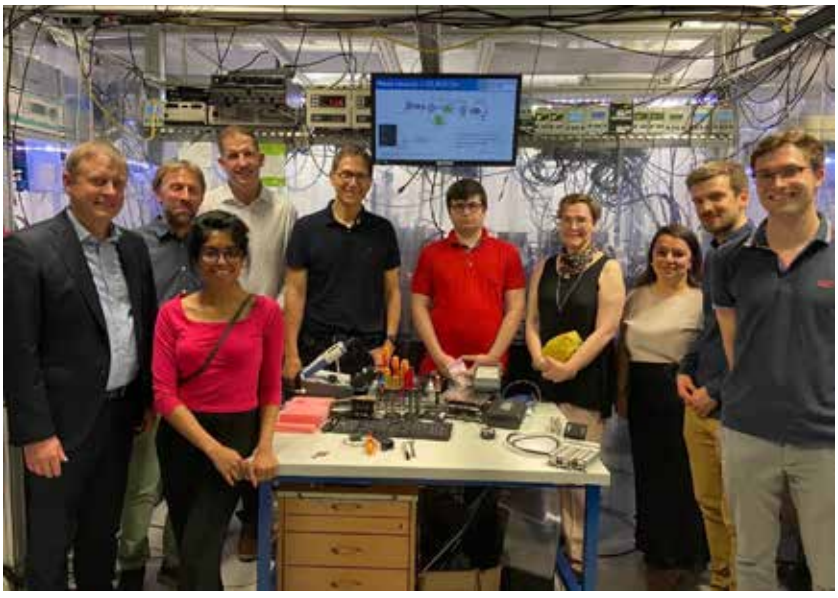
- In April ISP, joined by the U.S. Science Envoy for quantum, Dr. Pri Narang and Czech Republic's Special Envoy for Quantum Technologies, Dr. Petr Kavalir visited the Czech Republic to explore quantum research collaborations, with the trip organized by the U.S. Embassy in Prague. Across six municipalities, a key meeting at Czech Technical University Prague showcased advancements in quantum materials, computing, sensing, and communications.

Dr. Pri Narang and Dr. Martina Barnas, Prof. Jan Minar, Prof Miroslav Holecek and other delegates at the Quantum and Advanced Materials Lab at the University of West Bohemia. (Photo courtesy of ONR GLOBAL)

- In late June 2024, an ONR GLOBAL delegation of CAPT Andy Berner and Dr. Martina Barnas traveled to Vienna for ONR GLOBAL's annual progress review at the University of Vienna. Over two days, June 26-27, they engaged with U.S. Embassy officials, explored cutting-edge research facilities — including the AIT Austrian Institute of Technology and the RTA Rail Tech Arsenal Climatic Wind Tunnel — and discussed opportunities to expand partnerships in quantum and nanotechnology. Marking one year of ONR GLOBAL-sponsored NanoBioCool research, the visit highlighted the strategic importance of the Global Engagement Plan (GEP) in advancing international scientific collaboration.



- ONR GLOBAL's liaison visits in the Australasia region continued as Science Directors Dr. Clint Novotny and Dr. Joel Feldmeier visited James

CAPT Andy Berner, Dr Martina Barnas, Prof. Dr. Markus Arndt and Dr. Nafia Rahaman with other members of the Arndt group who worked on ONR GLOBAL-sponsored research project NanoBioCool. (Photo courtesy of ONR GLOBAL)

Cook University in Townsville, Australia to explore research in additive manufacturing for flexible ceramics. They engaged with researchers on biomedical implants, smart materials, biomass pyrolysis and biochar applications for water purification. Discussions highlighted cutting-edge advancements and reinforced the value of international collaboration in materials science.

Science Directors Dr. Clint Novotny (left) and Dr. Joel Feldmeier (middle) visit James Cook University's (Townsville, Australia) additive manufacturing laboratory for flexible ceramics. (Photo courtesy of ONR GLOBAL)

- In 2024, ONR GLOBAL Science Directors visited more than 30 universities in Chile, Brazil, Mexico, Argentina, Peru, Colombia, and Uruguay. The results of these visits are partnerships that leverage International Science Program (ISP) sponsorship of research, conferences, and visiting scientists to the United States of America. Specifically, ISP sponsored approximately 11 new multi-year research grants and continued sponsorship on 17 research grants. Naval Research Focus Areas with strong representation include Autonomy, Ocean/Atmosphere/Space, Human/Biological Systems, and Materials/Electronics. Naval Aerospace has also emerged as an area of interest due to the expertise focused on Embraer in Brazil.

- ONR GLOBAL Commanding Officer CAPT Andy Berner also conducted tours of academic labs with Science Directors around the globe. In Sao Paulo and Rio de Janeiro, Berner visited Brazilian Navy facilities with support from the Science Directors.

ONR GLOBAL Commanding Officer CAPT Andy Berner (fourth from right) visited the Institute for Nuclear Energy Research (IPEN) at the University of Sao Paulo, along with other ONR GLOBAL staff, hosted by the Director of IPEN, Prof. Isolda Costa (left of CAPT Berner). (Photo courtesy of ONR GLOBAL)

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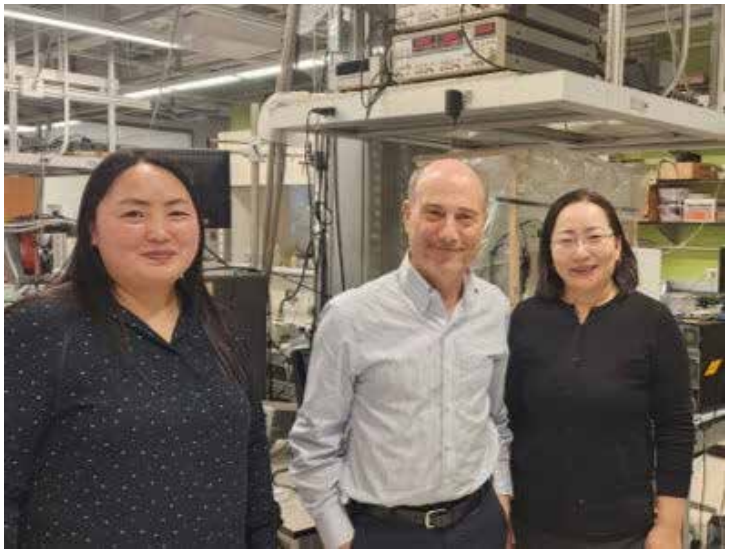
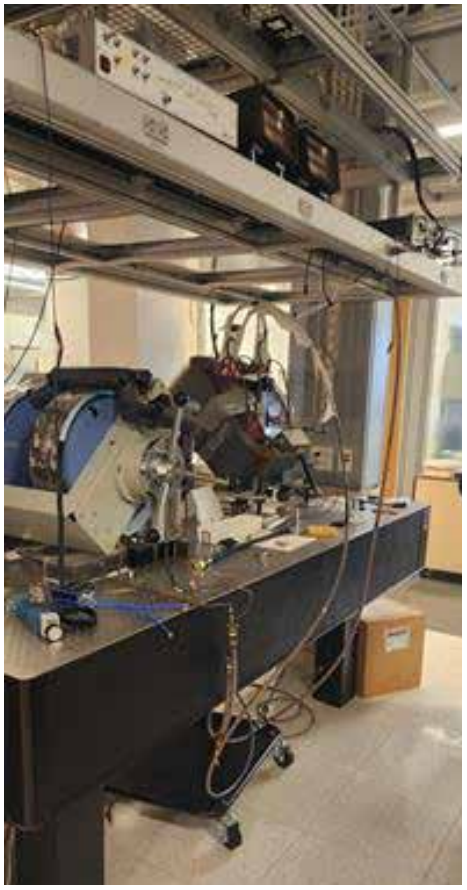
Visiting Scientists Program

The Visiting Scientists Program facilitates short-term travel opportunities for foreign and international scientists to the U.S. to explore new S&T ideas or findings within the Naval Research and Development Establishment (NR&DE) (a full report of the 2024 VSP can be found on page 86).

- Munkhsaikhan Gonchigsuren and Ganchimeg Yunden participated in the Visiting Scientist Program (November 30–December 15, 2024), engaging with top researchers across the U.S. They presented at the MRS Fall Meeting in Boston and met scientists at Harvard and MIT to discuss quantum transport, twistronics and nanomaterials. In New York, they collaborated with NYU researchers on molecular modeling and spintronics. At the Naval Research Laboratory in D.C., they explored advanced fabrication techniques. In Pittsburgh, they met experts on oxide nanoelectronics and semiconductors. Grateful for the support of the Office of Naval Research Global, together they resounded their eagerness for future collaborations and training opportunities to advance their research.
- ONR GLOBAL grantee Professor Alfred U'Ren, from the Universidad Autónoma Nacional de México (UNAM), visited the Naval Research Laboratory (NRL) in early 2024. At NRL, he was hosted by Dr. Daniel Bonoir and Dr. Tanner Crowder from the Center for Computational Science and met with Dr. Adam Black, a key leader in NRL's quantum science experiments. Dr. U'Ren presented his work on quantum sensing, second harmonic imaging and quantum optical coherence tomography. The focus on expanding partnerships and activities in Mexico will continue into 2025 following the signing on the U.S.–Mexico partnership agreement in 2024 and the sponsoring of seven conferences throughout Mexico focusing on Nanoscience, Nanotechnology, High Entropy Materials, Photovoltaic Structures, Artificial Intelligence, Semiconductors and Microdevices.





Munkhsaikhan Gonchigsuren and Ganchimeg Yunden, both professors from Mongolia, with Professor Andrew D. Kent of New York University Physics Department during their ONR GLOBAL sponsored Visiting Scientist program science and technology exchange. (Photo courtesy of ONR GLOBAL)

Collaborative Science Program

The Collaborative Science Program sponsors foreign and international workshops, conferences and seminars of naval interest.

- ONR GLOBAL extended its awareness of science and technology (S&T) developments in Africa through support and attendance at the 3rd International Synthetic Biology, Biosecurity and AI Conference in Nairobi, Kenya, July 2024. Dr. Martina M. Siwek, regional chief scientist at ONR GLOBAL, and Dr. Scott A. Walper, science director at ONR GLOBAL, engaged with scientists, engineers, and policymakers from across Africa as well as international representatives from the U.S., Europe and Asia. ONR GLOBAL representatives engaged with representatives from, more than 30 nations establishing key points of contacts to facilitate further targeted engagements in the region. The ONR GLOBAL International Science team has also received numerous white papers for conference and research programs furthering the ONR GLOBAL mission of supporting international S&T as the partner of choice.

Geoffrey Otim, Founder & CEO of SynBio Africa, hosts Dr. Scott Walper (second from left) and Dr. Martina Siwek (second from right) of ONR GLOBAL at the 3rd International Synthetic Biology, Biosecurity and AI Conference in Nairobi, Kenya. In attendance was also the Hon. Rose Obigah from the Parliament of Uganda (center). (Photo courtesy of ONR GLOBAL)

- ONR headquarters and ONR GLOBAL were sponsors of the International Conference on Materials Science and Nanotechnology 2024 held at the National University of Mongolia in Ulaanbaatar, Mongolia, July 8-9, 2024. This is the first time ONR/ONR GLOBAL sponsored conferences in Mongolia. Six Department of Defense program managers participated in the forum as speakers and panelists. The Honorable Richard Buangan, U.S. Ambassador to Mongolia shared remarks. The conference itself focused on the two main themes of materials science and nanoscience/nanotechnology, including application areas such as nanotechnology in biomedical research. Roughly 200 researchers attended the conference. In addition to the local Mongolian research community, there were sizable delegations from Australia and Japan in attendance. The forum ended with an evening reception at the U.S. Embassy complex in Ulaanbaatar, hosted by the Embassy Defense Attaché Office.

- ONR GLOBAL leadership visited Rabat, Morocco in January 2024 as part of an ONR GLOBAL sponsored event: Second U.S.–Africa Frontiers of Science, Engineering and Medicine Symposium. This event provided an opportunity to engage with many renowned scientists from across the African continent around topics such as sensing technologies, human-computer interaction and human and biological systems, just to name a few.

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- An initial grant under the Gulf of Guinea initiative has grown into a regional effort, which includes scientists from Senegal, Ghana, Benin, Nigeria, Cabo Verde and several other West African nations. To kick-start this work, ONR GLOBAL sponsored a meeting in Accra, Ghana in August 2024 to plan the upcoming research, expected to take place from 2025-2027. In addition to scientists from most West African nations, it will include contributions from an informal public/private partnership between ONR GLOBAL, the Schmidt Sciences and Ocean Institute, and OceanX.
- In Brazil, a CSP was awarded to SpaceWeek Northeast in September 2024. This event on basic and applied space technology, including remote sensing, drew several experts from NASA and featured keynotes from the U.S. Ambassador to Brazil and a representative of the Brazilian Ministry of Science and Technology.

A panel of military and civilian experts discussed the vital role of government funding in space initiatives during SpaceWeek 2024 in Brazil, an event sponsored by ONR GLOBAL. (Photo courtesy of ONR GLOBAL)

Research Grants

Research Grants support international scientists in addressing current and future S&T naval challenges. These grants galvanized the insertion of innovative international technologies into U.S. Navy portfolios.

- As part of the ONR Code 32-sponsored Gulf of Guinea initiative, an initial grant was awarded to Dr. Cyril Boateng at the Kwame Nkrumah University of Science and Technology (KNUST) in Kumasi, Ghana in 2023 for studying the the Keta Peninsula. His research will contribute valuable information to U.S. Navy atmospheric models. Boateng presented his work at the 2024 SEG Sub African Regional Conference in May.

The ONR GLOBAL-sponsored workshop held in August 2024 at the University of Ghana in Accra brought together experts for collaborative discussions. (Photo courtesy of ONR GLOBAL)

- ONR GLOBAL, in partnership with the U.S. Army Combat Capabilities Development Command, known as DEVCOM, awarded the first research grant enabling synthetic biology and biotechnology in the Kingdom of Saudi Arabia to Professor Kyle Lauersen of King Abdullah University of Science and Technology. Lauersen is developing leading edge biological engineering tools to domesticate a unique red algae species that is capable of surviving extreme environmental conditions. The research team will engineer this organism to produce value-added materials such as fuel precursors and polymer building blocks (bioplastics) from industrial, residential and agricultural waste which could one day enable point of need production of materials critical to the Naval mission.

- A notable new Research Grant in Argentina was awarded jointly by ONR GLOBAL and the Air Force Office of Scientific Research to the University of Buenos Aires for new work proposed by Professor Oscar Martinez, known worldwide as the inventor of the Martinez Stretcher method for pulsed laser energy. The project will develop a new technique using modeling and a tabletop laser, then transition the technique to a more powerful laser system at Colorado State University.

Science Director Dr. Kyle Gustafson, Prof. Omar Yaghi (University of California, Berkeley) and ONR GLOBAL grantee Prof. Alejandro Fracaroli (National University of Córdoba, Argentina) at the conferment of Doctor Honoris Causa to Prof. Yaghi in the Rectorate of the National University of Córdoba. (Photo courtesy of ONR GLOBAL)

- In 2024, Brazilian universities received grants in quantum machine learning (State University of Sao Paulo), computational fluid dynamics (Federal University of ABC) and applied mathematics (National Institute of Mathematics).

Sonia Wolff, ONR GLOBAL Associate Science Director in Santiago, Chile, participated in the 3rd International Workshop on Adaptive, Comprehensive, and Computational Imaging — an event sponsored by ONR GLOBAL. (Photo courtesy of ONR GLOBAL)

- Chilean researchers at the Technical University of Federico Santa Maria were awarded a GlobalX challenge grant to investigate the use of undersea fiber optic cables to detect earthquakes and other sources of acoustic signals such as cargo ships and marine mammals.

- In 2023 ONR GLOBAL sponsored the U.S.–Ukraine Quantum Forum, an inaugural U.S.–Ukraine collaborative discussion around quantum technologies. The event jumpstarted numerous collaborations between Ukrainian and U.S. researchers. In 2024, one of the resultant collaborations, led by researchers Dr. Denys Bondar (U.S.), Dr. Ryszard Buczko

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(Poland) and Dr. Andril Terekhov (Ukraine), secured significant a international two-year sponsorship opportunity via a National Science Foundation IMPRESS-U (International Multilateral Partnerships for Resilient Education and Science System in Ukraine). Additionally, regular Quantum Kharkiv Seminars (virtual) were initiated. These seminars attract international participants and are leading to not only greater collaboration, but also the propagation and dissemination of vital scientific research results and revolutionary ideas in the field of quantum science.

- In 2024, ONR GLOBAL was also part of supporting seven National Science Foundation (NSF) IMPRESS-U sponsored projects, all over Europe. These efforts span various technology areas, from C5ISRT, to manufacturing, AI, human and biological systems, directed energy, materials and even naval space. Through these collaborations, ONR GLOBAL has been able to leverage international sponsorship of groundbreaking multi-national research efforts involving Poland, Lithuania, Latvia, Estonia and Ukraine, with researchers from the U.S. to ensure the latest scientific discoveries are incorporated into naval research activities expeditiously.

Vision and Plans for 2025

Looking ahead to 2025, the ISP will continue to pursue partnerships with outstanding researchers around the world and actively participate in global scientific events in order to obtain and maintain up-to-date technology awareness and enable prioritization of engagement in specific locations and technology areas to, ultimately, enhance the Programs' inputs to the Global Engagement Plan. The ISP will also work across ONR and ONR GLOBAL Departments to evince whole of organization solutions to the most pressing needs of the U.S. Navy and Marine Corps.

In Africa and the Middle East, Science Directors will focus on expanding relationships with researchers and future scientific leaders in the nations visited in 2024 and several prioritized nations. In 2025, Science Directors plan to support synthetic biology efforts in Nigeria and C5ISRT, biotechnology, oceanography, and materials in Rwanda, Gabon, Senegal, Ethiopia, Ghana, South Africa and Tunisia, just to name a few. The ISP Science Directors will visit at least 4 new to ONR GLOBAL nations in 2025. Engagements will include liaison visits to some of the best universities in Africa with creative and energetic researchers and organizations conducting fundamental research in one of the 11 Office of Naval Research Focus Areas.

In the Middle East, Science Directors will focus their attention on expanding current partnerships in Oman and Saudi Arabia, while pursuing new relationships and activities in the Seychelles, Iraq, United Arab Emirates, Qatar and Kazakhstan. The ISP and the Science Advisor Program are also looking to work together more closely to ensure they are collaboratively working to fulfill the ONR GLOBAL mission in the Middle East. Additionally, given the unique environments in some of the nations in Africa and the Middle East, the goal will also be to identify the research and partnerships which will provide the opportunity to examine something completely unexpected, but which could solve some of most challenging issues facing the Navy and Marine Corps.

Meanwhile, in the Americas, in addition to pursuing greater partnerships in Mexico in 2025, ONR GLOBAL Science Directors will also focus on expanding partnerships and scientific

activities in the Caribbean, Argentina, Brazil, Peru, Chile and several central American nations, such as the 1st Advanced Materials Workshop-From Bioinspiration to Technological Innovation held in Costa Rica, as well as research in the areas of advanced materials, naval space, oceanography, C5ISRT and quantum science. ONR GLOBAL is excited about the opportunities in supporting fundamental research and expanding partnerships with new researchers.

For 2025, ONR GLOBAL SDs in Europe also plan to continue to pursue additional partnerships in Turkey, the Baltics, and more multi-national engagements spanning nations across various continents, especially in the areas of AI/autonomy, biotechnology, advanced materials, power and energy.

Finally, in the Indo-Pacific region, ONR GLOBAL SDs plan to work actively with colleagues, naval researchers, and international research partners to obtain up-to-date technology awareness, especially that related to China S&T. In particular, ONR GLOBAL SDs will explore new venues and paths to engage site visits and discussions, especially with researchers in Taiwan and Singapore, to gain first-hand knowledge of research development of our competitions in key technical areas, including quantum, artificial intelligence, material science, electronics, hypersonic and biology related efforts. We plan to strengthen our presence in the Melbourne and New Delhi, India office and to enhance our partnership and collaborations with researchers in the host countries.

The International Science Program will bring forth technology awareness and partnership building aligned with the Global Engagement Plan and naval Science and Technology priorities.

ONR GLOBAL's International Science Program team gathered at the Office of Naval Research headquarters in Arlington, Virginia. (U.S. Navy photo by Michael Walls)

RESULTS ACHIEVE

AND MENTS

ISP AT A

69 COUNTRIES

25 VISITING SCIENTISTS PROGRAM

11 RESEARCH FOCUS AREAS

In 2024 the ISP sponsored 137 New Research Initiatives in collaboration with external Science & Technology partners across 69 countries. All these grants were strategically distributed across the 11 Naval S&T focus areas listed in Bar chart.

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GLANCE

The world map (left) highlights the 69 nations engaged by the ISP, leveraging the four tools — Research Grants, the Collaborative Science Program, Liaison Visits and the Visiting Scientists Program. The yellow bordered countries represent the nations of our visiting scientists.

7 NEW RESEARCH INITIATIVES

VISITING SCIENTISTS PROGRAM DATA SUMMARY

Total Number of Countries Visited by International Visiting Scientists

In 2024, the ISP sponsored 25 international visiting scientists for short-term travel to the United States, providing them with the opportunity to collaborate, drive advancements in our research and explore cutting-edge Science and Technology innovations within NR&DE.

Visitor	Country	Organization	Title
Maria Carolina Volpato	Brazil	State University of Campinas (UNICAMP)	Quantum Information Science
SungKi Jung	Brazil	Universidade Federal do ABC (UFABC)	Vertical Lift Center of Excellent
Dr. Alfred U'ren Cortes	Mexico	Universidad Nacional Autonoma de Mexico (UNAM)	Quantum Optics
Dr. Adrian T. Sutinjo	Australia	Curtun University	High Power Microwave Effects on Electronics
Dr. Jodie Ann Wills	Australia	Macquarie University	Applications of Wearable Technologies for Military Relevant Activities and Sharing of Data Analytics Analyses
Dr. Christian Schmiegelow	Argentina	CONICET, Universidad de Buenos Aires	Research Awareness and Collaboration Opportunities in Quantum Physics • Schmiegelow • SPIEPhotonicsWest

Visitor	Country	Organization	Title
Dr. Giuseppe Carlo Tettamanzi	Australia	University of Adelaide	Advanced Superconducting Quantum Devices
Dr. Muhammad Javed	Australia	University of Newcastle	ONR Project Discussion with Navy Scientists and ONR Biodeterioration of Materials Thrust team members
Dr. Alexei Skvortsov	Australia	UNSW Sydney	Acoustic Metamaterials with Soft Matrix
Dr. Pat Wongpan	Australia	University of Tasmania	To attend and present work at the CICE Consortium User Workshop and Tutorial
Dr. Lorenzo Zampieri	Italy	Università Cattaneo	Exchange on sea ice modelling activities within the CICE consortium
Prof. Mitsuyoshi Akiyama	Japan	Waseda University	Provide Keynote and explore research collaborations at conference on Resilience Evaluation of Navy Facilities
Mr. Noah S. Day	Australia	University of Adelaide	Conference attendance and presentation at the CICE Consortium User Workshop and Tutorial
Dr. Tessa Maroni	United Kingdom	University of Chichester	UoC-U.S. Human Performance Research Collaboration Visit

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Visitor	Country	Organization	Title
Dr. Christopher Vine	United Kingdom	University of Chichester	UoC-U.S. Human Performance Research Collaboration Visit
Prof. Roger Smith	Germany	LMU Munich	Tropical Cyclones
Dr. Zbynek Koldovsky	Czeck Republic	Technical University of Liberec	Invited Speaker at Acoustical Society of America and Research Seminar at NSWC Carderock
Dr. Tarun Chandrayadula	India	Indian Institute of Technology (IIT) Madras	Deep water acoustics and ambient noise analysis
Dr. Jhoon Kim	Korea	Yonsei Universtiy	Applications of Korean Environmental Satellite Data
Dr. Jiri Brabec	Czeck Republic	Czech Academy of Sciences	Advanced Quantum Chemical Techniques for Strongly Correlated Molecules: Development & Applications
Prof. Nicholas C. Ovenden	United Kingdom	University College London	Bubble and Decompression Physiology Modelling
Dr. Toshio Narita	Japan	Hokkaido University	Diffusion Based Coatings for Advanced Materials
Mrs. Munkhsaikhan Gonchigsuren	Mongolia	National University of Mongolia	MRS Attendance and Visits to NRL and ONR PIs

Visitor	Country	Organization	Title
Mrs. Ganchimeg Yunden	Mongolia	Mongolian University of Science and Technology	MRS Attendance and Visits to NRL and ONR PIs
Mr. Shih-Nan Chen	Taiwan	Nationa Taiwan University, Institute of Oceanography	Constraining the Influences of Vortex Interactions on the Motion of Mesoscale Vortices

Countries	Total # of Visits
Argetina	1
Australia	7
Brazil	2
Czech Republic	2
Germany	1
India	1
Italy	1
Japan	2
Korea	1
Mexico	1
Mongolia	2
Taiwan	1
United Kingdom	3
Total= 13	**Total= 25**

RESEARCH RESULTS AND OUTCOMES

These are the results and outcomes of the ISP sponsored grants in 2024. These results come in various forms such as:

- **Award recognitions** are public recognitions of outstanding contributions to scientific research, highlighting significant discoveries, innovative approaches, or major advancements in a specific field.
- **Knowledge transfers** are broad range of activities our SDs use to support mutually beneficial collaborations between universities, businesses and the public sector like workshops.
- **Patents** are the exclusive rights granted for an invention.
- **Publications** showcase published findings with the scientific community, allowing for peer review, evaluation, and the advancement of knowledge within their field.
- **Presentations** are talks that our scientists or works related to our SD's have been made in order to report their work to the scientific community.
- **Press releases** are short summaries of our research understood by the public and journalists, aiming to generate media coverage and public interest in their work.

The ISP science directors listed in this section are the ONR Global technical representative points of contact (POCs) for these research outcomes and results.

Dr. Scott Walper

Bioprinting Electrical Networks (iPrint)

- Presentation: Uncovering the Neuromodulatory Potential of Organic Semiconducting Oligomers in Hydra Vulgaris_MRS 2024 Fall Meeting & Exhibit, U.S.
- Presentation: Neuromodulation by organic semiconducting oligomers in Hydra vulgaris, 2024 OrbItaly, Italy
- Presentation: The potential of Hydra vulgaris for biohybrid material fabrication, 2024 OrbItaly, Italy

Bottom-up nanowiring of primitive neural networks via tubulation (NanoTubeNet)

- Presentation: Reconciling past and future research: a study on calcium as a protein-free fusogen in negatively charged cell-sized vesicles; Heraeus Seminar-WE, Germany
- Presentation: On the way to creating conductive GUVs; SynCell2024, April 17-19, 2024, Toulouse, France.

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Fabrication of Electrically Conductive and Photoexcitable Porphyrin-protein Nanowires

- Presentation: Fabrication of electronically conductive metalloprotein nanowires for bioelectronics and bio-interfacing_12th World Biomaterials Congress, May 26-31, 2024. Daegu, Korea.
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- Presentation: Harnessing Protein Biotechnology for SynBio. March 13-15, 2024. Heraklion, Greece Synbio 2024 Conference

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New hardly bonded interface between copper and super-high thermal conductivity bi-layer diamond

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Modified Transition Metal Dichalcogenides: Manipulation of Magnetism

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Dr. Joel Goodman

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Dr. Mamadou Diallo

PAI-MACHINE - Synthesis of machine-optimized cryptographic protocols with applications in secure machine learning systems

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- Presentation: Arthur E, Fabio B, Antonio C, Jose A, Fernanda L. (2024). "Image Classification CNNs using the FINN Engine for SRAM-based APSoC in Satellite Applications". 37th SBC/SBMicro/IEEE Symposium on Integrated Circuits and Systems Design (SBCCI). 9 October 2024.

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- Presentation: Harnessing protein self-assembly to build electronically conductive nanowires for bioelectronics and biointerfacing. Bioelectronic Symposium, October 30, 2024, Melbourne, Australia

New compression concepts and pulse compression techniques for ultra high power lasers

- Presentation: Fabrication of metalloprotein nanowires for bioelectronics and biointerfacing. Materials research Society Fall Meeting, December 1-6, 2024, Boston, Massachusetts

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- Presentation: Uncovering the Neuromodulatory Potential of Organic Semiconducting Oligomers in Hydra Vulgaris. Materials research Society Fall Meeting, December 1-6, 2024, Boston, Massachusetts

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The Dynamics of Foil Tip Gap Flows

- Presentation: Neuromodulation by organic semiconducting oligomers in Hydra vulgaris. 2024 OrbItaly, Italy

Detection, localization and identification of underwater sources of sound using Distributed Acoustic Sensing data from undersea fiber-optic cables

- Presentation: The potential of Hydra vulgaris for biohybrid material fabrication. 2024 OrbItaly, Italy

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- Publication: Flores R, Kahrobaei D, Koberda T, Le C. (2024) "Right-angled Artin groups and the cohomology basis graph", Proc. of the Edinburgh Math Society, Cambridge University Press, under revision, https://arxiv.org/abs/ 2309.05495, 1–17.
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- Publication: Battarbee C, Kahrobaei D, Perret L & Shahandashti S. F, (2024). "A subexponential quantum algorithm for the semidirect discrete logarithm problem", International Conference on Post-Quantum Cryptography, pp. 202-226. Cham: Springer Nature Switzerland.
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- Publication: Hossein Rastgoftar (2024) "Safe Human-UAS Collaboration Abstraction". CoRR abs/2402.05277
- Publication: Meriem H., & Juba A. (2024) "Strategic Predictive Maintenance for Internet System Security and Risk Management: A Roadmap (to apear)".
- Publication: Brandon A. Mosqueda G, Omar H, Wisnu U, Youakim B & Lionel B (2024)

"Secure and efficient decentralized machine learning through group-based model aggregation". Clust. Comput. 27(4): 3911-3925

- Report: Juba A., Mohand-Saïd H., & Salim H. (2024) "Security & Privacy Framework: A short review and proposal".

NRL visit to Dr. Allan Bracker

- Publication: Zacarías-Bardají J., Morilla-Cabello D. & Montijano E. (2024) "Dynamics-Aware Fast Multi-Drone Exploration of Unknown Environments", ROBOT24 to appear.
- Publication: Plou C., Pueyo P., Martinez-Cantin R., Schwager M., Murillo A. & Montijano E. (2024) "Gen-Swarms: Adapting Deep Generative Models to Swarms of Drones", ECCV Workshop Multi-Agent Autonomous Systems Meet Foundation Models: Challenges and Futures.
- Publication: Wasim A., A.M. Mangini, J. Júlvez, C. Mahulea, M.P. Fanti, "Toward Enhancing Security in Intelligent Transportation: A Simulation-Based Approach," IFAC-Papers Online, Volume 58, Issue 4, 2024, Pages 156-161.

Behavioral and Morphologic Predictors of Resilience During Cold Weather and Arctic Operations

- Publication: Ojanen T, Margolis L, van der Sanden K, Haman F, Kingma B, Simonelli G* (2024). Cold operational readiness in the military: from science to practice. BMJ Military Health
- Presentation: N. Van Den Berg. When sleeping better is not an option: Predictors and manifestations of fatigue among sleep-restricted soldiers during a winter military training. Presentation at the European Sleep Research Society Meeting, Seville, Spain, 2024.

Acoustic field imaging based on fiber-optic distributed acoustic sensors for subsea applications

- Publication (on-demand): Rieser, P., Rahaman, N., Donnerbauer, F., Putz, S., Shayeghi, A., Troyer, S. & Arndt, M., August 26, 2024, In: Applied Physics Letters. 125, 9, 5 p., 094101.

Sail for Mangroves in The Gambia

- Publication: 7 peer reviewed publications including 3 Phys Rev; Proceedings and conference website: https://usuaqforum.github.io/

AISimEval: Qualifying Simulator Environments

- Publication: Terrestrial Very-Long-Baseline Atom Interferometry: Summary of the Second Workshop, https://arxiv.org/abs/2412.14960 to be published in a TBD journal

Translating automotive collision avoidance to maritime

- Publication: Controlling many-body quantum chaos: Bose–Hubbard systems, Lukas Beringer, Mathias Steinhuber, Juan Diego Urbina, Klaus Richter, Steven Tomsovic, New J. Phys. 26 073002 (2024)
- Movie: a five-minute movie as a teaser where all the authors explain in words what is the idea, the background and the main result of that paper. This has been submitted to be linked to the paper at the corresponding New Journal of Physics website.

Phytochemistry and structural diversification of secondary metabolites in the search for antimicrobials

- Presentation: Lorenzo, M.E.; Casero, C.N.; García, M.E.; Gómez, P.E.; Segovia, A.F.; Quiroga,

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A. Baroni, M.V. Bioguided fractionation of hydroethanolic extract of Larrea cuneifolia cav. and structural elucidation of active compounds on Staphylococcus aureus. VIII National Conference on Native Aromatic Plants and their Essential Oils- IV National Conference on Native Medicinal Plants, March 25-27, 2024, Tucumán, Argentina.

- Presentation: Tonino G. Adessi, Viviana E. Nicotra y Manuela E. García. Strategies for derivatization of sesquiterpene lactones in the search for libraries of bioactive compounds. Rioplatense Conference on Medicinal Chemistry, April 11-12, 2024, La Plata, Argentina.
- Presentation: Mateo Delfino, Adriana Pacciaroni, Franco Chiarini, Viviana Nicotra, Carina Casero, Manuela García. Search for antibacterial alkaloids from plant species from the province of Córdoba. Rioplatense Conference on Medicinal Chemistry, April 11-12, 2024, La Plata, Argentina.
- Presentation: Alejandro I. Recio-Balsells, Eugenia Rodriguez Ristau, Adriana Pacciaroni, Viviana Nicotra, Carina Casero, Manuela García. Xanthanolides as a starting point for the development of antimicrobial agents. Rioplatense Conference on Medicinal Chemistry, April 11-12, 2024, La Plata, Argentina.
- Presentation: Eugenia Rodriguez Ristau, Maria Luz Tibaldi Bollati, Claudia Sola, Viviana Nicotra, José Luis Bocco, Carina Casero, Manuela García. Steroidal alkaloids as a platform for obtaining antibacterial compounds. Rioplatense Conference on Medicinal Chemistry, April 11-12, 2024, La Plata, Argentina.
- Presentation: Maria Luz Tibaldi Bollati, Fabricio Bisogno, Gabriela Oksdath-Mansilla, Viviana Nicotra, Manuela García. Complexity to diversity: exploring chemical space through diverse semisynthetic strategies. Rioplatense Conference on Medicinal Chemistry, April 11-12, 2024, La Plata, Argentina.
- Presentation: Manuela García. Search for bioactive compounds of natural origin: a multidisciplinary approach. Rioplatense Conference on Medicinal Chemistry, April 11-12, 2024, La Plata, Argentina.

Quantum internet based on atomic ensembles

- Publication: A. A. C. de Almeida, L. S. Marinho, W. Martins, G. C. Borges, and D. Felinto. Stabilized Fabry-Perot Filters for Enhancing Nonclassical Correlations of Light Scattered by an Ensemble of Cold Two-Level Atoms. CLEO: Fundamental Science, Paper# JW2A.119 (2024).
- Presentation: Entanglement by parametric amplification in an atomic cloud", G. C. Borba, R. S. N. Moreira, L. S. Cruz, M. Martinelli, D. Felinto, and J. W. R. Tabosa, 2024 Autumn Meeting of the Brazilian Physical Society (EOSBF-2024).

Dr. Weilin Hou

Optical remote sensing of subsurface water temperature and salinity

- Publication: Pask, H., Taylor, C., Curtis, S., Spence, D., Kitzler, O., Dawes, J., & Downes, J. (2024) "Photon counting marine LiDAR using blue laser diode excitation", Optics Express 32 (26), 45969-45977, 2024 December 2024 - DOI:10.1364/OE.543523
- Publication: Pask, H., Taylor, C., Curtis, S., Spence, D., Kitzler, O., Dawes, J., & Downes, J. (2024). "Raman LiDAR for ocean remote sensing of temperature and salinity". In Applications of Lasers for Sensing and Free Space Communications 2024 Article LsM4C.1 https://doi.org/10.1364/LSC.2024.LsM4C.1
- Publication: Pask, H., Taylor, C., Curtis, S., Spence, D., Kitzler, O., Dawes, J., & Downes, J. (2024) "Simultaneous measurement of water temperature and salinity using Raman spectroscopy, Optics Continuum 3 (6), 909-920,1 024, url https://api.semanticscholar.org/CorpusID:269815530
- Publication: Pask, H., Taylor, C., Curtis, S., Spence, D., Kitzler, O., Dawes, J., & Downes, J. (2024) "Depth-resolved water temperature measurements using Raman LiDAR", Applied Optics 63 (16), 4366-4371, 2
- Publication: Ameera A. J, Helen M, David J. S., & Kitzler O. (2024). "Investigation of intracavity MgO:LiNbO3 terahertz polariton laser gain over an extended 1–5 THz range," Vol. 49, Issue 2, pp. 379-382 https://doi.org/10.1364/OL.507063

Dr. Chris Konek

Stratified Coastal Dynamics of Internal Waves and Glacial River Plume Interactions

- Papers: Escauriaza, C. & Williams, M. E. (2024). Antidune Simulations Using Continuum-Based Models. Accepted in Journal Earth Surface Processes and Landforms
- Conference presentation: Williams M., Escauriaza C., Fringer O., & Fermandois A. (2024). "Formation and fate of high frequency river plume internal waves in a Patagonian fjord ", GU Ocean Sciences.
- Conference presentation: Escauriaza C. & Barros M. (2024). "Effects of Turbulence Dynamics on Bedload Transport: A Lagrangian Perspective of Particle Interactions – Riverflow.
- Conference presentation: Williams M., Escauriaza C., Fringer O., WinklerPrins L., Monasterio M. & Gomez R. (2024). "River plume and internal wave dynamics in

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a Patagonian fjord" Physics of Estuaries and Coastal Seas PECS
- Conference presentation: Escauriaza C., Williams M., & Fringer O. (2024). "Near-Field Dynamics and Mixing of Freshwater Plumes" APS Division of Fluid Dynamics.
- Conference presentation: Barros M., Vinkovic I., & Escauriaza C. (2024). "Bedload sediment transport in the turbulent flow over a rough bed with an array of boulders"
- Conference presentation: Escauriaza C. & Barros M., at the AGU Annual Meeting. Bedload transport over a rough bed with an array of boulders: "From small to large scales"
- Conference presentation: Gutiérrez K., Escauriaza C., Williams M., Grez P., & Correa S. (2024). "Wave Effects on Closing a Bar-built Estuary in a Mediterranean Climate".

STEAM and Gender: Strengthening the trajectories of girls and young people from public schools in Villa Alemana, Chile

- Peer-reviewed articles :
- Yañez-Urbina, C., López, V., Aburto, J., Cruz, V., & Ramírez, D. (2024). Positions on sexuality education in a Chilean school: a collaborative ethnography from a partial perspective. Psychology & Sexuality, 1-16. https://doi.org/10.1080/19419899.2024.2424846
- Soto, P., López, V., Bravo, P., Urbina, C., Báez, T., Acum, F., Ipinza, R., Venegas, J., Jeldes, J.C., González, C., Lepe, S. and González, J. (2024). Towards a gendered STEAM education approach: building a comprehensive model to strengthen girls' and students with non-conforming gender identities' STEAM trajectories in Chilean public schools. London Review of: Education, 22 (1), 6. DOI: https://doi.org/10.14324/LRE.22.1.06
- Conference presentation: López, V., & Yañez-Urbina, C. (2024). Promoting STEAM education: From an interdisciplinary approach to the challenges of transdisciplinarity in Villa Alemana. ICERI, 1-6.
- Conference presentation: Lucero, R.; González Weil C. (2024). "Caracterización del proceso de construcción de identidad científica en profesoras de Física". Rev. Chil. Educ. Cient.; 25, [1], 37-40.
- Presentation: Título del trabajo (2024): Gatekeepers: "The Role of Physics Teachers in Latino Women's Physics Identity Development". Ponencia en la 4th World Conference on Physics Education. Jagiellonian University, Kraków, Poland.
- Presentation: Título del trabajo (2024): "Caracterización del proceso de construcción de identidad científica en profesoras de Física". Ponencia en el VIII Encuentro Nacional de Didáctica de la Física. Universidad del Bio-Bio, Concepción, Chile.

Indirect Excitation and Luminescence Activation Mechanism of Rare-Earth Doped Wide-Bandgap Semiconductors and their Impact on the Hosts's Optical and Electrical

- Publication: Journal of Physics D: Applied Physics. Impact of c- and m- sapphire plane orientations on the structural and electrical properties of β-Ga2O3 thin films grown by metal-organic chemical vapor de2position. 10.1088/1361-6463/ad76bb, 2024
- Publication: Journal of Physics D: Applied Physics. Description of Excitonic Absorption Using the Sommerfeld Enhancement Factor and Band-Fluctuations10.1088/1361-463/ad91c1, 2024
- Conference presentation: Guerra J. A. at iEEE Nano 2024 Lima, Peru: Physics and Engineering of Multifunctional semiconducting Materials.
- Conference presentation: Guerra J. A., at the IMRC 2024 Cancun, Mexico. Indirect Excitation Mechanism and Luminescence Activation of Tb Embedded ITO and AZO Thin Films and Its Impact on the Host's Optical and Electrical Properties.
- Publication: Journal of Physics D: Applied Physics. Impact of c- and m- sapphire plane

orientations on the structural and electrical properties of β-Ga2O3 thin films grown by metal-organic chemical vapor de2position. 10.1088/1361-6463/ad76bb
- Publication: Journal of Physics D: Applied Physics. Description of Excitonic Absorption Using the Sommerfeld Enhancement Factor and Band-Fluctuations10.1088/1361-463/ad91c1

Dielectric 3D-printing for millimeter wave (mmWave) topologies

- Publication: 3D-printed Integrated GRIN Lens-Polarizer Using Anisotropic Materials", IEEE Transactions on Antennas and Propagation, vol. 72, no. 6, pp. 5343-5348, 2024. DOI: 10.1109/TAP.2023.3329959
- Publication: 3-D-Printed High-Gain Multisection DRA With Symmetric Radiation Pattern," IEEE Antennas and Wireless Propagation Letters, vol. 23, no. 5, pp. 1458-1462, 2024 DOI: 10.1109/LAWP.2024.3358921
- Conference presentation: Speaker for Workshop National Payload, "Using novel manufacturing technologies for antennas in space applications"Colegio de Ingenieros, October 9, 2024, Santiago, Chile
- Conference presentation: Invited Speaker at the 3rd Australian Beyond 5G Connectivity Summit, October 17-18, 2024, University of Technology Sydney, Australia. Talk:" 3D Printed Antennas for Space Communications"
- Conference presentation: Invited Speaker at the 1st IOST Workshop: Building Bridges For A Global Network, April 4-5, 2024, Universidad de Chile, Chile. Talk: "Using Novel Manufacturing Technologies For Cubesat Antennas: Preliminary Results"
- Conference presentation: Invited Speaker for Simposio, Electromagnetismo Aplicado (Applied Electromagnetics) March 6, 2024, Universidad Nacional de Ingeniería en Lima, Perú. Talk: "On the use of 3D printing for antenna applications in millimeter waves - how cost-effective can it be?"

AI-supported forecasts of heat waves along the Pacific Coast of the Americas

- Publication: Carrillo, H., Mauro M., Lambert, F., and Wout, E., "Abrupt changes in heatwave evolution in Mediterranean Chile and California" October 23, 2024 https://doi.org/10.22541/essoar.172736358.88981046/v1

Energy-Aware Reinforcement Learning for Control of Autonomous Surface Vehicles Subject to Uncertain Dynamic Conditions

- Publication: Acuña-Ureta, D., Fuentealba-Secul, D., and Orchard, M (2024). Annual Conference of the Prognostic and Health Management Society. "Expected First Occurrence Time of Uncertain Future Events in One-Dimensional Linear Systems" 16(1) DOI: 10.36001/phmconf.2024.v16i1.4116

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Dr. Elena McCarthy

In vivo CT-based finite element model of echolocation beam formation

ICESHAPE – Investigation of critical ice floe and iceberg shapes for full-scale ship-ice collision simulations

- Presentation: VSP visit to Carderock to deliver a seminar to the Acoustic Signatures Technology Division (Code 70)
- Presentation: Acoustical Society of American annual meeting (May 2024).

Non-Collaborative Object Analytics (nCOA)

- Publication: Conti A., Torsoli G., Gómez-Vega C., Vaccari A., & Win M. (2024). "xG-Loc: 3GPP-compliant datasets for xG locaXon-aware networks," IEEE Dataport, Available: https://dx.doi.org/10.21227/rper-vc03

Shelf Slope Dynamics In The Sea Of Oman: How Sub-Mesoscale Processes Control Food And Water Security

- Publication: Font E., Swart S., Bruss G., Sheehan P. F., Heywood J. & Queste, B. Y. (2024). "Ventilation of the Arabian Sea oxygen minimum zone by Persian Gulf Water". Journal of Geophysical Research: Oceans, 129, e2023JC020668. https://doi.org/10.1029/2023JC020668
- Publication: Claereboudt M. & Bruss G. (2024). "Short distances dominate connectivity patterns of coral communities in the North-West Arabian Sea, Frontiers in Marine Science". Vol 11| https://doi.org/10.3389/fmars.2024.1494563

Surviving in the abyss: skeletal adaptations of deep-sea glass sponges

- Publication: Dr. Falcucci's forthcoming paper titled "Adapting to the Abyss: Passive Ventilation in the deep-sea Glass Sponge Euplectella aspergillum" has been selected for inclusion in the American Physical Society's outreach to the press.

Degradation of Ultra-High Temperature Materials under Extreme Conditions

- Award: Suren Kharatyan won the prestigious award from the National Academies in December for his outstanding contributions to material science and kinetics of materials. Application for U.S. patent: with Khachatur Manukyan for a method to aid in recycling electric vehicle batteries.

Dr. Clint Novotny

Development of Materials and Processes for Tandem Perovskite / Silicon Solar Cells

- Publication: Jiang F., Shi Y., Rana T. R., Morales D., Gould I. E., McCarthy D. P., & Ginger, D. S. (2024). "Improved reverse bias stability in p–i–n perovskite solar cells with optimized hole transport materials and less reactive electrodes. Nature Energy", 9(10), 1275-1284.
- Publication: Zhou S., Gallant B. M., Zhang J., Shi Y., Smith J., Drysdale J. N., & Snaith H. J. (2024). "Reactive passivation of wide-bandgap organic–inorganic perovskites with benzylamine". Journal of the American Chemical Society, 146(40), 27405-27416.
- Publication: Taddei, M., Jariwala, S., Westbrook, R. J., Gallagher, S., Weaver, A. C., Pothoof, J., & Ginger, D. S. (2024). Interpreting Halide Perovskite Semiconductor Photoluminescence Kinetics. ACS Energy Letters, 9, 2508-2516.
- Publication: Taddei M., Contreras H., Doan H. N., McCarthy D. P., Seo S., Westbrook J., & Ginger S. (2024). "Diamine Surface Passivation and Post-Annealing Enhance Performance of Silicon-Perovskite Tandem Solar Cells". arXiv preprint arXiv:2411.18756.

Heat tolerance in humans: Understanding the responder/non-responder phenomenon and its implications for balancing force protection

- Presentation and Publication: Dechichi M. J., Carter H., Loacatelli C., Wigati K., Criddle J., Haynes A. & Green J. (2024). "Brachial, Femoral, And Skin Haemodynamic Responses To Walking In Hot Conditions: Comparison Between Males And Females". Journal of Clinical Exercise Physiology, 13(s2), 481-481. Research to Practice Annual Conference Sydney, Australia, May 2-4, 2024.
- Presentation & Publication: Loacatelli, M. J. C., Carter, M. H. H., Collis, M. J., Haynes, M. A., Dechichi, M. J. G. C., Wigati, M. K. & Green, M. D. J. (2024). "Sex Differences In Cerebral Blood Flow Velocity Responses To Exercise In The Heat". Journal of Clinical Exercise Physiology, 13(s2), 480-480. Research to Practice Annual Conference Sydney, Australia, May 2-4, 2024.
- Presentation and Publication: Criddle M. J., Haynes M. A., Carter H., Collis M. J., Wigati K., Dechichi C. & Green D. (2024). "Determinants Of Physiological Response To Exertional Heat Stress In Humans". Journal of Clinical Exercise Physiology, 13(s2), 408-408. Research to Practice Annual Conference Sydney
- Publication: Criddle, J. L., Wigati, K. W., Locatelli, J. C., Costa, J. G., Collis, J. J., Haynes, A., & Green, D. J. (2024). Physiological response to exercise in the heat: Implications for

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risk mitigation and adaptation. Temperature, (accepted November 13, 2024). https://doi.org/10.1080/23328940.2024.2431402

Biomechanical and Biophysical Biomarkers of Musculoskeletal Injury: A Machine Learning Approach to Injury Prediction and Performance Enhancement

- Publication: Fain A, Nindl B, McCarthy A, Fuller J. T, Wills J. A, Doyle A. (2024) "Load increases IMU signal attenuation per step but reduces IMU signal attenuation per kilometre". Gait Posture. 2024 Sep; 113:519-527. doi: 10.1016/j.gaitpost.2024.08.003. Epub. PMID: 39173442.
- Publication: Doyle, T. L., Nindl, B. C., Wills, J. A., Koltun, K. J., & Fain, A. C. (2024). "Biomechanical and physiological biomarkers are useful indicators of military personnel readiness: a multi-institutional, multinational research collaboration". BMJ Mil Health.
- Publication: McCarthy A, Feigel E.D, Lovalekarc M, Koltun K.j, Bird M.B, Martin B.J, Forse J.N, Steele E.J, Fain A.F, Wills J.A, Doyle T.L.A, Nindl B.C. (2024). "Principal Component Analysis Reveals Distinct Wearable-Assessed Biomechanical and Physiological Demands During Load Carriage and Tactical Mobility Tasks Among Male and Female Military Personnel – MQ and Pitt Collaborative effort, Journal of Science and Medicine and Sports".
- Publication: McCarthy A, Wills J. A, Fain A, Nindl B. C, Beach A. J & Doyle T. L. A. (2024) "VALD HumanTrak Measures Valid Hip and Knee Joint Angles with and Without Body Armour", Military Medicine.

Detection, prevention and physiology of hypoxia, hypercapnia and nitrogen narcosis in rebreather diving

- Publication: Brenner, R. J., Balan, K. A., Andersen, M. P., Dugrenot, E., Vrijdag, X. C., Van Waart, H., & Tillmans, F. (2024). "A review of nutritional recommendations for scuba divers". Journal of the International Society of Sports Nutrition, 21(1), 2402386.
- Presentation: "Results of the project have been presented to the scientific community at the ONR program review" (Groton, April 2024), the SPUMS scientific meeting (Fiji, May 2024), the EUBS scientific meeting (Brest, France, September 2024), and the British Hyperbaric Association (BHA) scientific meeting (Hull, U.K., November 2024).

cardiGAN: A Generative Adversarial Network Model for Design and Discovery of Multi Principal Element Alloys

- Publication: Li Z., Li S., & Birbilis N. (2024). "A machine learning-driven framework for the property prediction and generative design of multiple principal element alloys. Materials". Today Communications, 38, 107940.

Multifunctional Carbon Fibers for Battery Electrodes

- Publication: Zenkert D, Harnden R, Asp LE, Lindbergh G, Johansson M. (2024) "Multifunctional carbon fibre composites using electrochemistry" – A mini-review, Composites Part B, 2024;273; 111240. https://doi.org/10.1016/j.compositesb.2024.111240
- Publication: Xia Z, Li Z, Xu J, Sasidharan S, Sanchez JS, Palermo V, (2024) Asp LE. Green

synthesis of positive electrodes for high performance structural batteries - a study on graphene additives, Composites Science and Technology, 2024; 251:110568. https://doi.org/10.1016/j.compscitech.2024.110568

- Publication: Johansen M, Singh M. P, Xu J, Asp L. E, Gault B, Liu F. (2024) "Unravelling lithium distribution in carbon fibre electrodes for structural batteries with atom probe tomography", Carbon; 225:119091. https://doi.org/10.1016/j.carbon.2024.119091
- Publication: Tavano R, Xu J, Creighton C, Liu F, Dharmasin B, Henderson L. C, Asp L. E. (2024) "Influence of carbonisation temperatures on multifunctional properties of carbon fibres for structural battery applications. Batteries and Supercapacitors, e202400110https://doi.org/10.1002/batt.202400110. Cover page: https://doi.org/10.1002/batt.202480801
- Publication: Chaudhary R, Chetry A, Xu J, Xia Z, Asp L. E. (2024) Structural Positive Electrodes Engineered for Multifunctionality. Advanced Science, 24014012. https://doi.org/10.1002/advs.202404012
- Publication: Gray R, Rodriguez Santana P, Barthelay T, Bouton K, Marken F, Lunt A, Xu J, Asp LE, Zenkert D, Bowen C, Rhead A. (2024) Carbon fibre reinforced electrodes for structural battery applications. Journal of Materials Chemistry A. https://doi.org/10.1039/D4TA01008F
- Publication: Chaudhary R, Xu J, Xia Z, Asp L. E. Unveiling the Multifunctional Carbon Fibre Structural Battery, Advanced Materials, 2409725. https://doi.org/10.1002/adma.202409725
- Publication: Tavano R, Spagnol M, Al-Ramahi N, Joffe R, Johanna J, Asp L. E. (2024) Mechanical characterisation of a structural battery electrolyte Polymer, Polymer, Vol. 312, 127646. https://doi.org/10.1016/j.polymer.2024.127646

Manufacturing Carbon Fibers for Battery Electrodes

- Publication: Coia, P.; Dharmasiri, B.; Stojcevski, F.; Hayne, D. J.; Austria, E.; Akhavan, B.; Razal, J. M.; Usman, K. A. S.; Stanfield, M. K.; Henderson, L. C. (2024) "Scalable electrochemical grafting of anthraquinone for fabrication of multifunctional carbon fibers". Journal of Materials Science & Technology, 200, 162-175. DOI: https://doi.org/10.1016/j.jmst.2024.03.006
- Publication: Harte, T.; Dharmasiri, B.; Coia, P.; Eyckens, D. J.; Henderson, L. C. (2024) "Bicontinuous solid polymer electrolytes using Li+ enriched ionic liquids". Journal of Molecular Liquids, 402, 124689. DOI: https://doi.org/10.1016/j.molliq.2024.124689
- Publication: Simon, Ž. Dharmasiri, B.; Harte, T.; Sherrell, P. C.; Henderson, L. C. (2024) "From stress to charge investigating the piezoelectric response of solvate ionic liquid in structural energy storage composites". Materials Horizons, 11 (18), 4321-4328, 10.1039/D4MH00612G. DOI: 10.1039/D4MH00612G
- Publication: Inside front cover. Materials Horizons 2024, 11 (18), 4228-4228, 10.1039/D4MH90098G. DOI: 10.1039/D4MH90098G
- Publication: Coia P, Dharmasiri B, Hayne D. J, Borkar A, Hua C, Austria E & et al. (2024) Hierarchical Polyimide-Covalent Organic Frameworks Carbon Fiber Structures

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Enhancing Physical and Electrochemical Properties. Small Structures, 5 (10), 2400166. DOI: https://doi.org/10.1002/sstr.202400166

Nucleation and Cavitation Physics of a Marine Propulsor

- Publication: Takahashi, K. (2024). Effect of tip-gap height on tip-leakage flows in a stationary NACA hydrofoil. Ships and Offshore Structures, 1-15

Development of High-Efficiency Organic Solar Cells

- Publication: Zhang R., Chen H., Wang T., Kobera L., He L., Huang Y., & Gao F. (2024). "Equally high efficiencies of organic solar cells processed from different solvents reveal key factors for morphology control". Nature Energy, 1-11

Dynamic Catalytic Reactors (DCR)

- Publication: Trangwachirachai, K., Rouwenhorst, K., Lefferts, L., & Albanese, J. A. F. (2024). Recent Progress on Ammonia Cracking Technologies for Scalable Hydrogen Production. Current Opinion in Green and Sustainable Chemistry, 100945.
- Publication: Two poster presentations: (1) "Cooperative Integration of Thermosolar and Wind Energy with Molten Salts and Green Ammonia Enables Sustainable Power Generation in Morrocco: A Study Case in Dakhla" in Netherlands Process Technology Symposium (NPS) organized by the University of Groningen (The Netherlands). (2) At the workshop on "Stimulated Dynamic and Resonant Catalysis" organised by the Lorentz Research Center at the Leiden University

Enhanced hypersonic aerodynamics and stability models through hardware in the loop ground tests in TUSQ

- Conference presentation: Hoffen V., Buttsworth M., Jahn D. (2024) "Aerodynamic Controllability Testing in a Short-Duration Hypersonic Facility", NATO Workshop Technological Challenges due to Hypersonic Flight and the related Weapons Threat, STO-MP-AVT-SET-396

Fast ramping superconducting magnets

- Conference presentation: ISS2024 (the 37th International Symposium on Superconductivity) December 3-5, 2024, in Kanazawa, Japan. "AC loss reduction in a REBCO coil assembly by applying superconducting shielding coils" and Magnetic flux diverters" by Y. Sun, S. You, T. Huang, and Z. Jiang and
- Conference presentation: "10 T fast-ramping HTS magnets for characterizing new rare-earth permanent magnet materials" by Z. Jiang, Y. Sun, and T. Huang.

Investigating the Inner-Magnetosphere Hot Zone and the Magnetosphere-Ionosphere (M-I) Conjugate Subauroral Flows

- Publication: Horvath I., & Lovell B. C. (2024). Investigating the 17 March 2013 geomagnetic storm impacts on the wholly coupled solar wind-magnetosphere-ionosphere-thermosphere system-of-systems. Journal of Geophysical Research: Space Physics, 129(9), e2024JA032917. https://doi.org/10.1029/2024JA032917
- Publication: Horvath I., & Lovell B. C. (2024). "Magnetosphere–Ionosphere Conjugate Harang Discontinuity and Sub-Auroral Polarization Streams (SAPS) Phenomena Observed

by Multipoint Satellites". Atmosphere, 15(12), 1462.

- Publication: Horvath, I., & Lovell, B. C. (2024). "Investigating the hot zone developed under short-circuiting conditions and the coupled magnetosphere-ionosphere (M-I) system for the subauroral arc's inner-magnetosphere generation environment". Journal of Geophysical Research: Space Physics, 129(6), e2024JA032552.

Dr. Martina Siwek

Patterning by Casimir Forces: From Chaos to Complex Patterns of Life

- Publication: Bojana Bokić, Yovan de Coene, Maria Antonietta Ferrara, Thierry Verbiest, Yves Caudano, and Branko Kolaric, Structured Light from Classical to Quantum Perspectives, Symmetry, 16,1053, 2024, https://doi.org/10.3390/sym16081053
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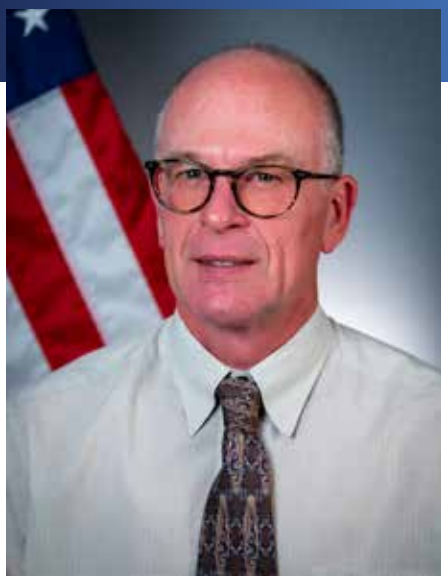
Dr. Stephen Turner



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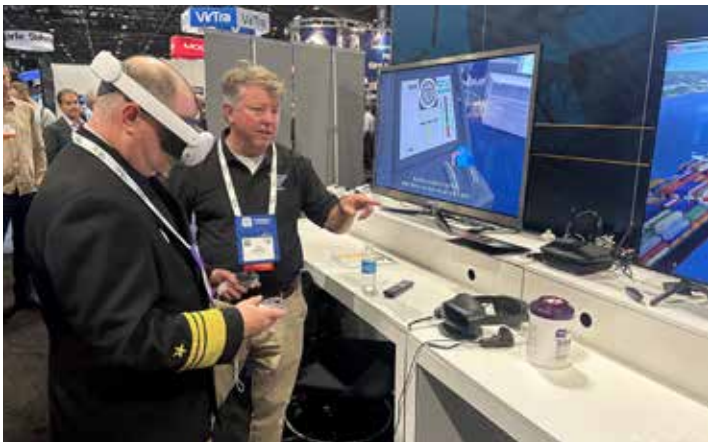
ONR GLOBAL TECHNICAL DIRECTOR Closing Thoughts

As we conclude another year of rapid technological progress, I reflect on my six months in this role and the remarkable pace of innovation. Breakthroughs in artificial intelligence, machine learning, synthetic biology, and quantum technology have led to significant milestones we are proud to achieve. I must also recognize Dr. Rhett Jeffries, the outgoing ONR GLOBAL Technical Director, for his impactful transition, mentorship, and valuable contributions to global technology engagement.

Aligned with our strategic objectives, ONR GLOBAL has achieved remarkable milestones across our seven technical departments and Business Operations unit. This includes exceptional progress with our Global Engagement Plan (GEP), showcasing our commitment and capability in driving impactful initiatives. This year's GEP captured over 400 activities across all departments and was a significant step in realizing its full potential. I am extremely excited to see it grow to encompass more global activities across the Naval Research and Development Establishment (NR&DE) to help us make informed decisions on international engagement and technology partnerships.

Our prospectus effectively showcases our incredible accomplishments, and I want to emphasize a couple of our standout efforts:

The Virtual Bridge and Nautical Trainer (VIBRaNT) showcases innovation through collaboration with TechSolutions and the Navy Information Warfare Center Pacific. Using technology from the London Tech Bridge, VIBRaNT provides an Extended Reality (XR) training system for up to 12 Surface Warfare Officers and bridge crew members. It helps maintain navigation and ship-handling proficiency in a virtual setting, especially when Seamanship Trainers are unavailable or before entering a new port. This system builds confidence and skills for Officers of the Deck, Navigators, Commanders, and Executive Officers, potentially enhancing overall fleet effectiveness.



The Deputy Chief of Naval Operations for Warfighting Requirements and Capabilities (OPNAV N9), VADM James Pitts, operating the Virtual Bridge and Nautical Trainer (VIBRaNT), a system developed through collaboration between ONR GLOBAL's Tech Solutions and the Navy Information Warfare Center Pacific. (Photo courtesy of ONR GLOBAL)

At TOEE 24.3, we drove innovation with expertise collaboration. E&A, IEO, SA, FCT in partnership Ventura Tech Bridge to establish an Unmanned Operations Center (UOC) at Naval Base Ventura County, testing remote operations in a dynamic environment to advance Unmanned Surface Vehicle (USV) capabilities through Integrated Battle Problem 24.2. IEO led event coordination, aligning with global partners, while SA worked with Fleet/Forces to ensure real-world operational impact. FCT focused on assessing autonomous systems, pushing the technology forward. This was more than an experiment — it was a powerful step toward the future of naval autonomy, made possible through teamwork and innovation.

And the Microelectronics Collaborative Science Program (CSP) in Mongolia showcases ONR GLOBAL's commitment to discovering talent and expanding research into new fields and regions. This year, in partnership with the International Science Program and the 'Mongolian Microelectronics Career Skills Program,' ONR GLOBAL hosted the region's first International Conference on Materials Science and Nanotechnology with nearly 200 scientists in attendance, including Nobel laureate Sir Konstantin Novoselov. Led by Dr. Chagaan Baatar, whose expertise and regional ties were key, the event strengthened Mongolia's role in DOD-sponsored research. ONR GLOBAL also established three research grants focused on advanced materials and nanotechnology, reinforcing its mission to foster global scientific collaboration.

A Department of Defense panel featuring ONR GLOBAL personnel — Dr. Baatar, Dr. Joel Feldmeier and Mr. Hoa Nguyen — engaged with attendees at the ONR GLOBAL-sponsored Microelectronics CSP in Mongolia. (Photo courtesy of ONR GLOBAL)

Looking Ahead - 2025

We are guided by key strategic documents like the Naval Science and Technology Strategy and the Chief of Naval Operations' NAVPLAN, known as Project 33. This strategy serves as a global call to action, inviting collaboration from scientists, engineers, and innovators to tackle naval challenges and protect our freedoms. It opens technological possibilities for the Navy and Marine Corps, ensuring a sustainable strategic advantage.

In addition to the superb performance of our ONR GLOBAL team, we will continue to iterate on the Global Engagement Plan and expand its scope to represent the interests of ONR Headquarters and eventually the entire NR&DE. Through the continued efforts across the organization, we will leverage corporate global knowledge to strategically apply our resources and get after building relationships with partner nations, institutions, and researchers who can expand our capacity and keep us at the forefront of technology.

A key underlying component of our success will be how we empower the organization to achieve its highest potential and leverage the talents we have to the utmost. In addition to maintaining a culture of warfighter focus, lethality, readiness, continual improvement and the ONR GLOBAL family values instilled in us by CAPT Berner, we are steadfastly pursuing a digital transformation to ensure that all of our knowledge is preserved and shared across the global network.

And in the words of the Chief of Naval Research, "We will continue to operate with a sense of urgency in a world of strategic competition and rapid technological change." We will continue our Get-Real-Get-Better journey to ensure we are the ONR the Fleet/Force need us to be, well into the future.

Respectfully,

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Glossary of Terms

ACE - Advanced Capability Experiment

ACV - Amphibious Combat Vehicle

AUKUS - Australia, United Kingdom and U.S.

AWOTF - Air Wing of the Future

CONOPS - Concept of operations

DCS - Delivering Combined Seapower

DSTL - Defense Science Technology Lab

DOD - Department of Defense

DON - Department of the Navy

E&A - Experimentation and Analysis

EOTG - Expeditionary Operations Training Group

EMD - Engineering and Manufacturing Development

ExMed - Expeditionary Medicine

FCT - Foreign Comparative Testing

HMD - Head-mounted display

IP&E - Office of the Under Secretary of Defense for Research and Engineering International Prototypes and Experiments

IEO – International Engagement Office

ISP - International Science Program

JPO - Joint Program Office

LAR - 1st Light Armored Reconnaissance

LTB - London Tech Bridge

MCWL - Marine Corps Warfighting Laboratory

MUM-T - Manned-unmanned teaming

NAE - Naval Air Enterprise

NPS - Naval Postgraduate School

NAVSEA - Naval Sea Systems Command

NAVWAR - Naval Information Warfare Center

NIWC - Naval Information Warfare Center

NR - New Research

NR&DE - Naval Research Enterprise

NR&DE - Naval Research and Development Establishment

NRL – Naval Research Laboratory

NUWCDIVNPT - Naval Undersea Warfare Center Division, Newport

OPNAV - Office of the Chief of Naval Operations

ONR GLOBAL – The Office of Naval Research Global

ONR – The Office of Naval Research

POM - Program Objective Memorandum

RoK - Republic of Korea

RN - Royal Navy

ROV - Remotely operated vehicle

SA - Science Advisor

SSW - Subsea and Seabed Warfare

S&T - Science and technology

TOEE - Technology Operational Experimentation Events

TS - TechSolutions

UAS - Unmanned aircraft systems

USFFC - U.S. Fleet/Forces Command

USN - United States Navy

USV - Unmanned surface vessels/vehicle

UUV - Unmanned undersea/underwater vehicles

ViDAR - Visual Detection and Ranging

VR - Virtual Reality

XR - Extended Reality


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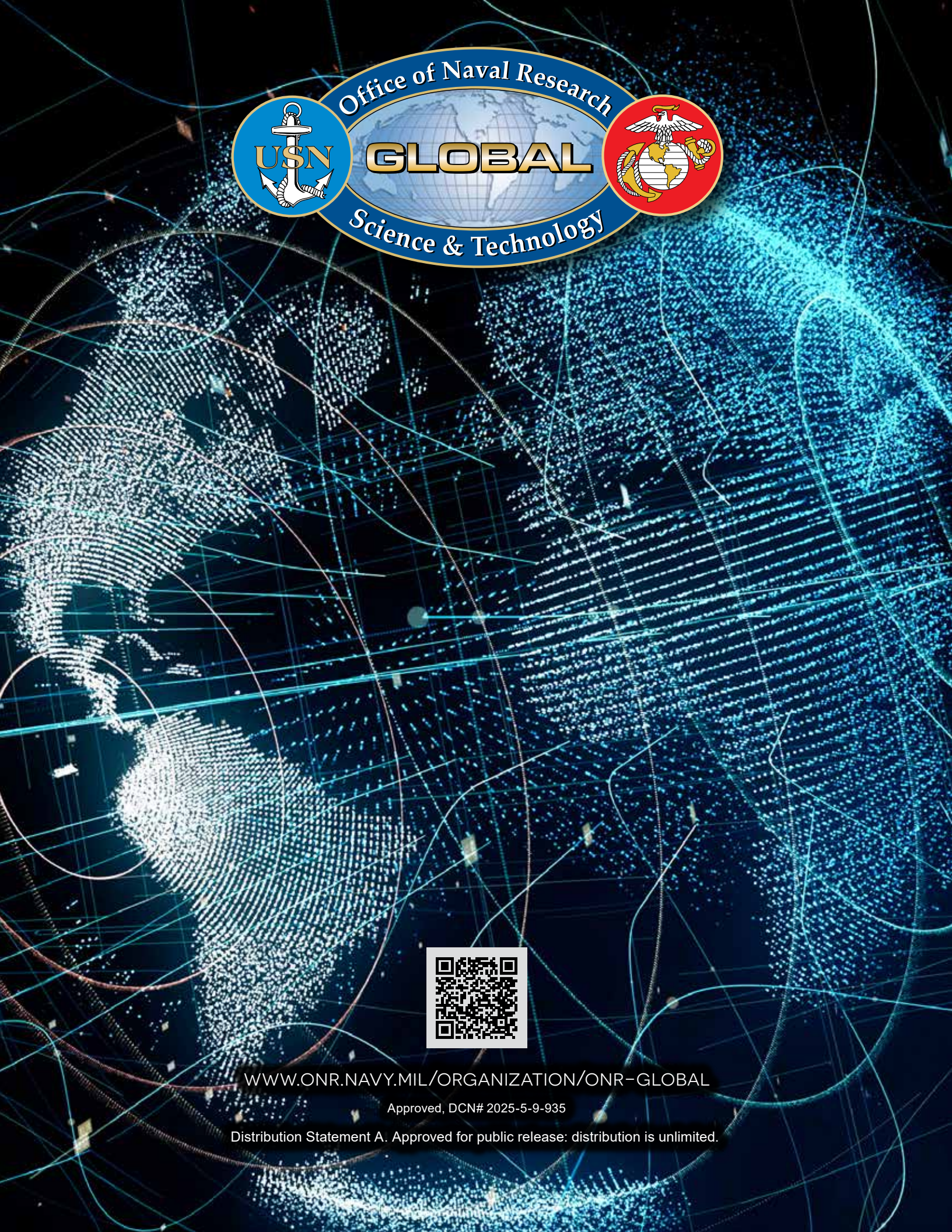

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