USACE R&D

FY22 ANNUAL REPORT

US Army Corps of Engineers

DR. DAVID W. PITTMAN

Testifying before Congress about the newly released U.S. Army Corps of Engineers (USACE) Research and Development Strategy, our Commanding General and Chief of Engineers, Lt. Gen. Scott Spellmon said, "we must execute our comprehensive research and development strategy to meet the challenges of the 21st Century."

Released in November 2021, the strategy issues a clarion call to invest in and embolden R&D across the enterprise. It has encouraged me and other R&D leaders to connect the dots and better share the story of how USACE R&D is meeting and exceeding mission expectations.

This annual report is an important way we "Tell the Story" of the innovative R&D being done by USACE, and specifically the U.S. Army Engineer Research and Development Center, to support the nation, from Civil Works to Warfighter Support, and everything in between.

In addition, we have launched an annual USACE Operational R&D Workshop to better connect our world-class research with Division and District engineers, as well as stakeholders throughout the Department of Defense and beyond.

Focused on applying off-the-shelf solutions to today's problems, this workshop has already provided innovative answers to long-standing challenges and has given USACE leaders critical information.

In that same spirit, we also started the "Power of R&D" newsletter to shine a light on the engineers and scientists working each day to tackle the engineering obstacles before them. It has given better insight into their processes, their abilities and the passion they bring to this mission.

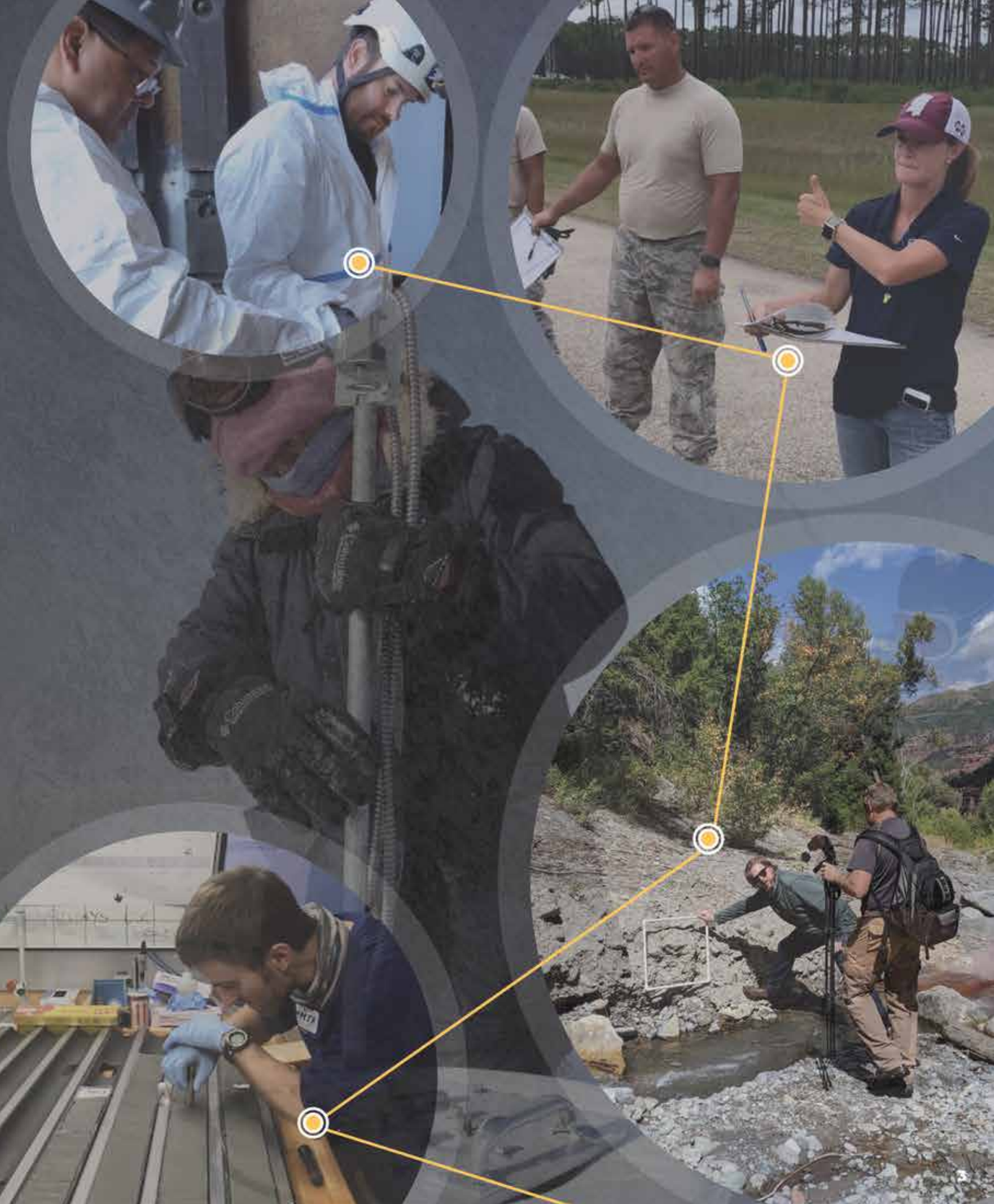
These efforts seek new pathways to ensure targeted research meets critical needs.

We are an organization and a community that thrives on solving what others think is unsolvable and discovering what many thought could not be found. It is that dedication, commitment and tenacity to never fail that has made the USACE R&D community successful. It is also those traits that will ensure we succeed in the future.

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

US Army Corps of Engineers

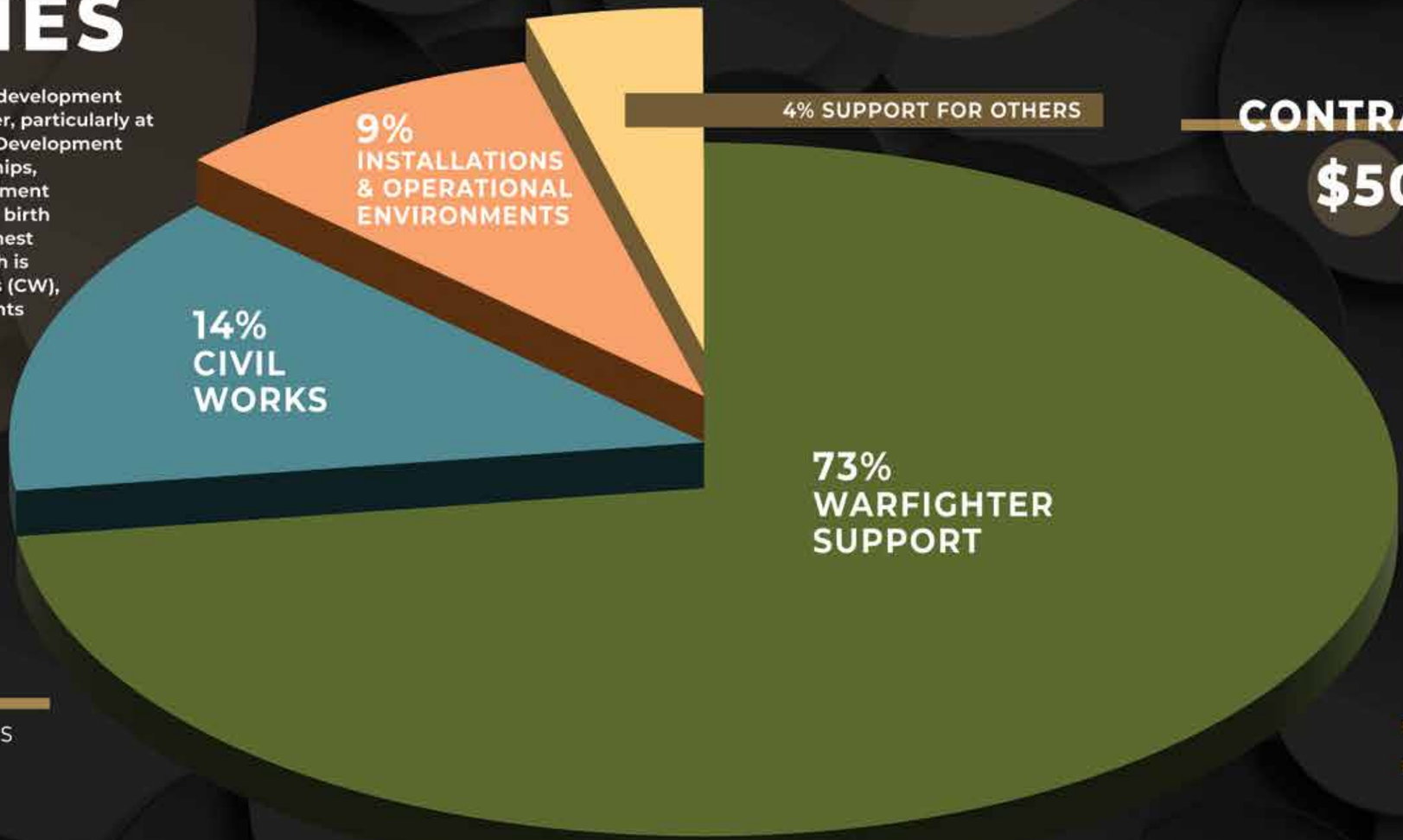
Our mission is to deliver vital engineering solutions, in collaboration with our partners, to secure our nation, energize our economy, and reduce disaster risk.

R&D ACTIVITIES

During FY22, the USACE research and development community continued to grow stronger, particularly at the U.S. Army Engineer Research and Development Center (ERDC). Through new partnerships, agreements and contracts, R&D investment at ERDC surpassed $1.86 billion, giving birth to more solutions to our nation's toughest engineering challenges. ERDC research is sorted into four categories: Civil Works (CW), Installations & Operational Environments (IOE), Warfighter Support (WfS) and Support for Others (SfO).

R&D INVESTMENTS FY22

$1.86 BILLION



ENGAGEMENTS OCT 2021 TO SEPT 2022

110 VISITS

1,177 VISITORS

CONTRACTS

$500M OBLIGATIONS

1,881 NEW ACTIONS

$153 MILLION
SMALL BUSINESS CONTRACTS

123 CRADAS
COOPERATIVE R&D AGREEMENTS
23 UNIVERSITY CRADAS

87 EPAs
ACTIVE **10** NEW EDUCATIONAL PARTNERSHIP AGREEMENTS

PUBLICATIONS

JOURNAL ARTICLES	294
TECHNICAL REPORTS	280

TESTING AGREEMENTS

304

22+
INTERNATIONAL PARTNERSHIPS

ALIGNMENT WITH USACE R&D STRATEGY

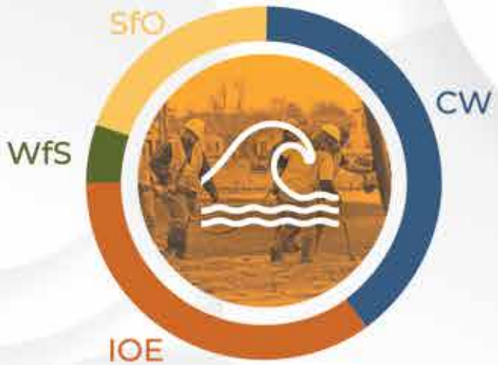
When released in November 2021, the USACE R&D Strategy laid out a framework that reshaped the focus and direction of its R&D community. ERDC's rich history and expertise well positions it as a leader for each of the strategy's 10 priorities.Since its founding in 1929, ERDC has leveraged its world-class 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

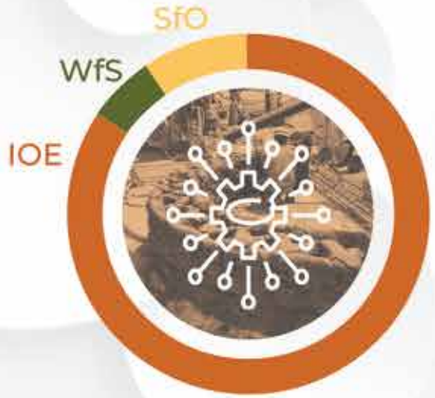
Future conflicts will occur at a longer range and greater speed than ever before. American Warfighters must be agile to rapidly respond to evolving threats from increasingly advanced adversaries. ERDC's foundation in geospatial research, military engineering, environmental characterization and advanced 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 AND 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

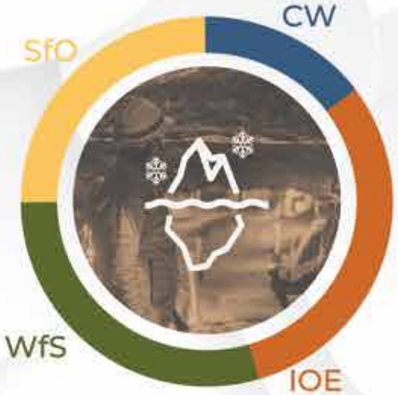
Military installations and missions must redesign their energy systems and move from carbon-intensive fuels while increasing resilience and grid independence. As extreme weather tests the strength of power-generation assets, ERDC is developing cyber-secure technologies that provide renewable and resilient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

REVOLUTIONIZE AND 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 AND 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 AND 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.

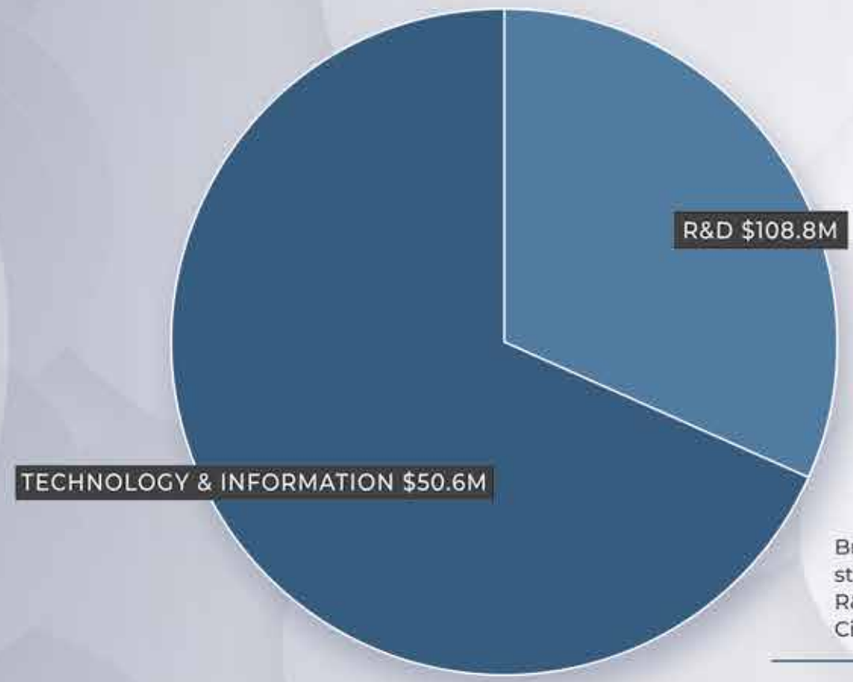
USACE R&D AREA

CIVIL WORKS

Our nation's engineering challenges are growing dramatically – from aging and often inadequate infrastructure, to rapidly changing demographics and urbanization, to mitigation of environmental contamination and climatic extremes.

USACE demands world-class research and development to best execute its Civil Works mission to support public and commercial navigation; restore, protect and manage aquatic ecosystems; and reduce flood risk.

Innovation must be particularly focused on reducing implementation times; improving resilience in the face of climate changes; and maximizing benefits to the economy, ecosystem quality, and public health and safety as part of an integrated water resources management approach.



Breakdown of direct, strategic and tactical R&D funding in ERDC's Civil Works portfolio

Breakdown of operational R&D funding by source in ERDC's Civil Works portfolio

FIRO

Forecast-Informed Reservoir Operations

Initial pilots have provided a
15-20% INCREASE
in water availability

Managing a reservoir can be a delicate balancing act between flood risk management, water supply and environmental needs.

For decades, this process has been guided by water control manuals that dictate when to retain and when to release water based on ground conditions. But a new research and operations partnership called Forecast-Informed Reservoir Operations (FIRO) uses modern weather and streamflow forecasting to better inform water management decisions.

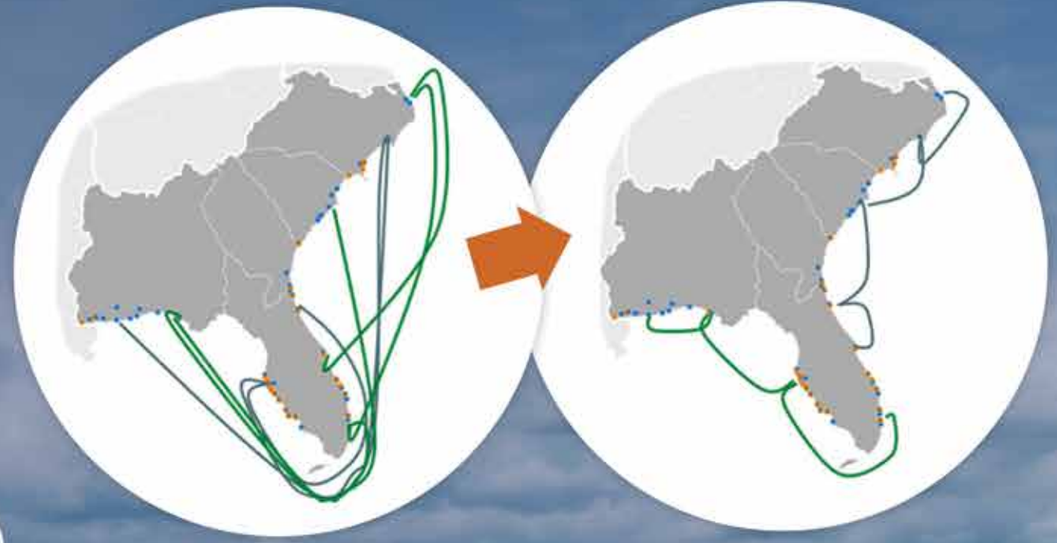
Initial pilots in Western regions have provided an increase of up to 15 to 20 percent in water availability and have enabled deeper understanding of the volatile atmospheric rivers that cause 84 percent of California's floods. Current efforts will apply FIRO more broadly across the nation, enabling water managers to be as precise and efficient as possible as climate change threatens to bring more extreme floods and droughts.

DREDGING
OPTIMIZATION STRATEGIES

USACE spends $1.5 billion each year to dredge hundreds of navigation projects across the country – its largest civil works expenditure. Yet, there has not been a rigorously quantitative or repeatable process to determine the most efficient and effective way to conduct maintenance dredging across hundreds of projects nationwide.

Through ongoing research and development, USACE engineers have created dredging optimization models using artificial intelligence to streamline and optimize dredging operations across the enterprise. Two separate models – the Dredge Project Selection Optimization model and the Dredge Fleet Scheduling Optimization model – aim to facilitate strategic decision making. These models can highlight the most critical locations from a nationwide perspective.

Adopting these strategies will enable more cost-effective mission delivery and limit disruptions to our nation's ports and vital supply chains.



SCHEDULING OPTIMIZATION CONCEPT
While accounting for project-level requirements and environmental work windows, new models allow decision makers to schedule dredging so as to minimize mobilization costs.

Optimizing dredging operations will
LIMIT DISRUPTIONS
to our nation's port operations & supply chain

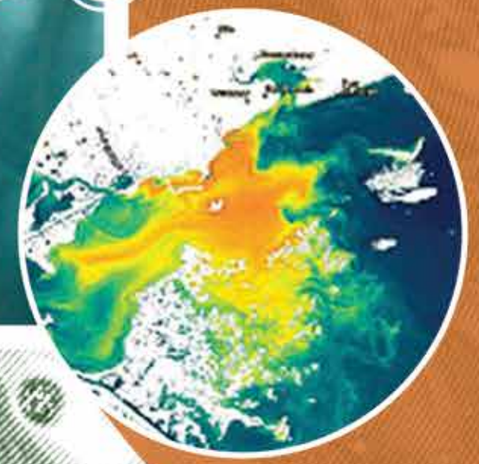
HARMFUL ALGAL BLOOMS

HABs

Harmful algal blooms, which occur in freshwater when microorganisms grow rapidly and sometimes release dangerous toxins, are one of the most complex and economically damaging issues threatening the nation's ecosystems. In addition to harming aquatic life and threatening drinking water supplies, these events cause an estimated $82 million in economic losses annually.

Given the immense damage harmful algal blooms cause the environment and economy, the 2018 Water Resources Development Act authorized USACE to implement a five-year technology research program to deliver scalable technologies for harmful algal bloom detection, prevention and management.

During the program's first three years, 32 projects have been initiated, featuring collaboration between USACE and federal, state and academic partners, including 24 led by ERDC.



Between 2010 and 2020 HABs cost U.S. communities

$1 BILLION

NATURE AS A NATIONAL PRIORITY

For more than a decade, the USACE Engineering With Nature® (EWN) initiative has partnered with multi-sector organizations worldwide to advance the use of nature-based solutions for infrastructure and communities.

In April 2022, President Biden focused national attention and federal effort on nature-based solutions through Executive Order 14072, which directs multiple actions to tackle the climate crisis. EWN contributed to key products of that order: a White House roadmap and resource guide for accelerating progress on nature-based solutions.

During FY22, USACE incorporated nature-based solutions across its missions, including civil works and military engineering. EWN worked with the Army, Navy, Marine Corps and Air Force to advance the use of natural infrastructure for installation resilience, a growing opportunity across the Department of Defense.

EWN also sponsored and co-hosted the Measuring What Matters Summit at the National Academies of Sciences, Engineering and Medicine, which drew more than 1,000 participants and leaders from multiple sectors to highlight opportunities to expand and diversify value through nature-based solutions.

In its fifth season, the EWN Podcast reached 30,000 listeners.

EWN®

Scan for the EWN website

Scan for the EWN podcast

Executive Order 14072
FOCUSED FEDERAL EFFORT
on Nature-Based Solutions

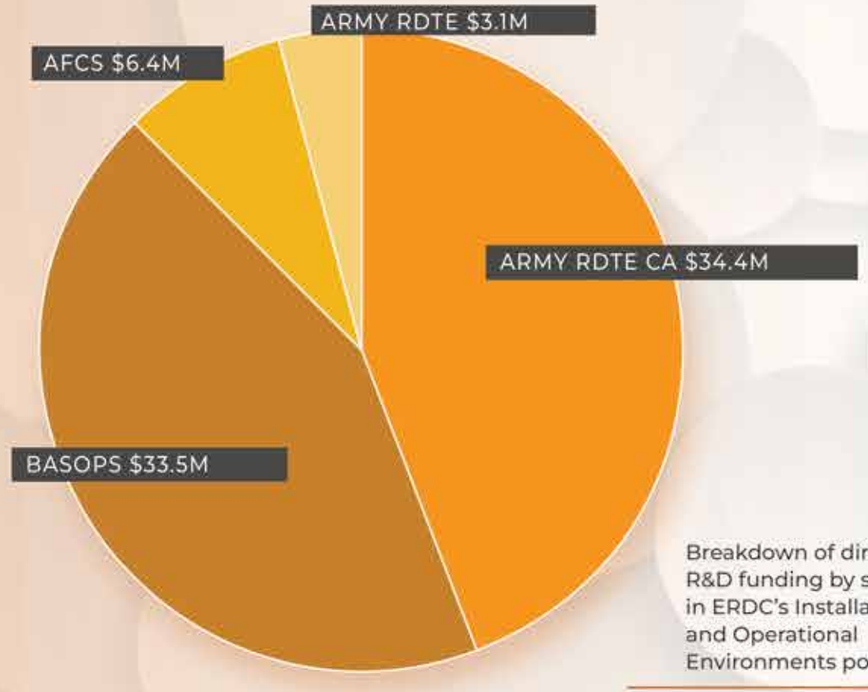
USACE R&D AREA

INSTALLATIONS & OPERATIONAL ENVIRONMENTS

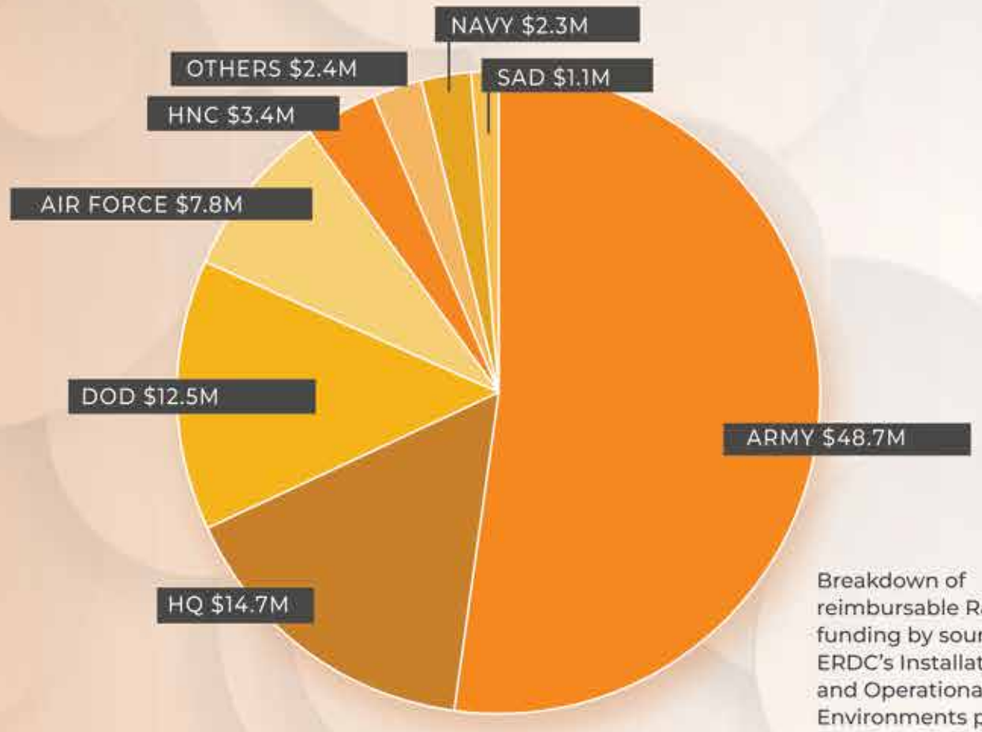
The Installations and Operational Environments portfolio is focused on improving the reliability, efficiency and effectiveness of military infrastructure at installations and on the battlefield.

This includes improvements in military construction technology, capacity and resource planning, and minimizing negative impacts of military infrastructure to the environment and communities. Through this work, USACE enables the execution of the Army Modernization, Installations and Climate strategies.

This effort 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 installation energy.



Breakdown of direct R&D funding by source in ERDC's Installations and Operational Environments portfolio



Breakdown of reimbursable R&D funding by source in ERDC's Installations and Operational Environments portfolio

STRUCTURAL HARDENING

Updated design guidance is being adopted at military facilities
AROUND THE WORLD

As modern weapons advance, the U.S. military needs new solutions to protect its structures against these threats. This includes replacing outdated elements that are inadequate, impractical and cost-prohibitive.

ERDC leveraged its long-standing expertise and core competency in blast and weapons effects to develop new Unified Facilities Criteria (UFC) guidance for the design and analysis of protective structures. These improved design concepts leverage advanced materials to modernize hardened structure design.

In addition, ERDC has developed modeling solutions to accurately assess vulnerabilities of existing structures and to predict their responses from multi-hit impacts from modern precision penetrators. This effort will mean better protection and enhanced survivability for Soldiers and critical assets currently vulnerable to modern and emerging threat weapons.

SALTWATER CONCRETE

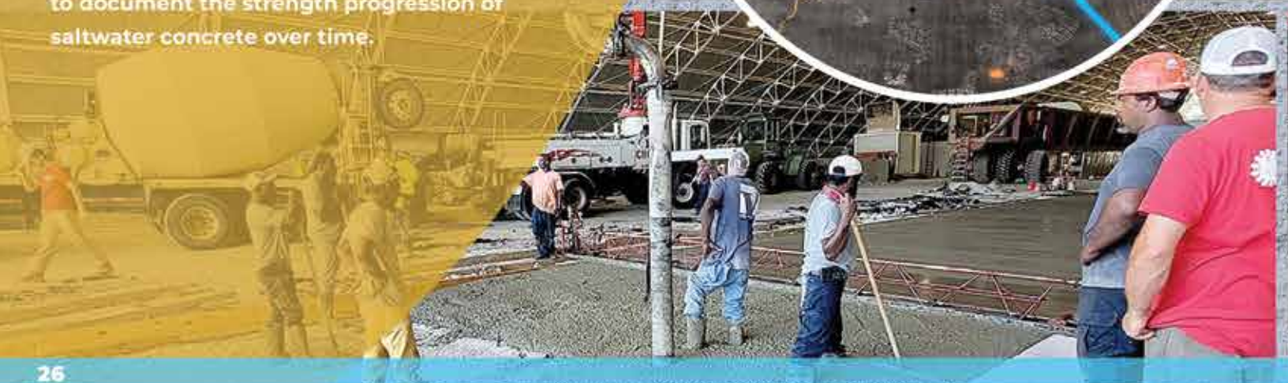
Research proves nearshore CONCRETE CONSTRUCTION IS FEASIBLE using locally available saltwater

Existing concrete technologies are insufficient in remote and austere environments, where access to the required freshwater is limited. However, ongoing concrete research is providing military planners with a new tool in the deployment of airfields and other concrete infrastructure.

The development of saltwater concrete, an ERDC research project for the Naval Facilities Engineering and Expeditionary Warfare Center, enables nearshore concrete construction using locally available saltwater. Among other advantages, this eases military construction on island and forward locations.

In FY22, ERDC conducted traffic performance testing of two full-scale saltwater concrete airfield pavement test sections using a heavy vehicle simulator. The sections represented two different thicknesses of airfield pavement that were trafficked with a P-8 Poseidon Navy aircraft to determine the performance of concrete using saltwater. Both sections performed similarly to the control sections that used freshwater.

Laboratory testing is also being completed to document the strength progression of saltwater concrete over time.



SUSTAINABLE BUILDING MATERIALS IN MILITARY CONSTRUCTION

ERDC engineers test non-destructive sustainable concrete materials at ERDC's field exposure site at Treat Island, Maine.

USACE R&D is developing techniques and technologies to better use sustainable materials in military construction.

The project will debut its materials and processes during the construction of a barracks facility at Joint Base Lewis-McChord. It is being led by USACE in support of the Assistant Secretary of the Army for Installations, Energy and Environment and the Army Materiel Command. Scheduled to begin in 2024, the project will include designing and constructing an 89,082-square-foot barracks capable of housing 168 Soldiers at the military base using sustainable materials aimed at reducing carbon emissions by 30 percent.

The project's design portion calls for selecting low emissions construction materials, including concrete, steel and masonry products.

As part of this project, ERDC, as the subject matter expert, is coordinating information exchange with the Navy and Air Force, as well as ongoing technical support and required reporting to Congress.

Rendering of a planned barracks at Joint Base Lewis-McChord. The three-story facility is designed to house 168 Soldiers and will use sustainable building materials aimed at drastically reducing carbon emissions.

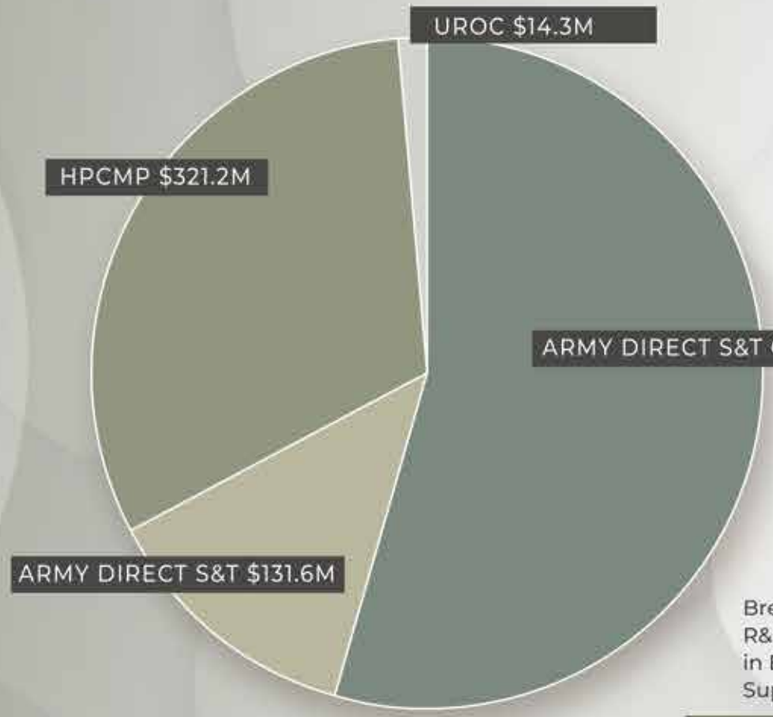
Use of sustainable materials seeks a
30% REDUCTION
in carbon emissions

USACE R&D AREA

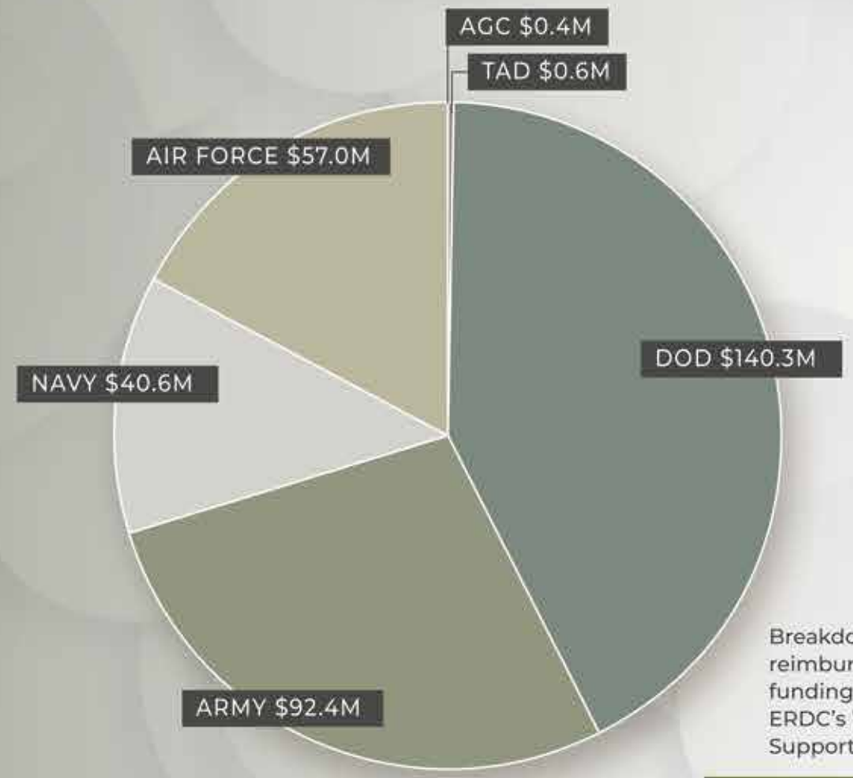
WARFIGHTER SUPPORT

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 U.S. 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 Department of Defense and other federal agencies that support the Warfighter.



Breakdown of direct R&D funding by source in ERDC's Warfighter Support portfolio



Breakdown of reimbursable R&D funding by source in ERDC's Warfighter Support portfolio

ANYWHERE, ANYTIME

RAIL LINE OFFLOAD & SEAPORT REPAIR

The military has long used trains to transport heavy equipment over great distances. However, it often faces a logistical challenge when offloading vehicles like tanks and positioning them where they are needed.

Anticipating military mobility needs in Europe, ERDC collaborated with the Combat Capabilities Development Command Ground Vehicle Systems Center (GVSC) to develop the Rapidly Available Interface for trans-Loading (RAIL), a ramp system that can be easily transported and deployed, allowing heavy military vehicles to be offloaded anywhere along a rail line without the need for a permanent railyard.

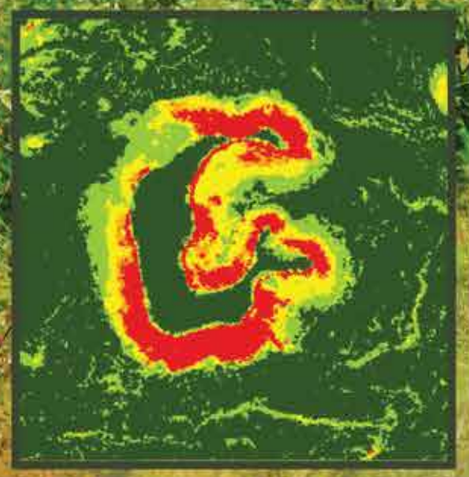
The ERDC and GVSC team created the system by rapidly adapting technology (PODS) they had previously developed for offloading battle tanks at damaged seaport facilities.

Because both RAIL and the Pier Over-Decking System (PODS) use the same components, they can easily be configured for either sea or rail missions, giving commanders broad operational flexibility.

RAIL enables offloading of a heavy armor vehicle up to 170,000 pounds

ANYWHERE ALONG A RAIL LINE

TACTICAL GEOSPATIAL INFORMATION CAPABILITIES



Tactical Geospatial Information Capabilities (TGIC) form the framework for understanding the physical environment and its impact on combat operations. TGIC provides timely and tactical scale-3D geospatial data with high-fidelity resolutions and accuracy. Through innovative techniques for automated and semi-automated generation of geospatial products, battle command capabilities are enhanced to support all aspects of command and control, along with intelligence, surveillance and reconnaissance missions.

Features, such as the ability to provide high-fidelity terrain information, support improved analysis for tactical-level planning and decision making. For example, tree cover impacts military operations by impeding vehicle and troop movement, preventing helicopter access and providing concealment.

TGIC features give military leaders the right information at the right time for critical mission planning.

Tactical Geospatial Information Capabilities provide
TIMELY, ACCURATE & TACTICAL-
scale 3D geospatial data

COLD WEATHER MOBILITY

In support of USACE's mission to develop new techniques and technologies to support our military in the Arctic, ERDC engineers and scientists developed new criteria and specifications for evaluating cold weather tire performance.

Snow and ice degrade ground vehicle traction and impact mobility, reducing operational effectiveness, and creating safety hazards for those operating military vehicles in frigid conditions.

In FY22, ERDC transitioned specifications for tires supporting 700 High-Mobility Multipurpose Wheeled Vehicle within the 11th Airborne Division. ERDC expects to update performance specifications for Joint Light Tactical Vehicle tires in FY24.

This vital information will provide our Armed Forces cost-effective solutions for improving the safety and performance of ground vehicles operating in Arctic environments. These new specifications enable and support enhanced mobility in the Army's mission of "Regaining Arctic Dominance."

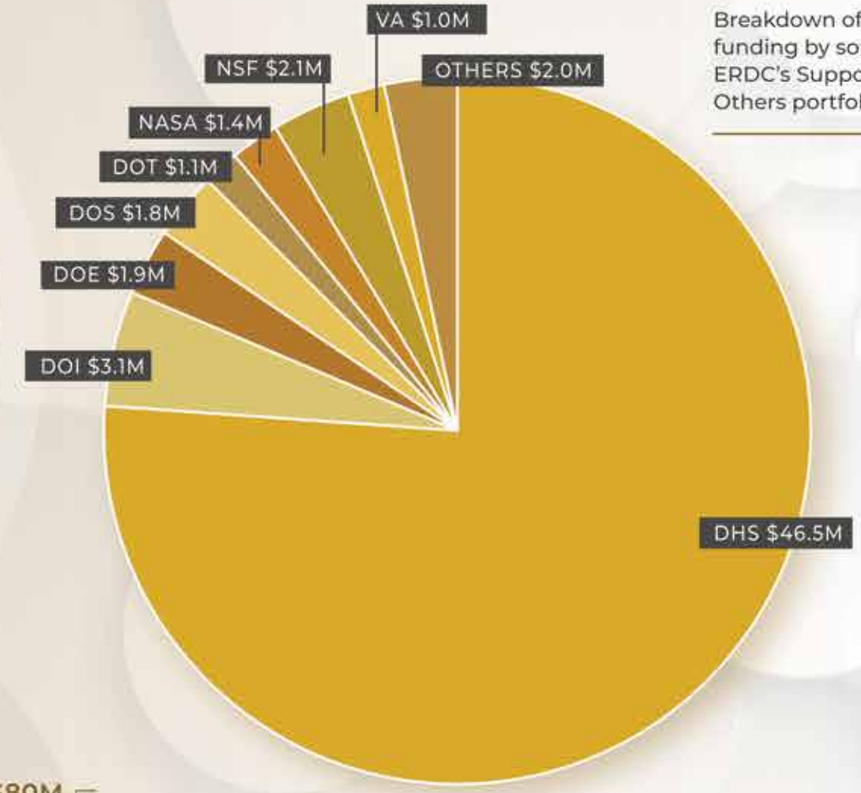
New tire specifications will improve the
SAFETY & PERFORMANCE
of ground vehicles operating in the Arctic

USACE R&D AREA

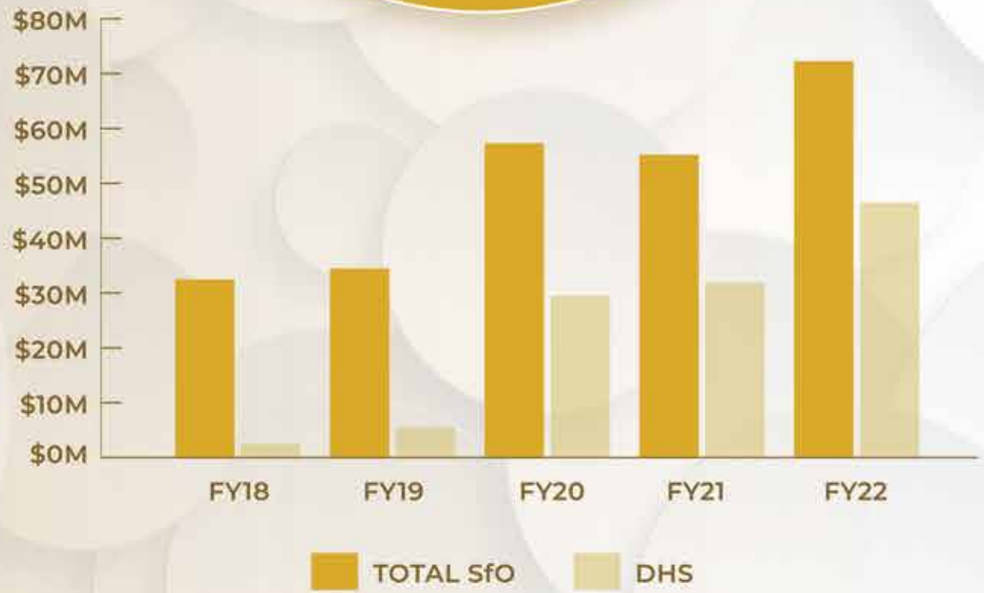
SUPPORT FOR OTHERS

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. These can be applied to diverse national challenges – from climate change to aging infrastructure to cybersecurity to soft-target protection, and the lessons learned from this research can often be leveraged to shape new USACE innovations.



Breakdown of R&D funding by source in ERDC's Support for Others portfolio



Breakdown of ERDC R&D funding in support of the U.S. Department of Homeland Security, compared to funding for the entire ERDC Support for Others portfolio

ENABLING COLD REGIONS RESEARCH

Home to the DOD's only R&D organization focused on cold regions, USACE also supports the National Science Foundation (NSF) in the U.S. Antarctic Research Program.

Researchers who call the Scott-Amundsen South Pole Station home must deal with extreme conditions. Although their elevated facility was designed to mitigate the effects of windblown snow, it must periodically be lifted on its support columns to maintain its height above the snow surface.

A USACE-developed computational model simulates snowdrift formation around the building, giving decision makers a better understanding of when and how the building's elevation needs to be changed. USACE is also building a basic understanding of Arctic and Antarctic climate processes and incorporating this knowledge into predictive models to inform operations and provide future situational awareness.

This effort helps the NSF successfully execute its cold regions research missions, increasing the safety and efficiency of personnel and providing reliable, resilient infrastructure.

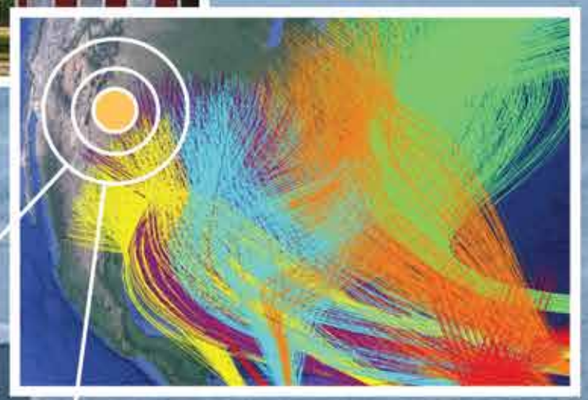
Cold regions research supports

RESILIENT INFRASTRUCTURE & MILITARY OPERATIONS

in cold, complex and austere environments

PROTECTING NUCLEAR POWER PLANTS

U.S.NRC



Natural hazards represent a principal threat to nuclear facility safety. Storm surge from hurricanes or tropical cyclones typically represents the most significant source of flooding in the coastal environment.

Leveraging its modeling and simulation capabilities and coastal engineering expertise, ERDC partnered with the U.S. Nuclear Regulatory Commission (NRC) to research potential hurricane and cyclone risks and develop mitigation strategies against these natural threats.

ERDC performed an assessment of uncertainties in storm surge models to develop a probabilistic flooding hazard assessment for nuclear power plants.

Using tools developed for USACE, these results will guide NRC activities and provide improved understanding and reduction in uncertainty for extreme hazards and their impact on nuclear power plant facilities.

Research outcomes support risk-informed licensing for future operations, NRC oversight guidance, and tools for assessing flooding hazards at nuclear power plants.

Modeling and simulation research
REDUCES THE UNCERTAINTY
for extreme hazards at nuclear power plants

CRITICAL INFRASTRUCTURE RESILIENCE

USACE is an industry leader in science and technology related to critical infrastructure, natural hazards and resilience. A new partnership with the Department of Homeland Security is focused on addressing infrastructure challenges and supporting the priorities of the Cybersecurity and Infrastructure Security Agency and the Federal Emergency Management Agency. These include mitigating flooding impacts and using research to extend the service life of aging water resources infrastructure.

ERDC, in partnership with the USACE Inland Navigation Design Center, Hydrologic Engineering Center, Risk Management Center, and Kansas City District, has been conducting research to demonstrate improved repair methodologies and risk assessment tools over the next two years.

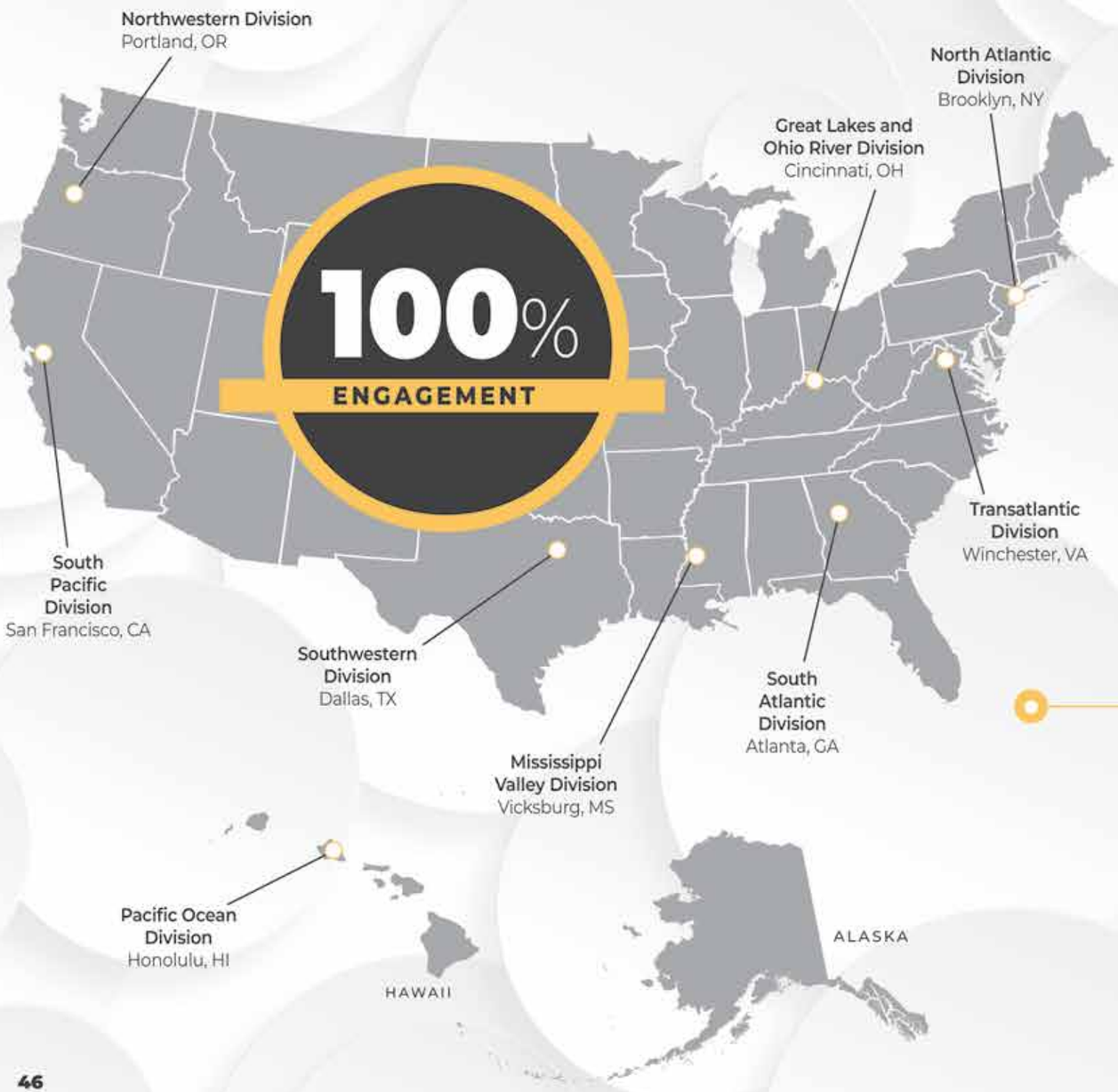
This effort will mitigate billions in damages from natural disasters, enhancing community resilience and ensuring the reliability and economic benefits provided by the USACE infrastructure portfolio.

USACE efforts will mitigate
BILLIONS OF DOLLARS
in infrastructure damage from natural disasters

SHARING THE STORY

VISITS TO **ERDC** • OCTOBER 2021 TO SEPTEMBER 2022

To fulfill our Commanding General's guidance to better connect the dots between researchers and practitioners, ERDC invited USACE leaders to tour its facilities and engage one-on-one with its engineers and scientists. Representatives from all nine USACE Divisions made a visit during the fiscal year. The average visit lasted nearly two days and included capabilities from all seven ERDC laboratories.



In FY22, R&D senior leaders engaged with critical decision makers throughout the Department of Defense. These engagements allowed DOD leaders to learn more about how ERDC's world-class people, facilities and multi-disciplinary capabilities are providing innovative solutions to the Warfighter and the Nation.

Hon. Michael Connor
Assistant Secretary of the Army for Civil Works

Hon. Rachel Jacobson
Assistant Secretary of the Army, Installations, Energy & Environment

Mr. William Nelson
Deputy Assistant Secretary of the Army for Research and Technology

Mr. Jaime Pinkham
Principal Deputy Assistant Secretary of the Army for Civil Works

Lt. Gen. Thomas Todd
Deputy to the Commanding General, Army Futures Command

Maj. Gen. Jim Bonner
Commanding General, Maneuver Support Center for Excellence

Brig. Gen. Joseph Ricciardi
Director of Operations, Office of the Deputy Chief of Staff, G9

Brig. Gen. William Glaser
Director, Synthetic Training Environment Cross Functional Team

Mr. Gregg Thompson
Deputy to the Commanding General, Maneuver Support Center for Excellence

Dr. Shawn Howley
Deputy Commandant, U.S. Army Engineer School

Col. Joseph Goetz
Director, Office of the Chief of Engineers

ACADEMIA

ERDC's commitment to attract the best talent and maintain a diverse workforce includes its engagement with Historically Black Colleges and Universities and Minority Serving Institutions. This effort supplies student recruiting pipelines, stimulates collaborative R&D, increases continuing education opportunities and facilitates exchanges between faculty and researchers. In FY22, ERDC specifically engaged three HBCU/MI institutions.

BUILDING STRONG
PARTNERSHIPS
TODAY & BEYOND

UAF UNIVERSITY OF ALASKA FAIRBANKS

Alcorn State University

JSU 1877 JACKSON STATE UNIVERSITY

FY22 PATENTS

Hardened Alternative Trailer System and Methods of Producing Same

Deployable Expedient Traffic Entry Regulator

Digital Buoy Systems and Methods

Vertical Draw System and Method for Surface Adhesion of Crystalline Materials

Measuring Deflection to Determine a Characteristic of a Cantilever
Inventors: Rebekah C. Wilson, Benjamin C. Masters
Patent Number: 11,209,369

Comprehensive, Multi-Species Environmental Modeling System
Inventors: Mark A. Chappell, Michael L. Mayo, Jonathon A. Brame, Matthew C. Brondum
Patent Number: 11,210,441

Over Decking Systems and Methods
Inventors: Jonathan M. Polom, Ashley L. Genna, Justin S. Strickler, Gary E. Johnston
Patent Number: 11,214,932

Advanced Filtration Membranes using Chitosan and Graphene Oxide
Inventors: Victor F. Medina, Christopher S. Griggs, Jose Mattei-Sosa, Brooke Petery, Luke Gurtowski
Patent Number: 11,235,291

Deployable Expedient Traffic Entry Regulator
Inventors: August N. Johnson, Bowen G. Woodson, Austin C. Hopkins
Patent Number: 11,248,351

Hardened Alternative Trailer System and Methods of Producing Same
Inventors: Justin M. Roberts, John M. Hoemann, Craig R. Ackerman
Patent Number: 11,267,516

Scalable Three-Dimensional Printing Apparatus
Inventors: Megan A. Kreiger, Michael Patrick Case, Gerald R. Northrup, Ghassan Al-Chaar, Bruce MacAllister, William Jacob Wagner
Patent Number: 11,273,574

Compositions and Methods for Treating Contaminated Water
Inventors: Clint M. Arnett, Martin A. Page , Donald M. Cropek, Ashley N. Boyd, Justin Lange
Patent Number: 11,279,542

Ready Armor Protection for Instant Deployment and Loading
Inventors: Omar Esquilin-Mangual, Catherine S. Stephens, Omar G. Flores, Andrew B. Edwards, Erik M. Chappell
Patent Number: 11,280,588

Hardened Compression Frame Systems and Methods
Inventors: John S. Judson, David V. Senior, Craig R. Ackerman, Daniel Duke
Patent Number: 11,286,711

Modular Guard Towers and Methods of Construction
Inventors: John M. Hoemann, Justin M. Roberts
Patent Number: 11,293,724

Multi-Spectral Photocatalytic Compounds
Inventors: Emily Asenath-Smith, Emma K. Ambrogi
Patent Number: 11,298,689

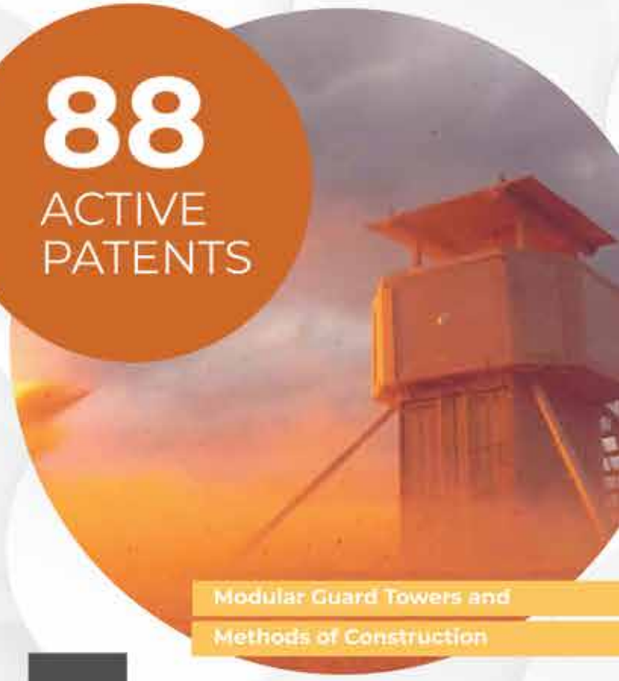
Digital Buoy Systems and Methods
Inventors: Tung N. Ly, Duane N. Morrison, Denise R. LaDue
Patent Number: 11,350,382

Airfield Tie-Down and Deployable Talons
Inventor: Nolan R. Hoffman
Patent Number: 11,370,558

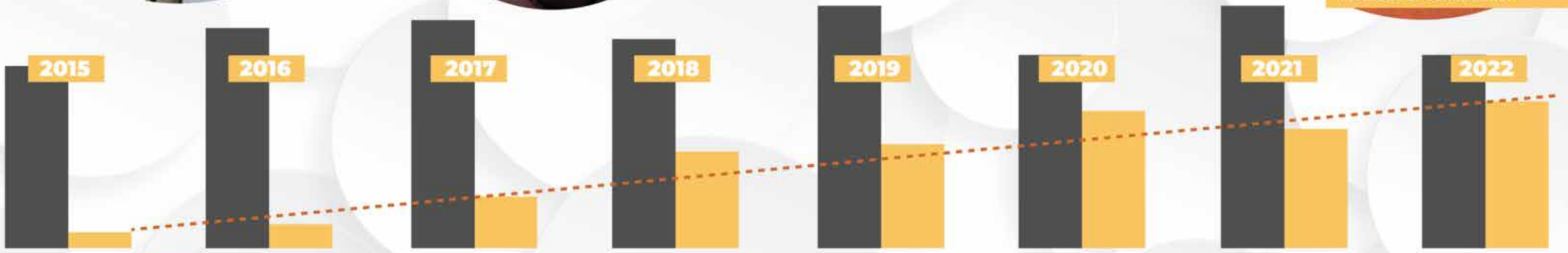
Vertical Draw System and Method for Surface Adhesion of Crystalline Materials
Inventors: Emily Asenath-Smith, Garrett R. Hock, Christopher J. Donnely, Jordan M. Hodge
Patent Number: 11,421,340

Predicting the Future Magnetic Alignment of a Runway
Inventors: Theodor A. Lee, Mihan McKenna Taylor
Patent Number: 11,454,737

88 ACTIVE PATENTS



Modular Guard Towers and Methods of Construction



NOTABLE AWARDS

2022 Presidential Rank Award - Distinguished Senior Professional (SL/ST)
Dr. Todd Bridges

2022 Presidential Rank Award - Meritorious Executive (SES)
Dr. David Pittman

2022 Federal Laboratory Consortium Award (Tech Transfer)
Bart Durst
2022 Director of the Year

Southern Public Relations Hall of Fame Induction
COL Christian Patterson

Congressional Record Recognition from Congressman Bennie Thompson
Donna Williams

2022 Black Engineer of the Year Awards (BEYA)
Christo Lunderman
2022 Science Spectrum Trailblazer

Brianna Thompson
2022 Modern-Day Technology Leader

Herman Moore
2022 Modern-Day Technology Leader

2022 Women of Color Awards
Dr. Afrachanna D. Butler
Technology Rising Star

Brenna E. Bennett
Technology Rising Star

Soniael Duncan
Technology Rising Star

Vernessa Noye
Career Achievement Award

2022 HENAAC Award
Margarita Ordaz
Military STEM Hero for Most Promising Scientist or Engineer (Undergraduate Degree)

2022 Society of American Indian Government Employees Military Meritorious Award
Sissy Hudson

2022 ASCE Norman Medal
Dr. Fred Tracy

2022 USACE Innovation of the Year Award
Personnel Bunker Retrofit
(Team of ERDC-GSL, USACE TAD, and USACE Omaha Protective Design Center)

2022 Sustainability and Environmental Award
Green Dream Team *(of Fort Hunter Liggett PDT; ERDC & USACE Sacramento, Mobile Districts and U.S. Army Engineering and Support Center-Huntsville)*

2022 HR Community of Practice Award
Lauren Dunkin
USACE Manager of the Year

2022 USACE Meritorious Logistician of the Year
Thomas Bouke

2022 Bagley College of Engineering Distinguished Fellows (MS State U)
Dr. David Pittman

Meritorious Civilian Service Medal (from GEN Daly, AMC)
Dr. Buddy Bartels

2022 Technology Transfer Advocate (3QTR)
Lynn Zanow

2022 Federal Laboratory Consortium Award (Tech Transfer)
Bart Durst *2022 Director of the Year*

2022 Presidential Rank Award - Distinguished Senior Professional (SL/ST)
Dr. Todd Bridges

USACE INNOVATION OF THE YEAR AWARD WINNING PROJECT:
Expedient Personnel Bunkers

The Jan. 8, 2020, attacks on the Al Asad Air Base in Iraq resulted in more than 100 service members and civilian contractors being diagnosed with traumatic brain injuries (TBI). In response, engineers and scientists at the U.S. Army Engineer Research and Development Center (ERDC), in coordination with the USACE Transatlantic Division and USACE Protective Design Center, developed, tested and validated enclosure door designs that decrease the exposure to personnel within the bunker and reduce their vulnerability to TBI. The design was quickly adopted at nearly 1,000 bunkers spread throughout multiple countries, and the research team was recognized with a 2022 USACE Innovation of the Year award. "I am confident that your study findings will reduce the risks posed to our military and will ultimately save lives," USCENTCOM Commander Gen. Kenneth F. McKenzie Jr. said in a note thanking the research team.

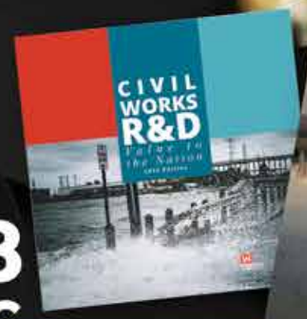
TELLING THE STORY

The ERDC communications community combines best-in-their field journalists, designers, visual information specialists, social media experts and support personnel. Spread across ERDC's laboratories and offices, these professionals are working to both elevate the story of research and development and connect this research to real-world opportunities.

4,563
SOCIAL MEDIA POSTS

20%
SOCIAL MEDIA GROWTH

ARTICLES WRITTEN ABOUT ERDC
3,414



348
ERDC PUBLICATIONS

$40M
ADVERTISING EQUIVALENT

245
ARTICLES & VIDEOS

38
BROADCASTS

Power of ERDC Podcast, ERDC Live, Beyond the Gates radio show

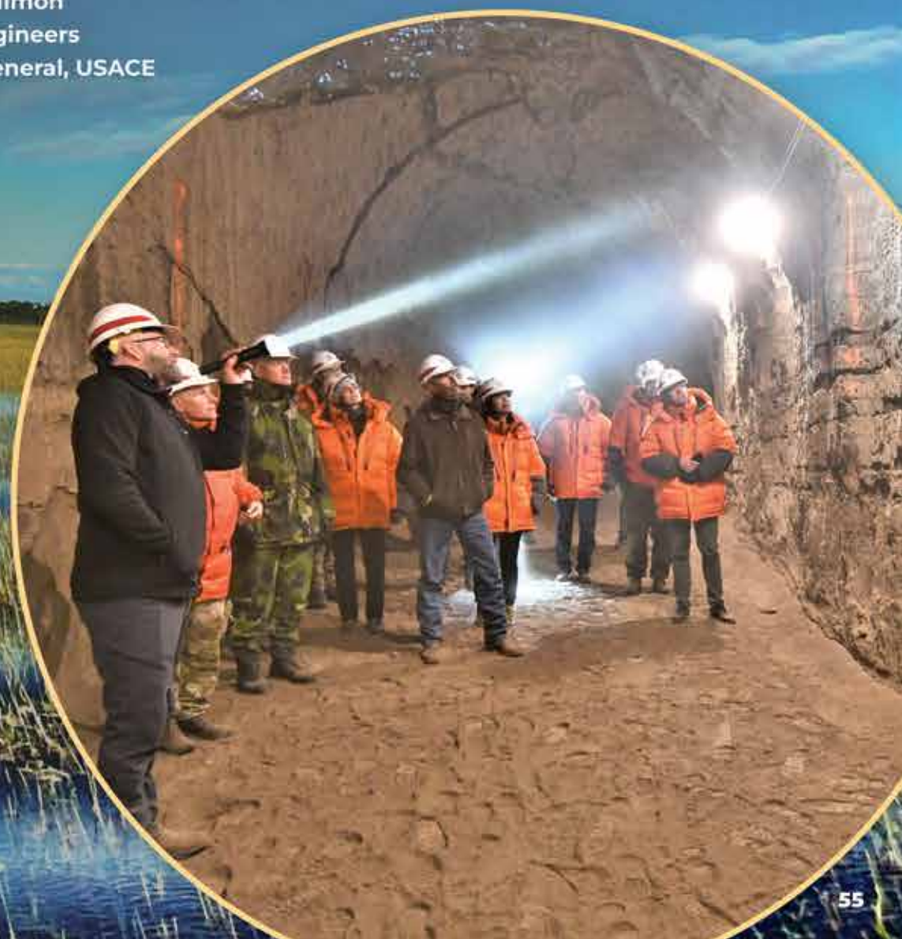
1.1M
ONLINE IMPRESSIONS

GLOSSARY OF TERMS

AFCS – Army Facilities Components System
AGC – Army Geospatial Center
Army Direct S&T – Army Direct Science & Technology
Army Direct S&T CA – Army Direct Science & Technology Cost Analysis
ARMY RDTE – Army Research, Development, Test & Evaluation
ARMY RDTE CA – Army Research, Development, Test & Evaluation Cost Analysis
BASOPS – Base Operations
DHS – Department of Homeland Security
DOE – Department of Energy
DOI – Department of the Interior
DOS – Department of State
DOT – Department of Transportation
HNC – USACE Huntsville Engineering Center
HPCMP – High-Performance Computing Modernization Program
LRD – Great Lakes and Ohio River Division
MVD – Mississippi Valley Division
NAD – North Atlantic Division
NASA – National Aeronautics & Space Administration
NSF – National Science Foundation
NWD – Northwestern Division
POD – Pacific Ocean Division
SAD – South Atlantic Division
SPD – South Pacific Division
SWD – Southwestern Division
TAD – Transatlantic Division
UROC – USACE Reachback Operations Center
VA – Veterans Affairs

"I STRONGLY FEEL THAT TO ACHIEVE THIS VISION, WE MUST EXECUTE OUR COMPREHENSIVE **RESEARCH & DEVELOPMENT** STRATEGY TO **MEET THE CHALLENGES** OF THE 21ST CENTURY."

LTG Scott A. Spellmon
55th Chief of Engineers
Commanding General, USACE



U.S. ARMY

US Army Corps of Engineers

ERDC B-23-2