

POWER OF

R&D

NEWSLETTER

— **CONNECTING THE DOTS.**
TO INNOVATION



ROOTED IN NATURE

Seeking a sustainable future, USACE explores
innovative building materials & techniques



US Army Corps
of Engineers®

FIELD NOTES

BRIGADIER GENERAL JOHN LLOYD

COMMANDER, NORTH ATLANTIC DIVISION



During a recent change of command, I challenged the incoming District commander to keep in mind command goes beyond accountability for projects, people and money. Among other things, command is about innovation at the ground level.

For USACE, innovation is the cornerstone from which we – the best builders in the world – are constructed.

Innovation comes in all forms. It could be new techniques and technologies developed and delivered by our world-class research laboratories, or it could take the form of simply taking another look, from a different angle, at a challenge we have long faced.

At the North Atlantic Division, our team of 3,600 strong executes a program of more than \$6 billion to plan, design and construct projects. These include critical infrastructure components and systems that protect our nation's water resources, mitigate disaster risk, restore, enhance our environment, and support the men and women serving in our Armed Forces.

Throughout my USACE career, I have cherished the opportunity to see our enterprise at its best as we deliver on the USACE promise, whether that is in the projects we plan and build better and safer than anyone, or the speed and professionalism we exhibit in our response to national disasters. But our challenges are evolving, and we must evolve with them. Innovation must be involved in everything we do, and it begins as a critical ingredient to every plan.

One example of this innovative mindset is the development and deployment of Surveyor Amy, an autonomous vessel that gives us the capability to survey waters that are remote or inaccessible by a traditional vessel. Its expedient delivery to an area following a storm allows for highly accurate inspection of dams, levees, bridges and navigable waterways.

Our teams are also applying advanced paint and protective coating techniques (such as, metallization) to extend the service of infrastructure components across the Division. These processes and products are allowing us to delay corrosion of bridges and other steel structures for 10 years longer than previous techniques, extending the lives of these structures and ultimately reducing the costs of critical maintenance.

USACE has taken me across the globe, and to this day, I remain inspired by the passion and dedication of those with whom I have had the pleasure to serve. I am also impressed and energized each day by the creative thinking and spirit of innovation with which we tackle every obstacle.

Essays!

Brig. Gen. John Lloyd
Commander, North Atlantic Division
U.S. Army Corps of Engineers

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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.

Mike Cockrill, with ERDC's Field Research Facility in Duck, North Carolina, captured this image of a January sunrise.

FRIGID EXPERTISE

USACE develops techniques for concrete construction in cold environments

Leveraging its unique experience in cold weather research and material science, ERDC is pioneering methods that can enable concrete construction in frigid conditions. Fresh concrete can be irreversibly damaged by the formation of ice before it has had time to cure and strengthen. Current techniques and technologies to protect concrete during this process are time-consuming and expensive. ERDC has developed Additive Regulated Concrete for Thermally Extreme Conditions – or ARCTEC – to support the use of commonly available concrete additives as alternative freeze-protection in cold conditions. ARCTEC accounts for differences in placement size and shape, mixture design, and ambient temperature to provide users recommendations to protect from freezing conditions. It can be used in any application that requires cold-weather concrete construction. ARCTEC is also being evaluated in the context of military engineering for use in extreme cold applications. In this area, future research is focused on development of novel additives and extreme cold placement techniques.

“DECADES OF RESEARCH AND COLLABORATIVE PARTNERSHIPS WENT INTO DEVELOPMENT OF ARCTEC, WHICH WE BELIEVE WILL BE A GAME CHANGER FOR CONSTRUCTION IN COLD WEATHER.”

DR. BEN WATTS

Danielle Kennedy
Research Civil Engineer
U.S. Army Engineer Research
and Development Center

Dr. Ben Watts
Research Civil Engineer
U.S. Army Engineer Research
and Development Center

To read the full story, visit:
<https://www.erdcl.usace.army.mil/Media/News-Stories/Article/3656328/techniques-developed-to-advance-concrete-construction-in-frigid-environments/>

CONNECTING THE DOTS
ARCTEC addresses the challenge of
PROTECTING CONCRETE
from freezing during winter construction

ATTACKING CHALLENGES AT

HIGH SPEED

Computing power gives researchers capability to quickly scale mountains of data

Lakenya Walker
Computer Scientist
U.S. Army Engineer Research
and Development Center

Dr. Alicia Ruvinsky
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and Development Center

With the assistance of high-performance computing (HPC) capabilities, ERDC can give engineers and scientists the ability to scour through massive amounts of data for the information critical to take the next steps or make the best decisions. Known as High-Performance Data Analytics (HPDA), the process leverages supercomputer processing to run powerful analytics software at speeds higher than a teraflop, or a trillion floating-point operations per second. Using HPC resources, which provide solutions to process data and execute calculations at a rate that significantly exceeds other computers, ERDC can confront seemingly unapproachable issues. Projects on vehicle design and maintenance, cyber analytics, airfield quality assessment, waterways data mining, and soil classification are a few areas in which the team has applied its research and experienced a significant impact.

**THE PROMISE
OF THIS EVOLVING
DISCIPLINE FOR
SUPPORTING
FUTURE MISSIONS IS
UNIMAGINABLE.**

DR. ALICIA RUVINSKY

To read the full story, visit:
<https://www.erdcl.usace.army.mil/Media/News-Stories/Article/3656295/attacking-challenges-at-high-speed/>

CONNECTING THE DOTS

HPDA can process more than a
trillion floating-point operations
PER SECOND

To learn more about these projects and programs, email: cerd.info@usace.army.mil

Honoring a Hero • A new supercomputer with the ability to perform 9 quadrillion calculations per second has been added to ERDC's high-performance computing capabilities. The new Carpenter supercomputer is named for Medal of Honor recipient Cpl. William "Kyle" Carpenter, who attended December's ribbon cutting. Carpenter, a retired Marine and Mississippi native, received the Medal of Honor in 2014. The supercomputer is the second largest unclassified supercomputer in the DOD and the fastest supercomputer in the DOD High Performance Computing Modernization Program.



Working with Nature • ERDC researchers joined Louisville District officials on visits to sites on Kentucky's Nolin River Lake to assess and monitor existing shoreline protection and adaptive management and discuss planning and alternative designs for new projects. The Louisville District recently constructed pilot projects using limited riprap and reef balls adjacent to the shoreline to provide both erosion protection and environmental habitat in the shallow waters behind the revetment.

Carp Collaboration • The spread of invasive carp in our nation's inland waterways is a threat to native species, ecosystems and vital commercial fisheries, including those in the Great Lakes. ERDC has been among the leaders in researching ways to slow – and even stop – the spread of invasive carp. ERDC recently helped analyze the performance of electrode arrays, part of electric barriers across the Chicago Sanitary and Ship Canal to prevent carp passage. The work was focused on validating the voltage envelope measured by the Chicago District, giving additional data to make decisions about the barriers' performance and design.



Creative Approach • Combating the development of harmful algal blooms (HABs) in fresh water sources is a USACE research priority. Techniques and technologies to detect, mitigate and remove HABs is at the forefront of this work. A team from ERDC and the Oak Ridge Institute for Science and Education recently completed field trials of a new device aimed at rapidly and safely suspending an algal bloom – or destroying it completely – without using any chemicals. Together, the team developed the Cyanobacterial Suppression Through Ultraviolet-Light-C Neutralization, or CyanoSTUN™, vessel, which uses germicidal ultraviolet light to suppress and potentially eradicate cyanobacterial harmful algal blooms.



PEERING INTO THE FUTURE

Innovative tools help forecast
risk of infrastructure failure

Haden Smith
Senior Hydraulic Engineer
USACE Risk Management Center

Willie Brown
Research Civil Engineer
U.S. Army Engineer Research
and Development Center

“THE RMC-TOTALRISK
TOOL STANDS TO
NOT ONLY IMPROVE
THE QUALITY OF
STUDIES GOING
FORWARD, BUT ALSO
**REDUCES THE
OVERALL TIME**
TO DEVELOP A MODEL.”

HADEN SMITH

Dams are a critical infrastructure component for many communities and are vital to managing watersheds across the nation. USACE operates and maintains more than 700 dams and associated structures that provide significant benefits to these communities and our nation's economy. To better operate and maintain those dams, USACE applies risk-informed decision making to evaluate, prioritize and justify dam safety decisions. Using this information allows USACE to repair its dams in the most effective manner, within a constrained budget. To streamline this process, USACE researchers have developed a systemwide approach for assessing risk in flood-risk-management watersheds. These new approaches have enabled these inspection and maintenance efforts to become more consistent and transparent. With the addition of new software developed by USACE's Risk Management Center, USACE is elevating and advancing new techniques and technologies for better risk-informed decision making.

To read the full story, visit:
<https://www.erdc.usace.army.mil/Media/News-Stories/Article/3656312/researchers-develop-tools-to-forecast-risk-of-potential-infrastructure-failure/>

CONNECTING THE DOTS

New USACE tool allows for more
CONSISTENT & TRANSPARENT
failure risk assessment

FROM THE GROUND UP

ERDC guides DOD advances in sustainable materials for military construction



“THE MODIFIED DESIGN HAS THE SAME ENGINEERING PERFORMANCE REQUIREMENTS AND DURABILITY REQUIREMENTS. WE ARE JUST REDUCING THE EMBODIED ENERGY BY USING A DIFFERENT MATERIAL.”

DR. ROBERT MOSER

Possessing the federal government's largest inventory of buildings, the Army can greatly shrink its carbon emissions by integrating sustainable materials in future construction projects and developing standards to enable others to do the same. USACE, fueled by innovative ERDC research, is helping lead this charge through cutting-edge efforts to develop new materials, analysis tools and design guidance specifications. ERDC is also leading tri-service coordination of four pilot projects that incorporate sustainable materials into military construction. Those projects, including three that are Congressionally directed in the 2022 National Defense Authorization Act, take multiple approaches, such as modifying construction specifications, incorporating new types of concrete, and maximizing the use of mass timber – a strong and durable material that is more sustainable than steel or concrete. ERDC is supplying subject-matter expertise, supporting project delivery, testing how well these innovative materials meet the military's elevated performance standards, and completing lifecycle analyses to determine broader applicability.

To read the full story, visit:
<https://www.erd.usace.army.mil/Media/News-Stories/Article/3656261/erd-lead-advances-in-sustainable-materials-for-military-construction/>



CONNECTING THE DOTS

Sustainable designs seek to
REDUCE EMISSIONS
by at least 30% over conventional designs

CONNECT WITH

Lakenya Walker

Lakenya Walker is a computer scientist with ERDC's Information Technology Lab.

How is R&D important in your projects?

R&D is our lifeblood for staying ahead of the competition. From a project perspective, R&D allows the team to continually learn and innovate to provide optimal solutions for the DOD, Army and USACE. Ultimately, R&D is the way we can help move the organization forward.

Where do you see the need for more R&D?

Across the DOD, Army and USACE, there currently exists a hyper-focus on data analytics and modeling with minimal concern for data. As a result, data is often neglected and not properly managed, requirements are improperly identified, and analytic efforts are plagued by the "garbage in, garbage out" paradigm. Each of these impacts results in suboptimal solutions leading to poor decision making and loss of battlefield and operational advantage. There needs to be more R&D in capability to manage all aspects of the data lifecycle to include the management and enrichment of data to support better, more responsible analytics.

USACE R&D STRATEGY

Below are the current Top 10 USACE R&D Priorities to address the nation's toughest challenges with multi-disciplinary solutions. These strategies lay the foundation for a bold, new era of USACE R&D.

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Mitigate & Adapt to Climate Change



Ensure Environmental Sustainability and Resilience



Win Future Wars



Secure Reliable Installation Energy



Modernize Our Nation's Infrastructure



Revolutionize and Accelerate Decision Making



Support Resilient Communities



Improve Cyber and Physical Security



Enable Smart & Resilient Installations



Protect and Defend the Arctic



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