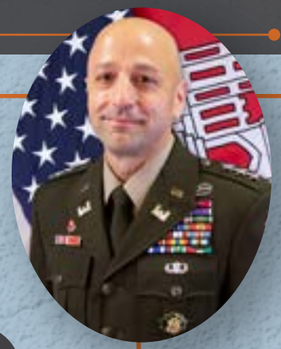
USACE R&D

FY24 ANNUAL REPORT

U.S. ARMY

US Army Corps of Engineers



SEP 2020
Lt. Gen. Scott A. Spellmon takes command as 55th Chief of Engineers

AUG 2021
USACE Top 10 R&D Priorities Defined

NOV 2021
USACE R&D Strategy published

JAN 2022
1st Technology Spotlights presented at CG Monthly R&D Update

FEB 2022
The Honorable Michael Connor, Assistant Secretary of the Army for Civil Works, lists R&D among his top priorities

FEB 2023
Inaugural USACE R&D Annual Report published

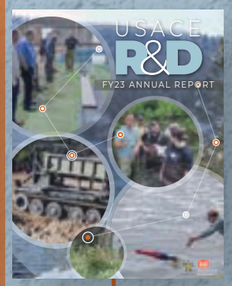
NOV 2023
USACE Innovation Workshop at San Antonio EGM

JAN 2024
USACE IE&E TI Strategy published

FEB 2023
"Connect the Dots" Technology Spotlights introduced 2QFY23 EGM

JUL 2022
1st edition of Power of R&D published

APR 2022
1st Operational R&D Workshop; initial S&T Cadre presents MSC R&D opportunities



FEB 2024
USACE R&D FY23 Annual Report published

JUL 2024
USACE CW RD&T Strategy draft release

SEP 2024
Lt. Gen. William "Butch" Graham takes command as 56th Chief of Engineers

NOV 2024
Virtual USACE Innovation Workshop held

DR. DAVID W. PITTMAN

There have been many occasions during my career in which I have watched a team of people strive together to accomplish something that seemed impossible.

It's part of our DNA and is the reason that the U.S. Army Corps of Engineers (USACE) and the U.S. Army Engineer Research and Development Center (ERDC) are world class.

Yet, that doesn't temper my amazement to see what USACE research and development has accomplished in recent years.

Shortly after becoming the 55th Chief of Engineers, Lt. Gen. Scott Spellmon committed to elevating the story of research and development across the USACE enterprise. Using the slogan, "It All Starts Here," he emphasized the impact R&D is having and could have on addressing many of the challenges facing our nation and our world.

Buoyed by this charge, USACE R&D has reached levels in recent years that I never thought I would see. The commitment and investment we have received from our leaders across the federal government, the Department of Defense (DOD) and elsewhere have propelled us to historic research portfolios, with the team and capabilities to solve seemingly impossible challenges on a global scale.

And now, under the leadership of our 56th Chief of Engineers, Lt. Gen. William "Butch" Graham, we take our next step in developing and transitioning our innovative techniques and technologies faster than ever to help USACE deliver the program. Our enterprise, our Warfighters and our nation are depending on us, and we must answer the call – as we have done throughout our history.

Our new Chief has put a huge emphasis on innovation in all forms – technology, business processes and leadership – leveraging the ingenuity of our greatest strength – our people.

This annual report continues to be an important way we are sharing the story of USACE R&D. We are thrilled to share how our laboratories, centers of expertise and districts are creating and deploying cutting-edge solutions.

From ongoing efforts to embed nature-based features and new technologies in future infrastructure projects to leveraging the power of artificial intelligence and machine learning (AI/ML), there has never been a more exciting time to be a part of R&D in USACE.

Things once thought impossible when I began my career are possible today because of this great team. Let's continue to Innovate Together!

ESSAYONS!

David W. Pittman, PE, PhD, SES
Director of R&D and Chief Scientist
U.S. Army Corps of Engineers

Director
U.S. Army Engineer Research and Development Center

NAVIGATE

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US Army Corps of Engineers

Our mission is to deliver vital engineering solutions, in collaboration with our partners, to secure our nation, energize our economy, and reduce disaster risk.

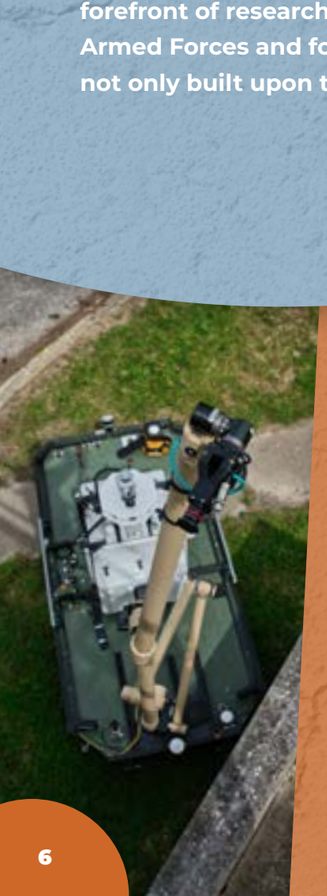
POWER OF ERDC:
DISCOVER, DEVELOP & DELIVER

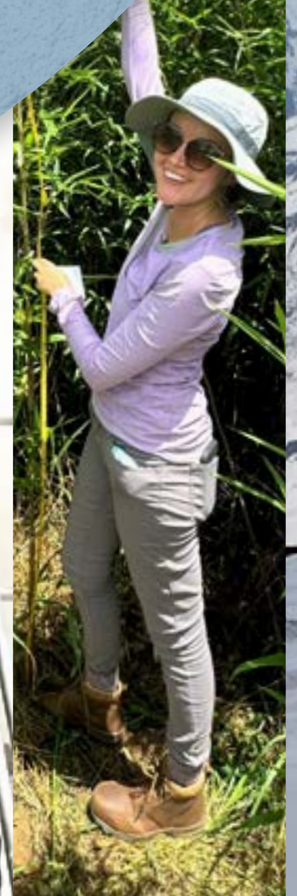
For an organization focused on solving the next challenge and overcoming the next obstacle, looking back is not often on the to-do list. But during FY24, ERDC saw tremendous advancements in the programs delivered, innovations discovered and partnerships formed.

ERDC's research portfolio once again surpassed $2 billion, continuing a trend of tremendous investment and support from industry, academia, federal agencies and the DOD. To meet that portfolio's demands, ERDC's diverse and talented workforce once again reached historic levels. Including federal employees, contractors and military personnel, ERDC's team is now more than 3,000 strong and growing.

The year saw increases in the number of small business contracts, and ongoing investment in ERDC's research facilities was highlighted by several new buildings, renovations and the groundbreaking of a new research facility in Fox, Alaska.

For more than 25 years, ERDC has built a legacy of being at the forefront of research and development for our enterprise, for our Armed Forces and for our nation. This report will show that FY24 not only built upon that legacy but made it even stronger.





A GROWING INVESTMENT IN R&D

The USACE research and development community continued to grow stronger in FY24, particularly at ERDC. Through new partnerships, agreements and contracts, R&D investment at ERDC reached $2.2 billion, fostering the discovery, development and delivery of innovative solutions to the USACE enterprise, the DOD, federal agencies and countless partners across academia and industry. USACE research is sorted into four categories: Civil Works (CW), Installations & Operational Environments (IOE), Warfighter Support (WfS) and Support for Others (SfO).

$2.2 BILLION

CONTRACTS

$775.3 MILLION

2,318 NEW ACTIONS

A RECORD

$202.1 MILLION

SMALL BUSINESS CONTRACTS

1,258 NEW ACTIONS

19.5% SOCIAL MEDIA GROWTH

PUBLICATIONS

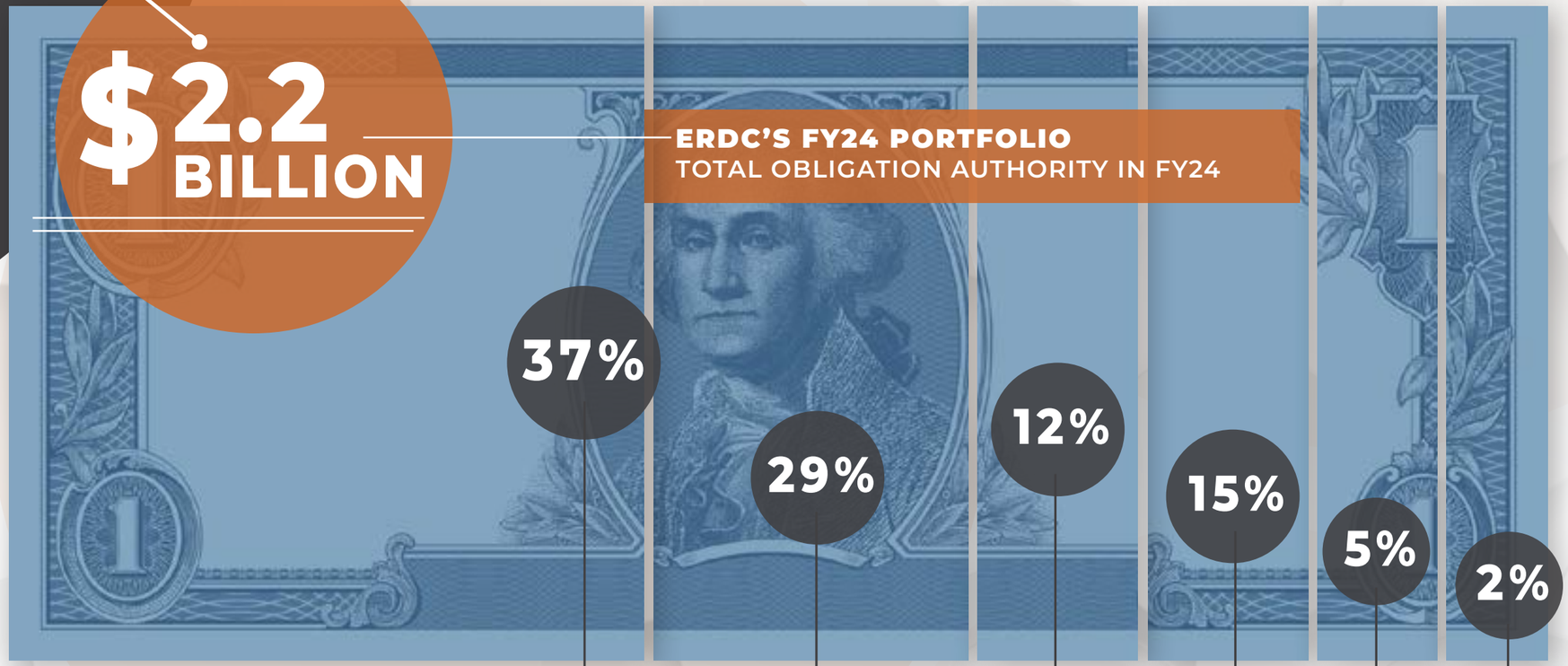
JOURNAL ARTICLES 330

CITATIONS BY ERDC AUTHORS 207

TECHNICAL REPORTS 195

ERDC'S FY24 PORTFOLIO

TOTAL OBLIGATION AUTHORITY IN FY24



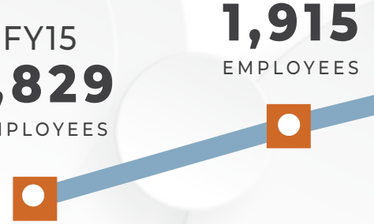
VISIT THE ERDC LIBRARY: WWW.ERDC.USACE.ARMY.MIL/LIBRARY/

POWER OF ERDC:
THE PEOPLE

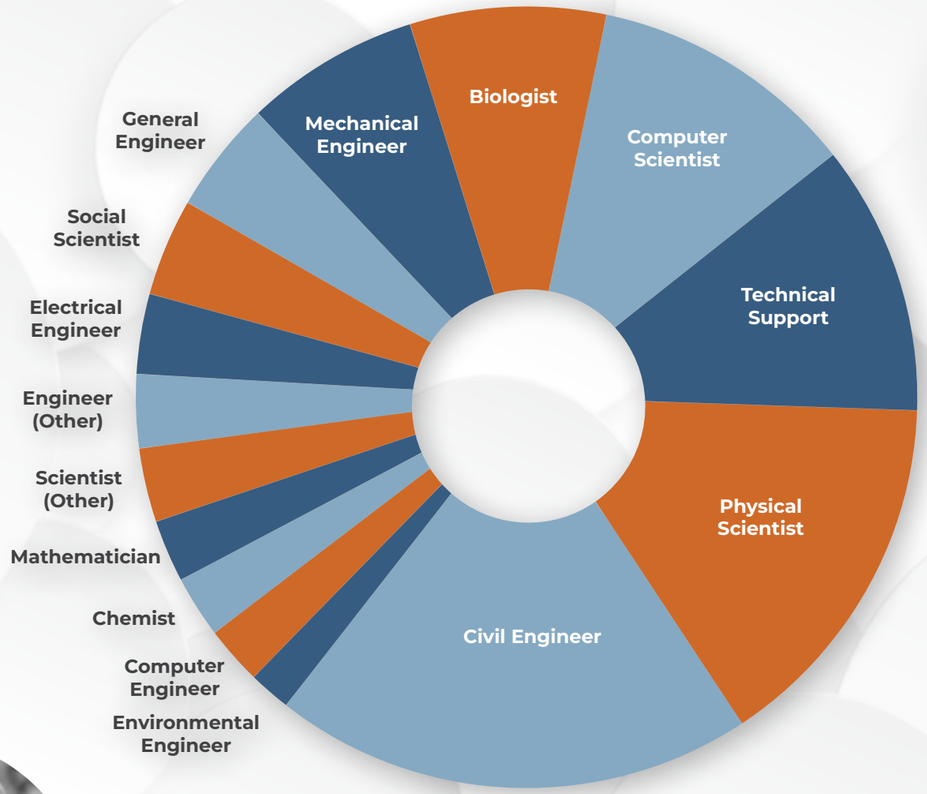
The force behind any innovation is the people who thrive on solving the unsolvable. The USACE R&D community is dedicated and driven, led by the engineers, scientists, technicians and support personnel at ERDC. Our multi-disciplinary workforce, stretched across 46 states, the District of Columbia, Puerto Rico and four foreign counties, is committed to overcoming the generational challenges faced by our nation and Warfighters today and tomorrow. Strengthened by this multi-disciplinary team, USACE has the capability to confront threats from the environment to the battlefield to cyberspace and beyond. This ability to attack a problem from any direction is what continues to make USACE's R&D community exceptional.

3,000+
ERDC TEAM MEMBERS WHEN COMBINING FULL-TIME EMPLOYEES, CONTRACTORS AND MILITARY PERSONNEL

A GROWING WORKFORCE



DIVERSE CAREER FIELDS



MULTIPLE LOCATIONS, ONE TEAM

October 2023 marked the 25th anniversary of the orders that combined USACE's R&D laboratories into one organization – ERDC – that today features seven world-class laboratories with the unique ability to work individually and collaboratively on a wide spectrum of research projects. Those laboratories – located in Mississippi, Illinois, New Hampshire and Virginia, with headquarters in Vicksburg, Mississippi – are further supported by additional field sites where critical tests seek to enhance and validate research efforts. Combined, these laboratories and field sites form "One ERDC, One Team."

Cold Regions Research and Engineering Laboratory (CRREL)
Hanover, New Hampshire

Geospatial Research Laboratory (GRL)
Alexandria, Virginia

Construction Engineering Research Laboratory (CERL)
Champaign, Illinois

Coastal and Hydraulics Laboratory (CHL)
Vicksburg, Mississippi

ERDC Headquarters
Vicksburg, Mississippi

Information Technology Laboratory (ITL)
Vicksburg, Mississippi

Geotechnical and Structures Laboratory (GSL)
Vicksburg, Mississippi

Environmental Laboratory (EL)
Vicksburg, Mississippi

ERDC **FIELD OFFICES**

Permafrost Tunnel Research Facility
Fox, Alaska

Alaska Research Office
Fairbanks, Alaska

Lewisville Aquatic Ecosystem Research Facility
Lewisville, Texas

Contingency Base Integration Technology Evaluation Center
Fort Leonard Wood, Missouri

Field Research Facility
Duck, North Carolina

Corbin Field Station
Woodford, Virginia

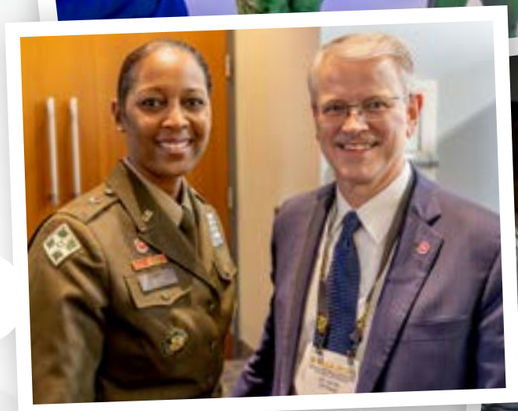
Extreme Exposure Station
Treat Island, Maine

ERDC International Research Office
London, England

CONNECTING THE DOTS

LEADERSHIP ENGAGEMENTS FOCUS ON NEW RELATIONSHIPS, COLLABORATION

Building strong relationships, fostering new partnerships and connecting with key projects and programs across the DOD, Army and USACE enterprise were among key strategic engagement goals for FY24. Senior ERDC leaders met face-to-face with leaders from each of USACE's Divisions, and also held high-level meetings with major commands in the Army and other services. In addition, events targeting new connections across the science and technology landscape have already started producing fruitful conversations about future collaboration with ERDC.



SELECT PRINCIPAL ENGAGEMENTS

Honorable Rachel Jacobson
Assistant Secretary of the Army, Installations, Energy, and Environment

Honorable Michael Connor
Assistant Secretary of the Army, Civil Works

Gen. James. E. Rainey
Commanding General, U.S. Army Futures Command

Honorable Dr. Aprille J. Ericsson
Assistant Secretary of Defense for Science and Technology

Mr. Chris Manning
Deputy Assistant Secretary of the Army for Research and Technology

Dr. Eric L. Moore
Deputy to the Commanding General, U.S. Army Combat Capabilities Development Command (DEVCOM)

Lt. Gen. Robert A. Rasch
Director of Hypersonic, Directed Energy, Space and Rapid Acquisition, ASA(AL&T)

Dr. Forrest Shull
Principal Director for Advanced Computing and Software, Office of the Under Secretary of Defense for Research and Engineering

Mr. Young Bang
Principal Deputy Assistant Secretary of the Army, Acquisition, Logistics and Technology

Mr. Joseph D. Martin
Director, Center for Excellence in Disaster Management and Humanitarian Assistance, DOD

Lt. Gen. Jody Daniels
34th Chief of Army Reserve and 9th Commanding General, U.S. Army Reserve Command

Maj. Gen. Brian E. Miller
Commanding General, 416th Theater Engineer Command

Maj. Gen. Gavin J. Gardner
Director for Logistics and Engineering (J4) U.S. Indo-Pacific Command

Dr. George Ka'iliwai III
Director of Requirements and Resources, U.S. Indo-Pacific Command (USINDOPACOM)

Brig. Gen. Todd M. Lazaroski
Commanding General, 412th Theater Engineer Command

Brig. Gen. Matthew Warne
Deputy Commanding General for Operations of the 412thTheater Engineer Command

Brig. Gen. Noel F. Palmer
Deputy Commanding General - Support, 412th Theater Engineer Command

Brig. Gen. Craig McPike
Reserve Director, U.S. Southern Command

LAUNCHING THEIR ERDC CAREERS

INTERNSHIP PROGRAMS REACH HISTORIC LEVELS DURING FY24

During FY24, ERDC hosted a record number of interns at its seven laboratories – 544 of them to be exact.

In an annual survey of these interns, 95 percent of the students, interns, and fellows said their internship provided a positive learning experience. In addition, 90 percent felt the laboratories they worked for provided a professional, yet fun, atmosphere.

ERDC's broad appeal caught students' attention from colleges and universities ranked among the best by U.S. News & World Report. Of those interns during FY24, 161 attend 30 of the "Top 50 Engineering" schools, such as Arizona State University, Cornell University and Texas A&M University.

One hundred and sixty students attend 27 of the "Top 50 National" schools, such as Dartmouth College, Harvard University and the Massachusetts Institute of Technology.

ERDC's effort to cast a wide net to find the most gifted students from all demographics is also reflected in the survey, as 119 students from Historically Black Colleges and Universities (HBCU)/Minority Serving Institutions (MSI) came on board during the year.

Several cadets and midshipmen from our nation's military academies also participated in internship programs and research projects.

Those interested in internships and career opportunities can send their resumes and transcripts to ERDCRecruitment@usace.army.mil.

544
INTERNS DURING FY24

161
STUDENTS FROM THE TOP 50 ENGINEERING SCHOOLS IN THE U.S.

119
STUDENTS ATTENDING AN HBCU/MSI

131
COOPERATIVE R&D AGREEMENTS
31 SIGNED IN FY24
CRADAS

103
EPAs
EDUCATIONAL PARTNERSHIP AGREEMENTS
20 SIGNED IN FY24

28
UNIVERSITY ENGAGEMENTS

Alcorn State University
Arizona State University
Baylor University
California Institute of Technology
Dartmouth College
Florida International University
Hinds Community College [Miss.]
Jackson State University
Mississippi State University
Mississippi Valley State University
Missouri University of Science and Technology
Prairie View A&M University
Rice University
South Carolina State University
South Dakota School of Mines and Technology
Southern University
Stony Brook University
Texas Southern University
University of Alaska Fairbanks
University of Delaware
University of Georgia
University of Hawaii
University of Illinois Urbana-Champaign
University of Louisiana at Monroe
University of Mississippi
University of Nebraska
University of Puerto Rico at Mayaguez
University of Southern Mississippi

A COLLECTION OF EXCELLENCE

ERDC'S AWARD-WINNING LIBRARY SUPPORTS GROWTH IN REPORT AND JOURNAL PUBLISHING

The ERDC Library is an extensive print and digital information hub with more than 300,000 items, including more than 28,000 online journals and a collection of online books and reports in excess of 34,000 titles.

The library supports the mission-related research needs of ERDC scientists and engineers at three physical locations with a centralized library catalog and website. It also hosts Knowledge Core, an online digital repository of ERDC-authored reports, pre-ERDC reports and datasets.

In FY24, the library supported researchers publishing 291 reports, a 40-percent increase over the previous year. In addition, researchers contributed 282 refereed journal articles to scholarly journals, the second-highest year since tracking began in FY12.

In May, the library was named the large library recipient of the Federal Libraries/Information Centers of the Year Award. During the award period in FY23, the library resolved nearly 900 complex research questions and 5,000 quick reference questions, in addition to working with more than 500 researchers on technical reports.

In addition, ERDC's library was the first in the DOD to take part in a partnership with Google Books – a digital database that contains the full text of books, magazines and other printed material, allowing users to easily access information.

To search ERDC's library, visit https://www.erdc.usace.army.mil/Library/

300,000+
DIGITAL & PRINT ITEMS IN ERDC LIBRARY

40%
INCREASE IN PUBLISHED REPORTS IN FY24

5,000
QUICK REFERENCE QUESTIONS ANSWERED

NEW LABORATORY LEADERSHIP NAMED

ERDC honored and celebrated the retirement of two long-standing leaders and laboratory directors in FY24, as both Dr. David Horner and Bart Durst retired after decades of distinguished federal service.

Both Horner and Durst became laboratory directors in 2015, with Horner leading ERDC's Information Technology Laboratory (ITL) and Durst leading ERDC's Geotechnical and Structures Laboratory (GSL).

In June, Nick Boone, who had served as a Senior Scientific Technical Manager (SSTM) and as Technical Director for Force Projection and Maneuver Support for Military Engineering R&D, was named to the Senior Executive Service (SES) and as director of GSL.

Boone had previously served as principal investigator and program manager in the Survivability Engineering Branch as a subject matter expert for fortifications, protective structures and weapons' effects on structures.

In July, Dr. Robert Moser, who had served as an SSTM, leading basic and applied research in several areas, including autonomy and robotics, computational mechanics, multi-scale modeling, and advanced manufacturing, was named an SES and director of ITL.

Prior to becoming an SSTM, Moser worked as a senior research civil engineer, principal investigator and program manager in GSL's Concrete and Materials Branch as a subject matter expert in advanced materials, infrastructure, modeling, data analytics, structural sensing and digital engineering.

DELIVERING INNOVATION

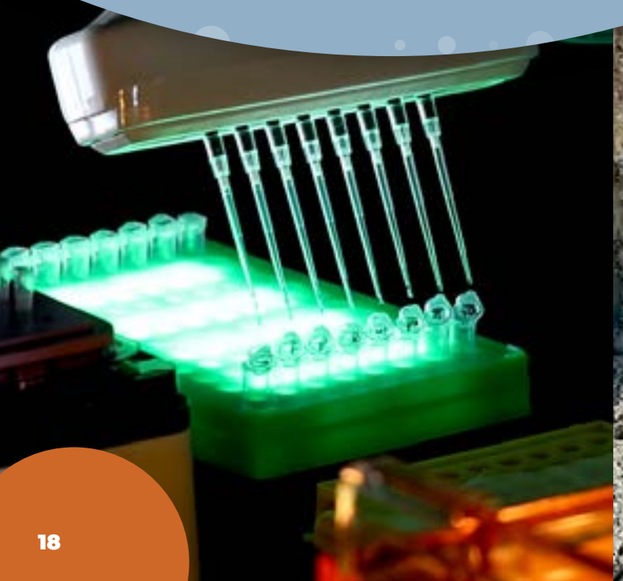
ERDC's world-class research mission is built on the goal of discovering, developing and delivering engineering solutions for our nation's most difficult challenges.

It is critically important that the technologies that come as a result of our research are quickly transferred from our research laboratories to the American people and to our customers, stakeholders and the men and women of our Armed Forces.

ERDC's Office of Research and Technology Transfer (ORTT) oversees the transfer of R&D technologies and products to several groups, including the DOD and its agencies, other federal agencies, private companies, academic institutions, state and local governments and more.

ORTT works to identify and facilitate opportunities to collaborate with others on research and to commercialize developed technologies, which is where ERDC's vital partnership with ERDCWERX is so valuable. As a neutral facilitator, ERDCWERX takes innovation to the marketplace through technology transition and transfer, providing a streamlined path to collaboration and contracting with ERDC.

In support of ORTT's mission, ERDCWERX seeks to expand networks to include industry and academia, simplify the process to engage with ERDC, promote and leverage ERDC's innovation strengths, and accelerate the progress of research, commercialization and other initiatives.



DEMONSTRATING **INNOVATION**

Technologies seek to enhance military operations, strengthen infrastructure resilience

ORTT supports ERDC's ability to advance cutting-edge technologies through critical demonstrations, showcasing a commitment to innovation and a focus on developing solutions that enhance military operational readiness, environmental resilience and infrastructure sustainability. These initiatives strengthen ERDC's partnerships and reinforce its role in turning research into real-world solutions.

Deployable Resilient Installation Water Purification and Treatment System (DRIPS) Demonstration

DRIPS combines advanced filtration with ultra-violet and chlorination treatments to purify graywater. This process reduces the need to transport large volumes of water, allowing units to produce their own clean water on-site, even in resource-constrained environments.

The combined system provides a field-based water purification solution that reduces dependence on external supplies, increasing operational flexibility.

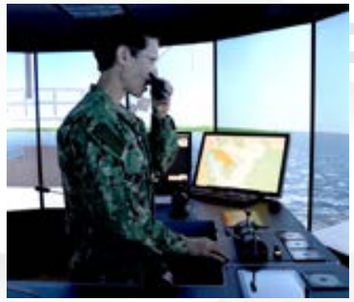
Combined with the Baffled Bioreactor and the Graywater Logistics Assured Deployable Installation Advance Technology for Operational Resilience system, DRIPS offers a solution to provide critical water resources for military operations in remote or compromised environments. A demonstration at Camp Shelby, near Hattiesburg, Mississippi, highlighted how DRIPS provides a scalable solution.

PODS/RAIL Over-Decking Capability Expansion for Tactical Gap Crossing

The Pier Over-Decking System (PODS), originally developed under the 2017 Port Improvement via Exigent Repair (PIER) Joint Capability Technology Demonstration, has evolved and proven to be an adaptable solution across multiple mission sets for the joint services.

In 2019, the Rapidly Available Interface for Trans-Loading (RAIL) program adapted PODS to provide an expeditionary ramp system for heavy armor vehicles. Building on this success, ERDC funded research into adapting the PODS/RAIL components into a mid-length tactical bridging asset.

This prototype bridge, deployable via Joint Light Tactical Vehicles or Marine Corps MTVR trucks, provides units a versatile, modular system capable of executing multiple missions. The development enhances maneuverability and sustainment, ensuring tactical units can traverse difficult terrain efficiently in combat environments.



U.S. Army Watercraft and Ship Simulator Software Comparison and Demonstration

The Watercraft Simulation Software Comparison and Demonstration compared two advanced simulation suites, HR Wallingford and K-Sim Navigation, to identify gaps and optimize the performance of simulation tools for tactical missions. These simulations are essential for preparing military units for complex watercraft operations that are crucial in both combat and peacetime scenarios. By comparing these systems side-by-side, the demonstration aimed to improve accuracy, functionality and overall ease of use in the simulation software. The integration of the Bridge Erection Boat and the Improved Ribbon Bridge into these simulations has ensured military personnel can rehearse tactical maneuvers in a safe, controlled environment, refining their skills and readiness for real-world operations.

STRONG **PARTNERS**

Relationship with ERDCWERX flourishes

ERDC has secured significant returns on investment through its Partnership Intermediary Agreement with ERDCWERX. This collaboration has been pivotal in driving ERDC's mission forward, yielding substantial financial and strategic benefits.

Since FY20, ERDCWERX has facilitated **more than $723 million in 129 awards** by ERDC to industry and academia.

$723 million IN CONTRACT AWARDS SINCE FY20

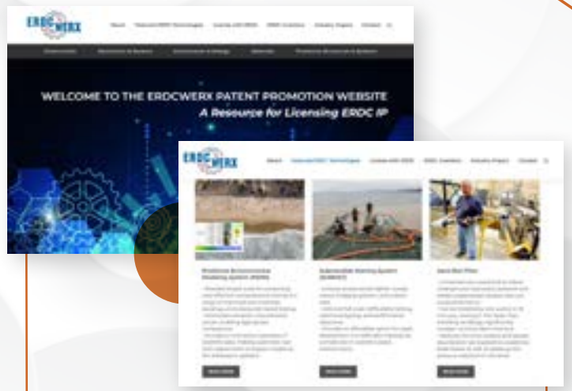
These contracts and agreements, directed through mechanisms such as Other Transaction Authority, Commercial Solutions Openings, Broad Agency Announcements, and Tech Challenges, represent a major financial return, ensuring that ERDC remains a leader in technology development.

26,000 Contacts IN ERDCWERX'S EXPANDING ECOSYSTEM

For ERDCWERX, it's all about making the right connection, with the right person, for the right opportunity.

Today, ERDCWERX's ecosystem includes **more than 26,000 contacts,** including key industry and academic leaders. Its online and social media platforms have attracted more than 49,000 unique visitors over the past year.

This expanded reach and networking capability has been crucial in fostering collaborations that drive innovation and accelerate project timelines for ERDC and its researchers.



ERDCWERX has been instrumental in commercializing innovations discovered and developed at ERDC, with 15 technology transfer agreements. This highlights the effectiveness of ERDCWERX's targeted strategies in promoting ERDC-patented technologies.

Notably, the creation of **ERDCinnovation.org** has featured **34 patents**, further enhancing the visibility and market potential of ERDC's technological advancements.

Scan for the ERDCWERX website

Scan for ERDC's Office of Technology Transfer

FROM DEVELOPED TO DEPLOYED

New technologies are becoming valuable tools for our military and other agencies

Interagency Collaboration Achieves Far-Reaching Perimeter Security Solutions

ERDC's perimeter security solutions, developed in collaboration with the Department of Homeland Security, are advancing both military and civilian protection. The Aggressor Vehicle Entry Readiness Technology, Ready Armor Protection Instant Deployment, and Deployable Expedient Traffic Entry Regulator systems provide rapid, adaptable defenses against vehicular threats. Originally designed for military use, these systems have been adapted for civilian applications, including deployment at the NFL Draft. Their successful use in urban environments highlights their effectiveness. This interagency collaboration has streamlined development, supported through cooperative research and development agreements and commercialization, and strengthened national security efforts across multiple sectors.

Sustainment Management System Team Revolutionizes Infrastructure Management

The Sustainment Management System (SMS) team at ERDC developed an asset management toolset that supports infrastructure maintenance across federal agencies. The SMS suite, including the BUILDER® software, has assessed nearly 2.3 billion square feet of federal facilities, providing essential data for infrastructure management. The team's focus on technology transfer through cooperative agreements and licenses has expanded the toolset's use beyond the DOD to other federal agencies and industry partners. The success of BUILDER® and the future release of the Enterprise SMS toolset are aimed at advancing infrastructure management and supporting national readiness.

INTERNATIONAL PARTNERSHIPS

ERDC has long celebrated its outreach and collaboration with foreign countries. In FY24, ERDC continued building international agreements that focused primarily on military-to-military research. The projects included new robotic platform research, geospatial research, better ways to operate in extreme environments, and further development in scientific computing technologies.

ERDC continually assesses the commercial potential of technologies developed in our research facilities and pursues patent, trademark or other intellectual protection for technologies deemed commercially viable. A new patent's term is 20 years from the date the patent's application was filed in the U.S. or, in special cases, from the date an earlier related application was filed. Developing patented technology is part of ERDC's mission, but the ability to quickly transfer that technology is critical.

Active Ice Management Systems and Methods

FY24 PATENTS

Tribometer with Real-Time Observation of Interface Processes
Inventor: Emily Asenath-Smith
Patent Number: 11,835,444

Classification Engineering Using Regional Locality-Sensitive Hashing Searches
Inventors: Ashley N. Abraham, Althea C. Henslee, Haley R. Dozier, Mark A. Chappell
Patent Number: 11,886,445

Active Ice Management Systems and Methods
Inventors: Nathan J. Lamie, Christopher J. Donnelly, Jordan M. Hodge, William T. Burch
Patent Number: 11,898,315

Roller Jack for ISO-Type Containers
Inventors: David M. Rogillio, Christopher M. Ables, Timothy P. Hynum, Jeremy N. Sellers
Patent Number: 11,993,453

Hardened Operable Window Systems and Methods
Inventors: John S. Judson, Jessica K. Fulk Vankirk, David V. Senior
Patent Number: 12,012,801

Portable Road Segment Wedge and Pin Connection and Method
Inventors: Gary E. Johnston, David A. Nguyen, Christopher M. Ables, Thad C. Pratt
Patent Number: 12,024,833

Modular Bathymetry Systems and Methods
Inventors: Jeremy A. Sharp, Zachary S. Smith, Duncan B. Bryant
Patent Number: 12,046,150

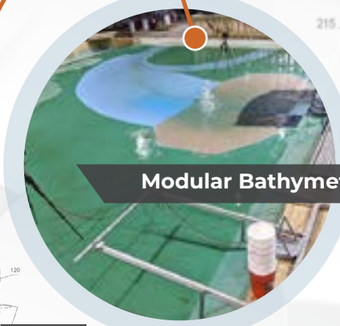
Acoustic Camera Systems and Methods for Large Scale Floe Analysis in Turbid Field Environments
Inventors: Brian C. McFall, David L. Young, Duncan B. Bryant, Timothy L. Welp
Patent Number: 12,072,220

Method for Treating Reducible Compound Residues Using Iron-Containing Bioreactor
Inventors: Heather Marie Knotek-Smith, David Lyman Smith
Patent Number: 12,077,461

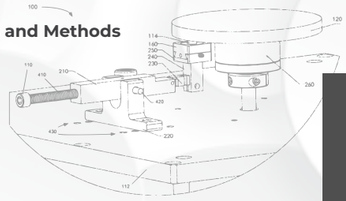
Hydrogel-Enzyme Systems and Methods
Inventor: Donald M. Cropek
Patent Number: 12,098,272

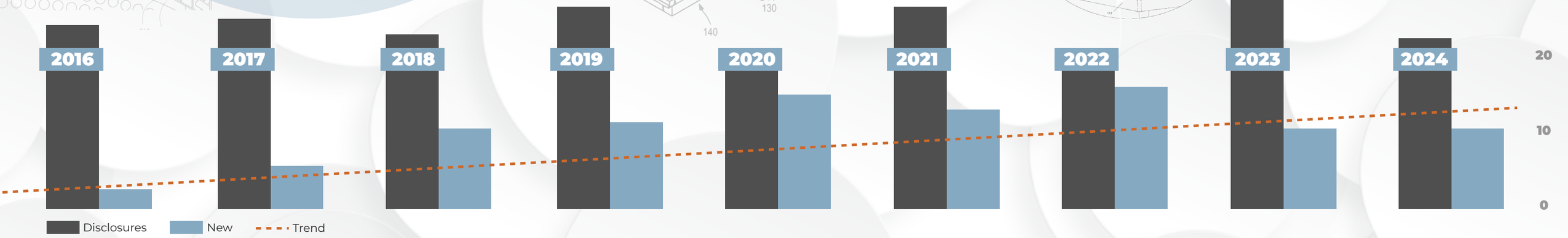
Bioreactor

107 ACTIVE PATENTS



Modular Bathymetry Systems





ONLY THE BEST

PREMIER FACILITIES SUPPORT R&D MISSION

To support ERDC's research and development efforts, millions in new facility construction were announced in FY24, along with significant other investments in upgrades, expansions and renovations.

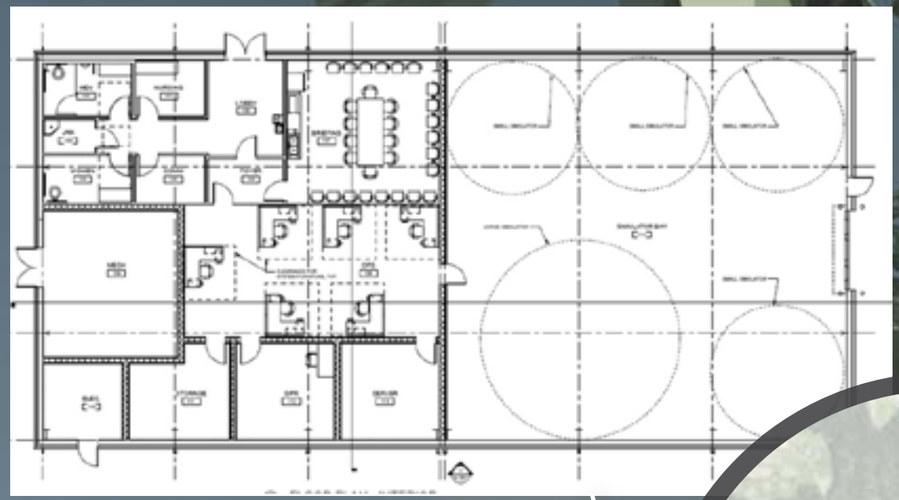
Thanks to the investment of more than $40 million, ERDC's research capabilities continue to remain cutting edge. Four new construction projects were announced in FY24 that will add to ERDC's inventory of research facilities, now valued at more than $2 billion.

Among the projects announced was the Permafrost Tunnel Operations Facility in Fox, Alaska, which is expected to be completed in November 2025. The facility will house office and meeting space, a visitor briefing area, and garage work and maintenance space. It will also house a laboratory with cold storage and a three-dimensional permafrost test bed.

A new Watercraft and Ship Simulator and Multi-Domain Operations Facility was announced and is expected to break ground in early FY25. The new facility will add to the simulator team's ability to support civil works and military operation missions across the globe.

In addition, a new Projectile Penetration Research Facility and a Military Pavement Research Facility were announced for ERDC's Geotechnical and Structures Laboratory.

These projects, along with continued construction efforts at several other laboratories and more than $8 million in additional renovations, ensure ERDC provides the environment needed to discover, develop and deliver innovative engineering solutions.



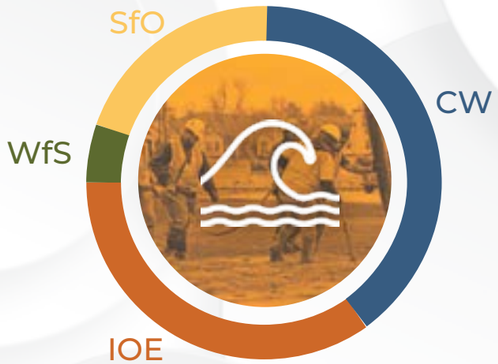
U.S. ARMY WATERCRAFT AND SHIP SIMULATOR

U.S. ARMY WATERCRAFT AND SHIP SIMULATOR

ALIGNMENT WITH USACE R&D STRATEGY

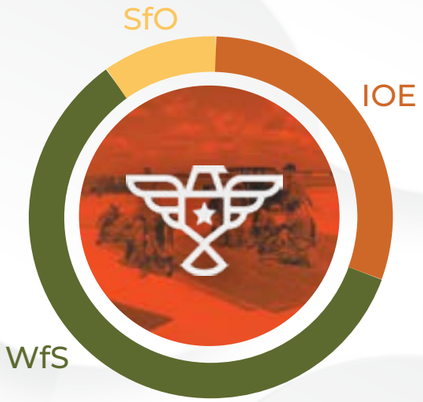
When released in November 2021, the USACE R&D Strategy laid out a framework that reshaped the focus and direction of its R&D community. ERDC's rich history and expertise well positions it as a leader for each of the strategy's 10 priorities. Since its founding in 1929, ERDC has leveraged its facilities, capabilities and most importantly, its people to confront the most difficult engineering challenges of our time.

- CW **CIVIL WORKS**
- IOE **INSTALLATIONS & OPERATIONAL ENVIRONMENTS**
- WfS **WARFIGHTER SUPPORT**
- SfO **SUPPORT FOR OTHERS**



MITIGATE & ADAPT TO CLIMATE CHANGE

Climate change and extreme weather require unprecedented innovation. ERDC plays a key role in the national response, including assessing DOD and national vulnerabilities to climate-change effects; accelerating transition to renewable and zero-carbon energy; sequestering greenhouse gas emissions; and protecting Warfighters and communities from severe weather impacts.



WIN FUTURE WARS

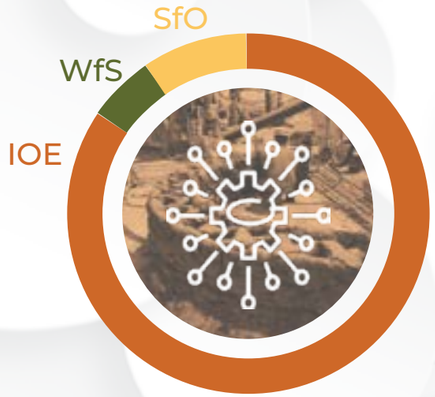
Future conflicts will occur at a longer range and greater speed than ever before. American Warfighters must be agile to rapidly respond to evolving threats from increasingly advanced adversaries. ERDC's foundation in geospatial research, military engineering, environmental characterization and advanced modeling and simulation will ensure our Armed Forces maintain overmatch and battlefield superiority.

MODERNIZE OUR NATION'S INFRASTRUCTURE

Much of our nation's civil and military infrastructure is beyond its original life expectancy. ERDC is developing new materials and practices, advanced maintenance and construction techniques, new structural designs, innovative data capture analysis, computer models, and other methods to ensure America's infrastructure is resilient, safe and affordable to support tomorrow's demands.

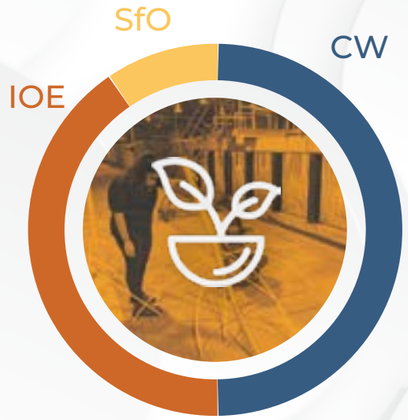
SUPPORT RESILIENT COMMUNITIES

Local and regional communities are facing growing hazards to commerce, human and ecosystem health, water supply, transportation, and other functions. ERDC provides open-access data and technologies to quantify present and future hazards and evaluate alternatives to support resilient communities while meeting national goals, such as environmental justice and social equity.



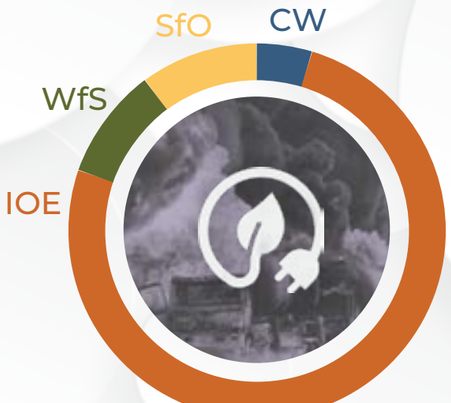
ENABLE SMART & RESILIENT INSTALLATIONS

Army installations must be more resilient in the face of constantly changing missions and threats. ERDC is developing advanced technologies and analytical capabilities and integrating smart features that will increase efficiency; enhance Soldier and family well-being; save money, water and energy; and make installations more resilient to hazards.



ENSURE ENVIRONMENTAL SUSTAINABILITY & RESILIENCE

ERDC is developing design guidelines and techniques for executing projects that maximize environmental benefits. This includes innovative technologies and approaches that improve and sustain ecosystems while supporting the Warfighter and civil works missions.

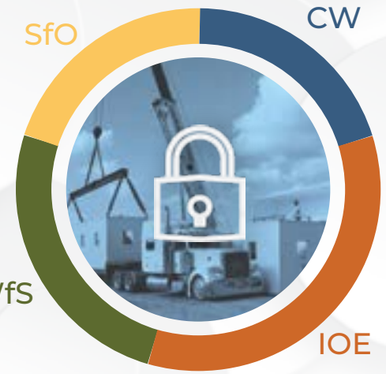


SECURE RELIABLE INSTALLATION ENERGY

Military installations and missions must redesign their energy systems and move from carbon-intensive fuels while increasing resilience and grid independence. As extreme weather tests the strength of power-generation assets, ERDC is developing cyber-secure technologies that provide renewable and resilient energy for Army installations.

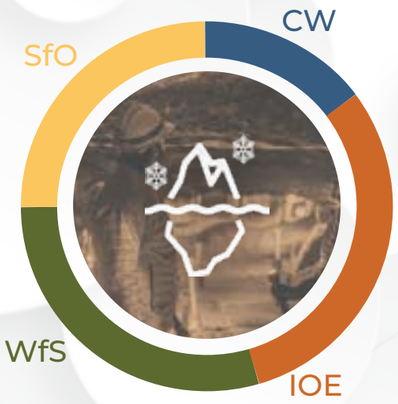
REVOLUTIONIZE & ACCELERATE DECISION MAKING

Decision makers must use timely and reliable datasets to understand societal and environmental threats to operational capabilities faster and more accurately. ERDC is developing decision-support solutions powered by advances in big-data analysis, machine learning, artificial intelligence, computer simulations, autonomy and robotics.



IMPROVE CYBER & PHYSICAL SECURITY

Attacks on our nation's critical infrastructure by our adversaries have become more frequent and severe, including sophisticated cyberattacks. Through innovations in risk detection, mitigation and reduction, ERDC is developing technologies that ensure critical infrastructure remains safe.



PROTECT & DEFEND THE ARCTIC

As Arctic ice melts, competition for resources and influence in this strategically significant region increases. ERDC leads USACE, Army and DOD efforts to understand and adapt to changes in permafrost, snow, sea ice cover and ecosystems to promote mission resilience, military operations and polar region navigation.

CIVIL WORKS

Facing such increasing civil engineering stressors as aging infrastructure, climatic extremes and new environmental concerns, USACE must discover new methods to overcome new challenges.

This includes both rapid innovations to solve time-sensitive operational challenges, as well as transformative technologies and methodologies to address infrastructure resilience, ecological health, disaster preparedness and other long-term strategic needs. Impactful Civil Works R&D provides greater returns on the investments being made by the American people, enhancing the nation's water resources, enabling economic growth and promoting public safety.

NAVIGATE

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Stopping the Spread: Hydrilla research aims to eradicate aquatic nuisance ..... Page 36

Ripple Effect: Large commercial ship wakes are powerful, unpredictable ..... Page 38

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TURNING A **PROBLEM** TO **POTENTIAL**

HABITATS converts algae collected from waterways into fuel source

The 2018 Water Resources Development Act authorized USACE to implement a research and technology demonstration program focused on scalable approaches for Harmful Algal Bloom (HAB) detection, prevention and management intended to reduce HAB frequency and its effects on our nation's water resources.

ERDC, in collaboration with other agencies, developed an innovative mitigation approach called the Harmful Algal Bloom Interception, Treatment, and Transformation System (HABITATS). The system collects HAB-impacted water, then rapidly separates the algae using dissolved air flotation. It then returns the clean water back to the environment.

By physically removing algae from the water, this approach removes both nutrients and potential toxins that accumulate in algal cells. The removed algae is later converted into fuel feedstocks using a process called hydrothermal liquefaction, which also provides rapid, energy-efficient destruction of any algal toxins.

Innovative system mitigates the threat posed by Harmful Algal Blooms

STOPPING THE SPREAD

Hydrilla research aims to eradicate aquatic nuisance

Hydrilla, which the U.S. Fish and Wildlife Service lists as the "world's worst invasive aquatic plant," was first identified in the Connecticut River in 2016. It has rapidly spread into the river's many coves, tributaries and boat basins – posing considerable risk to navigation, flood control, hydropower, recreation and aquatic ecosystems. And because this strain of hydrilla is genetically distinct from other known strains, new treatment methods are needed.

The USACE New England District and ERDC's Aquatic Plant Control Research Program are leading a study to better understand and treat this unique hydrilla strain. Researchers have studied its growth patterns and developed a detailed understanding of its weak points and effective treatment strategies. After completing laboratory testing of the efficacy of herbicides approved for safe aquatic use by the U.S. Environmental Protection Agency, researchers conducted field tests in the Connecticut River during the summer of 2024.

Lessons learned will be applied to treat the hydrilla to suppress its growth, diminish its negative effects, and benefit the Connecticut River's natural ecology and the local economy.

Hydrilla has been called world's worst invasive aquatic plant

RIPPLE EFFECT

Large commercial ship wakes are powerful, unpredictable

Today's commercial vessels are longer, wider and deeper, and their wakes are more powerful and complex. These wakes cause flooding and coastal erosion. They can allow the intrusion of saltwater into freshwater environments, shorten the timelines for needed dredging and accelerate receding shorelines along our nation's waterways and maritime ports.

As these ships grow larger, and the traffic around the nation's ports increases, the complexity of these wakes leads to uncertainty on how they will impact the need to expand and maintain navigable waterways in the future.

A solution lies with FUNWAVE, a numerical wave model that simulates ocean surface wave propagation in shallow and intermediate water, such as harbors and inland waterways. Developed and updated by ERDC, the model can be used to study complex coastal processes, such as tsunami waves, coastal inundation, wave propagation and surf zone-scale optical properties.

High-fidelity modeling, such as FUNWAVE, can save USACE time and money in planning and pre-construction of critical navigation infrastructure. The tool can be accessed remotely via a web browser and requires minimal training.

FUNWAVE

High-fidelity model can help
save time and money
in navigation infrastructure planning

KEEPING A CLOSE EYE

Camera systems allow for cost-effective critical infrastructure monitoring

Traditional methods for assessing infrastructure are costly, challenging and infrequent due to inaccessibility.

To overcome these challenges, ERDC research is leveraging imagery collected by inexpensive digital cameras along with computer vision and machine learning algorithms to monitor and evaluate structural health of critical infrastructure.

The techniques, referred to as "vision-based monitoring," allow for the measurement of large areas of a structure while only needing a clear line-of-sight.

By eliminating the need to physically access infrastructure, vision-based monitoring provides a cost-effective method to complement traditional manual inspections and contact-based structural health monitoring.

When coupled with state-of-the-art techniques, these vision-based approaches enable diagnostic and prognostic analysis of structural performance, inform metrics on structural condition and provide decision support information for prioritizating often-limited maintenance funding for critical infrastructure.

Key applications include monitoring the state of stress in structural components; automated identification of common damage types on structures, such as cracking and corrosion; and monitoring structural performance metrics from imagery acquired during normal operations.

Vision-based monitoring allows for

cheaper, more accurate

structural condition assessments

VIRTUAL BEFORE REALITY

Simulations put waterway infrastructure designs to the test

The Gulf Intracoastal Waterway (GIWW) is a 1,300-mile route along the Gulf of Mexico that is one of the nation's most vital shipping routes based on the tonnage and commodoties shipped.

A 98-mile portion of the GIWW, from Morganza, Louisiana, to the Gulf of Mexico, is the focus of the USACE Morganza to the Gulf of Mexico project, which aims to bolster flood control and infrastructure components, reducing threats posed by hurricanes to industries and residents in the region.

The U.S. Army Watercraft and Ship Simulator, based at ERDC, has played a key role in this project, allowing engineers and industry experts to test designs of planned infrastructure components along the waterway, making sure they meet maritime and flood protection goals.

Seasoned pilots with experience on the GIWW used the simulator to help determine optimal gate sizes, impacts on navigation and overall project effectiveness.

The simulations have given the USACE New Orleans District vital feedback on the effectiveness and safety of the designs through technical reports and track plots to help inform key decisions about the best flood protection structures in the area.

Use of simulator helps

reduce risk, costs

of infrastructure investments

WHEN IT SNOWS, IT POURS

Understanding the flood risk of warm rain on existing snowpacks

Scientists are working to better understand and model the phenomena called rain-on-snow, in which warm rain falls on existing snowpacks, often accelerating the speed in which that snow melts and increasing the risk of flooding in nearby areas and communities.

In the United States, data has shown earlier and earlier snow melt seasons. What had normally been observed in late April and May has now started occurring as early as March, with rain falling on those snowpacks that are closer to the melting point.

Through research at ERDC and the Hydrologic Engineering Center, USACE is working to develop tools that improve the accuracy to forecast these events and estimate potential runoff.

Rain-on-snow events are common on mountain slopes within the snow transition zone in the mountainous West but are also a concern in other mountainous regions across the United States. This research is also of critical importance as changes in climate cycles appear to be altering the timing of these events.

Changes in climate are leading to
earlier snow melt seasons
across the United States

TESTING THE FORCES OF NATURE

Centrifuge provides critical data into the stresses placed on I-walls, levees

I-walls are critical components in the structure of approximately 10 percent of USACE levee systems. They are composed of metal sheet piles driven into levees made of locally available soil, allowing higher water retention than levees alone.

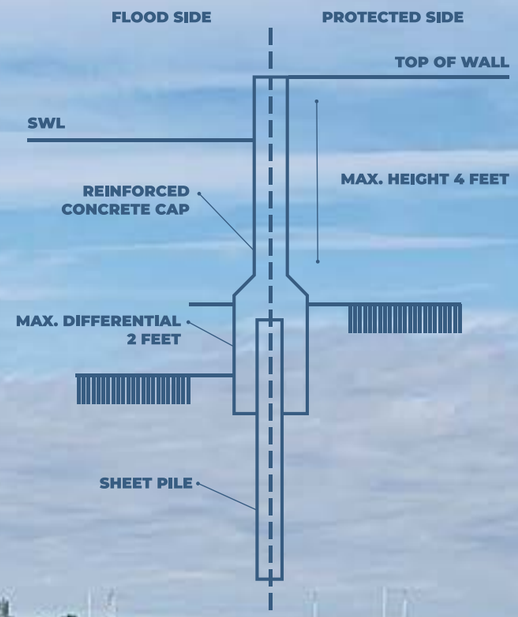
In New Orleans specifically, more than 70 I-wall systems are in place.

To test these components and to detect any weak points in their ability to mitigate floods, ERDC used its Centrifuge Research Complex (CRC). Researchers analyzed scaled versions of I-walls to improve numerical models and better understand the forces that stress I-walls.

Originally proposed as a full-scale experiment, ERDC leveraged the unique capabilities of the CRC to test nine scenarios in a controlled environment with instruments that can sense the entire testing area. This allowed researchers to test these nine scenarios in a third of the time it previously took to test one.

The scenarios also included testing for variable loads related to flooding.

Working in collaboration with the St. Paul and New Orleans Districts, researchers have collected important data on the structural and geotechnical performance of deteriorating I-walls.



Use of centrifugal force
drastically reduces time
to test infrastructure components

SMALL ALLY, BIG RESULTS

Deployment of thrips helps restore critical coastal ecosystems

Invasive plant and wildlife species, such as the Brazilian Pepper Tree, can overwhelm local flora and fauna, threatening ecosystem collapse. Introduced to the United States as an ornamental in the 1840s, the Brazilian Pepper Tree has a high germination rate and thick canopies that outcompete local flora for resources.

Hoping to better contain this invasive plant, ERDC researchers are studying the use of Brazilian Pepper Tree Thrips, tiny insects that gravitate to the invasive plant and are not a significant stressor to local plants and wildlife.

Thrips were approved for use in 2019 and have been effective in managing the noxious plant species in coastal and estuary systems in Florida when combined with traditional conservation efforts like manual extraction and herbicides.

Hoping to build on this success, ERDC researchers are now deploying this miniscule ally in Texas, studying how effective the insects are in this new environment.

Lowering Brazilian Pepper Tree propagation will help restore ecosystems along the Texas coastline.

Thrips attack invasive plant species

without harming local plants, wildlife

EXPANDING THE PLAYBOOK

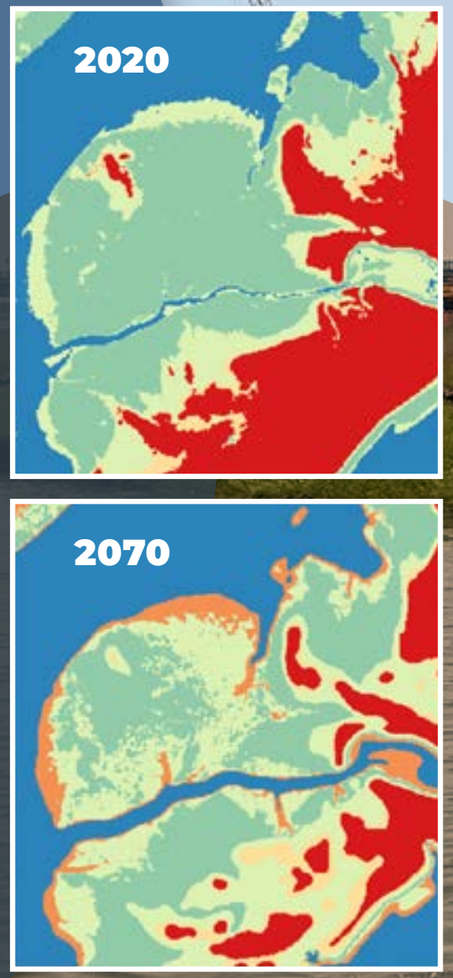
Ongoing research effort makes it easier to evaluate alternative management strategies

Models that evaluate physical processes and models used for landscape changes and ecological evolution currently operate separately. When these models are used independently, they do not capture the complex feedbacks driving system change and do not provide the fidelity USACE needs to evaluate both short-term and long-term benefits and risks of alternative management scenarios.

To address this need, USACE R&D has developed a framework that integrates ecological, hydrodynamic, transport and morphology modeling into a single system that better captures the complexity inherent in natural systems. Working in collaboration with the USACE Philadelphia District, the team used data collected from the Seven Mile Island Innovation Laboratory to demonstrate the coupled model.

Coupling these models will provide the required fidelity to evaluate benefits, risk and sustainability of strategies that are designed to improve wetland habitat.

This new framework will make it easier for planners to consider alternative solutions for water, sediment and habitat management, allowing them to integrate multidisciplinary approaches to support navigation, ports and harbors while also restoring critically important ecosystems.



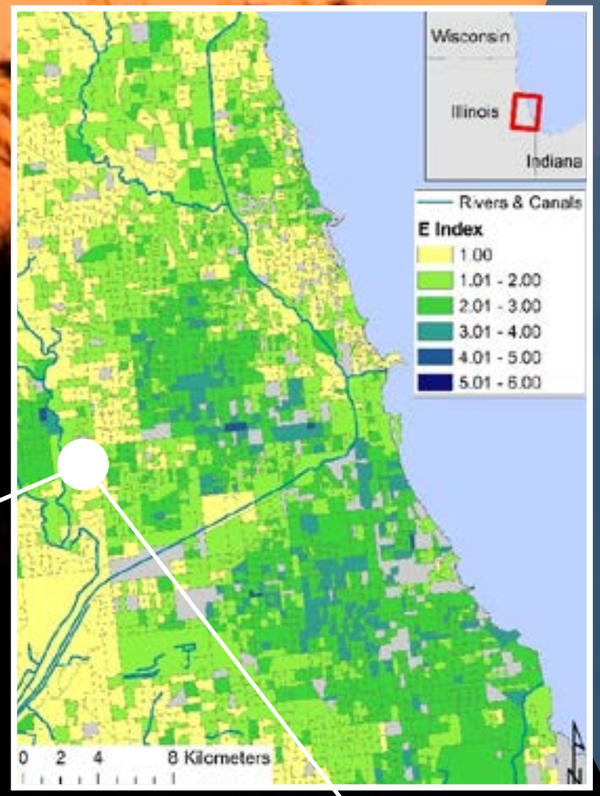
Land cover type in year 2020 (top) and predicted in year 2070 (bottom) under USACE medium RSLR scenario.

SMIIL marsh edge (image from Thomas Huff)

New framework enables greater use of natural and nature-based features

TESTED & REFINED

Ecosystem framework provides holistic picture of project impact



USACE planners need better methods to assess and quantify the full range of benefits or consequences that result from its water resources projects. Existing methodologies do not assess all levels of potential impacts, such as environmental, economic and social.

To provide a more complete picture for planners comparing various courses of action, USACE R&D developed the Ecosystem Goods and Services (EGS) framework.

Applying the best available science in a systematic and repeatable way, and leaning into the expertise of USACE planners and academics in the EGS field, the team developed a model for how ecosystems provide services, and they tested and refined the framework through case studies across a variety of settings and project types. The framework applies economic principles, even when outcomes are not being measured in monetary units. It has recently been applied to dredged sediment placement benefit evaluation.

This effort will improve USACE's understanding and ability to consider ecological benefit to humans and will lead to the development of new tools that will make EGS assessment in planning easier and more consistent.

Effort will improve USACE's ability to
consider ecological benefit to humans

KEEPING **SALTWATER** AT BAY

Study supports Panama Canal efforts to preserve, protect fresh water

The long-term sustainability of regional drinking water and the threat posed by frequent intrusions of saltwater in the Lake Gatun region of Panama is the focus of a study involving the Panama Canal authorities, the USACE Mobile District and several research teams and laboratories from ERDC.

Since 2016, when operation of the NeoPanamax – locks in Agua Clara designed to accommodate larger commercial vessels – began, the rate of saltwater intrusions into Gatun Lake, a source of freshwater for the region, has increased. With expected changes in environment and more demands on canal operations, the stress on those freshwater sources is forecast to grow stronger over the next 50 years.

The Integrated Water Resource Management Feasibility Study seeks efficiencies in lock operations that reduce freshwater demands – including ways to diminish the amount of water used per lockage – to ultimately reduce the saltwater mass intruding into Gatun Lake.

Neopanamax Locks (Autoridad del Canal de Panamá photo)

Image by Google Earth

Research looks to
REDUCE FRESHWATER DEMANDS
and saltwater intrusion

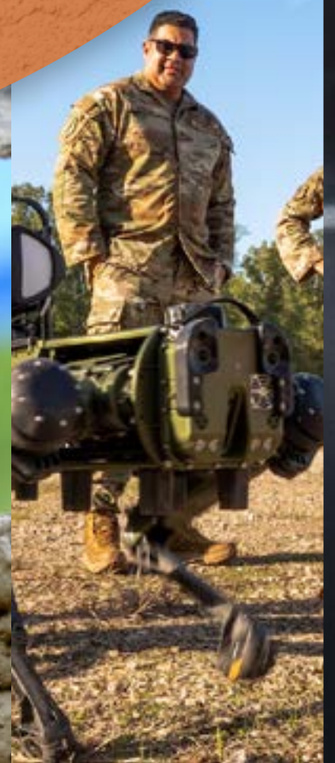
USACE R&D AREA

INSTALLATIONS & OPERATIONAL ENVIRONMENTS

With an eye on both innovation and stewardship, the USACE Installations and Operational Environments portfolio is focused on improving the reliability, efficiency and effectiveness of military installations and protection against environmental threats where Warfighters operate.

This includes efforts to support Army modernization and strengthen readiness; deliver modern and resilient facilities and services; protect Soldiers, communities and the environment; and ensure resilient and sustainable resources.

Pioneering research accelerates technological innovation to meet current and future mission and project delivery demands, specifically in the areas of enabling smart and resilient installations and securing reliable energy and water delivery systems both on and off base.



NAVIGATE

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A 'Jaqi' of All Trades: AI helps construction community nail down the right answers ..... Page 76

THREAT ASSESSMENT

Understanding infrastructure challenges posed by popular electric vehicles

The increasing number of electric vehicles (EVs) in national and international fleets brings with it a safety concern that existing infrastructure may not be able to handle.

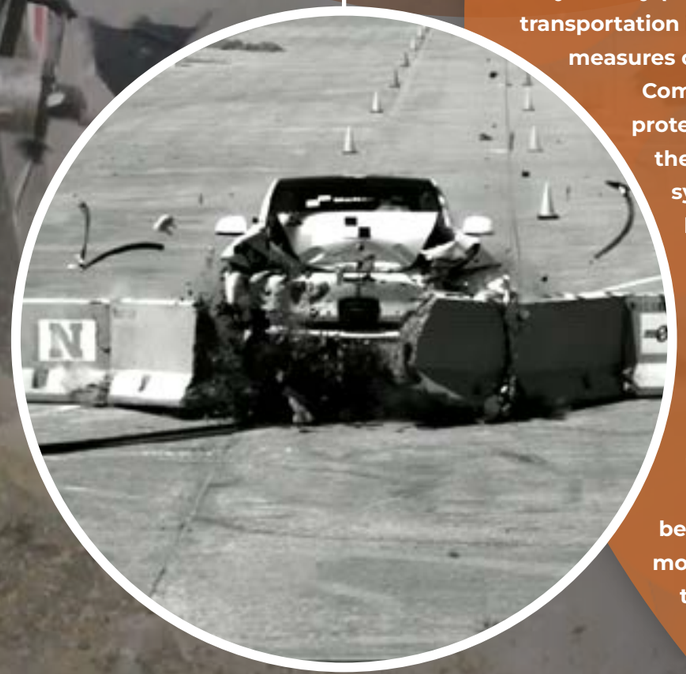
EVs are typically 20- to 50-percent heavier than gas-powered vehicles, and usually have significantly lower centers of gravity, which could lead to catastrophic failures of existing barriers.

Prior to the work conducted by ERDC and its partner, the University of Nebraska-Lincoln's Midwest Roadside Safety Facility (MwRSF), the preparedness of standard transportation infrastructure and current mitigation measures of hostile vehicles was unknown.

Combining ERDC's expertise in force protection and hostile vehicle mitigation and the MwRSF's experience in roadside barrier systems and other transportation safety hardware, a unique experimental program involving EV crashes into roadside safety barriers and hostile vehicle mitigation measures was designed and executed.

This program is the first step in assessing national infrastructure and DOD readiness in relation to changes in the vehicle fleet.

The data from these experiments will be used in conjunction with computational modeling and additional experiments to understand military and defense implications, with a focus on mitigation and control of hostile vehicles.



Electric vehicles are up to
50-percent heavier
than gas-powered vehicles

BETTER TREATMENTS, MORE POWER

Coatings research helps support solar energy production

Snow, ice, dust and other substances can significantly impact solar panel efficiency, creating a layer that can scatter and absorb light.

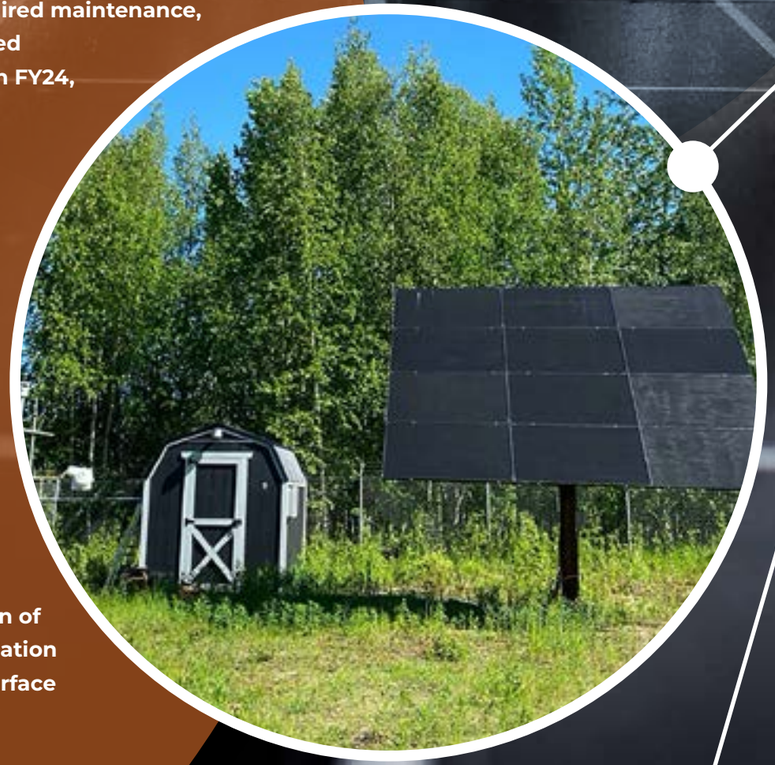
These substances can reduce the efficiency and output power of a solar panel by as much as 50 percent, requiring an increase in operating costs associated with solar panel maintenance.

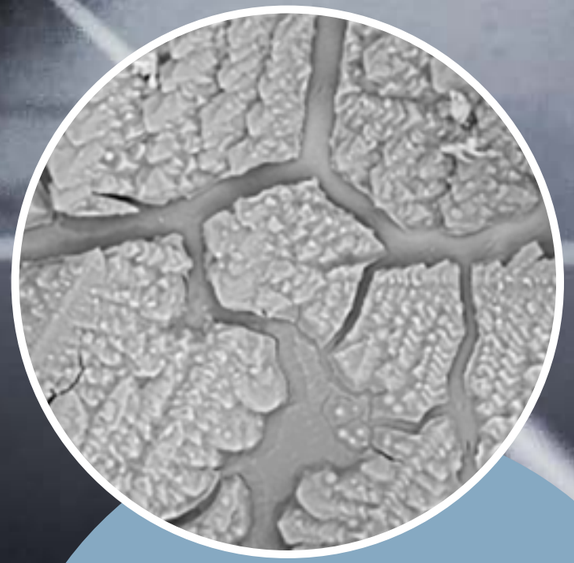
To help reduce those costs and required maintenance, chemical coatings can be applied to shed substances as they meet solar panels. In FY24, ERDC researchers released results of a study that examined the effectiveness of three commercial coatings that use self-cleaning glass technologies.

Over nine months of testing, incoming solar radiation was continuously monitored, and snow events were logged to estimate power production capabilities and surface accumulation for each panel.

The study did show the coatings helped decrease the accumulation of snow and other substances, which would help solar panels maximize their power production potential.

By maximizing the power production of solar panels by decreasing the accumulation of light scattering substances on the surface has universal importance to the field of renewable energy.





Testing showed coatings help maximize the power production potential of solar panels

PREDICTING, SLOWING • THE SPREAD

IRAMI provides decision makers actionable data during infectious outbreak

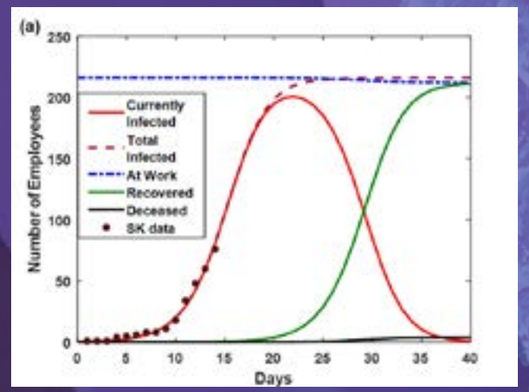
An ERDC multi-laboratory team has launched a project that seeks to revolutionize the way installations across the DOD prepare for and combat respiratory infections, with the potential to improve public health across the globe.

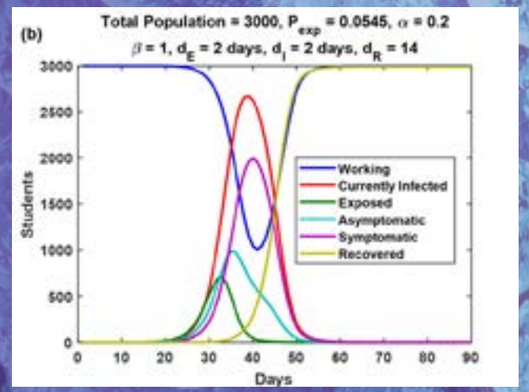
The Infection Risk Assessment on Military Installations (IRAMI) project aims to quantify the spread of infections and evaluate their impact on military personnel. By estimating the time, intensity and overall duration of a respiratory infection outbreak, the tool – when released – will allow leaders to make informed choices regarding mitigation policies. It is also expected to be able to predict the number of personnel present at work each day during an infectious outbreak.

Initially demonstrated during COVID-19, IRAMI can be used to predict the spread of flu, respiratory syncytial virus and other infectious diseases.

The U.S. Army's Fort Huachuca in Arizona served as the pilot site for the project and demonstrated that the modeling helped provide useful, actionable information for decision makers to stop or mitigate the spread of infection outbreaks.

Further applied research is needed and will be dedicated to studying the clustering population structure which applies to real installations and their personnel.





IRAMI will enable
precise mitigation
against infectious diseases

VIRTUAL MANAGEMENT, REAL-WORLD RESULTS

Real property monitoring enhances mission readiness, investment

The Enterprise Sustainment Management System (ESMS) is a comprehensive, data-driven tool developed for all real property asset management stakeholders to improve how they manage infrastructure.

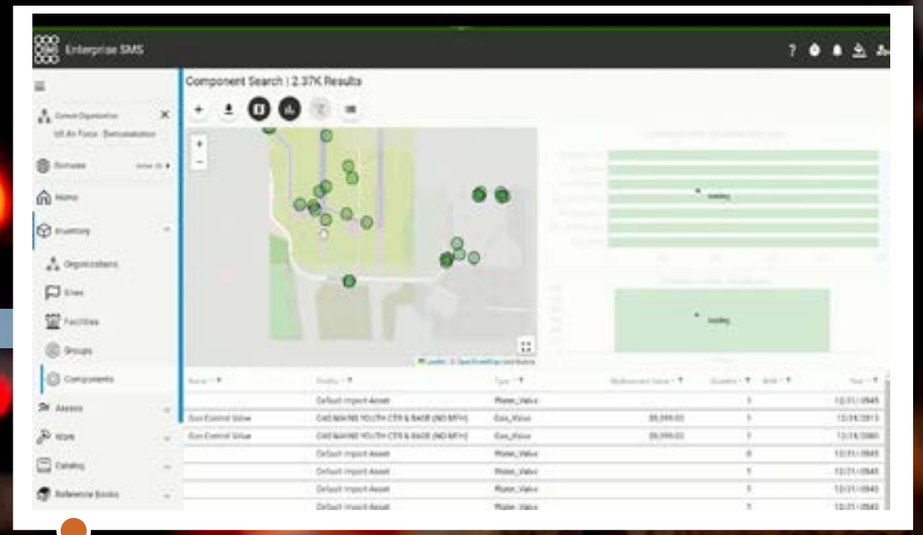
Managed by the Sustainment Management System Technical Center of Expertise, based at ERDC, ESMS consolidates multiple asset management systems, such as BUILDER and PAVER, into a unified platform that tracks the condition of facilities at the component level. This system offers more precise and objective assessments compared to older, subjective methods.

With predictive modeling, ESMS anticipates when repairs or replacements are needed, allowing for better resource allocation and cost savings.

As a new platform, it integrates various domains from buildings to railroads under one system, offering a holistic view of infrastructure management.

With a growing dataset of real property component data, there are opportunities for further research on component degradation behavior through AI/ML that will provide refined lifecycle models for more accurate condition and work candidate projections.

This approach improves efficiency and enhances mission readiness by ensuring critical assets are maintained and ready for use.



Data-driven digital platform provides precise, cost-effective infrastructure management

BREAKING THE MOLD

Team takes aim at mold, corrosion in munition storage facilities

Safeguarding the nation's munitions and explosives, Earth Covered Magazines (ECM) are critically important to the DOD. However, as these facilities age, they face growing threats from mold and corrosion, which can affect the munitions and rounds, increasing the risk of misfires, malfunctions or jams.

To mitigate this risk, experts from the USACE Paint Technology Center, Technical Center of Expertise (PTCx), based at ERDC, are partnering with the Army Corrosion Control, Protection Executive Office, Joint Munitions Command and the USDA Forest Products Laboratory.

Working at Crane Army Ammunition Activity in Indiana, the team is taking a multifaceted approach to care for these shelters, including such steps as monitoring moisture levels, checking sensors and testing the most effective cleaning products.

The long-term goal for this study is to increase readiness of munitions by mitigating mold and corrosion through new technology and providing guidance for more robust policy and procedures.

PTCx is also working with the Sustainment Management System to see how the web-based software application can work with ECM-related data to provide critical information to decision makers.

New techniques seek to
increase readiness
of nation's munitions, explosives

REDEFINING LIMITS

Research aims to expand acceptance, adoption of additive construction

Advances in additive construction have enabled the ability to produce structures. USACE R&D has been a leader in this field, demonstrating and testing the capability to print custom-designed expeditionary structures on demand, in the field, using locally available materials.

These structures – including buildings, obstacles, gap crossings and culverts – carry great potential in military deployment or disaster relief scenarios when personnel, time, materials and equipment are limited. However, before widespread acceptance and adoption, standards, guidelines and codes must be developed.

Leveraging its extensive additive construction expertise, USACE R&D has led the charge, taking lead roles on document development in ACI, ASTM, ICC, NATO and the UFC. During the past year, ERDC hosted two workshops alongside the National Institute of Standards and Technology to bring fieldwide alignment on standards development and reduce redundancy of efforts. Similarly, ERDC and ERDCWERX hosted a workshop focused on alignment across the DOD for additive construction in military construction.

ERDC's international impact is exemplified through keynote speakers on critical structural and material design considerations for additive construction during the International Conference on Concrete and Digital Fabrication in Munich, Germany.

These efforts will influence the development of methodologies and guidance throughout industry.

Additive construction carries great potential to reduce logistics when personnel, time, materials and equipment are limited

WHAT'S OVER THE HORIZON?

Installations require better, faster weather forecast models

Military installations are critical control centers supporting global operations planning, projection and sustainment with access to a massive volume and array of data. This complicates the task of preparing weather intelligence for installation leadership to facilitate timely decisions in advance of dangerous weather events.

An accurate numerical weather prediction (NWP) modeling framework is a major component of decision support at smart military installations.

ERDC is developing the Weather Research and Forecasting model for Fort Moore, Georgia, and Fort Carson, Colorado, using a high-performance computing platform, which may provide increased forecast fidelity above and beyond existing NWP products.

Real-time, event-driven meteorological data is key to developing machine learning methodologies. These tools automate the processes used to issue watches, warnings and advisories, and deliver enhanced guidance to improve speed and accuracy in the execution of mission-critical decisions.

This research improves the scheduling of installation activities that may be impacted by severe weather events to keep military and civilian personnel safe.

High-performance computing capabilities
support faster, more accurate
weather forecasts for military installations

ADVANCE WARNING

Program gives insight into potential toxic threats on the battlefield

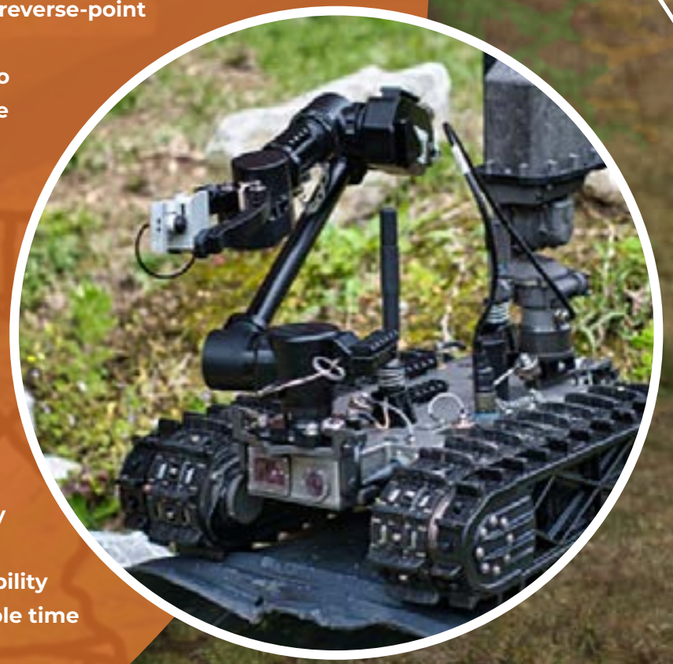
The threat to the Warfighter is not always visible to the naked eye. Toxic chemicals have been used in battlefields throughout history and in recent conflicts.

However, the Army did not have capabilities to locate and estimate the effects of common toxic industrial chemicals and materials for mission planning.

The ERDC Understanding the Environment as a Threat program provides mission planners the capability to locate industries; identify toxic industrial chemicals and materials with updated toxicity profiles; predict the threat radii in the air, soil and water; assess routing options using hazard-based weighed risks; and conduct subterranean reverse-point sourcing of adversaries.

The program develops tools to address this gap and advance the Intelligence Preparation of the Battlefield process through integration of knowledge, awareness, detection and planning of toxic industrial chemicals and materials, as well as emerging biothreats.

These tools allow leaders to take a holistic approach to analyzing the operational environment and result in successful operations. This ability to assess these threats reduces force protection and maneuverability risks, saving commanders valuable time and ensuring Soldier safety.



The ability to assess chemical, environmental threats ensures Soldier safety, saves commanders time

EXTENDED ENERGY, *LONGER MISSION*

Small robotic systems get boost from innovative hydrogen fuel cells

Soldiers serving at the tactical edge on the battlefield or securing military installations require advanced technologies to enhance their effectiveness. A collaboration between Honeywell and Ghost Robotics, and managed by ERDC, addresses this need by integrating a proton exchange membrane (PEM) hydrogen fuel cell into small, quadruped unmanned ground vehicles (qUGVs).

The innovative fuel cell technology seeks to replace conventional batteries, which could significantly extend the operational range of these robotic platforms. Current battery life restricts qUGVs to approximately two hours of mission time. However, with the PEM fuel cell, mission duration may be increased to more than eight hours, marking a substantial improvement in energy density and endurance.

Additionally, the project includes the development of a portable hydrogen refueler designed for in-field use.

Future research is planned for hydrogen produced through various methods, including renewable sources and electrolysis in remote areas. Safety is a critical focus, ensuring secure refueling practices.

Hydrogen fuel cell technology
extends qUGV missions by 4X

A 'JAQI' OF ALL TRADES

AI helps construction community nail down the right answers

The Construction Management Administration Application (CMA²) provides a single website where construction management professionals can access training, best practices and construction management articles to guide their work in the field.

To build CMA²'s repository of process resources, the Construction Management Innovation Office (CMIO) first needed to identify vetted construction management training and reference documents. After assembling these resources, the team found it had more than a thousand documents to process.

CIMO and ERDC developed Jobsite-Assisted Quality Intelligence (JAQI), a large-language AI model that can sort through high volumes of information and respond to queries within minutes with a written answer that feels natural to readers. Each query response within JAQI returns source document references so subject matter experts can quickly review the output.

CMIO helps establish a culture of construction management (CM) innovation within USACE, raising the standard of USACE CM practices through the project lifecycle, and transitioning the latest technology from industry and the research lab into practical use by USACE construction project delivery teams.

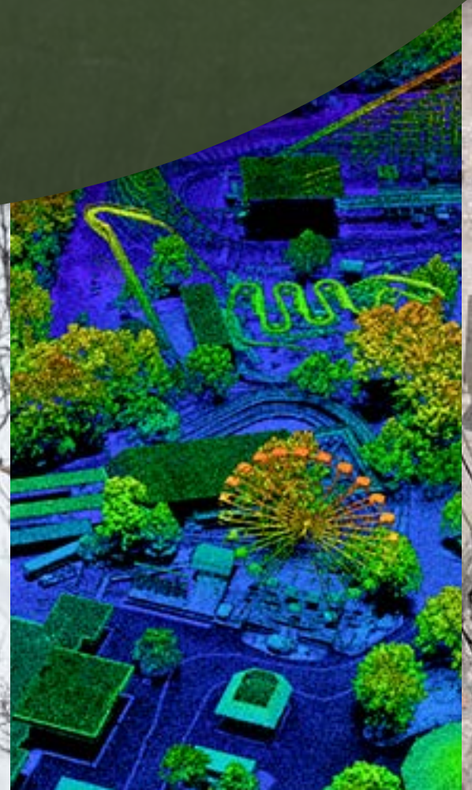
JAQI can sort through volumes of information, respond within minutes

WARFIGHTER SUPPORT

USACE applies its engineering and scientific expertise to support the Warfighter by improving all aspects of mission planning, preparation, execution and sustainment, including innovations to better protect our Soldiers.

The Warfighter Support portfolio helps advance Army modernization priorities, ensure battlefield dominance, and prepare the Armed Forces for multi-domain operations and other changes to the character of war.

USACE is applying this research and development around the world. It is engaged in more than 130 countries on any given day, working for combatant commands, the U.S. Army, the DOD and other federal agencies that support the Warfighter.



NAVIGATE

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A DIGITAL ADVANTAGE

Better geospatial data improves battlefield awareness

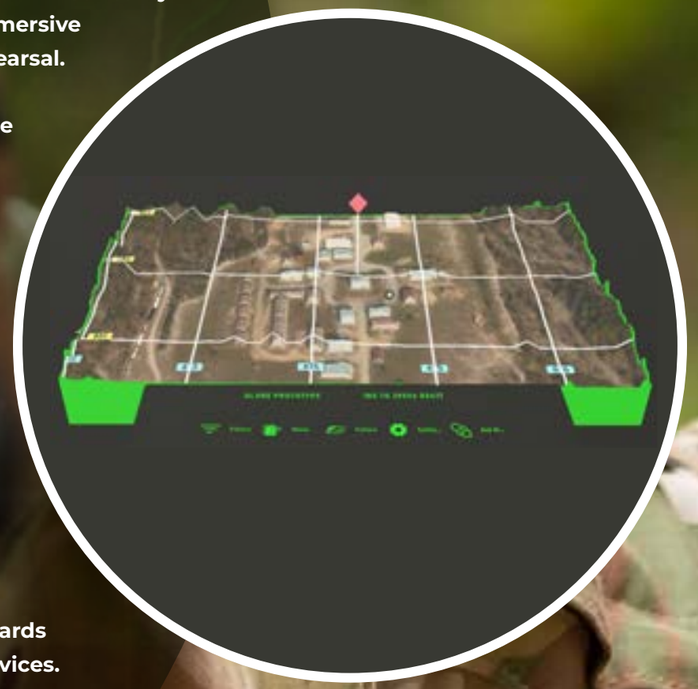
The ability to quickly disseminate geospatial data is crucial to all multi-domain operations.

The U.S. Army's Integrated Visual Augmentation System (IVAS) is an augmented reality/mixed reality technology enabling Soldiers to have vastly improved situational awareness and decision-making capabilities on the battlefield.

IVAS includes the ability to interact with 2D mixed reality maps in the heads-up display and a more immersive 3D map for shared mission planning and rehearsal. Sourcing, optimization and conversion of geospatial data is critical to the success of the IVAS program.

ERDC has worked to provide a series of utilities to successfully convert a broad range of 2D and 3D geospatial data into formats immediately consumable by the IVAS system. The tools and software support 2D map tile service streaming, conversion of digital topographic elevation data products, tactical edge production of geospatial data, and a texture remapping strategy that reduced the size of 3D model data by 9x without a loss in data quality.

The methodology and tools developed during this research will optimize IVAS standards and products for exploitation on end-user devices.



The methodology and tools developed will optimize IVAS standards, products for end-user devices

SEEING MORE CLEARLY

High-resolution 3D-lidar can greatly enhance Army geospatial capabilities

USACE R&D worked with the Massachusetts Institute of Technology Lincoln Laboratory to evaluate a high-resolution 3D-lidar system that greatly improves on geospatial mapping capabilities.

The PHOton Exploration and Novel Imaging eXperiments (PHOENIX) High-altitude Collaborative Airborne System for Tactical Lidar Experimentation (High CASTLE) can image at the highest optical resolution theoretically possible due to diffraction, or the spreading of light. This makes the high-resolution and high-area-coverage rate system ideal for wide-area mapping of desert, jungle and urban terrain, as well as foliage penetration imaging of terrain obscured by dense tree canopy.

The effort builds on more than 25 years of Lincoln Laboratory research to develop 3D direct-detection lidar systems.

USACE R&D collaborated with Lincoln Laboratory to develop a testbed to evaluate the latest advancements in airborne lidar systems and to identify best practices collecting high-quality 3D data in challenging environments. The team demonstrated PHOENIX High CASTLE during a flight campaign and modified the fully mission-capable lidar to add more flexible collection capabilities.

The system has the potential to significantly enhance U.S. Army capabilities to collect high-resolution geospatial imagery.

The system would be ideal for wide-area mapping of desert, jungle and urban terrain

The Massachusetts Institute of Technology Lincoln Laboratory-developed PHOENIX High CASTLE collected this imagery of the amusement park Kings Dominion in Virginia during an initial flight campaign to test and optimize the performance of this 3D airborne lidar.

IT'S IN THE GAME

Researchers turn to gaming software to model Arctic mobility capabilities

To expand and enhance its ability to model vehicle performance in extreme conditions such as the Arctic, ERDC turned to open-source software best known for creating video games.

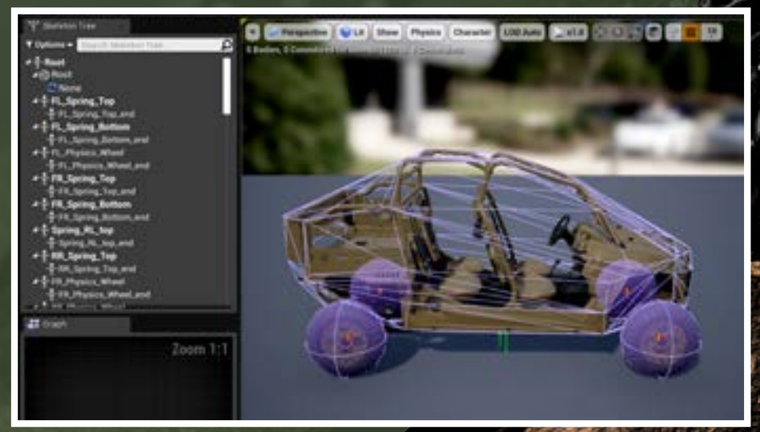
In a study released in FY24, researchers detailed work on developing new vehicle models and scenes in Unreal Engine (UE4) to improve the physics and graphics of differing terrains, especially for winter conditions.

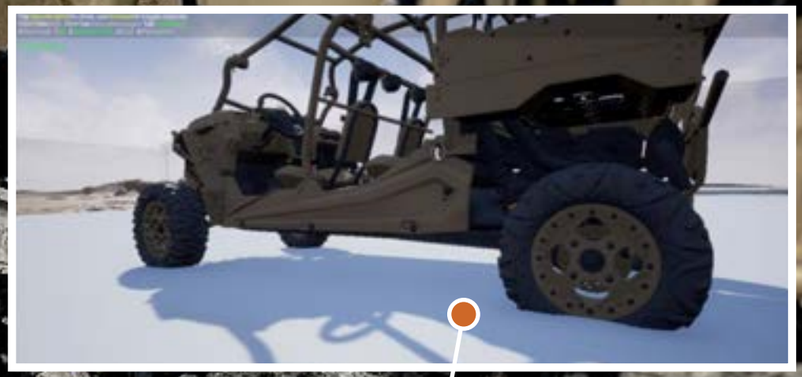
ERDC successfully implemented accurately functioning wheeled and tracked vehicles and created simulated and real-world environments. Each environment can apply various terrain conditions, including soil, rock, snow and sand.

Modeling snow for vehicle performance has been of particular interest in support of ERDC's cold regions mission, and recent motion resistance and sinkage models were integrated into the software to improve graphics and vehicle performance.

Additional testing is needed before the model can be used in a predictive manner on new terrain.

ERDC and the U.S. Army's Ground Vehicle Systems Center (GVSC) were involved in this study.

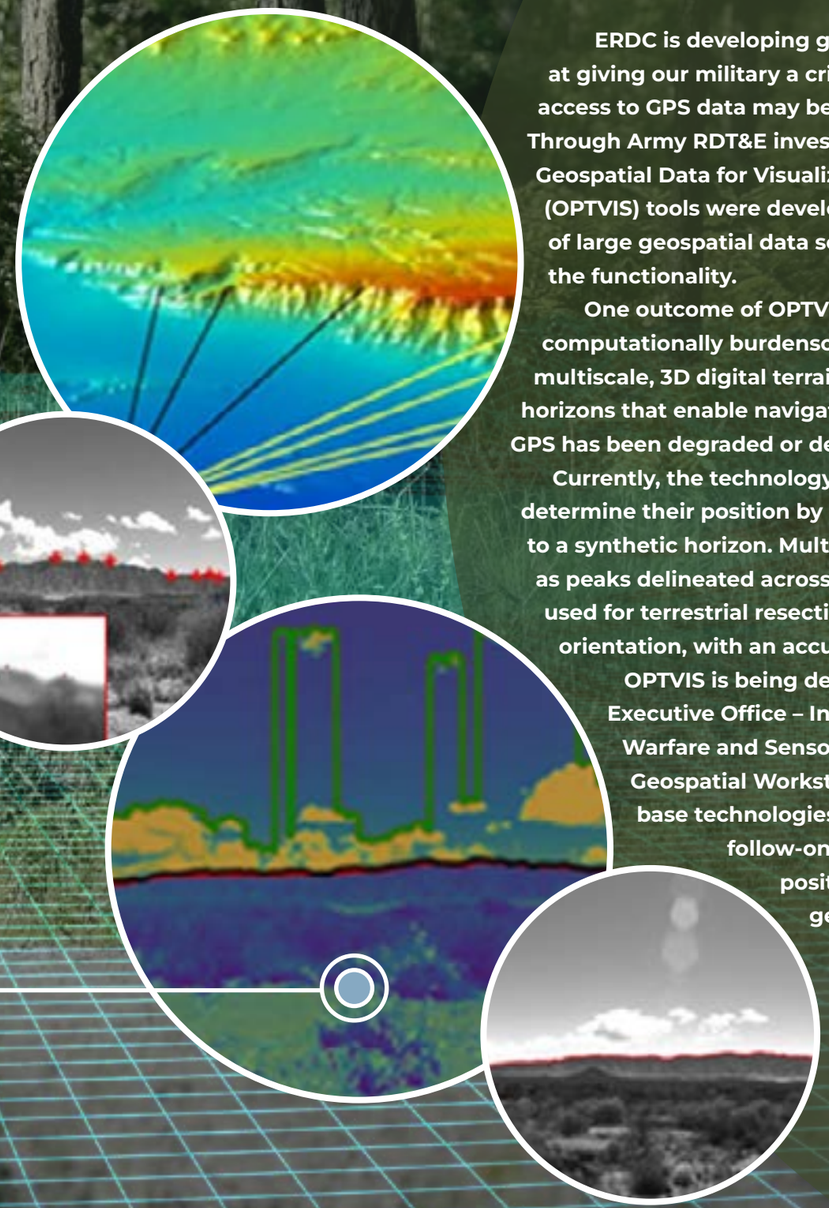




Open-source software
helps test mobility capabilities
in Arctic conditions

WHAT'S ON THE HORIZON?

Terrain models help Soldiers maneuver when GPS is not available



ERDC is developing geospatial technology aimed at giving our military a critical tool in domains where access to GPS data may be limited or not available. Through Army RDT&E investments, Optimization of Geospatial Data for Visualization (OPTVIS) tools were developed to reduce the burden of large geospatial data sets, while preserving some of the functionality.

One outcome of OPTVIS is producing a less computationally burdensome dataset that uses large multiscale, 3D digital terrain models to create synthetic horizons that enable navigation in environments where GPS has been degraded or denied.

Currently, the technology allows end-user devices to determine their position by using 2D images matched to a synthetic horizon. Multiple key terrain points, such as peaks delineated across the horizon profile, are used for terrestrial resection to calculate position and orientation, with an accuracy estimation.

OPTVIS is being delivered to the Army's Program Executive Office – Intelligence, Electronic Warfare and Sensors for future use on the Army Geospatial Workstation, and its related data base technologies are being integrated into a follow-on program to address assured position and navigation using geospatial data.

Digital terrain models
enable navigation
in GPS-denied environments

THE REAL WORLD IN DIGITAL FORM

Advanced imaging team works to create virtual training environment for Soldiers

An ERDC team completed surveys of two military training facilities with the goal of creating 3D virtual landscapes for future training purposes.

The work, conducted by the Local-scale Integrated Mapping of Buildings team, deployed groundbreaking 3D-lidar technology, and at times leveraged UAS support, to collect point-cloud data and high-resolution imagery of the Military Operations for Urban Terrain (MOUT) training areas at Fort Irwin, California and Fort Johnson, Louisiana.

The MOUT sites are mock cities and built-up areas to train Soldiers on urban combat operations.

The surveys focused on building interiors and subterranean spaces, such as tunnels and basements. The team also used unmanned aerial systems to collect data of MOUT sites and survey grade level data of key building exteriors and interiors to enable registration with the most accurate level of data.

The processed data and future 3D models will be used to support training operations at both the National Training Center at Fort Irwin and the Joint Readiness Training Center at Fort Johnson.

3D environments will further enhance vital training scenarios

OVERCOMING OBSTACLES

Remote systems may soon provide Soldiers an advantage on the battlefield

Building off the success of the initial Sandhills Future Breaching Experiment, ERDC has continued to develop new techniques that have been displayed at additional demonstrations.

ERDC has played a leading role in this partnership event that demonstrated breaching capabilities and highlighted gaps for future experimentation. Working alongside DEVCOM, ERDC supported the XVIII Airborne Corps' Sandhills Remote Breaching Experiment at Fort Liberty, North Carolina in December and the Joint Readiness Training Center at Fort Johnson, Louisiana in March.

That event culminated with Soldiers from the 20th Engineer Brigade breaching complex obstacles using fully remote systems under day and night conditions. The obstacle consisted of wire, dragon's teeth, live mines and an anti-vehicular ditch.

ERDC provided modeling and simulation support, uncrewed aircraft system overflights, robotic demonstrators, payload integration support, and expertise in explosives for obstacle breaching. In addition, ERDC supported a remotely launched Mine Clearing Line Charge for the Human Machine Integration event at Project Convergence Capstone 4.

This work is an example of transforming in contact. It aligns with the call for engineer modernization made by Gen. James Rainey, Commanding General, Army Futures Command.

"We've got to get back to making sure that we can breach anything," Rainey said. "We've got to get after the engineer transformation and modernization."

Remote systems allowed Soldiers to overcome
wire, dragon's teeth, live mines & an anti-vehicular ditch

FASTER, LESS EXPENSIVE, DEPLOYABLE

Resurfacing kit keeps airfield matting system in service

The current airfield matting system – AM2 – was first developed in the 1960s and has been a critical tool in our military's force projection capability, providing temporary landing surfaces in austere locations around the world.

As the matting technology has improved, the methods for maintaining and resurfacing these systems has needed attention.

Every five years, mats need to be resurfaced because UV exposure and traffic wears away the friction surface.

Traditionally, the individual mats – weighing 150 pounds each – would be removed by hand and sent back to the manufacturer for resurfacing. The months-long process was both time-consuming and costly.

ERDC developed an airfield matting resurfacing kit that allows military personnel to quickly recoat a mat's surface in place without having to remove it from service.

The process of using this kit – which is far less expensive than traditional methods – involves the removal of the surface using a high-pressure hydro blaster, then applying a water-based coating that cures in just 24 hours. The new coating has a life expectancy of 25 years.

Resurfacing kit allows critical airfield matting to be refurbished on site

USING **NATURE** TO CONTROL **ICE**

Novel technologies, methods are needed for sustained Arctic operations

Arctic warming has resulted in an expanded, evolving operational area in which the U.S. military must counter adversaries in prolonged extreme cold temperatures. Significant physiological and material barriers exist to establishing and maintaining a force capable of sustained operations in ice-prone environments.

To address these gaps, ERDC is partnering with Defense Advanced Research Projects Agency's Ice Control for Cold Environments (ICE) program to understand how to control the physical properties of ice crystals to protect assets and personnel for enhanced operational capabilities in extreme conditions.

ICE leverages biological adaptations to cold environments to develop novel materials. ICE-developed technologies will facilitate sustained operations through strategies to prevent frostbite and materials for anti-icing.

ERDC serves as the independent verification and validation partner to test the ice modulating properties of any new technologies developed. ERDC is also charged with analyzing results from tests conducted by the teams and developing an in-house analytical framework to integrate test results.

By the end of the program, partners will be asked to demonstrate properties of ice crystallization control and provide preliminary safety data for DOD relevant applications.

New technologies seek to prevent frostbite and icing

QUICK & STRONG

Rapid repair seeks to bolster Army's bridging capabilities

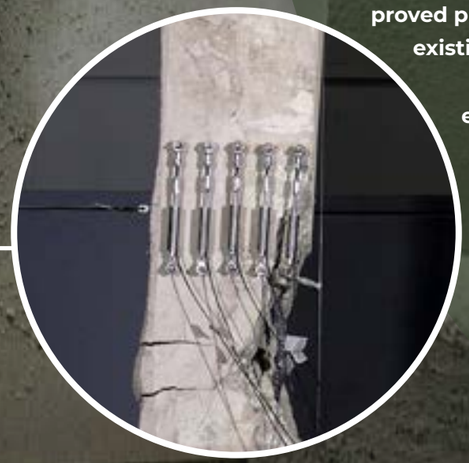
Standard techniques to bridge gap crossings are difficult and time intensive. The Army has a limited number of standard bridging assets available for use at any given time, and depending on the theater of operation, the supply of standard bridging may quickly be depleted or may not be suitable for the crossing.

In these scenarios, the need to use existing infrastructure is paramount; however, the condition of existing infrastructure may not support the crossing-force requirements.

ERDC research has evaluated a rapid-setting, high-strength shotcrete to repair damaged or aged infrastructure rapidly and effectively for use by military traffic. Extensive testing using concrete beams and columns fabricated and tested at ERDC's Structural Strong Floor facility, proved promising for repairing and retrofitting existing, non-standard bridges.

The repaired columns and beams met or exceeded all theoretical design values.

This method could help restore and potentially improve bridge capacity and existing road networks by providing opportunities for non-standard bridges to aid in distributed force projection.



Research seeks to improve methods for the repair and retrofitting of existing, non-standard bridges

A NEW APPROACH FOR **CRITICAL MISSIONS**

Hybrid AI development will improve autonomous UAS navigation

Recent military conflicts have demonstrated that unmanned aerial systems (UAS) have become battlefield gamechangers. They have highlighted how emerging UAS capabilities, such as the ability to freely navigate in any environment without relying on human pilots or GPS, will be essential to winning future wars.

Current communication systems between UAS and humans or satellites can be very fragile in hostile or austere environments. And AI-enabled autonomous UAS have faced significant challenges in real-world operations, indicating their current functionality cannot meet the high standards required to execute military operations.

USACE R&D is studying the use of hybrid AI, a method to fuse symbolic and non-symbolic AI to provide predictability, reliability and transparency in AI autonomous systems. Symbolic AI includes traditional types of AI, such as human cognitive logic, statistical inference and physics based on models. Non-symbolic AI represents deep learning and neural networks.

Using a hybrid AI approach allows users to overcome the limitations of widely used deep learning approaches for autonomous systems, leading to reliable and predictable auto navigation systems for austere battle environments. This will allow developers – and more importantly Warfighters – to trust AI-enabled UAS for critical mission assistance.

The ability to freely navigate UAS in any environment will be essential to winning future wars

SUPPORT FOR OTHERS

As the nation's premier public engineering and environmental sciences organization, USACE often supports other federal, state and local agencies, as well as private sector and international partners. USACE's Support for Others program largely focuses on five thrust areas: natural environment, infrastructure, security, contingency operations and energy.

USACE possesses unique engineering and scientific capabilities, which can be applied to diverse national challenges – from climate resilience to aging infrastructure to cybersecurity to soft-target protection.

The lessons learned from this research can often be leveraged to shape new USACE innovations.

NAVIGATE

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Better Technology, Better Visibility: ERDC-developed technology helping revolutionize dust forecasting .....Page 104

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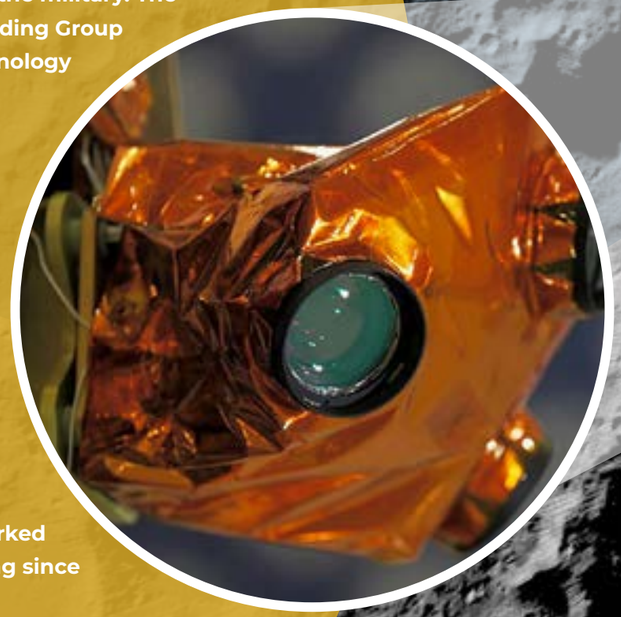
SHOOT IT TO THE MOON

Innovative technologies help deliver craft to lunar surface

Taking the next steps in space exploration will require research and development into an array of instruments to aid in the journey.

As part of the Pathfinder 3D program, ERDC joined with Psionic to explore and test emerging Navigation Doppler Lidar (NDL) technology for the military. The team includes NASA's Precision Landing Group that has helped accelerate the technology under a Small Business Innovation Research program.



ERDC and Psionic are testing the geometric and radiometric characteristics of SurePath™, a system developed by Psionic. The study is looking at positioning and navigation without GPS services to mitigate the impact of denied or degraded GPS services.

An NDL unit was part of February's mission by NASA and Intuitive Machines Odysseus to the moon's south pole. This landing marked the United States's first lunar landing since Apollo 17.

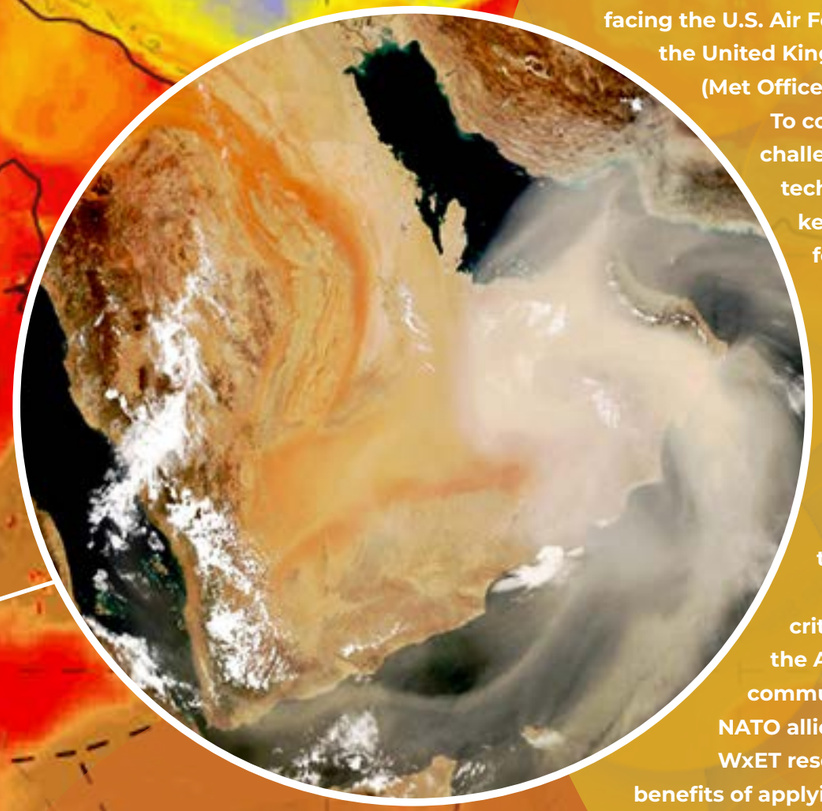
During the mission, the craft's laser altimeter failed, leaving the NDL as the inertial landing technology to assist in successfully landing the spacecraft.

Further investments have helped advance the design and processing of the laser system and inertial guidance and have demonstrated a dual use for both space precision landing and ground mobility capabilities.

Emerging technology seeks to provide position, navigation in GPS-degraded, denied environments

BETTER TECHNOLOGY
BETTER VISIBILITY

ERDC-developed technology helping revolutionize dust forecasting



Hazards caused by significant dust outbreaks and the impact they can have on surface visibility, location, time sensor effects and more is a forecasting challenge facing the U.S. Air Force 557th Weather Wing and the United Kingdom's Meteorological Office (Met Office).

To confront and overcome this challenge, ERDC-developed technology has been identified as a key to unlocking more advanced forecasting capabilities, leading to more accurate dust forecasts.

ERDC's Weather Effects Team (WxET) is collaborating with the Air Force and the Met Office to implement ERDC Geomorphic Surface Erodibility (ERDC-GEO) parameterization dust forecasting technology into the modeling systems.

These systems provide critical weather information to the Air Force, Army, the intelligence community, UK Ministry of Defence and NATO allies.

WxET researchers are also analyzing the benefits of applying enhanced terrain information and ERDC-developed dust source characterization methods into the Model Prediction Across Scales, a cutting-edge numerical weather prediction framework that NOAA and the Air Force plan to use for regional weather modeling applications.

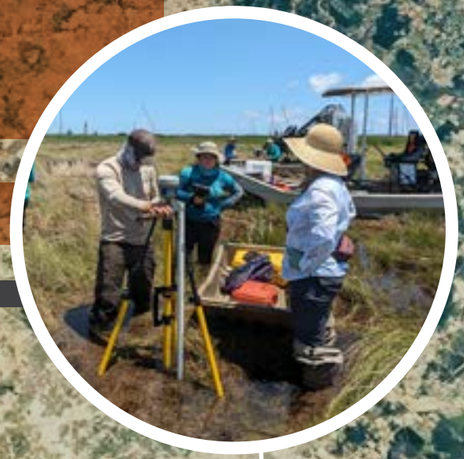
Cutting-edge modeling methods
critical in forecasting dust events

U.S. AIR FORCE

Met Office

A NATURAL LINE OF DEFENSE

Dredged material may be the best protection against stronger, more frequent storms



An ERDC team is supporting the development of a plan to beneficially use dredged sediment in the state of Texas.

ERDC is working alongside the U.S. Geological Survey (USGS), Ducks Unlimited, U.S. Fish and Wildlife Service and the Texas Parks and Wildlife Department to develop a beneficial use of dredged material (BUDM) master plan for the state.

Coastal wetland loss is a significant concern along the Gulf of Mexico as extreme storms become more frequent and flooding events intensify. The resilience of these marsh areas is dependent on biogeomorphic feedback between inundation, sedimentation and plant growth, which allow marshes to adapt to a changing environment. Restoration efforts often seek to maximize these feedbacks and increase marsh elevation through the implementation of BUDM. However, much remains unknown about the design and long-term viability of these sites.

The team's work also includes assessing the time-rate and magnitude of the dredged material placement and underlying soil foundation consolidation to provide the state with recommended design heights of BUDM projects.

Texas' BUDM master plan development is a result of state, federal and private agency collaboration

THE PATH OF LEAST RESISTANCE

Ground-penetrating radar used to identify safe routes in Antarctica

Overland traverse routes to the McMurdo Station in Antarctica are essential to the continued safe operation of the science facility. The routes ensure safe passage for personnel and are the main routes for critical materials and fuel.

Unfortunately, crevasses are prominent through the McMurdo shear zone, just 40 miles south of the station where the McMurdo and Ross Ice Shelves meet, and where most routes out of the station lead.

Hanna Wittmann, a research physical scientist ERDC, completed a two-month deployment to McMurdo.

During her deployment, Wittman used ground penetrating radar (GPR) to support accurate surveys of the overland routes to the station, as well as other facilities, such as the Black Island communications hub.

Wittmann combined Synthetic Aperture Radar imagery with ground-based GPR data to develop a comprehensive assessment of hazards identified along a prescribed traverse route.

Once a hazard is identified and mapped, personnel often clear the route by blowing up the hazard.

Deployment of ground-penetrating radar ensures safe, secure routes for personnel, critical materials and fuel

HONORING THEIR SERVICE, **PRESERVING THE PAST**

Latest technology deployed to document, restore historic cemetery

ERDC is working alongside the Department of Veterans Affairs (VA) to protect and preserve one of the oldest military cemeteries along the West Coast.

With the support of the ERDC Cultural Resources team, the VA's National Cemetery Administration is developing plans to restore the Mare Island Naval Cemetery in Vallejo, California. The cemetery is the final resting place for sailors, Marines, civilians and their loved ones dating back as far as the War of 1812.

The Cultural Resources team is providing recommendations on how to rehabilitate the cemetery. Their work includes ome of the work includes a historical landscape inventory, geotechnical technical survey, cultural landscape management plan and high-fidelity digital scans of the cemetery's headstones.

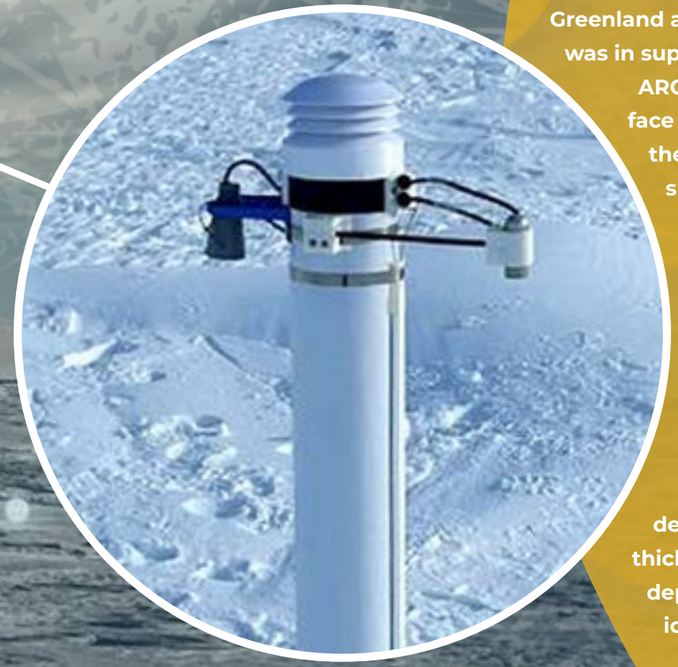
The goal is to preserve the cemetery's historical integrity and bring it into compliance with the standards of other veterans' cemeteries.

An ERDC team has also conducted an in-depth soil survey, which documented issues with the burial markers caused by runoff and soil slumpage.

Cultural Resources team
deploys high-fidelity lidar,
other tools to document cemetery

HIGH-RISK DEPLOYMENT

Challenging mission collects data on the Arctic's summer melt season



ERDC scientists completed a mission deploying ice mass balance buoys in the Lincoln Sea, north of Greenland and Canada's Ellesmere Island. The work was in support of NASA's ARCSIX program.

ARCSIX (Arctic Radiation-Cloud-Aerosol-Surface Interaction Experiment) studies many of the factors that add to the Arctic's summer surface radiation budget and impact the early melt season, which is May through mid-July.

ERDC's portion of the mission – through the deployment of the buoys – was aimed at measuring ice properties, net radiation budget, meteorological variables and Navy-relevant upper ocean properties on sea ice.

Using ski-equipped aircraft, the team deployed the buoys in an area known for its thick ice and minimal motion. After successful deployment, the sensors now drift with the ice, providing continuous real-time data and forming the basis for NASA's ongoing sea ice observations from Pituffik Space Base in Greenland.

Mission reinforces ERDC's ability to
execute high-risk operations
in austere environments

BIG DISCOVERY, SMALL FOOTPRINT

Research partnership focuses on endangered snail's limited habitat

A snail species thought to have perished following a 1989 chemical spill in Mississippi was rediscovered in 2021, and today is flourishing, but only along a small stretch of the Big Black River.

ERDC researchers have partnered with the Mississippi Museum of Natural Science to examine the distribution levels and substrate preference of the Big Black Rocksnail.

This snail species has only been found in a five-kilometer stretch of the Big Black River, near Edwards, Mississippi, therefore having one of the smallest ranges of any endemic snail species in North America.

Laboratory-based studies tested water quality; suitability of various substrate, such as gravel, cobble, bedrock and sand; depth in the water column; and what current velocity the snails can withstand.

The results will guide researchers in determining the snails' primary drivers. Furthermore, the knowledge will assist in finding a suitable habitat for the snails if at some point they need to be reintroduced into the wild or translocated to another area of the river to extend their range.

Big Black Rocksnail's habitat is one of the SMALLEST IN NORTH AMERICA

ENERGY IN TIME OF NEED

H2Rescue adds to our nation's natural disaster response arsenal

With natural disasters increasing in frequency, the H2Rescue vehicle offers a crucial tool for immediate relief, combining advanced fuel cell technology with environmental responsibility to enhance recovery efforts in times of crisis.

Developed by a team of federal and industry partners, H2Rescue is a zero-emission, hydrogen fuel cell-powered disaster relief vehicle that can provide electric power, heat, water and essential supplies to begin recovery efforts.

H2Rescue can provide 25 kilowatts of export power for up to 72 hours without refueling – enough to power 15-20 homes.

H2Rescue is the product of a collaboration between ERDC, the U.S. Department of Energy's Hydrogen and Fuel Cell Technologies Office and Vehicle Technologies Office, GVSC, the U.S. Department of Homeland Security's Science & Technology Directorate, the U.S. Naval Research Laboratory and Accelera™ by Cummins.

H2Rescue can provide enough
power for 15-20 homes
for up to 72 hours

PROTECTING HEALTH WITH SATELLITES

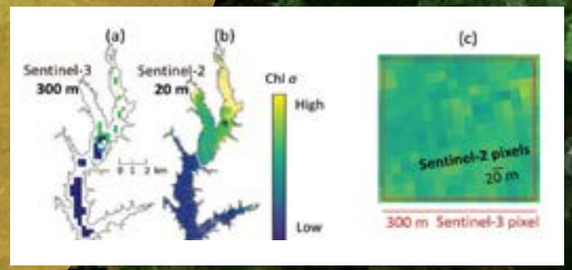
Enabling rapid HAB detection through partnership

Harmful Algal Blooms (HABs) occur in inland and coastal freshwater bodies, at times releasing cyanotoxins that can compromise drinking water supplies, impact recreation, shut down fisheries, and kill fish, birds and other aquatic species. Monitoring for cyanotoxins via traditional water sampling and analysis methods is slow and expensive, requiring a rapid and inexpensive HAB detection capability.

The Cyanobacteria Assessment Network – Sentinel 2 (CyAN-S2) is a USACE-sponsored interagency collaboration with the EPA (lead), NOAA, NASA and USGS.

This interagency team is developing a national product that uses Sentinel-2 satellite imagery to detect the presence of chlorophyll-a as a proxy for potential toxin-producing cyanobacteria. By taking advantage of the imagery's 20-meter spatial resolution, the interagency team is currently demonstrating its HAB detection potential on waterbodies in Florida, Ohio and Oregon, including 29 USACE reservoirs.

CyAN-S2 has the potential to enable satellite HAB monitoring for more than 270,000 lakes and reservoirs across the country, including more than 400 managed by USACE. This will provide guidance to water managers on when and where they need to collect water samples and will enable better-informed decisions regarding water release and beach closure.



Comparison of spatial coverage from the original CyAN project Sentinel-3 300m pixel resolution and Sentinel-2 20m pixel resolution in the northern section of Jordan Lake, N.C.

CYAN-S2 HAS THE POTENTIAL TO SAVE USACE $42M annually

SNOWING ITS STRENGTH

Study probes snowpack mechanical properties

Knowing mechanical and structural properties of a snowpack, at both the micro and macroscales, is critical to understanding how snowpack architecture evolves over each winter season and gauging its strength and stability to support mobility. However, current knowledge is limited.

Hoping to fill this gap, USACE researchers used 2017 NASA SnowEx SnowMicroPenetrometer (SMP) datasets from Grand Mesa, Colorado, to study the spatial relationships between snow mechanical properties that control snowpack strength and influence activities that rely on snow stability. The team investigated such properties as stability, snow density and compression strength, as well as microstructural element deflection at rupture.

Their effort provided evidence that supports the possibility of using SMP datasets to model snow mechanical properties. Improving the ability to assess the engineering capabilities of snow, such as stability, will help ensure physical safety and optimize mobility during winter conditions. This effort could also support a variety of applications, including avalanche forecasting, winter vehicle mobility and tracking wildlife movements, among others.

Improved knowledge will
optimize mobility
during winter conditions

FROSTY DETECTION

Sensor technology offers critical view of melting permafrost

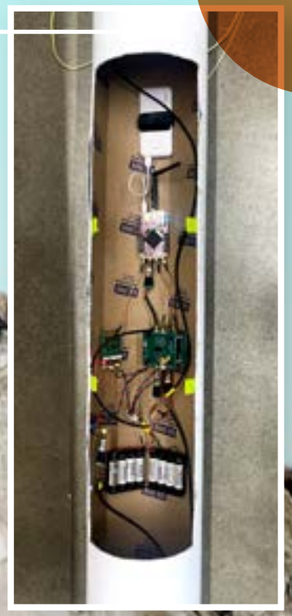
The In-Flight Rapid Observation and Surveying Tool (iFROST) is designed to be a sensor deployed on uncrewed aerial systems to detect, survey and map large areas of permafrost regions.

Permafrost, which is ground that remains completely frozen for at least two years, occupies approximately 24 percent of the Northern Hemisphere's terrestrial surface and accounts for approximately half of all organic carbon stored within the planet's surface.

Nearly 85 percent of Alaskan soil is permafrost, meaning this frozen soil is the foundation to most of the state's roads, houses and infrastructure. Yet, a direct impact of a warming climate is the accelerating thawing of the permafrost.

As this permafrost melts, the soils become unstable, putting the critical components built upon permafrost at risk. Rapid and accurate mapping of permafrost subsurface composition has been a long-standing challenge.

iFROST's sensor capability will be used to accurately predict the depth of permafrost in the subsurface and detect the presence or absence of ice features. This provides a cost-effective airborne geophysical technique to obtain high-resolution measurements of specific areas of interest.



This photo shows the inner electronics of the iFROST system.

The iFROST system collects elevation data over known permafrost in Alaska.

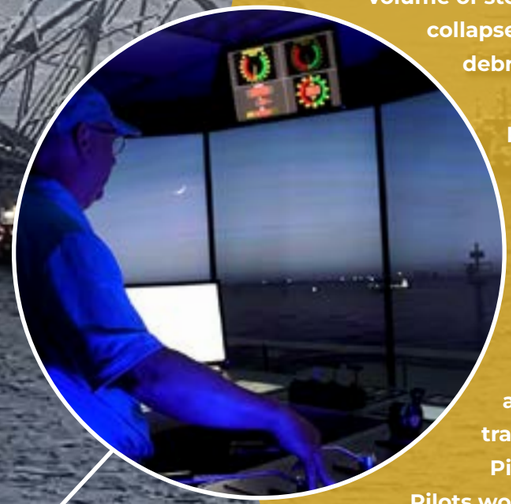
Background: A view of a 35-meter-high riverbank exposure of the ice-rich permafrost containing large ice wedges along the Itkillik River in northern Alaska. (University of Alaska Fairbanks photo/USGS)

iFROST can remotely

PREDICT THE DEPTH OF PERMAFROST

A PARTICULAR SET OF SKILLS

R&D teams play critical role in reopening Port of Baltimore following tragedy



After a cargo ship collided with Baltimore's Francis Scott Key Bridge on March 26, tragically killing six and temporarily shutting down one of the nation's busiest commercial port operations, the USACE R&D community played a critical role in the port's reopening.

Within 24 hours of the bridge's collapse, ERDC research structural engineers and certified bridge inspectors collaborated with North Atlantic Division structural engineers to determine the total weight and volume of steel and concrete for each of the collapsed bridge spans and piers – supporting debris removal decisions.

Meanwhile, ERDC's expertise in point cloud mesh modeling helped process raw sonar data of the collapsed bridge to enable viewing in ArcGISPro to aid analysis.

Also, the U.S. Army Watercraft and Ship Simulator at ERDC allowed USACE to validate plans to open a secondary bypass channel that could accommodate commercial vessel traffic during salvage operations.

Pilots from the Association of Maryland Pilots worked with the ship simulator team to thoroughly test the new route, simulating multiple variables with currents and weather. The experience provided local mariners with critical information on how to best transit the new route, and the pilots' feedback was used to best position buoys along the temporary channel.

USACE research laboratories
deployed unique capabilities
to help Port of Baltimore reopen

EFFICIENT & SUSTAINABLE

The establishment of Engineering With Nature® (EWN) revolutionized USACE, supporting a shift toward integrating natural elements into engineered solutions for maximum benefit, operational efficiency and sustainability. While nature-based features had been sporadically deployed, EWN introduced a more systematic and focused framework for their use.

Launched in 2010, the program has become a major partner with the DOD, and a surge of both Congressional and White House support has amplified EWN and the importance of nature-based engineering solutions.

Now working with all ERDC laboratories and across USACE in proving ground districts and divisions, EWN has blossomed from a conceptual framework to a widespread movement with nearly 60 projects across the United States and four continents.

Through its ability to inform policy, practice and research, EWN is helping discover and develop a more resilient, sustainable and collaborative future.

Scan for the EWN website

Scan for the EWN podcast

HELPING NATURE BY USING NATURE

Research explores the beneficial use of dredged sediment along critical waterway

The Atlantic Intracoastal Waterway (AIWW) is a portion of the larger intracoastal waterway, a 3,000-mile inland waterway that runs along the Atlantic seaboard and Gulf coast.

The Georgia and South Carolina portions of the AIWW consist of 161 miles divided into 36 operational reaches, including a 24-mile section in South Carolina and 137 miles within Georgia.

Georgia's coastal marshes make up nearly one-third of all the remaining East Coast salt marshes. These areas protect habitats and infrastructure by absorbing storm surge, act as natural filtration systems for runoff, and play a crucial role in the maintenance of fish species by providing nursery and spawning habitat.

Beneficial use of dredged sediment may allow the salt marsh to continue to accrete to combat rising sea levels, allowing this critical ecosystem to continue to function.

EWN-led research is developing several synergistic tools that can be evaluated and integrated to create an efficient, comprehensive approach to identifying and prioritizing the beneficial use of dredged sediment in the AIWW, serving as a roadmap for other inland waterways.

This integrated approach will allow for a more informed decision-making process and help prioritize potential projects that align with the overall goals and objectives of the AIWW.

To learn more about this effort, visit https://ewn.erdc.dren.mil/story-maps/beneficial-use-bu-opportunities-with-in-the-ga-aiww/.

OTHER INNOVATIONS

Engineering With Nature: An Atlas, Volume 3 was released in FY24. It showcases innovative projects worldwide that leverage nature-based solutions for sustainable engineering. This publication highlights the power of collaboration and the benefits of integrating natural features into engineering practices to enhance community resilience and environmental sustainability. The Atlas aims to inspire and inform practitioners, policymakers and stakeholders worldwide.

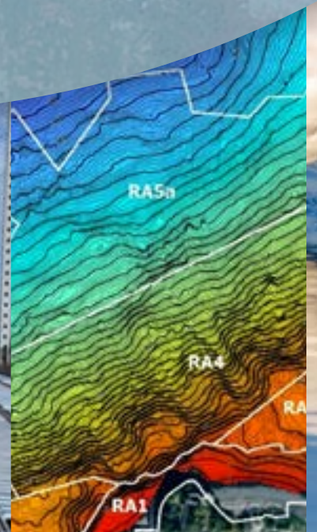
Together with partners from the Network for Engineering With Nature, in coordination with local agencies, EWN launched a study to investigate the ecological drivers of dune stability. This research will improve understanding of the role of natural vegetation in dune resilience under extreme wave action, crucial for informing coastal management practices and restoration designs. In a first-ever endeavor, researchers sampled a naturally developed dune segment from northeast Florida. This ongoing research holds promise in advancing the understanding of dune stability dynamics and better informing resilient and sustainable coastal management strategies.

INNOVATIONS AT WORK

The impact of innovation is being felt across the entire USACE enterprise. From small islands in the Pacific to minute ecosystems along the Rio Grande River in Texas to protecting our nation's Warfighters in the Middle East and beyond, the creative spirit of USACE districts and divisions is making a difference.

In collaboration with ERDC engineers and scientists, the EWN program, industry and academia, USACE has continued to push the boundaries of traditional planning, permitting, construction and infrastructure management.

The following pages contain stories of USACE engineers, scientists, technicians and support personnel applying new thinking to today's challenges. There are also solutions created and nurtured in USACE research facilities that are now being deployed, as well as tried and true methods being applied in new ways.



NAVIGATE

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OTHER INNOVATIONS

USACE engineers frequently rely on off-the-shelf engineering software and spreadsheets for analysis. While only a few engineers create custom code for data analysis, they often face limitations with third-party applications or Excel-based tools. The Chicago District's Mike Haefeli used generative AI to develop code capable of analyzing large datasets for levee screenings. By leveraging stream gauge data from the USGS, he was able to determine flood durations over extended time periods. This groundbreaking approach has allowed for more accurate results in less time.

Bluestone Dam in West Virginia is strengthened by more than 1,000 rock anchors that are drilled in as deep as 275 feet and locked-off at loads as high as 2.5 million pounds. These anchors undergo tests to identify if an anchor has long-term load-carrying capacity. To remove the human factor from these critical tests, the Huntington District developed requirements for an anchor stressing jack system that autonomously stresses and maintains the anchors' test load. Bluestone has been the proving ground for these autonomous systems, and the lessons learned will be incorporated into new specifications.

INNOVATIVE & EXPEDIENT

Soo Lock becomes proving ground for first-of-its-kind repair

As America's civil works infrastructure ages, managers need innovative solutions to repair and replace the individual parts that keep them functioning. Often, these original components were fabricated using vintage manufacturing methods, making them costly, burdensome and time-consuming to replace.

Responding to this need, USACE is employing cutting-edge additive manufacturing techniques to produce these parts faster and at a lower cost while maintaining, and often improving, their properties.

In March, the Detroit District installed the largest U.S. civil works infrastructure component produced by a 3D printer – a 12-foot-long, 6,000-pound metal part for the ship arrestor system on the Poe Lock, one of the two active locks on the Soo Locks facility. Building on years of ERDC research and the expertise of industry partner Lincoln Electric, the part was manufactured in 12 weeks, compared to a projected 18-month lead time for conventional manufacturing.

The part was installed during the Soo Locks' winter maintenance cycle, replacing a 60-year-old lever arm that had begun to show cracks. The rapid repair ensured normal operations were maintained at Poe Lock, a major transit point for domestic iron ore.

This was the first time USACE has used this fabrication method on large parts and is considered the prototype for this application. This innovative solution and process can greatly reduce the turnaround time to procure components, improving the reliability of critical flood risk management and navigation infrastructure to protect communities and preserve economic growth.

IN THE ‘NOTCH’ OF TIME

Creative underwater sill design slows saltwater intrusion up the Mississippi River

For the second consecutive year, the New Orleans District worked to slow the progression of salt water from the Gulf of Mexico up the Mississippi River, an event called a saltwater intrusion.

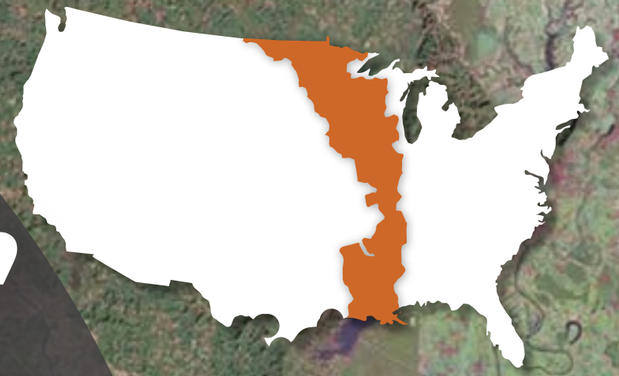
With much of the lower Mississippi River Valley experiencing extreme drought conditions in early 2023, the lack of rainfall led to lower levels of fresh water in the Mississippi River, allowing a denser layer of Gulf salt water to travel upstream, which threatened drinking water supplies in several Louisiana communities.

To slow the intrusion, the district constructed an underwater sill – or earthen levee – in July 2023. But the prolonged drought and extremely low flow rate of the river allowed the salt water to overtop the sill in September.

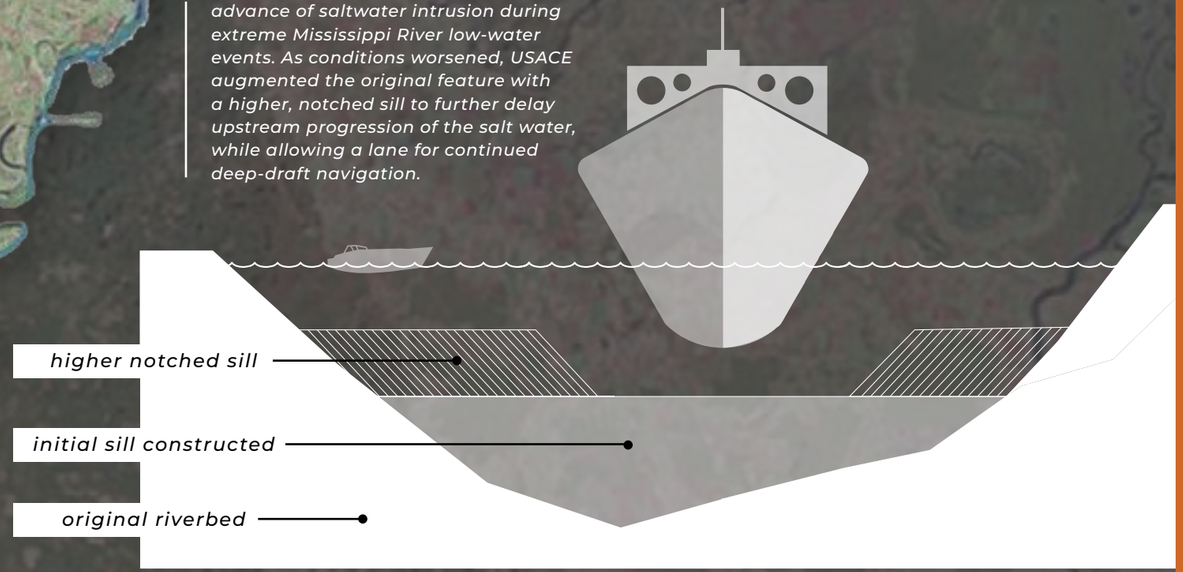
To keep the salt water from progressing, a novel approach was suggested and extensively modeled to build the sill higher, while creating a notch to ensure commercial shipping was not impacted.

The modification of this existing underwater sill involved raising the elevation from a depth of -55 feet to a depth of -30 feet, while maintaining a 620-foot-wide navigation lane, which allowed deep-draft shipping to continue.

The approach, which was first proposed by New Orleans District civil engineer Heather Jennings, halted the salt water better than expected and became a proven design that can be used to slow future saltwater intrusions.



A sill was constructed to slow the advance of saltwater intrusion during extreme Mississippi River low-water events. As conditions worsened, USACE augmented the original feature with a higher, notched sill to further delay upstream progression of the salt water, while allowing a lane for continued deep-draft navigation.



BRIDGING THE GAP

Advanced techniques, new technologies address aging infrastructure challenges

The use of special concrete additives, along with the use of innovative deck joints and other features deployed by NAP during the renovation of the St. Georges Bridge extended the service life of the bridge, which has already surpassed 50 years.

The St. Georges Bridge, located south of Wilmington, Delaware, spans the Chesapeake and Delaware Canal.

The bridge's previous deck, which had well surpassed its 30-year service life, had exhibited widespread and advanced deterioration that was prevalent throughout the bridge's length.

Local deck repairs were considered but determined to be a temporary measure that would not prevent the continued deterioration of the underlying deficient concrete. It was determined that only a complete deck replacement would fully restore deck integrity and ensure the highest level of serviceability for this critical crossing.

The concrete mix included polypropylene microfibers and a shrinkage reducing admixture. The use of these admixtures improved the finished product's quality by enabling uniformity across the deck section, restraining shrinkage cracks and reducing concrete permeability.

The new deck joints consist of a pre-compressed, silicone-coated, self-expanding-foam bridge joint system, which reduces maintenance and prevents water from infiltrating onto the superstructure.

The 18-month project was a coordinated effort between the Philadelphia District and the Delaware Department of Transportation.

OTHER INNOVATIONS

To provide a durable solution to repair spalls and delamination of large vertical surfaces common at large bridge piers, the USACE Philadelphia District (NAP) used ultra-high-performance concrete (UHPC), with its well-established high strength and durability, as a solution for repairing piers at the Chesapeake City Bridge in Maryland. The use of UHPC to repair bridge spall showed the application is promising and can provide an excellent solution for large surface vertical repairs. This application has potential for repairing USACE locks and dams, concrete gravity structures and large bridge piers.

The concrete overlay on the William V. Roth Jr. Bridge near St. Georges, Delaware, had exceeded its service life, forcing NAP to look for repair options. After a selection process, the district decided to use polyester polymer concrete (PPC), given it was designed for high-strength and rapid-setting applications. This synthetic material, like Portland cement concrete, is comprised largely of aggregate; however, polymer concrete has a polymer resin as its binder. The PPC overlay has a cure time of just four hours, greatly reducing construction time and traffic delays.

KEEPING WATCH

USACE deploys new techniques to monitor superfund site

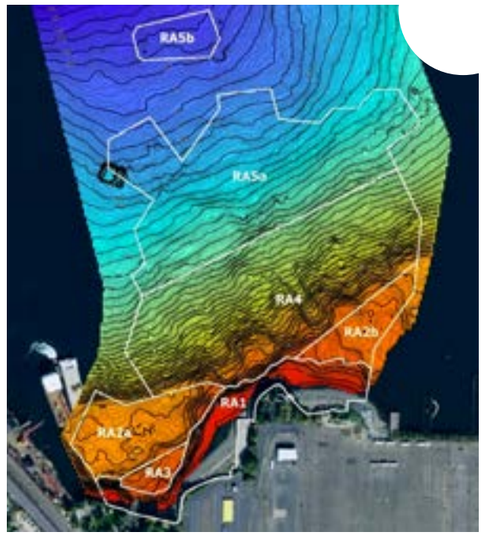
The Puget Sound Resources Superfund site at the south end of Elliott Bay, near Seattle, Washington, was historically used as a creosote plant and wood treatment facility. Discharges of process wastes into groundwater and Puget Sound resulted in extensive sediment contamination.

In 2004 and 2012, USACE designed and placed an engineered cap to contain the petroleum contamination across the 58-acre aquatic portion of the site, but because of the terrain and depth, monitoring the long-term protectiveness of the cap has been difficult.

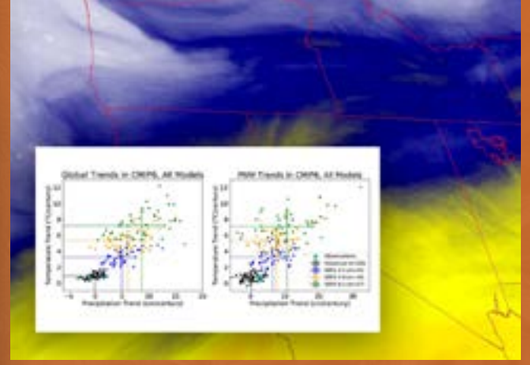
A multidisciplinary approach developed by the Seattle District and the Environmental Protection Agency deployed an array of existing and emerging technologies to evaluate the condition of underwater caps that contain sediment contamination across complex marine environments.

High-resolution bathymetry, remotely operated vehicle surveys, sediment profile imagery and passive sampler technologies were used in combination with traditional sediment sampling and analysis approaches to determine whether the engineered cap at the site remains protective of human health and the environment.

This project represents the effective integration of existing and emerging technologies to better understand contamination at complex sites.



OTHER INNOVATIONS



The performance of climate models used by water managers in the Northwest was tested as part of a study by the Seattle District, along with the National Center for Atmospheric Research, the Bureau of Reclamation, Colorado School of Mines and The MITRE Corporation. The process created a method for reducing, by an estimated 20 percent, the number of models to be considered for climate change impact applications. Doing so reduces the computational effort needed to gain a realistic simulation of the future climate for a given regional impact.

The water resources of the Columbia River Reservoir System (CRRS) sustain an economically critical food-energy-water nexus. Across the system, water management planning is challenged by future hydrologic variability. NWD's Columbia River Climate Change Team developed a novel approach – the Columbia River Reservoir System Vulnerability Assessment – to demonstrate how the CRRS would perform under a wide range of hydrological conditions. This approach provides decision-support products to anticipate potential hydroclimatic change and enable planning and increased resilience for water resources infrastructure.

A RESILIENT LINE OF DEFENSE

Researchers build models, plan to protect Kwajalein Atoll's defense islands

The Kwajalein Resiliency Project is designing solutions to improve the resiliency of three of the major islands in the Kwajalein Atoll – Kwajalein Island, Roi-Namur Island and Meck Island.

Resiliency of these defense islands will be improved by reducing flood impacts from rainfall and ocean inundation, preventing erosion of shorelines where infrastructure is threatened, and protecting and enhancing recharge of the freshwater lens under the ground surface.

The Honolulu District is collaborating with ERDC to create effective designs to mitigate flooding, coastal erosion and adverse groundwater impacts. The project has three major tasks – data collection, modeling and analysis; stormwater drainage and groundwater recharge design; and shoreline protection design. Architect and engineering firm AECOM also supported the project.

Collected data is being used to build comprehensive numerical models that will allow USACE and its stakeholders to conduct what-if scenarios of physical environment changes. The improved understanding of the islands' physical environment supports resilient design tasks for improved flood management, shoreline protection and groundwater enhancements that consider projected climate and sea-level changes.

A MODEL OF COLLABORATION

Digital, physical products join together to combat Harmful Algal Blooms

The effort to detect, mitigate and remove harmful algal blooms (HABs) for freshwater resources has seen focused investment, research and advancements in recent years.

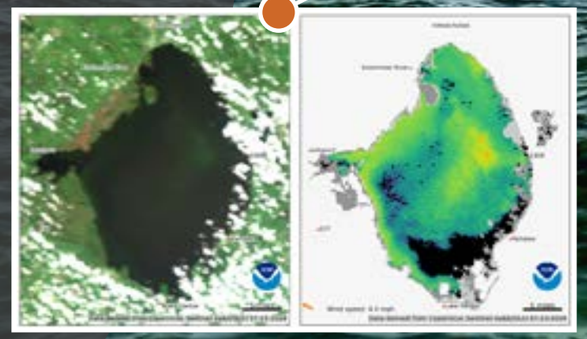
The collaboration of partners to confront the HABs challenge in Lake Okeechobee, Florida, coordinated by the South Atlantic Division (SAD), includes teams from academia, state agencies, federal organizations and authorities and ERDC.

Among the developments to address the HAB threat, SAD worked with NOAA and ERDC to develop a forecast model – called CyanoHAB Nowcast/Forecast – that provides data on algal blooms and scum location daily with a five-day projection. This forecast uses satellite, weather and water-quality data.

A project led by the University of Florida developed a model that simulates Lake Okeechobee's daily nutrient and algae exports to the Caloosahatchee River and Estuary (CRE) System, simulates nutrient fluxes from the watershed, and uses hydrodynamic models to assess CRE's vulnerability to HABs and other water-quality hazards.

These programs, along with the development and deployment of the HAB Interception Treatment and Transformation System – a system developed by ERDC that removes HAB biomass from the water and then concentrates and converts the biomass into fuel – are just a few of the efforts to better understand, curtail and ultimately eliminate the HAB threat in Lake Okeechobee and elsewhere.

Learn more about USACE HAB research efforts here: https://ansrp.el.erdc.dren.mil/HAB.html



FOR NATURE, FOR US ALL

Dredged sediment is helping restore vital wetlands

The mudflats and marshlands around San Francisco Bay have long been home to native species, as well as a critical component to the area's flood protection measures.

In December 2023, the South Pacific Division (SPD), led by the San Francisco District and supported by EWN, used dredged material from an earlier dredging project to support the renourishment and improved resiliency of important mudflats and marsh areas near Eden Landing.

During nearly three weeks of work, two scows – making a combined 169 trips – delivered approximately 90,000 cubic yards of sediment to the placement area. The scows operated around the clock and timed their deliveries with the tides.

The process, called strategic shallow water placement, is where sediment dredged from a navigation channel is deposited at a shallow location adjacent to a mudflat or tidal marsh so that natural hydrodynamic and morphodynamic processes can move the sediment onto the mudflat and marsh.

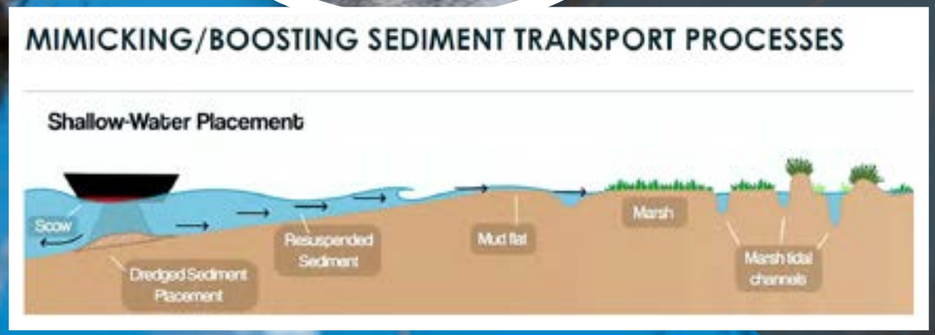
This method mimics natural sediment supply to wetlands by placing sediment in shallow water on the periphery of the bay to allow tides and currents to move the placed material to existing mudflats and marshes.

OTHER INNOVATIONS

Ongoing development of the Forecast-Informed Reservoir Operations (FIRO) continues to show its positive impact on reducing flood risk and improving water availability across the western U.S. During FY24, several of the original pilot projects advanced to the point in which 29 water control manuals are being updated and a national screening process has begun to assess FIRO suitability at USACE reservoirs nationwide.

Pictured above is Lake Oroville in October 2021 at 27-percent capacity (left) and June 2023 at 100-percent capacity (right). Photos by California Department of Water Resources

Working with EWN, SPD has continued to fine-tune a plan for the Upper Guadalupe River in San Jose, California, that incorporates natural and nature-based features in creating a riparian forest habitat that contributes to a robust flood risk management project. The updated plan, which is nearly half the cost of one previously authorized, calls for a self-sustaining, multi-stage channel that reduces maintenance requirements, including channel widening and flood benches that increase channel capacity and lower flood stages.



UNIQUE SOLUTIONS FOR A UNIQUE ENVIRONMENT

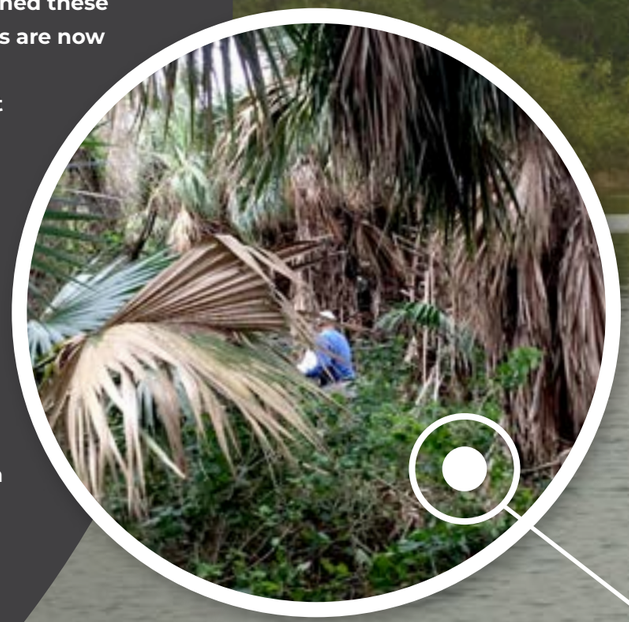
Agencies come together to restore, protect South Texas ecosystems

The Galveston District is among the leaders of a conservation effort focused on preserving a unique south Texas ecosystem.

Resacas are lakes near the Rio Grande River that formed during flooding events and were then left disconnected from the river when those flood waters receded. Because the flooding events that created and renourished these resacas no longer occur, these critical habitats are now threatened with extinction.

The Resaca Ecosystem Restoration Project seeks to create nesting areas for the red-crowned parrot, using habitat models developed through collaboration between the Galveston District, U.S. Fish and Wildlife Service, Texas Parks and Wildlife, The Nature Conservancy, the National Park Service and the University of Texas. The effort is also supporting natural resaca hydrology by manipulating water to mimic the system's natural seasonability and is exploring the use of biocontrol agents, such as the Brazilian Peppertree Thrip, to mitigate the impact of invasive and problematic plant species.

These efforts are part of an overall project to restore and protect these one-of-a-kind ecosystems.



OTHER INNOVATIONS

The Galveston Survey Data Management System represents a major advancement in project management for coastal projects. By integrating Esri's interactive mapping capabilities with Bentley ProjectWise, this project delivers a user-friendly, efficient and accurate solution that enhances the way users manage and access project data, including the ability to add and view surveys at folder locations. This development saves users significant time while accelerating and enhancing project management.

The Fort Worth District is managing the construction of a multi-story administration facility on Joint Base San Antonio-Randolph designed to meet Net Zero goals for energy use and sustainability, supporting the needs of the U.S. Air Force while also navigating requirements to match adjacent historical facilities. Intelligent design elements include redirecting storm water runoff to underground storage tanks for use in the non-potable water system, incorporating natural light to reduce lighting load during peak daylight hours, using photovoltaic cells on the roof to enable renewable energy systems, adding a high-efficiency building envelope to reduce cooling and heating load, and more.

FROM SCARCE TO RESILIENT

Model helps Iraq identify internal, external threats to water security

Water security in semi-arid and arid Middle Eastern climates has been severely impacted by the effects of prolonged heat waves, reduced precipitation, increased evapotranspiration and other factors brought about by a changing climate.

These changes are compounded in Iraq, where population centers and industry rely on varying transboundary water flows to meet water demands. Iraq's most profitable sector – energy – is especially threatened by insufficient water supply, which complicates government decision making in energy infrastructure development.

The Transatlantic Division (TAD) and ERDC, funded by the U.S. Agency for International Development and working with the University of Virginia, developed a toolkit and model that helps analyze and prioritize important infrastructure investments and how those projects may impact water security in the region. A particular innovation in the study was the evaluation of hydrology data derived from satellites in determining water scarcity impact on individual energy facilities.

With a tentative 30-year window (e.g., 2025-2055), the toolkit simulates performance across key water security conditions, such as transboundary challenges in sharing water between Turkey, Syria, Iran and Iraq; and climate risk, such as increasing aridity and evaporation of local water.

OTHER INNOVATIONS

Working with allies in the Middle East region, TAD applied existing technology in an innovative way to strengthen earth covered magazines (ECM). Typically, ECMs are covered with shotcrete, which can break up and become hazardous flying debris in the event of an accidental detonation. Instead, geosynthetic cementitious composition mats (GCCM) were used on the magazines to mitigate the threat. GCCM is a dry powdered concrete encapsulated between pieces of non-woven geotextile. When deployed and hydrated, it forms a durable concrete layer.

INNOVATION AWARDS

The USACE Innovation of the Year Awards recognize successful innovations associated with the incorporation of new technologies, the novel application of science-driven methodologies, or the implementation of research and development results with the goal of enhancing delivery of the USACE mission.

2024 Innovation of the Year Award recipients:

Autonomous and Semi-Autonomous Hydraulic Jack Pumps with Data Logger
Michael McCray and Brenden Mckinley, Dam Safety Modification Center

Fabrication of Large-Scale Replacement Parts for the Poe Lock Ship Arrestor Lever Arms through Metal Additive Manufacturing
Clint Dougherty, Detroit District; and Zachary McClelland, ERDC

Generative AI in Support of Dam and Levee Safety
Michael Haefeli, Chicago District

Mississippi River below New Orleans Notched Sill Barrier
Heather Jennings, Michelle Kornick, Ashley Wainright, Andrew Oakman, Dave Ramirez, Kevin Derbigny, Hailey Laurent, Deborah Centola, Brendan Yuill, Katelyn Keller, Anthony Pegues, Julie Murphy, Eden Krolopp, Noah French, Dan Wiet, Canda Lorson, Andrew Tsay, Cameron Alexander, Leeland Brandon, New Orleans District; and Gary Brown and Phu V. Luong, ERDC

NAE Beneficial Use Planning Tool
Aaron Hopkins and Gabriella Saloio, New England District

Maryland Stream Mitigation Framework
Nicholas R. Ozburn and Matthew R. Hynson, Baltimore District

Ultra-High-Performance Concrete for Repair of Vertical Surfaces
Sabah Alsabbagh, Adrian Kollias, William Nash, Cameron Chasten and Carl Leunig, Philadelphia District

Cost-Tracking Database
Jeremy Kellett, New England District; and Rilee Potter, Chris Horihan and Corina Zhang, Omaha District

Air Force Personnel Center, B499 B-Wing
Mick Nyenhuis, Christopher Reinhardt and Val Oppenheimer, Fort Worth District

USACE Sustainability Award
Engineering With Nature® program

Revolutionizing Conduit Inspection: Harnessing Lidar Technology for Enhanced Infrastructure Assessment
Bryson Webber, Daniel Salto, Michaelangelo Hermoso, Jeffrey Phillips and Larry Ferguson, Fort Worth District

Deep Learning Algorithm for Rapid Estimation of Shoreline Total Water Level from Continuously Scanning Lidar
Adam M. Collins, Annika O'Dea, Katherine L. Brodie, A. Spicer Bak, Tyler J. Hesser and Matthew W. Farthing, ERDC

Submersible Matting System
Timothy W. Rushing, Benjamin A. Rutherford, Meghan J. Buffington, Alicia K. Bounds, Terry Ann Stanton, Zachary J. Tyler, Stanley J. Boc, Jr., Allison B. Hudson and Melissa A. Keen, ERDC

- Dr. Nathan Beane, a research forester with ERDC, captured this image from Myakka State Park in Sarasota, Florida, the second-most diverse ecosystem in North America.

"WHAT WORKED WELL TODAY MIGHT NOT WORK AS WELL TOMORROW. TO KEEP IMPROVING AND TO STAY AHEAD OF CHANGE, WE KNOW THAT WE NEED TO **KEEP INNOVATING.**"

Lt. Gen. William H. "Butch" Graham
56th Chief of Engineers
Commanding General, U.S. Army Corps of Engineers

U.S. ARMY

US Army Corps of Engineers

ERDC B-24-5