

POWER OF

**R&D**

NEWSLETTER

CONNECTING THE DOTS.  
TO INNOVATION

SCIENCE  
**IMITATES**  
NATURE

Using innovative additive  
manufacturing to enhance  
coastal resilience



US Army Corps  
of Engineers

# FIELD NOTES

COLONEL JAMES J. HANDURA

SOUTH PACIFIC DIVISION

“WE CAN NO LONGER THINK THE SAME, USE THE SAME TOOLS, OR DRAW UP SOLUTIONS IN THE SAME WAY. WE MUST BE **CREATIVE AND INNOVATIVE AND CHALLENGE EVERY APPROACH.**”



For nearly eight months, I have had the honor to serve as commander of the South Pacific Division, a division whose work and environmental stewardship stretches across portions of ten states. It is a responsibility I value and one that I am honored to hold alongside more than 2,600 teammates who help me steward an average annual program of \$3 billion, including a number of mega-projects.

But this responsibility, this stewardship, comes at a time when the demands, challenges and opportunities have never been more complex or diverse. For this reason, we can no longer think the same, use the same tools, or draw up solutions in the same way. We must be creative and innovative and challenge every approach.

I would hate to rely on the old cliché of “think outside the box,” but it does apply in today’s environment. It applies in how we confront challenges and solve the questions of today and tomorrow.

This creative approach is exemplified in the ongoing development and transition of the Forecast-Informed Reservoir Operations effort that has been tried and tested in our division and is now being deployed to others. In just a few years, this innovative methodology for managing our critical water resources has already proven its worth and is now being reviewed for application nationwide.

FIRO turned traditional thinking on its ear. It took long-standing reservoir management techniques thought to be the way things should always be, and, through research and looking at processes in a different way, created a better approach to operating our reservoirs through significant swings in climate – from years of extreme drought to those inundated with several rounds of atmospheric rivers, with SPD managing nearly 30 water control manual updates in the region.

As an enterprise, we focus on how we can do things better, safer, and more cost-effectively than ever before. We must also now focus on how we can build more resiliently, providing greater returns on the investments made by the American people and our stakeholders.

For nearly 250 years, USACE has been at the leading edge of building and protecting our nation. For that to continue as we meet today’s demands, the spirit of innovation must be the fuel that drives us.

Essays!

COL James J. Handura  
Commanding General  
South Pacific Division



# NAVIGATE

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• Dr. Nathan Beane, a research forester with the U.S. Army Engineer Research and Development Center, captured this sunrise in Sarasota County, Florida, during field work by ERDC's Forest Ecosystem Dynamics team. See page 9 to learn more about this team.



**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.

# FROM WASTE TO RESOURCE

Project uses dredged material to 3D-print infrastructure



**Dr. Al Kennedy**  
*Research Biologist*  
U.S. Army Engineer Research  
and Development Center



**Dr. Andrew McQueen**  
*Research Biologist*  
U.S. Army Engineer Research  
and Development Center



USACE needs innovative strategies to reach its ambitious goal to beneficially use 70 percent of its dredged material by the year 2030.

A new Engineering With Nature® project is helping meet this target by exploring how 3D printers can transform what was once viewed as a waste material into a building block for ecosystem restoration.

The idea is to use sediment dredged in USACE projects as printer feedstock to 3D-print coastal infrastructure. Doing so will not only help meet beneficial usage goals, but it will also enable better infrastructure design. That is because

advancements in additive manufacturing, or 3D printing, have made it easier to create the geometrically complex structures needed to mimic nature.

There are a wide variety of ways these 3D-printed structures can be deployed, including habitat restoration, coastal protection and wave energy dissipation. And the research team, which has experts from multiple ERDC laboratories, continues to explore new ideas, such as the possibility of large-format prints using dredged material directly in the field.

To read the full story, visit:  
<https://www.erd.usace.army.mil/Media/News-Stories/Article/3854461/from-waste-to-resource/>

“... IT BECAME CLEAR TO US THAT WE COULD START USING SEDIMENT AS A RESOURCE TO CREATE A PARADIGM SHIFT FROM BEING A WASTE MATERIAL THAT NEEDS TO BE DISPOSED OF TO A CLEAN ENVIRONMENTAL RESOURCE ...”

DR. AL KENNEDY

**CONNECTING THE DOTS**

**EWN project transforms  
dredged material  
into geometrically complex  
COASTAL INFRASTRUCTURE**

To learn more about these projects and programs, email: [cerd.info@usace.army.mil](mailto:cerd.info@usace.army.mil)

**Extinct Mussel Rediscovered** • 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 worked with the Mississippi Museum of Natural Science to examine the distribution levels and substrate preference of the Big Black Rocksnail. This species of snails has only been found in a five-kilometer stretch of the Big Black River, therefore having one of the smallest ranges of any endemic snail species in North America.



**Swine** • ERDC and the Jacksonville District (SAJ) are studying the impact feral swine are having on unique and ecologically significant Florida habitats. According to the Southwest Florida Water Management District, feral swine “negatively impact wetlands and other habitats by ‘rooting’ up the soil while searching for food. ... [the swine] facilitate the spread of exotic plant species by transporting seeds and/or providing germination sites through rooting.” During a visit to Myakka State Park in Sarasota County, Florida, ERDC’s Forest Ecosystem Dynamics team, along with members of SAJ’s Invasive Species Branch, evaluated damage before and after management activities implemented to reduce the feral swine populations in the area.



**Microwave Sensors** • Working alongside academic partners, ERDC conducted the first experimental use of specific sensors to better predict performance in frigid environments. The experiment, conducted by ERDC and the University of Sherbrooke in Canada, tested the use of covert passive microwave sensors to predict vehicle performance on winter surfaces. Carried out in Alaska’s White Mountains and over the frozen Tanana River, the test used custom microwave sensors from Sherbrooke and an instrumented MRZR Alpha (lightweight tactical vehicle) from ERDC as the testbed. Results from the research seek to advance the use of passive technology for real-time vehicle performance analytics.



**Construction Equipment Corrosion** • During a recent tour of facilities in Guam, a multi-laboratory ERDC team examined U.S. Air Force construction and readiness equipment that had experienced corrosion due to the environment in which it operates. The team toured several storage sites and documented issues on more than a dozen different types of equipment. The visit is part of ongoing laboratory testing at the USACE Paint Technology Center of Expertise to find material and procedural solutions aimed at limiting future corrosion.



# DARK AND DAMP



**Drew Miller**  
Engineering Technician  
USACE Paint Technology  
Center of Expertise

**Research seeks to better protect military munitions storage**

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

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

Working at Indiana's Crane Army Ammunition Activity, 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 to provide guidance for more robust policy and procedures. PTCx is also working with CERL's BUILDER Sustainment Management System to see how the web-based software application can work with ECM-related data to provide decision makers with critical information.

To read the full story, visit:  
<https://www.erdcl.usace.army.mil/Media/News-Stories/Article/3825853/erdcl-researchers-combat-corrosion-and-mold-at-crane-army-ammunition-activity/>



## CONNECTING THE DOTS

**Study seeks to increase READINESS OF MUNITIONS through mitigating mold & corrosion**

# DOING THE WAVE

**FUNWAVE is a feasible solution for vessel wake issues**

Today's commercial vessels are longer, wider and deeper, and their wakes are more powerful and complex. These wakes cause flooding, coastal erosion, saltwater intrusion, an increased need for dredging and receding shorelines along our nation's waterways and maritime ports.

This complexity leads to uncertainty on how these wakes 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, resources and money in planning and pre-construction.

To read the full story, visit:

<https://www.erd.usace.army.mil/Media/News-Stories/Article/3854349/funwave-model-is-a-feasible-solution-for-vessel-wake-issues/>



**Dr. Matt Malej**  
*Research Mathematician*  
U.S. Army Engineer Research  
and Development Center

**“... YOU HAVE WAVES BEING GENERATED THAT ARE BIGGER, THAT ARE A LOT MORE POWERFUL, AND A LOT MORE COMPLEX. THE WAVES DON'T JUST COME AND GO AWAY.”**

DR. MATT MALEJ

**©CONNECTING THE DOTS**

**High-fidelity modeling such as FUNWAVE can save USACE time, resources and money in planning and pre-construction**

# PROVIDING RELIEF

## Wellbot offers innovative solutions to cleaning, maintaining relief wells

Critical components of earthen dams and levee systems are relief wells that offer a line of defense to cracking and potential failure caused by rising water levels. But those relief wells, dug 50 or more feet into the dam or levee to relieve hydrostatic pressure, require cleaning and maintenance that is costly, risky and not very effective.

Wellbot, developed by ERDC, is an autonomous device that blends the power of UVC-emitting lamps with powerful brushes to address the fouling and corrosion that limits a well's capacity.

With an estimated cost of just \$5,000, and its ability to be deployed quickly and repeatedly, Wellbot provides districts a cost-effective alternative without the potential risk from using chemicals, or the need to deploy significant equipment and manpower.

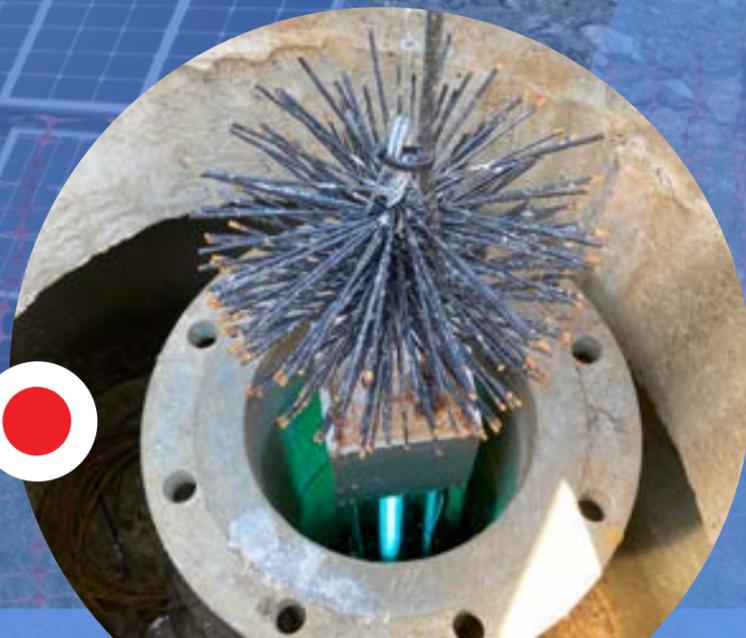
USACE has around 20,000 relief wells in its inventory and last year spent an estimated \$10 million to clean roughly 1,000 of those wells by traditional methods.

To read the full story, visit:

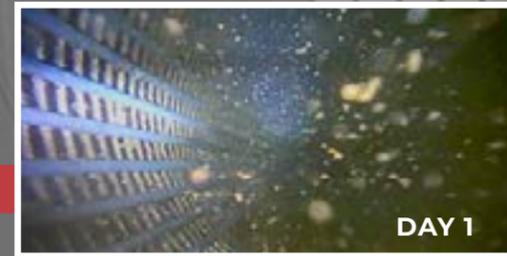
<https://www.erdc.usace.army.mil/Media/News-Stories/Article/3854367/wellbot-offers-innovative-solution-to-cleaning-maintaining-relief-wells/>



**Taylor Rycroft**  
Environmental Engineer  
U.S. Army Engineer Research  
and Development Center



BEFORE



DAY 1



DAY 7



DAY 14

(Above) Images of a fouled relief well before and during treatment using the Wellbot system. Future testing will help developers determine the optimal number of days to use the system on a fouled well.



**CONNECTING THE DOTS**

**Autonomous, reusable and  
easy-to-handle system costs just \$5,000**

# CONNECT WITH **Dr. Al Kennedy**

Kennedy is a research biologist/toxicologist with ERDC's Environmental Laboratory and leads research initiatives in advancing novel and sustainable advanced materials, including 3D printing technologies for environmental applications.

## How is R&D important in your projects?

Research and development is the way to go from crazy new ideas to innovative technology applications that improve tomorrow's USACE mission execution, and benefit the nation and the world. Not every path is successful, but the journey is always worth it, and the successes make up for the failures. Our research team focuses on both the applications and toxicological implications of traditional and novel advanced material technologies and manufacturing processes to not only accelerate the mission but to get ahead of environmental issues before they become a pervasive threat. From green munitions, sustainable flame retardants and novel processes, R&D gets us ready to solve tomorrow's challenges faster.

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

A critical need is improved sustainable materials process development through consolidation of existing data by leveraging machine learning to identify critical data gaps. This could increase the success of scaling laboratory solutions to pilot demonstrations and application in the operational and natural environment. Environmental engineering focused research can then fill missing parameters to enable rapid scenario screening to improve technology transfer to civil and military operations. Proactive inclusion of environmental toxicology considerations during the early stages offers a low-cost initial investment and large benefits in safe and rapid technology development, mission sustainability, addressing regulatory hurdles and good public optics.

# 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



SCAN FOR MORE ON USACE R&D PRIORITIES

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