



Supplement to Gannett Government Media Publications

# SPECIAL EDITION U.S. ARMY CORPS OF ENGINEERS

**FREE**  
2014 EDITION



# Building Bridges

**CORPS'  
MISSION AT  
HOME AND  
ABROAD**

**CORPS VS. NATURE**  
Climate change creates  
new battles

**PRIME POWER**  
Profile of the 249th  
Engineer Battalion

**TEAM STEM**  
Outreach from  
pre-K to college

**GREAT GETAWAYS**  
5 recreation areas  
perfect for summer

**HOW IT WORKS: AN INSIDE LOOK AT AN INNOVATIVE DAM PROJECT**

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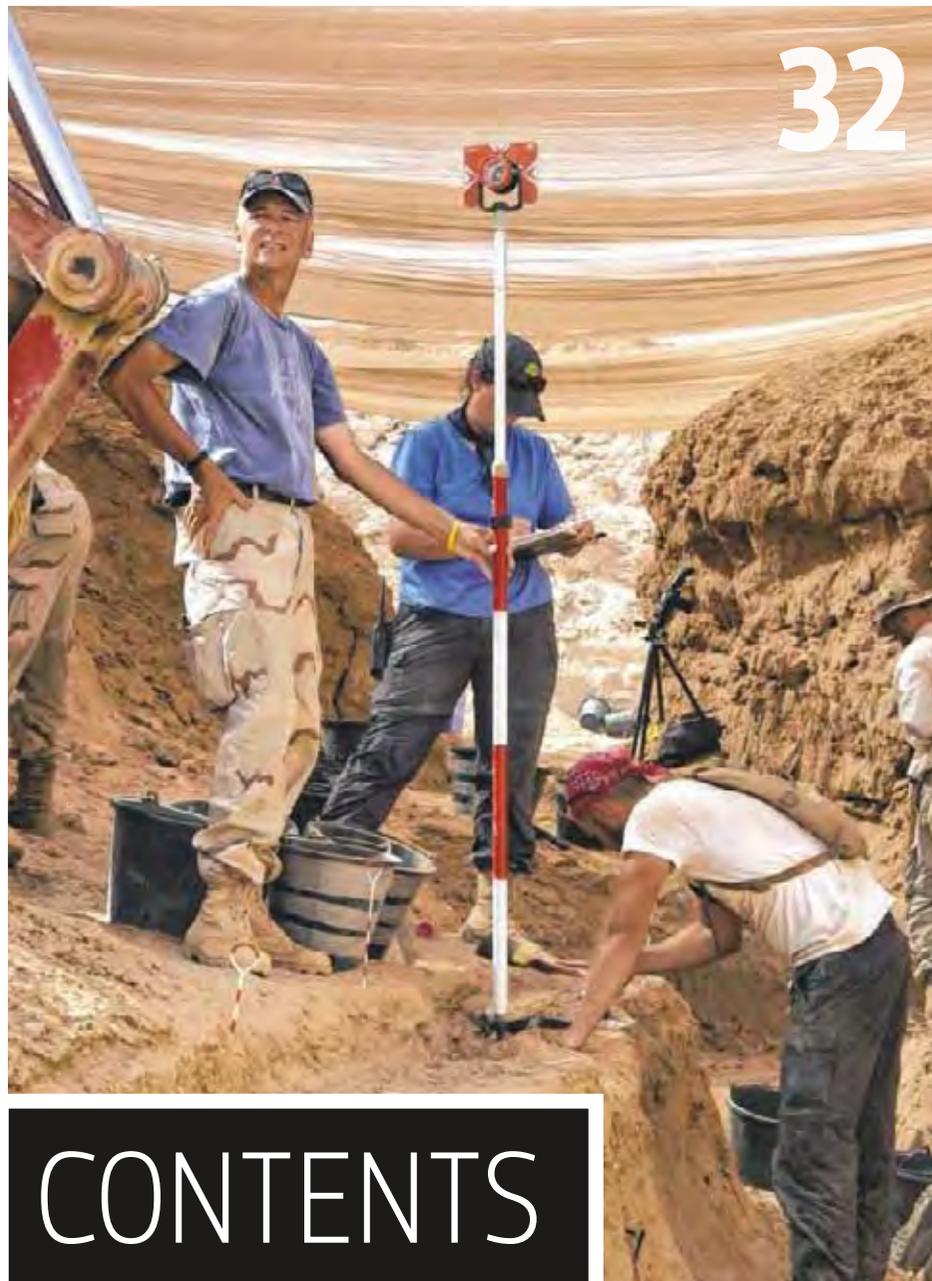
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**Natalie Tran**

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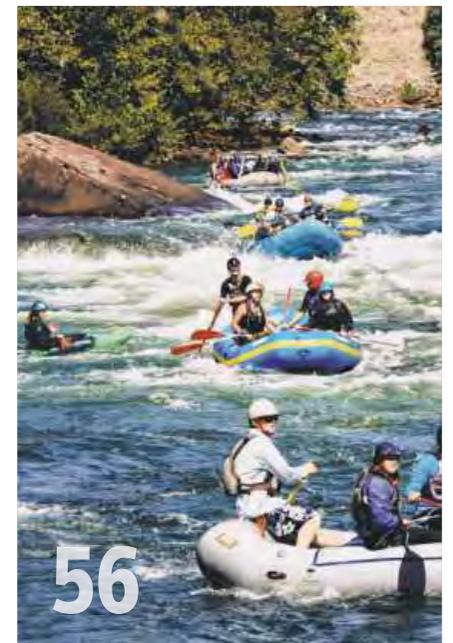
**ABOUT THE COVER**

Members of the U.S. Army Corps of Engineers inspect a bridge under construction in the Zabul province of Afghanistan. The bridge is an example of the work performed by the Corps in Afghanistan during Operation Enduring Freedom.

MASTER SGT. ADRIAN CADIZ/U.S. AIR FORCE

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## LETTER



An example of the Corps work is the recently completed Portugués Dam, near Ponce, Puerto Rico. The dam will reduce the impact of flooding for 40,000 people along the Portugués River.

JOHN CAMPBELL/USACE

# FROM THE EDITOR

**C**OMMUNITIES AROUND THE world depend on the U.S. Army Corps of Engineers. (To get a feel for just how broad the agency's reach is, take a look at our map on page 30.)

When floodwaters rise, when power goes down, when war looms and disasters strike at home or abroad, the men and women of the Corps appear, as if on cue. Wearing those ubiquitous white hard hats — with the unmistakable red-castle logo on the front — they come in with the equipment needed to do the job, whatever that job may entail.

They fix dams, they dredge harbors. They restore power to towns disrupted by the wrath of nature, or of war. They bring some comforts of home to our soldiers overseas and build bridges in communities halfway around the world. And they even manage to have a little fun by opening up

their lakes and trails to visitors.

In this second edition of USA TODAY's U.S. Army Corps of Engineers publication, we delve deeper into the projects and people that define the Corps. You'll meet employees like Brig. Gen. Margaret Burcham, the Corps' first female general officer (page 10); John Anderson, a researcher developing ways to model terrain for troops (page 76); and Angela H. Jones, who may have the organization's best job, as a park ranger in Hawaii (page 32).

We look at the cutting-edge research being performed at Corps centers around the country and the world. We also look ahead at the challenges that the Corps will face in the years to come — and how the agency plans to handle them.

One of the biggest challenges, according to Maj. Gen. Todd Semonite, deputy commanding general of the Corps,

may come from an unexpected source: us.

As taxpayers call for tighter federal budgets and Congress complies with cuts, the agency will be strained to meet the demands of its job.

But the Corps has a plan.

"We have to continue to be better stewards of the taxpayers' money," said Semonite. How? By encouraging innovation and entrepreneurship, increasing efficiency and sustainability and building partnerships with government agencies, industry and beyond, he said.

"Every day, we put millions of dollars in the ground with steel and concrete. We build big things," said Semonite. "But what we think is most important are the relationships we build and maintain ... Projects will come and go. We've been doing this for 239 years, and we are in it for the long haul." ●

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## Q&amp;A

# LOOKING AHEAD

**Lt. Gen. Thomas P. Bostick**, the 53rd U.S. Army chief of engineers, directs the U.S. Army Corps of Engineers' four-part campaign "to support the war fighter, transform civil works, reduce disaster risk and prepare for tomorrow." USA TODAY interviewed him as he completes his second year as commanding general.

By Mary Helen Berg

**Q** In May you will celebrate your two-year anniversary as commander. What have you learned about the job and the Corps that surprised you?

**BOSTICK:** Maybe it wasn't a surprise to me, but (one example is) the international community and how high a regard they hold for the U.S. Army Corps of Engineers. I was at the (2013) UNESCO conference when the secretary-general opened the conference on disaster response and water resource management and the kind of things that we could do as an international community. The Corps of Engineers was asked to be a participant in that. Since then, seeing the international interest in what the Corps is doing, the talent that we have and what we can provide has been heartwarming.

**Support of U.S. troops overseas has always been a top priority for the Corps. With the U.S. withdrawal from Iraq and Afghanistan, what arenas will be the next focus for USACE?**

Today we're working on U.S. foreign policy and presidential initiatives that include rebalancing to Asia and Power Africa, just to name a couple. If you look at this area

of "support the war fighter," I sometimes say it should be "support national security" because we work a lot in the interagency, and a lot of our work in support (of) the combatant command is with the State Department, USAID.

**The Corps is one of 30 federal agencies named as part of the Council on Climate Preparedness and Resilience to help prepare the nation for the impacts of climate change. What role will the Corps play?**

One of the many things that we have done in the wake of Hurricane Katrina is to re-look at our designs, at our construction and our methods of reducing risk in areas like New Orleans. Part of what the Congress directed the Corps to do was to help lead a comprehensive study of about 31,000 miles on the north Atlantic coast and how we should address the impacts of climate change in the future. I think the results of that will help not only the Northeast but other parts of the country ...

Another area is to work with the communities and the nation on a term called resilience. We're looking at an effort to ensure that when the storm comes — and it is going to come — that the

community has multiple lines of effort that will reduce the risk and absorb it and then still come back and continue in the future

**"One of the many things that we have done in the wake of Hurricane Katrina is to re-look at our designs, at our construction and our methods of reducing risk."**



JENN MILLER/USACE

**Lt. Gen. Thomas P. Bostick**, commanding general of the U.S. Army Corps of Engineers, is responsible for 37,000 civilian employees and 600 military personnel in more than 100 countries.

as a community. The way to do that is (with) multiple lines of defense. Part of that is going to be the ocean marshes, and part of that is going to be the dunes, and part of that may be putting homes on elevated platforms, and building some resilience and ability to absorb what we know is coming. Some of it may be to ultimately retreat from particular areas. So, the Corps is involved in education.

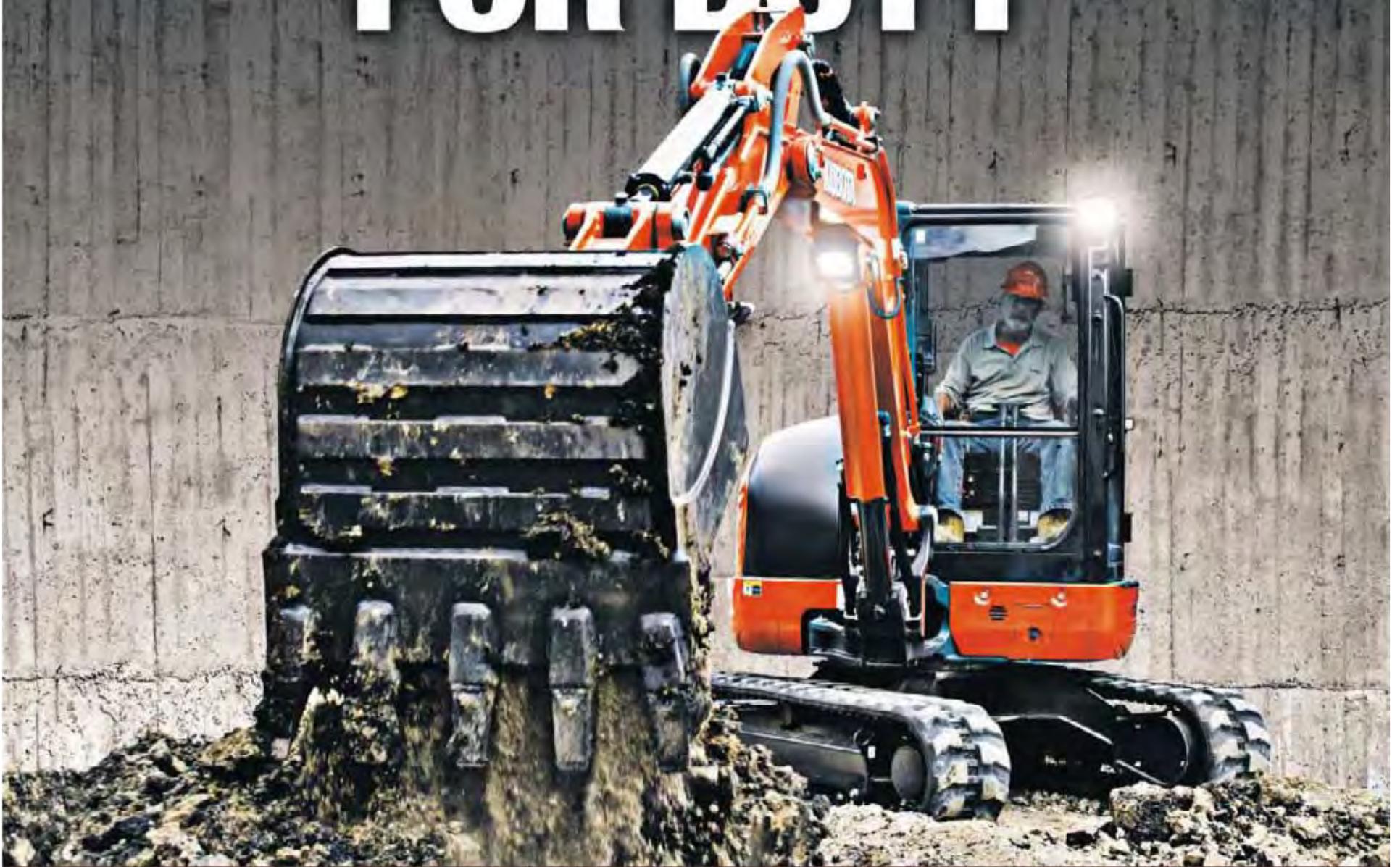
**George Washington established the Corps during the American Revolution and it has played a significant role in historic events and structural feats ever since, including the Panama Canal, which celebrates its 100th anniversary this year. What should be considered the greatest legacy of the Corps?**

I couldn't pick one event ... (But consider) the Hurricane Storm Damage and

Risk Reduction System that the Corps and the nation built post-Katrina. That's \$14 billion worth of work in about six to seven years. First, I would think many people would say it couldn't be done. It took great engineering, great design, a committed national leadership and teamwork to accomplish that, and we have people from all over the world come and look at what was built post-Katrina.

We've got the Western Closure Complex, the largest drainage pump station in the world. It can pump 19,000 cubic feet per second. In layperson's terms, that's an Olympic-size swimming pool in about three seconds. We have the Inner Harbor Navigation Canal surge barrier. It's the largest surge barrier of its kind in the world. It is 1.8 miles (long), 26 feet above the water line, supported by concrete piles that go 144 feet deep ... People from all over the world come to see that. ●

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2013 PROJECTS

# YEAR IN REVIEW

The nine divisions of the U.S. Army Corps of Engineers had a busy year in 2013. Here's a small sampling of the diverse projects that took place around the globe.

1

114-foot-long river towboat, christened the George C. Grugett, added to the river fleet  
 — Memphis District, Mississippi Valley Division



2,000

heads of cabbage used to make 5 TONS of kimchi for needy families in Seoul, South Korea  
 — Far East District, Pacific Ocean Division

50

women-owned small businesses awarded contracts worth \$21 million  
 — Nashville District, Great Lakes and Ohio River Division

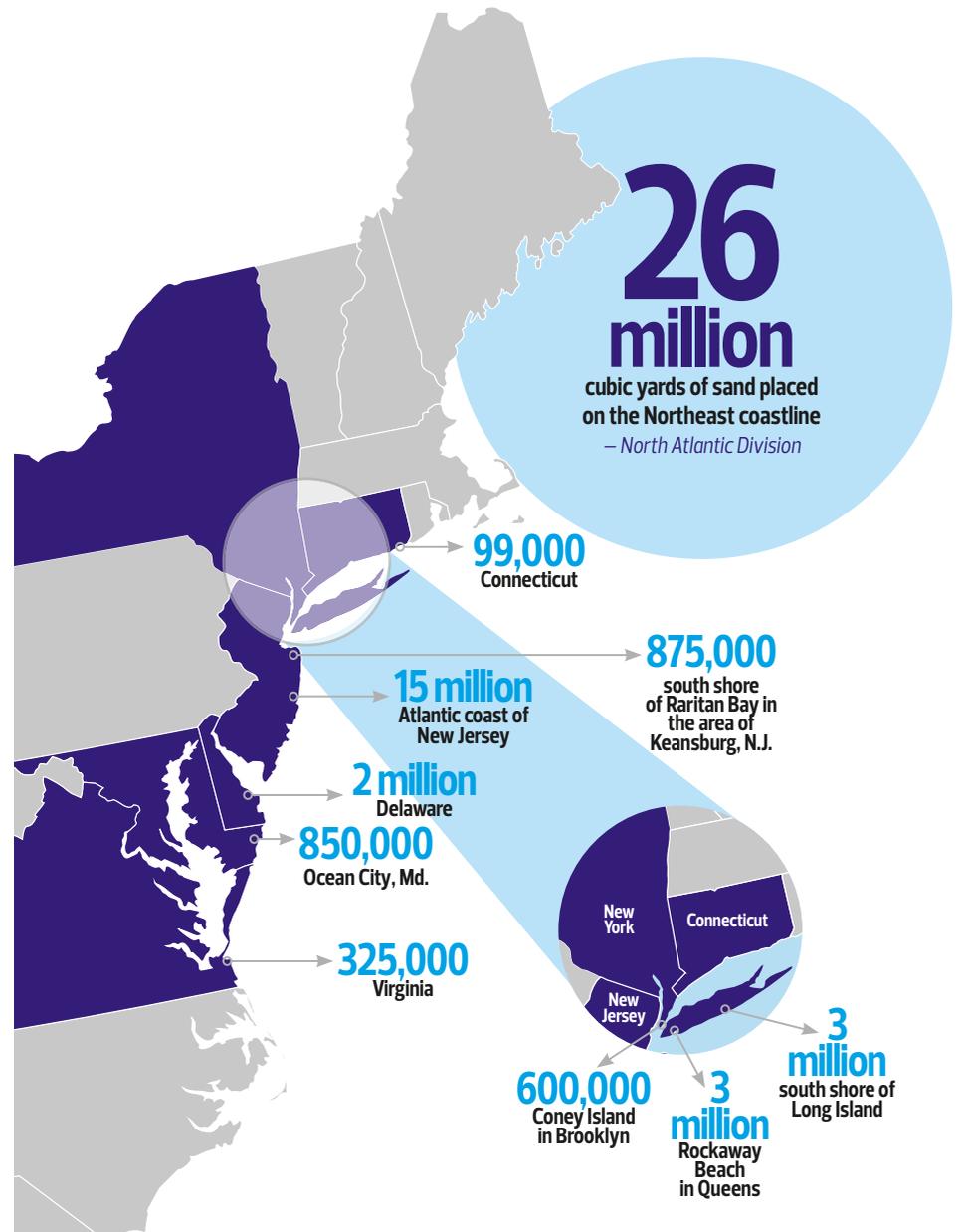


30

eagles spotted at The Dalles Lock and Dam in Portland, Ore., during Eagle Watch  
 — Portland District, Northwestern Division

3

275-kilowatt wind turbines erected at Fort Buchanan, Puerto Rico  
 — Jacksonville District, South Atlantic Division



425

stolen sacred artifacts returned to the Navajo Nation  
 — Omaha and Albuquerque districts, Northwestern and South Pacific divisions

3

Afghan National Police headquarters facilities completed in Kabul  
 — Afghanistan District, Transatlantic Division

1.72 million

cubic yards of shoal material dredged from the Freeport Harbor Entrance and Jetty channels in Texas  
 — Galveston District, Southwestern Division



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Right: **Gulf Intracoastal Waterway**  
11 x Cat C280-12 engines

Left: **Cat D6N LGP Track-type Tractor**  
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## PROFILE

## BRIG. GEN. MARGARET BURCHAM

**Education:** U.S. Military Academy at West Point, graduated 1982

**Age:** 53

**Hometown:** Arlington, Va.

**Family:** Married with two children — a son who is a senior at the University of Virginia and a daughter who is an Army officer at Fort Bragg, N.C.

**Favorite Corps project:** "All of the Corps projects are important, so I don't have a favorite. But the Great Lakes and Mississippi River Interbasin Study project takes a good deal of my attention due to its complicated nature and the very high level of public interest. The Olmsted Lock and Dam (on the Ohio River) is the Corps' biggest civil works project now and is going very well — on schedule and so important to our nation's economy. Our recreation projects are fun and positive contributions to the health and recreation of our fellow citizens and the various local economies."



USACE

# Meet Margaret Burcham

## USACE's first female general officer

By Jaime Netzer

**B**RIG. GEN. MARGARET BURCHAM started her career at the U.S. Military Academy at West Point just three years after the college opened its doors to women. The decision was simple. Her two older brothers had gone to West Point; she admired them and wanted to go, too.

It didn't bother her that, when she was a freshman, West Point had no female seniors. Or that she was one of only a handful of women on the college ski team — just as it hadn't bothered her when, in middle school, she joined the track team the year Title IX opened it up to girls. She was one of two female runners.

Throughout her life, Burcham has walked through doors newly opened to women, and in 2012, she continued to go where few women have gone by becoming the first to be promoted to general officer in the U.S. Army Corps of Engineers.

Not that she takes much personal credit for it: "This was a really big deal, not for

me personally but because women in the Engineers had finally advanced to that stage," she said.

Burcham's career follows what she called a "very traditional army officer" path. She rose from platoon leader, where she was in charge of 25 to 30 soldiers, through the ranks over the span of nearly 30 years. At each step, she learned more about leadership. "I'm an engineer, that's the work that I do. But more than anything, as an officer, I am a leader of people," Burcham said. "We really spend our whole career honing and fine-tuning that skill."

Becoming a general was "absolutely not" a long-held goal of Burcham's, but the Army helped prepare her for it anyway. She can remember, as a new lieutenant in Germany, being called into battalion formation as a commander addressed the crowd of 450 soldiers. She thought, "I could never do that." Eighteen years later, when she was a battalion commander, she said, "I thought about that day. And the reason I can do this is because of those 18 years of experience."

As a woman in the Corps, Burcham said she never met much resistance from her male junior officers and soldiers. But she did often hear from colleagues who said, "I've never worked with a woman before."

"You feel like you're just breaking in every single man in the Army to the idea of working with women," Burcham said. But, she added, the typical follow-up statement was often, "But now I see it's not so bad," or "But you've changed my mind."

In some ways, she paved the way for her daughter, who now serves as an Army officer at Fort Bragg, N.C. "I'm exceptionally proud that my daughter elected to focus her career in the same direction that I did, most of all to know she desires to serve her country, and that I presumably provided her with a good example and gave her confidence that she can have a family, raise children and also be a successful Army officer."

Burcham will soon add another title to her résumé. Her daughter and son-in-law, an Army Special Forces captain, are expecting their first child in June. ●

### 3 RISING STARS



**Traci L. Clever**, 48, from Hamburg, N.Y., director of regional business in the South Pacific

Division. Clever serves as principal adviser to the commanding general and is responsible for strategic direction, technical engineering and financial management for a \$2 billion average annual program and an organization that includes approximately 2,500 active-duty military and civilians.



**Karen Berresford**, 38, of San Francisco, lead civil works program manager in the Civil Works

Integration Division of the South Pacific Division. Berresford began her Corps career in 2002. She manages a civil works program of approximately \$200 million annually including two mega-projects estimated at more than \$1.4 billion.



**Patricia Donohue**, 47, of Smithtown, N.Y., sustainable engineering program manager of the North At-

lantic Division. Donohue, who was named USACE's Sustainable Hero of the Year in 2011, has more than 24 years of experience in charge of design, construction and operation projects. In her current role, she introduces sustainability and energy management to six districts from Maine to Virginia and Europe.



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SPC. MARK VANGERPEN/U.S. ARMY NATIONAL GUARD

Pfc. Tyrone House, left, and Staff Sgt. Andrew Garza of the 249th Engineer Battalion stand next to a new electrical transformer in Forward Operating Base Shank in Afghanistan.

# Taking Charge

When war looms or disaster strikes, the 249th Engineer Battalion plugs in and powers up

By Laura Laing

**I**N 2000, MASTER Sgt. Frank Darling faced a big problem. As a newly minted member of the U.S. Army's 249th Engineer Battalion, Darling, from Honesdale, Pa., was tasked with repairing a couple of old generators for a U.S. Army camp in South Korea.

The generators' 30-year-old controls had bitten the dust, and the parts were no longer manufactured by General Electric. Darling contacted the company to see if it had any of the vintage controls in its storerooms. GE tracked down a replacement in Thailand, but when Darling called to have the part shipped, he learned it wasn't actually available.

He had only one solution left: build the components from scratch.

Darling and three other platoon members drove to Seoul's electronics market, a sprawling five-story city within a city. Lacking the language skills necessary to describe the parts, the foursome moved from merchant to merchant. Six hours later, they had all the parts — most smaller than a dime — and spent no more than \$3. Back at Base Bonifas, the soldiers rebuilt the controls and got the generators up and running. Problem solved, mission accomplished — just like the 249th Engineer Battalion expects.

When you talk about the Black Lions, a nickname for the 249th's elite soldiers, it's easy to picture a group of mechanically



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**The Prime Power** battalion prepares cables to connect to generators at the James J. Peters VA Medical Center in the Bronx, N.Y.

inclined gear-heads, people who grew up taking apart their clock radios and car engines to learn how they worked. And that wouldn't be too far from the mark.

But the work they do is deadly serious. Wherever and whenever the military needs electrical power — from the French front in World War II to Iraq during Operation Iraqi Freedom — the Black Lions are there, often before combat boots hit the ground. And when disaster strikes in the U.S., the Federal Emergency Management Agency (FEMA) enlists the 249th's help to bridge the gap between blackouts and a permanent power source.

With such a unique charge, the battalion is the only one that reports directly to the U.S. Army Corps of Engineers. And that's not the only thing that makes this 300-soldier unit, known as Prime Power, different.

The entrance standards are demanding. Not just anyone can sign up. Before applying to the Army Prime Power School (a one-year course that includes studies in math, physics, engineering and power plant operations), soldiers must have at least three years enlistment in the Army and be an E4, Corporal and Specialist. The yearlong training program is one of the longest in the Army, and graduates leave



EJ HERSOM/DOD

**Sgt. Muy Thor** inspects a large generator cable before it is installed at a fuel depot in New Jersey after Superstorm Sandy knocked out power to the region in 2012.

with up to 38 hours of college credits. Then, armed with new skills and specialized training, they face deployment.

Prime Power has participated in military operations in Bosnia, Rwanda, Haiti, the Gulf War, Panama, Afghanistan and Iraq. "We're the only battalion that's been in Iraq since Day One," Darling said.

First Sgt. Kris Gable from East Berlin, Pa., was one of the first to arrive as Camp

Anaconda was being set up in Balad, Iraq. Before the Army moved into the country in March 2003, Gable's job was to move at least 20 generators in Kuwait closer to the border.

"You could probably power up large portions of a city" with that many generators, Gable said. Each produced 750 kilowatts

**CONTINUED »**

## BLACK LIONS HIGHLIGHTS

In and out of activation since 1943, the 249th Battalion (Prime Power) was most recently reactivated in 1994. Since then, it has provided power support for military and disaster-response missions.

### 2001

Restored power to Manhattan and the Pentagon after terrorist attacks on 9/11.



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### 2001

Deployed to Afghanistan. Supplied and supported generator power to Bagram Airfield, among other missions.

### 2003

Deployed to Iraq. Set up the power for Logistical Support Area Anaconda and made improvements to Haditha Dam, an important hydropower source.

### 2005

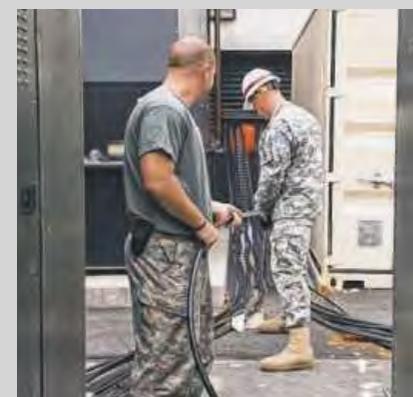
Provided power for pumping stations after Hurricane Katrina hit the Gulf Coast.

### 2012

Provided temporary power to large public housing complexes and fuel pumping stations after Superstorm Sandy.

### 2013

Provided support at the James J. Peters VA Medical Center in the Bronx, N.Y., during renovations of the building.



JAMES HOLMES/USACE



## WHAT IS PRIME POWER?

The 249th Engineer Battalion has four companies, each with four platoons. Each Prime Power platoon can produce 3.2 megawatts of power at 4,160 volts and can support a 1,200-person base camp. Each platoon has an 18-person team that can conduct 30–50 electrical system assessments per day.

Here's how the companies break down:

### COMPANY A

*Schofield Barracks, Hawaii*

- ▶ Four platoons, with 18 people each
- ▶ Covers Pacific region responses

### COMPANY B

*Fort Bragg, N.C.*

- ▶ Four platoons, with 18 people each
- ▶ Deploys overseas, currently Afghanistan and Iraq
- ▶ Responds to FEMA-directed emergency response efforts

### COMPANY C

*Fort Belvoir, Va.*

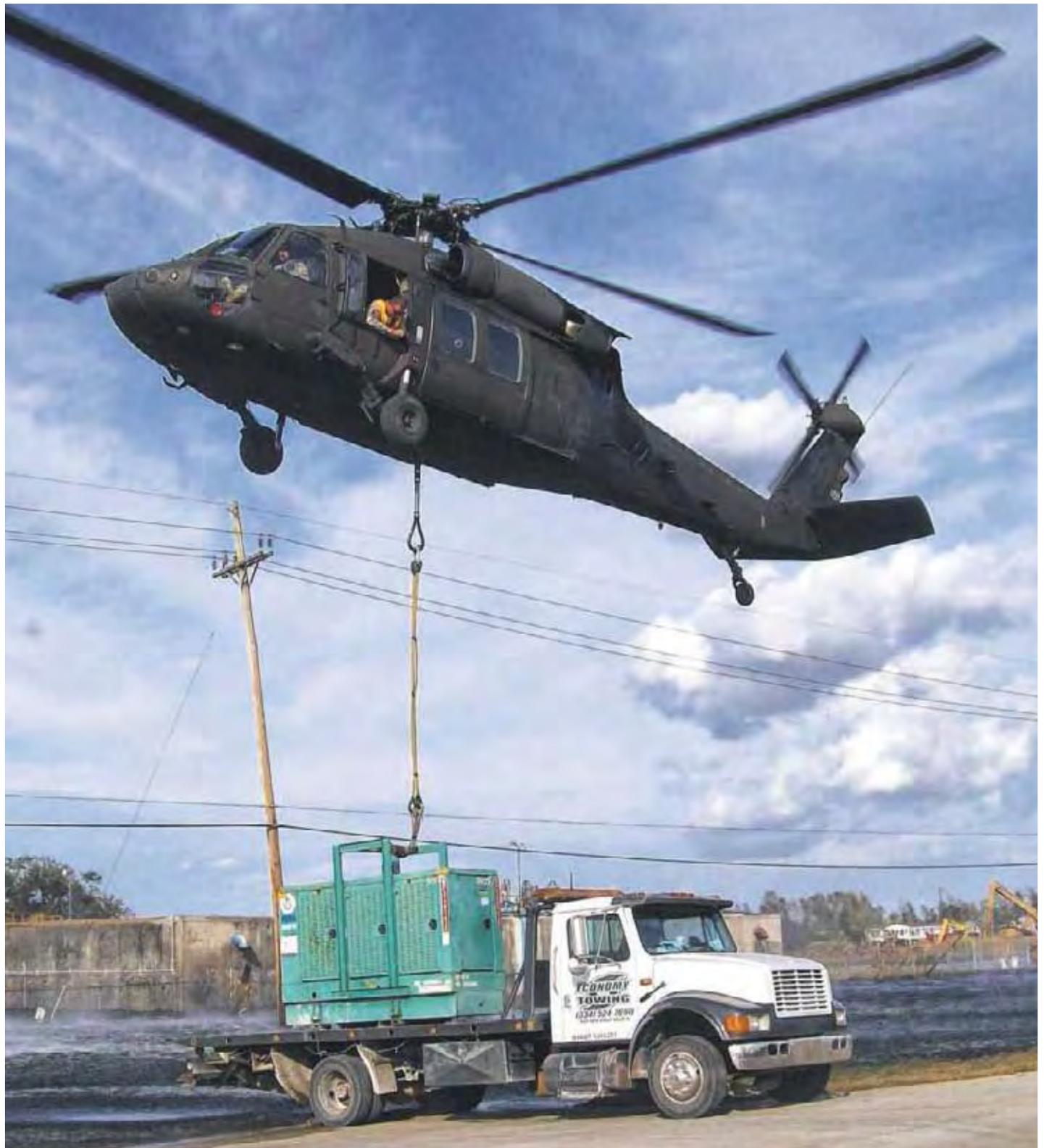
- ▶ Serves as headquarters
- ▶ Four platoons, with 18 people each
- ▶ Responds to FEMA-directed emergency response efforts

### COMPANY D

*Reserve unit*

- ▶ Three power line platoons at Cranston, R.I., with 17 people each
- ▶ One prime power platoon at Fort Belvoir, Va., with 18 people

Members of the 249th Engineer Battalion are trained at the U.S. Army Prime Power School at Fort Leonard Wood, Mo. This highly competitive program has three phases, the last of which prepares soldiers for one of three specialties: instrumentation, production mechanics or production electronics. Soldiers can receive up to 38 college credits through the training.



**The 249th Engineer Battalion** airlifts an emergency generator to power water storage pumps in Louisiana after Hurricane Isaac in 2012.

USACE

(enough power to run about 1,000 homes) and ran on diesel fuel. The generators would provide the initial electricity for Camp Anaconda while a power station was being established.

When Gable first arrived at camp, he could see the remnants of the Iraqi air force base that had been bombed by U.S. forces. The electrical equipment had been

destroyed and scavenged in the fight. He realized Prime Power specialists had a big job ahead of them. Thankfully, they had some assistance. Local Iraqis were hired to help the team.

"They worked it; they knew it," Gable said. "They saved us a lot of time and effort."

Gable returned to the Iraq camp in

October 2004 and could hardly recognize the place. During the first sergeant's brief absence, the 249th had provided enough kilowatts to bring deployed soldiers some of the comforts of home. Spot generators were gone, and a centralized power plant had been established. This allowed for a

**CONTINUED »**

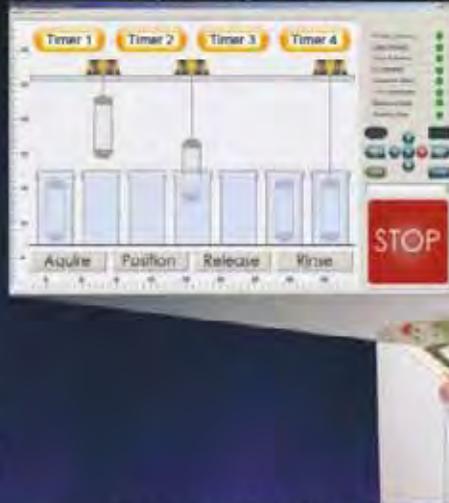
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**In 2011, the U.S. Army Corps of Engineers' Afghanistan Engineer District-South completed a series of power lines and substations connected to the Kajaki dam's hydroelectric power plant. The project brought electricity to 332,000 people.**

few modest luxuries, including air conditioning, Xboxes, DVD players and even a Burger King. "It was strange to see the base more developed," he said.

Providing electrical power stateside is an equally important task for the unit — especially when a natural disaster occurs.

"The number of disaster-response deployments that we've had in the last six years or so has increased," Darling said. Prime Power provided relief after 9/11, Hurricane Katrina, numerous tornados and ice storms and Superstorm Sandy, when 160 soldiers responded to four locations at 16 disaster sites across seven states.

First Sgt. Jeffrey Rhoads from Tyrone, Pa., was among the soldiers called to action. "We were called to move our equipment. We deployed the majority of our team," he said.

The first stop was a public housing building in Far Rockaway in the New York City borough of Queens. "Within 24 hours, we had power up," Rhoads said. The building had suffered a great deal of storm damage and was still flooded in many places, so only temporary power could be provided by generators. The battalion replicated the process at sites in the beachfront communities of Red Hook and Coney Island.

"Water damage kept us from safely energizing the (existing electrical) system," Rhoads said. "It was hard to tell (residents) it's not safe to energize their building." Still, after days without electricity and heat, residents were happy to see Rhoads and his crew.

"They came down and talked to us," he said.

Some even cheered when the generators restored power.

A recent project taken on by the 249th encouraged the Black Lions to tap into their softer side. Last fall, the 249th's Bravo Company was called to the Bronx to help out with the renovation of the 431-bed James J. Peters VA Medical Center. The construction was underway when Army Corps officials realized they needed to shut down one-fourth of the hospital's power to get the job done.

Staff Sgt. Jeremy Watson of Cambridge, Ohio, visited the hospital to see how his 249th team could help. Back at Ft. Bragg, N.C., they developed plans for the project,



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and on Sept. 27, 2012, he and a convoy of trucks carrying massive generators arrived in the Bronx.

Each of the four generator units, totaling 2.2 megawatts of power, was carried on a 20-foot semi-trailer. "A lot of the truck drivers didn't want to go up there, because of the traffic," Watson said.

The mission took seven weeks, and members of the 249th worked seven-day weeks. "During the week, we were moving things around and setting up," Watson said. On the weekends, when the hospital was

less busy, the construction team shut down the main power and the generators ran the building.

Patients had to be moved from one section of the hospital to another, while staff and visitors navigated a web of cables on the ground and floors. Still, people enjoyed seeing uniformed Prime Power soldiers on site.

"Walking through the hospital was always fun," Watson said. "People were amazed to see active duty up there working. They would stop and talk, tell us stories."

Whether it's equipping the troops to do their job while bringing some comforts of

**"The number of disaster-response deployments that we've had in the last six years or so has increased."**

**— Master Sgt. Frank Darling**



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home, or helping restore communities in the aftermath of disasters, Prime Power is eager to lend a hand and power up.

"There hasn't been a day that I've been in the 249th that's been the same," Darling said.

And he and his fellow Black Lions like it that way. ●

**Sgt. Koutodjo Ayivi**, a Prime Power production specialist with the 249th Engineer Battalion, is one of two soldiers who live and work at the small Bagh-E Pol power plant in Kandahar, Afghanistan. Electricity produced there is distributed to 450,000 residents in the city of Kandahar.



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# Weathering the Storm

As Mother Nature tests the nation, USACE mans the front lines, researching climate change and preparing for an uncertain future

By Mary Beth Griggs

**O**NE OF THE biggest adversaries of the U.S. Army Corps of Engineers doesn't wear a uniform, carry a weapon or even slash spending. She's as dangerous and unpredictable as they come, a shape-shifter who can be perfectly pleasant one minute and cause mass destruction the next.

She's Mother Nature, a force that's

gaining power as climate change affects weather patterns, melts Arctic ice and raises the seas. But her strength has not gone unmatched. A team of experts at USACE are studying her wily ways and coming up with creative solutions.

"People are stressed about climate change. It's new, and they want consistency, and we want to be consistent," said Kathleen White, the senior lead for

**CONTINUED »**



A researcher with the Cold Regions Research and Engineering Laboratory surveys sea ice and snow in Barrow, Alaska.

CHRIS POLASHENSKI/USACE

climate and global change at USACE. The challenge now is to form a clear picture of what climate change means to the Army Corps' mission.

### WATER WORLD

The Corps has been actively studying climate change since at least the 1970s. A 1986 mandate charged it with studying changing sea levels as well. The USACE Responses to Climate Change Program examines possible weather events and develops ways to make the nation's infrastructure less vulnerable to the effects.

The Corps has a compelling need to do so since it manages a big part of the nation's water resources infrastructure (700 dams, 55,000 acres of shoreline and 422 lakes in 43 states).

"Water is one of the first ways in which climate change manifests itself," said White.

A changing climate can alter the form of precipitation, shifting it, in some areas, from snow to rain. It can also change the amount of precipitation. Since warmer air can hold more water, storms and rainfall can be more intense.

An example of this was Hurricane Katrina, which caused massive destruction in 2005. The disastrous impact on the Gulf Coast served as an impetus for the Corps to take a deeper look. "Following Hurricane Katrina it became clear to us that we needed to be specific about the kinds of sea-level change we might expect in the future, what kind of acceleration we might be talking about," White said.

All Corps projects are now under review, a sort of triage in which researchers assess how each will be affected by climate change. White said the Corps has analyzed and ranked about 45 percent of the current projects to focus resources on the areas of highest need.

The Corps is also looking for ways to prepare for environmental changes. In 2012, it conducted pilot studies in areas such as the Florida Everglades, Missouri River reservoir system, Great Lakes harbors, Rockaway (N.Y.) Beach and the West Maui watershed in Hawaii. The studies looked at everything from preparing for sea-level change in an urban area to estimating the cost of harbor dredging in the face of increased precipitation. The hope is that the Corps will be able to establish policy based on science and be better prepared when issues do arise.

The Corps doesn't work in isolation. Other agencies, such as the Bureau of Reclamation in the U.S. Interior Department, which manages water in the West, are



TIMOTHY STAMP/USACE



JACK GRUBER/USA TODAY

**Beachgoers take in the sun and surf while contractors for the Corps' Philadelphia District restore the beach in Harvey Cedars, N.J.**

part of the effort. "What we're doing, in a sense, is developing a consistent approach to hydrologic impacts of climate change. What that does is help us all progress faster, and it allows the stakeholders in a watershed to all get the same information," White said.

The Corps is particularly interested in how climate change affects the military.

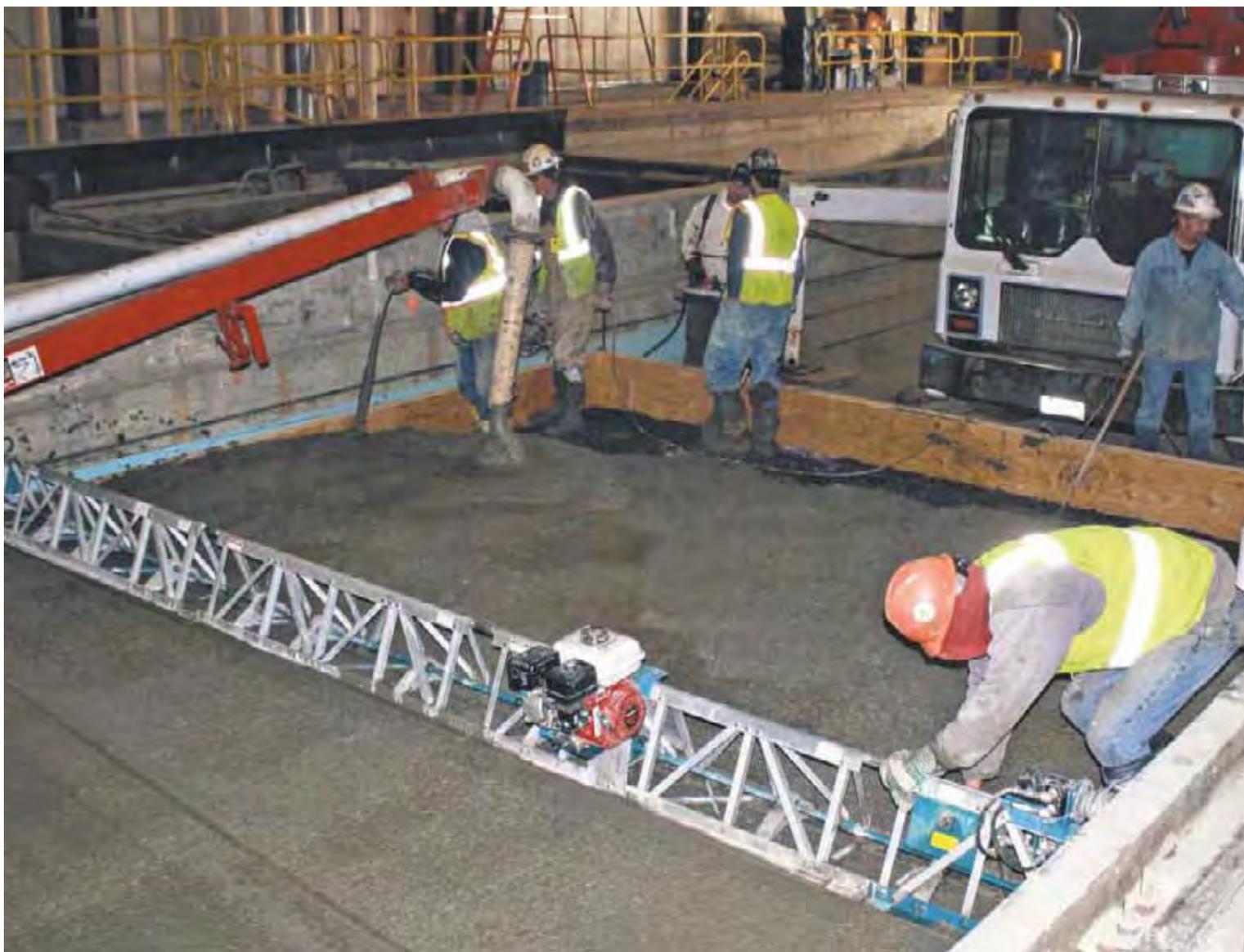
At the permafrost tunnel in Fairbanks, Alaska, the Corps analyzes the permafrost (frozen soil and rock) and determines how changes

could affect the performance of military equipment. The research lab originally came about as a result of Cold War fears that Russians would exert influence over the Arctic region. And in Norfolk, Va., the Navy and Corps are working together to figure out how to keep a shoreline naval base from becoming obsolete as sea levels rise.



JOANNE CASTAGNA/USACE

**Army Corps archaeologists look for artifacts in sand that was dredged offshore and placed on the beach in Monmouth Beach, N.J., after Superstorm Sandy.**



## FROST EFFECT

Roughly the size of 1½ football fields, the Frost Effects Research Facility (FERF) at the Cold Regions Research and Engineering Laboratory is one of a kind.

With four massive refrigerated rooms, the facility allows businesses and inventors to test all sorts of materials in frigid cold temperatures.

Experts can study how highways and asphalt roadbeds respond to freezing by cycling the pavement through periods of freezing temperatures and a spring thaw at a rapid clip, far quicker than nature could manage. Utilities can see how cables, wires and pipes perform in the cold, buried under a layer of soil. And a heavy-vehicle simulator shows the toll traffic takes on materials.

The facility doesn't stop at everyday wear and tear. When the Army needed a hardy strain of grass to stand up to foot traffic and vehicles on its testing grounds, FERF spent months growing samples. And when an agency based in Antarctica needed to test a brand-new superglue for its work at The McMurdo Station research center, FERF got the call.

ERDC/USACE

**Workers test concrete** at the Frost Effects Research Facility in Hanover, N.H., where cold-weather conditions are simulated to predict how materials will perform.

## OUT IN THE COLD

While warming temperatures create one set of problems, freezing weather poses another. At the Cold Regions Research and Engineering Laboratory (CRREL), the Corps looks into cold weather on a very practical scale.

Located in Hanover, N.H., the facility is a massive playground where researchers in government, business and academia test how materials work in some of the harshest environments on the planet — think the Arctic, Antarctica and the colder regions of the U.S.

CRREL has just about everything a scientist needs to create experiments focused on the colder regions of the world. Facilities include a refrigerated warehouse larger than a football field, a gigantic swimming pool used to grow ice and an outdoor pond that mimics sea ice. Robert Davis, director of CRREL, compares the research center to a boutique shop: “We can get problems solved in a cost-effective way,

very fast, faster than academia.”

In the 23 years Davis has been at CRREL, he's seen many changes in the field of study. He remembers when researchers worked on long-term projects for 12 to 15 years. Today many prefer a faster-paced style, ready to respond when problems arise.

As an example, Davis points to research on flooding caused by ice jams in northern rivers and streams. Nowadays, those kinds of floods are much less common, so CRREL has shifted its focus. But the laboratory space and facilities remain, if the center needs to address river flooding again.

The lab works regularly with private industry and groups from all over the

country who rent out facilities to test their equipment. “Where you have cold coming together with people and risk and hazards and (the) economy, that's where my lab's niche lies,” Davis said.

Some of the problems being tackled by CRREL scientists and engineers have increasing urgency. As the ice melts in the Arctic, oil companies are eyeing the ocean there as the next frontier for offshore drilling. This raises concerns about what might happen if an oil spill occurred in ice-covered waters.

Leonard Zabilansky, a research engineer at CRREL, tests ways to detect oil under ice. Scientists from a variety of disciplines, including the oil industry, are experimenting with a few different techniques.

Facilities include a refrigerated warehouse larger than a football field (and) a gigantic swimming pool used to grow ice.

“A lot of it has to do with what happened with Deepwater Horizon,” Zabilansky said. The 2010 explosion on a drilling rig in the Gulf of Mexico caused the largest offshore oil spill in U.S. history. If such a blowout happened under the ice, experts would need to map the size of the problem and start cleanup — and they'd need the tools to do it.

Zabilansky and his team have developed aquatic technologies that can be deployed under the ice and instruments that can be dragged or rolled across the surface. Eventually he hopes to build aerial oil sensors that can accurately gauge the extent of a spill from the sky.

Zabilansky grows vast sheets of ice in CRREL's facilities and injects oil into the ice to gauge the effectiveness of his equipment and see how the oil and ice interact over time. The goal is simple. “If an emergency comes up, you (need to) know what tools

**CONTINUED »**



Z. COURVILLE/USACE

**Researchers from the** Cold Regions Research and Engineering Laboratory traveled to Antarctica in January as part of a resupply mission.

are in your toolbox and what would be best to use," he said.

In other areas of the lab, CRREL researchers are looking into the most basic building block of the Arctic: how the sea-ice cover works, grows and melts.

Donald Perovich, a geophysicist, studies the "albedo," or ability of ice to reflect sunlight, and how it's changing. Like many other CRREL researchers, he spends a lot of time in the field, traveling to points across the Arctic Ocean. When he can't be there, he uses buoys to take measurements. Made of PVC pipe, the webcam-enabled

buoys hold instruments that measure temperature and the thickness of the sea ice. They're not as expensive as other measuring stations — but they're not cheap. "Right now, it's like parking a Camry on the ice," Perovich said, estimating that each costs around \$25,000.

Six buoys are put out each season across the Arctic. Researchers hope the instruments make it through the ravages of the Arctic winter. "It is a rough neighborhood. The ice moves and it can break apart," Perovich said. And at least one of them has been destroyed by a particularly curious

polar bear. The last image that CRREL found from that buoy was of the bear's snout.

Human endeavors in the Arctic Circle have been threatened by changing ice conditions. Once coating the ocean, ice cover has steadily shrunk during the summer months. Ice that remains tends to be thinner one-year ice, as opposed to thicker multiyear ice.

These changing dynamics mean a lot more open water, which has governments eyeing the Arctic Ocean as a potential shipping lane. But that open water doesn't necessarily mitigate the threats. "In some

ways, it's a difficult time to operate in the Arctic," Perovich said.

More open water means more space for ice to move. And unlike a glacier, whose weight anchors the moving ice against the ground like a brake, sea ice can move with relative ease, sometimes traveling miles or tens of miles within a single day.

This rapid and unpredictable movement of ice echoes the swiftly changing current of knowledge around climate change. As the world shifts, drifts and adapts to this new reality, the Corps is preparing for whatever lies ahead. ●

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Members of the 569th Engineer Dive Detachment support the U.S. Army Corps of Engineers in Afghanistan by conducting hydrographical surveys and inspections of underwater structures at Kajaki and Dahla dams.



USACE

# MISSION: NEXT

As Operation Enduring Freedom draws down, USACE builds infrastructure, relationships in Afghanistan, Africa and Asia

By Matt Alderton

**K**ABUL, AFGHANISTAN, LOOKS nothing like West Point, N.Y.

The latter is lush and green, blanketed in trees that drink from the Hudson River. The former consists of arid urban sprawl, mostly desert beige but for the Hindu Kush mountains standing stoically behind town.

In geography, climate and culture, one place could not be more different from the other. But if you look closely on any given morning, you'll notice at least one thing Kabul and West Point have in common: a swarm of uniformed cadets standing in formation outside an elite military academy that turns soldiers into leaders.

In Kabul, that academy is the National Military Academy of Afghanistan (NMAA), one of several military schools that make up the Afghan National Defense University (ANDU). The brand-new campus provides education and training to the commissioned and non-commissioned officers of the Afghan National Army.

Inspired by the world's great military

academies, including the United States Military Academy at West Point, ANDU occupies 1,500 acres in Quarga, Afghanistan, a mountainous region on the far west side of Kabul. Construction on the first phase of the three-phase project included a headquarters building for NMAA, as well as barracks for instructors and students, a dining facility and classrooms. Contractors started work in 2010 and completed the project in 2012, at which point the U.S. Army Corps of Engineers took over the \$200 million effort.

Presently, the Corps is overseeing construction of the campus' remaining schools, including the Sergeants Major Academy, the Afghan Foreign Language Institute, the Officers Academy and the Command and General Staff College. Work is expected to continue through 2016.

"There's still quite a lot of work to be done, but it will be one of the Corps' prized projects because of the impact it's going to have on the Afghan National Army," explained Maj. Gen. Michael Eyre, commander of the Corps' Transatlantic Division, which oversees activities in the Middle East and Central Asia.

Although the Corps is known for public works in the U.S., it also executes military construction, host-nation construction, foreign military sales, humanitarian assistance and emergency response projects in 33 countries. By providing engineering and construction expertise in nations that lack it, the Corps helps the U.S. military create stability and prosperity that ultimately have a positive influence on national security at home.

"There's a reason Afghanistan has been a war-torn nation for decades, and that's its location and lack of governance," said Col. Michael Price, commander of the Transatlantic Afghanistan District. "What the United States has provided for Afghanistan is a basis for governance. We've provided an army and a police force that is securing their nation. The Corps is putting in the infrastructure to support that."

In fact, it will continue to do just that — even as U.S. forces in Afghanistan persist with the drawdown, which is slated for completion by December 2014.

"Afghanistan is still the main priority, not just for the U.S. Army Corps of Engineers, but for our nation," said Maj. Gen. Kendall Cox, USACE's deputy commanding general for military and international operations. "We will have a long-term presence in the region and a potential long-term enduring presence in Afghanistan as we build critical

CONTINUED »

facilities and infrastructure in support of securing the region.”

Even as it digs in its heels in Afghanistan, the Corps must prepare to support the U.S. military in strategic areas around the world. The years ahead therefore promise to be among the most active — and impactful — in the overseas history of the Corps.

## AFGHANISTAN: DRAWING DOWN

The Transatlantic Afghanistan District is one of two districts in the Corps' Transatlantic Division, which provides construction, engineering and project management support to 20 countries in the Middle East and Central Asia. The other is the Middle East District.

As U.S. troops withdraw from Afghanistan, the Corps will gradually have a reduced workload there, which ultimately will lead to a reduced presence. The district has approximately 200 projects left to finish, valued at about \$1 billion, said Eyre. Projects that aren't finished by December 2014 will be completed by the Middle East District, which will absorb the Transatlantic Afghanistan District after the drawdown in the same way it absorbed the former Gulf Region District when U.S. troops left Iraq in 2011.

“We went from two districts in Iraq to a single district — the Gulf Region District — that then stood down, as well, and fell under the Middle East District. They now have an Iraq resident office collocated with the U.S. Embassy in Baghdad,” explained Eyre. The same consolidations will be made in the Afghanistan districts, until all that's left is a single resident office within the U.S. Embassy under the authority of the U.S. State Department.

Consolidating should not be mistaken for exiting. “As U.S. forces draw down in Afghanistan, it doesn't necessarily mean the U.S. Army Corps of Engineers will draw down,” said Tom Waters, the Middle East District's deputy for programs and project management. “We will stay in Afghanistan as long as there's a workload that supports Afghanistan.”

Many of the Corps projects currently underway in Afghanistan support the Afghan National Army and the Afghan National Police. Projects include the \$9 million Afghan National Army Presidential Information Coordination Center in Kabul — a three-story, reinforced concrete and structural steel complex where the Afghan president will coordinate with military leaders — and a slew of border crossing sites, border police stations and provincial district police headquarters.

“We're providing infrastructure for the Afghan National Army and the Afghan National Police so they're able to provide a safe, secure and stable country,” Eyre said.

Going forward, the Corps' enduring presence will be focused on a different kind of infrastructure — power, water and



**U.S. Army Sgt. John Graham**, far left, provides security for Rob Brochu, a Corps engineer who speaks with contractors working on the Parwan-Bayman Road in Afghanistan.



**Left, Prime Power** engineers inspect transformers at an Afghan Uniform Police center. **Right**, an overhead view of the Kajaki hydroelectric plant. The Corps installed a primary switch center at the dam to fix electrical problems.



MARK RAY/USACE; U.S. AIR FORCE



**The Corps completed** construction on three new Afghan Uniform Police district headquarters in western Afghanistan in 2013.

transportation — that will make the nation more stable by strengthening its economy, rather than its military.

Dam upgrades are the thrust of these efforts. “Afghanistan has two very significant dams: the Kajaki Dam and the Dahla Dam,” Cox said. “We have very large programs in support of the Department of State and USAID (U.S. Agency for International Development) to refurbish and enhance those two dams.”

Repairs and upgrades to Dahla Dam will improve irrigation in southern Afghanistan, where agriculture is prevalent, while the work on the Kajaki Dam will increase the nation's ability to generate electricity from hydropower. Work on both dams, a total investment of more than \$400 million, is expected to last through 2017.

## ASIA: A REBALANCING

As important as Afghanistan remains, the Corps also is heavily invested in East Asia. In 2011, the Obama administration announced a strategic “rebalancing” of U.S. forces to that region from the Middle East.

“The Corps' mission overseas in Asia is tangible evidence of our rebalance to the Pacific,” said Eugene Ban, director of programs for the Corps Pacific Ocean Division, which includes four districts supporting 36 countries that fall under the purview of U.S. Pacific Command (PACOM).

It's hoped that by rebalancing existing military resources, democracies in Asia, which are heavily influenced by communist regimes in China and North Korea, will be strengthened. “To quote Secretary of Defense (Chuck) Hagel, this rebalance is not only about our security interests in this area; it's about a partnership of prosperity for this region and the world,” Ban continued.

Corps activity is especially strong in Korea and Japan, home to the Pacific Ocean Division's Far East and Japan districts, respectively. “As part of the rebalance, we have two very large programs that are relocating forces in both of those countries,” Cox said. “With direct support from the host nations, they're allowing us to enhance our partnership and strategic posturing in support of those two partners, but perhaps even more so in support of the overall PACOM theater-security strategy and objectives.”

In Korea, the Corps is executing nearly \$5 billion a year in military and host-nation construction through 2015, up from an average of \$2.6 billion a year over the last 10 years. The increase is owed largely to a \$10.7 billion program that will relocate approximately 12,000 U.S. troops stationed in South Korea to Camp Humphreys, about 40 miles south of Seoul. The bases they're moving from — including U.S. Army Garrison Yongsan in downtown Seoul — will be

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The aircraft carrier USS George Washington visits Yokosuka Navy Base in Japan. As Afghanistan winds down, the Corps, like the military, is shifting interests to East Asia.

USACE

returned to Korea as the country assumes a larger role in its own defense.

Col. Bryan Green, commander of the Far East District, called the relocation program “the largest military construction since the Panama Canal.” “Scope- and scale-wise, this is bigger than anything we’ve ever done in Korea,” said Patrick Beard, chief of the Korea Program Relocation Office. “It’s the largest peacetime effort the U.S. Army Corps of Engineers has executed.”

The program, 92 percent of which is being funded by South Korea, includes an expansion of Camp Humphreys from 1,200 acres to more than 3,500. The camp will accommodate more than 36,000 residents, up from the current 9,000, when work is complete in 2016.

“We’ll be constructing 655 new and renovated facilities over the next three years,” said Beard. The program includes everything from new schools and hospitals to new barracks. “Essentially, we’re getting the opportunity to build a city,” he said.

Similar relocations are underway in Japan. The Corps is relocating 59 jets from the USS George Washington’s carrier wing, currently stationed at the Naval Air Facility Atsugi, to the Marine Corps Air Station Iwakuni, some 600 miles away. Scheduled for completion by 2017, that relocation alone includes nearly 200 projects. Likewise, the Corps is consolidating Marine Corps bases in Okinawa, where a major undertaking is the construction of a new facility for Marine Corps Air Station Futenma, which will require another 200 projects executed through 2022.

“All of these programs are very large; they’re multibillion-dollar programs in aggregate, and 97 percent of the investment is by the government of Japan,” explained Ban. The programs, he said, are “realigning our forces in Japan for the long, enduring future.”

In Southeast Asia, the Alaska District is also planning for a long, enduring future. Instead of building military bases, however, it’s building schools, medical clinics, disaster centers and drinking-water infrastructure. Currently, it’s engaged in 100 of these projects in countries such as Cambodia, Laos, Sri Lanka, Vietnam, Thailand and Bangladesh.

“We’re establishing friendships for the United States in those countries as we rebalance toward Asia,” said Stan Wharry, chief of the Alaska District’s Asia Office.

#### **AFRICA: SMALL PROJECTS, BIG IMPACT**

According to Cox, the same types of friendships that are valuable in Asia can prove fruitful in Africa. There, the Corps’ Europe District is engaged in humanitarian-assistance projects in support of a presidential initiative to increase U.S. aid to sub-Saharan countries.

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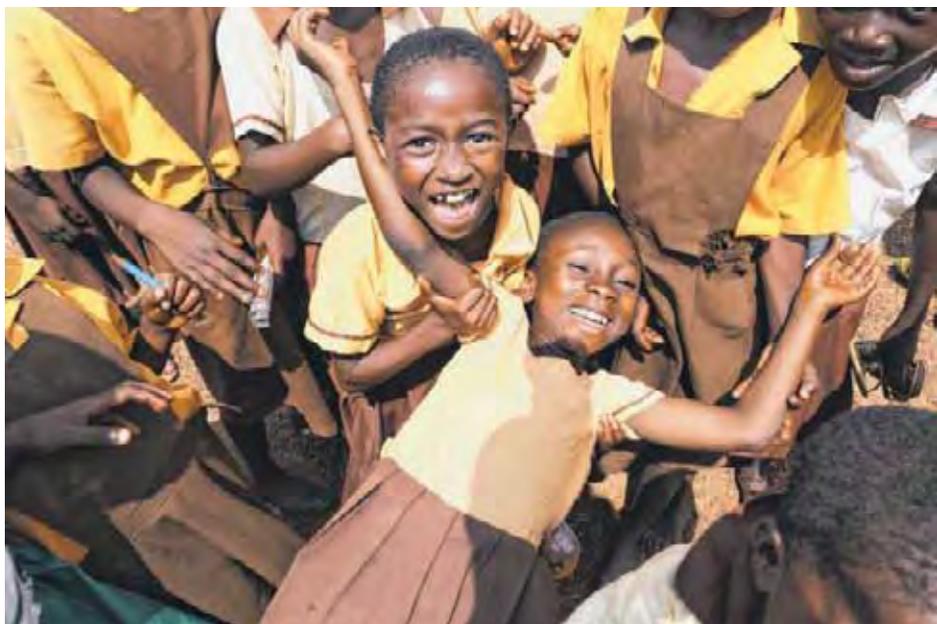


- 104 countries and territories where the Corps is engaged
- 35 countries and territories where the Corps has a physical presence (represented in **bold** text below)
- \*Not shown

<b>Afghanistan</b>	Belize	Chile	Estonia	Haiti	Kosovo	Marshall Islands	Niger	<b>Puerto Rico</b>	South Sudan	Turkmenistan
Albania	Benin	China	Ethiopia	<b>Honduras</b>	<b>Kuwait</b>	Mauritania	Nigeria	<b>Qatar</b>	Spain	Uganda
Algeria	<b>Bolivia</b>	<b>Colombia</b>	Finland	Hungary	<b>Kyrgyzstan</b>	Mauritius	<b>Oman</b>	<b>Romania</b>	Sri Lanka	Ukraine
American Samoa	Bosnia-Herzegovina	Costa Rica	France	<b>India</b>	Laos	Mexico	<b>Pakistan</b>	Russian Federation	Suriname	<b>United Arab Emirates</b>
Angola	Botswana	Ivory Coast	Gambia	Indonesia	Latvia	Micronesia	Palau	Rwanda	Swaziland	<b>United Kingdom</b>
Antarctica*	<b>Brazil</b>	Croatia	<b>Georgia</b>	<b>Iraq</b>	Lebanon	Moldova	Palestinian territories	Saint Lucia	Sweden	<b>United States</b>
Armenia	<b>Bulgaria</b>	Cuba	Germany	Ireland	Liberia	Mongolia	Panama	Saudi Arabia	Switzerland	Uzbekistan
Australia	Burkina Faso	Djibouti	Ghana	Italy	Libya	Montenegro	Paraguay	Senegal	Taiwan	Venezuela
Austria	Cambodia	Dominican Republic	Great Britain	<b>Japan</b>	Lithuania	Morocco	<b>Peru</b>	Serbia	<b>Tajikistan</b>	Vietnam
Azerbaijan	Cameroon	<b>Ecuador</b>	Guam	<b>Jordan</b>	Macedonia	Mozambique	Philippines	Singapore	Thailand	Virgin Islands (U.S.)
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Bangladesh	Chad	<b>El Salvador</b>	Guyana	Kenya	Maldives	<b>Netherlands</b>	Portugal	South Africa	Turkey	Zambia
<b>Belgium</b>					Mali	Nicaragua		<b>South Korea</b>		

SOURCE: USACE

KATHLEEN RUDELL



JENNIFER ALDRIDGE/USACE

**Students in Ghana** pose for a photo near the site of a new school building being constructed by the USACE Europe District in partnership with U.S. Africa Command.

“In many cases, what we’re doing in Africa are very small programs, but they have a significant potential long-term effect in terms of prosperity, security and stability,” Cox said. “These are partnership relationships we want to enhance and maintain for a very long time.”

Typical of U.S. efforts in Africa is Power Africa, a White House program that commits \$7 billion through 2018 to energy projects in countries such as Ethiopia, Ghana, Kenya, Liberia, Nigeria and Tanzania. More than two-thirds of the population lacks electricity in these countries.

“With power comes opportunities for prosperity and economic growth, and that leads to security and stability in the region,” continued Cox, who said the Corps has offered support to USAID to execute the Power Africa mission.

Europe District Commander Col. Peter Helmlinger said small projects — ranging in investment from \$100,000 to \$500,000 — to renovate schools, refurbish medical clinics and sanitize water in Africa are

“strategically the most important thing” his district does. He expects the Corps to ramp up African activities even further as more U.S. troops leave Afghanistan.

“I see Africa as a growing interest to the United States,” Helmlinger said. “Many of the troops that used to deploy to Afghanistan are now regionally aligned with Africa. So, you will see more stateside-based brigades sending battalions and other elements to Africa for different engagement-type missions; the Corps of Engineers’ activities will grow commensurate to support those missions.”

From Afghanistan to Asia to Africa, the Corps isn’t just building facilities. It’s building relationships.

“The best way to win a war is to never have a war, and the only way you can prevent war is by shaping the environment with capabilities to enhance partnerships,” Cox concluded. “Engineering is the backbone for the relationships we need to enhance international security that then enhances our national security back home.” ●

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# THE CORPS DOES *THAT*?

Sure, it's called the U.S. Army Corps of Engineers, but there are lots of *non-engineering* jobs to be had in the Corps, which employs nearly 37,000 civilian and military personnel from archaeologists to social-media experts. **Stephanie Anderson Witmer** takes a look at a handful of the Corps' most unusual jobs — and the compelling people who do them.



**Charlie Bryan, supervisor** of the U.S. Army Corps of Engineers Nashville District Dive Team, dons his scuba gear at the Tennessee River Operations Center in Colbert County, Ala.

LEE ROBERTS/USACE

## CHARLIE BRYAN

**Age:** 52

**Position:** Supervisor, Nashville District dive team; chief, maintenance and fleet section

**Location:** Nashville

**Education:** High school

**Years in Army Corps:** 34

**I**N 1980, CHARLIE Bryan was 19 and planning to be a farmer. That summer, the self-described “Tennessee country boy” took a part-time maintenance job in the U.S. Army Corps of Engineers’ Nashville District and expected to leave come fall. “But I fell in love with what I was doing,” he said, “and the next thing I know, it’s 34 years later.”

Since those early days, Bryan has risen through the ranks to become chief of the district’s maintenance and repair section and the leader of its dive team, which performs underwater

maintenance of locks, dams, channels and hydroelectric power plants along the Cumberland and Tennessee rivers.

As in other areas of the Corps, Bryan and his divers have collateral duties, meaning that diving is not their primary job. They do all sorts of maintenance work on dry land, but they have the additional training to also do it underwater.

Working underwater poses a special set of challenges. For starters, visibility is often a

problem, and divers must use their hands to navigate the repairs by feel to ensure the job has been done completely and correctly. “There are some places in the water where you can’t see inches in front of you,” Bryan said.

Additionally, divers have to be fit enough to carry 60 to 80 pounds of diving equipment on their backs while also lifting, carrying and operating heavy equipment, rigging and concrete blocks.

The more difficult the job, the more Bryan wants to tackle it. “I love a challenge,” he said. “The harder it is, the more I want to do it. I don’t like to be told that something can’t be done.”

“I love a challenge. The harder it is, the more I want to do it. I don’t like to be told that something can’t be done.”

— Charlie Bryan, Nashville District dive team supervisor

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## JACK DOHALLOW

**Age:** 56

**Position:** Dam operator

**Location:** Painted Rock Dam in Gila Bend, Ariz.

**Education:** Some college and “lots of on-the-job training”

**Years in Army Corps:** 1



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**Jack Dohallow** shows off his woodworking skills. This jack-of-all-trades, who oversees the Painted Rock Dam in Arizona, lives hours away from the nearest grocery store.

**JACK DOHALLOW** MAY be one of many dam operators in the Corps — except that the dam he oversees doesn't contain any water.

Painted Rock Dam in Arizona is a dam built by the Corps in the late 1950s to control flooding from the nearby Gila River. Dohallow and his sole coworker measure and report any water flow in the dam, maintain its gates and generators, reset culverts and control erosion.

Dohallow began working for the Corps a little more than a year ago, but he's no stranger to public service. In 1994, he and his wife sold their home, packed up an RV and spent the next 15 years traveling the country. They worked temporary and seasonal positions with the federal bureaus of Land Management and Reclamation, the National Park Service and the National Forest Service at Mount St. Helens in Washington, Mojave National Preserve in California, Organ Pipe National Monument in Arizona and other locations.

During their extended road trip, Dohallow and his wife fell in love with the desert. He refers to Painted Rock Dam as their “little oasis” — and it's the epitome of remote. “When we want to go grocery shopping, it's four hours round-trip,” he said.

Dohallow has developed an array of maintenance skills, from repairing fences to fixing electrical problems. He and his coworker live on site with their families and perform most maintenance on the dam and their homes themselves. He refers to himself as a literal “Jack-of-all-trades.”

He's happy to be doing work that allows him to “give back” to the desert and its other residents. “We're protecting the lands and towns downstream from floods,” he said. “It's a nice feeling knowing you're serving people, even if they don't realize it.”



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**Angela H. Jones** speaks to Brownie Troop 276 of Iolani School in Honolulu about protecting the environment on National Public Lands Day.

## ANGELA H. JONES

**Age:** 55

**Position:** Lead park ranger, Pacific Regional Visitor Center

**Location:** Honolulu

**Education:** B.S., psychology

**Years in Army Corps:** 33

**A S A CHILD** in Georgia, Angela H. Jones had no idea that her love of the outdoors, vivacious personality and natural curiosity would one day translate into a job as a park ranger — in Hawaii.

Jones had her heart set on being a school counselor. But shortly after graduation from college, she took a public tour of a new dam being constructed by the Corps in its Savannah District in Georgia, and was impressed by the female park ranger who led it. “I thought, ‘What a cool job!’” Jones said. “You get to wear a uniform and talk to people.”

A week later, Jones inquired about working for the Corps and was hired as a payroll clerk in Savannah. She befriended the park rangers there, who encouraged her training, and within two years, she was one herself.

By 2008, Jones wanted a change of scenery. She'd recently gotten divorced, and her three children were grown. “I just wanted something totally different,” she said.

When a colleague told her about a ranger position available in the Honolulu District, she jumped at the opportunity. She got the job and, in 2009, relocated to the Aloha State. She's now the lead park ranger at the Pacific Regional Visitor Center, situated in an old Army battery in the heart of Waikiki on the island of Oahu.

Jones and the center's other rangers tell their nearly 60,000 annual visitors the story of the Corps in Hawaii and its various projects, including flood and erosion prevention and beach restoration. Additionally, the district leads community-outreach events, including programs with local high schools to foster student interest in science and math careers.

For Jones, it doesn't get much better. “I get to do exactly what I love doing,” she said, “and when you love doing something, it isn't really work.”



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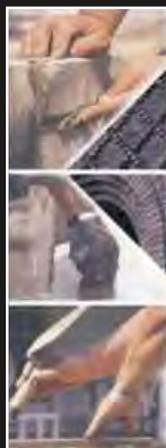
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## JON LANE

**Age:** 49

**Position:** Chief, Invasive Species Branch

**Location:** Jacksonville, Fla.

**Education:** M.A., international development economics

**Years in Army Corps:** 16

**J**ON LANE'S FIRST foray into working with invasive species began 25 years ago as a Peace Corps volunteer in Africa. But back then, he wasn't trying to control them — he was trying to proliferate them.

In the late '80s and early '90s, he explained, he and the Peace Corps didn't know what they know today: that raising Nile River Basin tilapia in the Congo River Basin and bringing plants from Asia and South America to Africa could be damaging to the ecosystem and the economy.

He certainly understands now, as he works tirelessly to protect the Corps' Jacksonville District and the Everglades from non-native invasive species. Without such oversight, said

Lane, invasives would profoundly affect navigation, flood control and ecosystem restoration, the Corps' three main business lines.

One of his primary tasks is controlling water hyacinth on Lake Okeechobee and surrounding navigation channels. Originally from the Amazon,

fast-growing water hyacinth clogged waterways and obstructed river traffic in Florida and Louisiana so severely in the late 19th century that Congress intervened to pass the River and Harbors Act, Lane said. More than 100 years later, the plant is still a problem. "We're protecting these waterways from the water hyacinth becoming so impacting that it closes boat ramps and the federal navigation channel," Lane said.

Even more challenging is educating the public about invasives. Many people don't understand that emptying a fish tank or releasing a pet snake outdoors can damage an ecosystem, which relies on a delicate balance of interconnected plants, insects and animals in order to function, he explained.

Cooperation with the public and other agencies is vital, he said: "Invasives don't know boundaries. If we don't manage them on our land, we're causing other people problems when they spread."

**Jon Lane says** emptying a fish tank or releasing a pet snake outdoors threatens the ecosystem.

"We're protecting these waterways from the water hyacinth."

— Jon Lane, chief of the invasive species branch



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Archaeologist **Sonny Trimble**, left, led a team of experts in Iraq in the excavation of mass graves in 2006.

USACE

## MICHAEL "SONNY" TRIMBLE

**Age:** 61

**Position:** Archaeologist; founder, Mandatory Center of Expertise for the Curation and Management of Archaeological Collections

**Location:** St. Louis

**Education:** Ph.D., archaeology

**Years in Army Corps:** 27

**M**OST PEOPLE DON'T get a front-row seat to history, but for Michael "Sonny" Trimble, it's all in a day's work.

In the late 1980s, fresh from graduate school and newly hired by the Corps, Trimble knew Congress was preparing to pass the Native American Graves and Repatriation Act. The new law would require government agencies to inventory their collections of artifacts, Trimble explained, and return any Native American human remains and materials

found buried with them to the respective tribes.

He immediately recognized how daunting compliance was going to be for the Corps, which had artifacts dating back to the 1940s excavated from thousands of construction sites. In 1988, just a year after he began working for the Corps, Trimble established the Mandatory Center of Expertise for the Curation and Management of Archaeological Collections. Its purpose was to bring together other archaeologists, anthropologists, archivists and similar experts to pool their collective skills and knowledge.

Though the center is based in St. Louis, Trimble and his team travel wherever needed to do archaeological, forensic and archival work for the Corps, the Department of Defense and other federal agencies. They have overseen several high-profile cases, including those of Kennewick Man in the Pacific Northwest, Saddam Hussein's mass graves in Iraq and the African Burial Ground National Monument in New York City. Most recently, Trimble has set his sights on securing something for the National Archives that's a bit smaller: a rare pre-Civil War document signed by Jefferson Davis.

For Trimble, the more challenging a task, the better. "I enjoy the projects that are the most difficult," he said. "It's just the way I'm wired. You're using all your knowledge and training and education to the maximum extent."



USACE

**Romanda Walker**, center, has developed a mobile app on water safety.

## ROMANDA WALKER

**Age:** 34

**Position:** Public affairs specialist

**Location:** St. Louis

**Education:** M.S., bioinformatics

**Years in Army Corps:** 4

**T**ESTING LIMITATIONS IS nothing new to Romanda Walker.

Diagnosed with muscular dystrophy as a baby, she has used a wheelchair for most of her life. As a college student, she landed an internship with the public affairs office in the Corps' St. Louis District, where she interned every summer as she completed her undergraduate and master's degrees. Despite the fact that she was a biology student, she excelled at writing, social media and graphic design.

Now a full-time employee, Walker manages the district's website, as well as its social media and strategic communication. Her academic background has given her an edge in translating what she calls "engineer-speak" for a wide audience, everyone from farmers to navigation workers, members of Congress to elementary-school students.

"There are so many awesome things that the Corps and our district do," she said, "and I get to be in the middle of it all."

Her hard work has paid off. In 2011, Walker was named the Army Corps' Civilian Journalist of the Year for writing, graphic design and videos she created for her district. Her latest project is developing a mobile app to educate people about water safety and recreational activities at nearby lakes.

A native of St. Louis, Walker recalls U.S. Army recruiters visiting her high school. She'd stop by their tables and help herself to the free pencils, but, with her disability, she never thought she'd be able to actually join the Army.

"Now I'm able to be a part of the Army and of this organization," she said. "Even though I wasn't physically able to serve overseas, I'm able to serve on my home turf."



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# HOW TO: FIX A DAM

The U.S. Army Corps of Engineers manages 707 dams around the country, performing routine inspections and risk assessments of each. In 2005, the Corps discovered seepage in the wall of Wolf Creek Dam on the Cumberland River in southeastern Kentucky near the Tennessee border. The Corps immediately lowered the level of water in the reservoir — the largest reservoir east of the Mississippi River — and developed a plan to reinforce the structure. Construction started in 2007 and wrapped up in 2013. Not only is the dam now fully functioning and safe, the project received several national awards. See how the Corps completed this innovative work.

BY CHRISTINE NEFF | INFOGRAPHIC BY PATRICK WELSH

## WOLF CREEK DAM



USACE

**Wolf Creek Dam**, shown in a February 2014 photo, was originally designed and built between 1938 and 1952.

**Length:** 5,736 feet

**Normal water level:** 723 feet

**Materials:** Earth and concrete

**Purpose:** Flood risk management and hydropower

**Cost of repairs:** About \$594 million

### SPOTLIGHT: WIRTH DRILL RIG

The Wirth drill rig uses a reverse-circulation method, similar to a tunnel-boring machine. The massive drill weighs 85 tons and is 65 feet long. The drill bit is weighed down with lead shot.



4.1 foot in diameter

DRILL BIT

Earthen embankment

Cumberland River



### STEP 1

Workers first create a concrete wall inside the earthen embankment to protect the dam during construction. To do so, they excavate an area of the embankment 6 feet by 9 feet and up to 230 feet deep. They fill the excavated area with concrete. The process is repeated 433 times to create the protective wall.



### STEP 2

With the protective wall in place, workers drill holes to create the permanent concrete barrier wall. They first drill small pilot holes through the protective wall using a water hammer. They then use an auger (not shown) to do the first part of the excavation for the area that will become a "pile," or panel of the barrier wall.



### STEP 3

Now in comes the big rig — the Wirth drill rig. Workers use this machine for the second part of the excavation. The drill reaches a depth of 275 feet, piercing into the limestone underneath the dam. When one hole is complete, the drill moves on to the next location.



### STEP 4

Workers backfill the piles with concrete. In all, 1,300 piles are created along the 4,200-foot wall. The piles overlap, which strengthens the structure. "Part of the reason we know it was successful — out of 1,300 piles, from the top of the dam to the foundation, only one was marginally out of alignment," said Eric Halpin, the Corps' special assistant for dam and levee safety.

## ENVIRONMENT



JOSE LOPEZ/USACE

A 275-kilowatt wind turbine was installed at Fort Buchanan, Puerto Rico, in 2013, part of ongoing efforts to reduce energy usage.

# GREEN TO THE CORE

## Sustainability ethos roots and blooms with USACE projects

By Adam Hadhazy

**I**N THE CAMPAIGN to go green, the U.S. Army Corps of Engineers' efforts run the gamut. Reducing greenhouse gas emissions. Doing sustainable construction. Using water efficiently. Preventing pollution. Managing waste, and increasing renewable energy sources.

For the 37,000 employees of the Corps, these green initiatives make sense — and they make dollars.

“By reducing water and energy consumption, we’re looking to help the Army, the Department of Defense and ourselves save the taxpayers’ dollars,” said Christopher Evans, acting chief of the Corps’ Environmental Division. “More simply, it’s just the right thing to do.”

Examples of the green zeitgeist can be seen popping up on the 12 million acres of land and water managed by the Corps.

New solar panels have been installed at recreation area visitor centers, and additional recycling bins have been placed at campgrounds and parks to serve as a visible reminder of the Corps’ sustainability efforts.

“We’re finding ways and incentivizing visitors to save energy and water, reduce waste and increase recycling,” said John Coho, senior adviser for environmental compliance. “All those things you’re trying to do at home, we want people to do when they visit our campgrounds.”

**CONTINUED** »



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## ENVIRONMENT

In working with the armed services, the Corps plays a defining role in putting sustainability practices in place. The Corps aims to develop a billion watts of renewable energy — enough to power approximately 250,000 homes — for Army and Air Force installations by 2025.

The Army has selected installations for “net zero” pilot projects to be launched by 2020. Six installations were chosen to be net-zero energy, meaning the site will use only the energy it produces. Six will be net-zero water and six net-zero waste. Two installations will accomplish all three missions.

The USACE Sacramento District is spearheading efforts to get Fort Hunter Liggett in Monterey County, Calif., to net-zero energy and waste levels.

The Corps has just completed two of four planned solar panel microgrids at the Army post. Each unit generates one megawatt of electricity. The solar panel expanses have already saved about a third of a million gallons of fuel, while reducing carbon dioxide emissions by approximately 3,000 tons.

California is known for having blackouts, so the microgrids will end Fort Hunter Liggett’s reliance on offsite power, offering environmental as well as tactical benefits. “We need to be able to produce our own power in case something happened, like an earthquake,” said Jon Revolinsky, an engineer in the Sacramento District. “Instead of being a victim of the earthquake, we’d be a first responder.”



USACE

The Tobyhanna Army Depot in Pennsylvania has a roof system covered in vegetation.

As a bonus, the microgrids — situated over a parking lot — shade vehicles, lowering their internal temperatures and helping with upkeep. “It gets really hot here, well into the hundreds in the summertime,” said Revolinsky. “And keeping vehicles out of direct sun keeps the gear on them, like antennas and rubber parts, from deteriorating.”

Toward the goal of net-zero waste, Fort Hunter Liggett has added an on-site recycling sorting center to divert waste and reuse materials where possible. An incinerator will soon be installed to burn rubbish, which generates additional

electricity.

A unique green project is also underway in the Great Lakes. In Ohio, Michigan and New York, the Corps is replacing old blocks that form breakwaters — structures that reduce wave intensity and erosion in navigable waterways — with textured and shelved versions. These special blocks, placed under the waterline, create a habitat for marine creatures and spawning areas for fish.

Meanwhile, atop Ashtabula Harbor-area breakwaters in northeastern Ohio, the Corps is fashioning recessed, gravel-filled plots to serve as nesting sites for the

common tern — an endangered species in Ohio, despite its name.

Efforts to create so-called green breakwaters are part of an “Engineering with Nature” initiative, which represents a shift in thinking when the Corps builds infrastructure that takes into account environmental needs. “The whole point is we can be more creative with our infrastructure to serve multiple purposes,” said Thomas Fredette, a research biologist for the Engineer Research and Development Center in Vicksburg, Miss.

Innovation and a strong green perspective will continue to guide the Corps as it seeks to meet sustainability goals. And progress is apparent: In fiscal year 2011, the agency recorded a dismal seven “red” metrics on its Sustainability and Energy Scorecard, as graded by the White House’s Office of Management and Budget. Red indicates a failure to meet requirements and not being “on track.”

For fiscal year 2012, however, the Corps scored three positive “green” metrics for a portion of its greenhouse gas emissions, renewable energy use and water use goals.

Better reporting and data collection have helped. But fundamentally, the Corps is turning over a new, green leaf, something officials speak of as an ongoing “cultural change” at the organization. “We’re continuing to work toward sustainability in everything we’re doing as an agency,” said Evans. “It’s not only good for us, it’s good for the country.” ●

## LETTER OF THE LAW

During the last decade, the sustainability ethos has really taken root at the U.S. Army Corps of Engineers, driven from within and without by federal law.

In 2002, the Corps published its first environmental operating principles. Under these guidelines, the USACE sought to better manage and protect the health of air, water and land resources. “We looked across our entire organization to achieve environmental sustainability,” said Christopher Evans, acting chief of the USACE Environmental Division.

Then, in 2009, the Obama administration issued Executive Order 13514, setting sustainability goals for federal agencies with regard to “their environmental, energy and economic performance.” The order upped the ante, giving the Corps a comprehensive array of sustainability targets. “The executive order is certainly the driving force we’re following for our sustainability efforts today,” Evans said.



JOSE LOPEZ/USACE

Engineers install the first of three wind turbines at Fort Buchanan, Puerto Rico. Other green measures taken in 2013 included installing solar power and a water conservation system.

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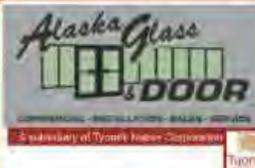
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MIKE BOLES/USACE



USACE

**Left, water hyacinth** is harvested on the St. Johns River in Florida. Above, the Corps evaluates the hydrilla on Lake Seminole in Florida. Hydrilla, an aquatic plant with branches that reach 25 feet in length, originated in the Sunshine State and can now be found in Canada and much of the United States. Control and management cost millions of dollars annually.

# RESTORING NATURE'S FLOW

## Corps forces invasive species to retreat

By Adam Hadhazy

**T**HOUGH THE U.S. Army Corps of Engineers has a diverse portfolio of projects, a common current runs through many of them: "The Corps is a water resources development agency," said Mark Cornish of USACE's Invasive Species Leadership Team. "We've got our feet in the water."

During its two centuries of service, the Corps has tackled major water infrastructure problems by building dams, levees and canals. Historically, nature has taken a back seat to the needs of human development. But that sentiment has evolved, and the Corps now plays a significant role in

restoring damaged ecosystems.

Efforts range from fixing small wetlands that measure a few dozen acres to collaborating on the world's largest ecosystem restoration project, the Comprehensive Everglades Restoration Plan (CERP), which spans southern Florida and will take decades to complete.

"Our mission is subtly changing from moving rocks and dirt to better managing the waterways for our native species and eradicating invasive species," Cornish said.

The term "invasive species" refers to foreign organisms that have been introduced by human activity into new habitats. Without natural predators to check their growth, the invasives can out-compete

native flora and fauna, sometimes taking over the ecosystem.

Some infamous members of this rogues' gallery include zebra mussels, phragmites (or "common reeds") and Asian carp. Invader species often wreck biodiversity and cause economic damage as well.

Economic damage was the impetus for the Corps' first mission against invasive species more than a hundred years ago. The River and Harbor Act of 1899, the nation's oldest environmental law, authorized the agency to eliminate aquatic vegetation — namely, invasive water hyacinth — that was clogging commercial waterways in the

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## ENVIRONMENT

South.

Navigation and flood control remained the focus of the Corps' ecosystem and invasive species management over the next decades. In recent years, the goal has shifted to preserving and restoring natural habitats for nature's sake.

"Part of our cultural heritage is lost when invasive species come in and change things," said Cornish.

In 1999, President Clinton's Executive Order 13112 created the interagency National Invasive Species Council. The order prompted the Corps to develop an agency-wide policy and provide guidance on how to handle invasives.

"Now with that in place, all the new projects coming online have very comprehensive invasive species considerations in them," said Jon Lane, chief of USACE's Invasive Species Management Branch. One example: having construction workers keep their equipment clean as they move from job to job to avoid cross-contamination.

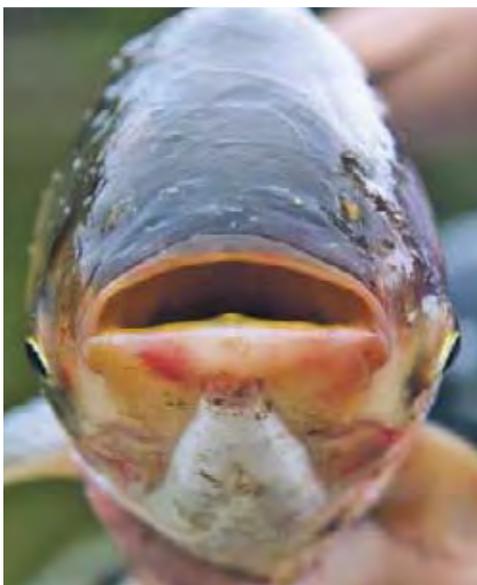
Currently, the Corps has 29 estuary restoration projects on the books; construction has finished on six projects that continue to be monitored. Projects range from the 28.3-acre Colorado Lagoon in Long Beach, Calif., a tidal lagoon that provides recreation, wildlife habitats and flood protection, to the 14-acre Stewart's Creek in Barnstable, Mass., a restored salt flat.

Restorative work typically involves removing and repositioning earthen material and planting desirable plant species while culling invasives. But fighting these invaders does not come cheap: From fiscal years 2009 through 2013, between \$110 million and \$160 million was spent annually on invasive species management, with fiscal year 2014 pegged at \$144 million.

Early action is necessary to prevent the alien species from establishing itself and spreading rapidly. "There's an old saying, 'An ounce of prevention is worth a pound of cure,' and that's basically true when it comes to invasive species management," said Cornish.

Successfully partnering with other restoration-minded outfits is critical to the Corps' effort.

For instance, the Corps worked with



MICHAEL HEINZ/AP



JOHN FLESHER/AP

**An Asian carp**, jolted by an electric current from a research boat, jumps from the Illinois River near Havana, Ill., during a study on the fish population. In January, the Corps submitted a report to Congress offering options for keeping the invasive species out of the Great Lakes.

The Nature Conservancy (TNC), a non-governmental organization, on modernizing dam operations on the Green River, a tributary of the Ohio River in central Ken-

tucky. The project replicated more natural river flow patterns and has rejuvenated wildlife downstream. Hundreds of dams operated by the Corps may benefit from a similar treatment.

Balancing civil needs with nature's can be a win-win situation. "There are no single-purpose water resources projects," said Robert Sinkler, a former Corps district commander and currently the water infrastructure director at TNC. "We are taking a holistic approach to complex water issues, and that's a perspective that the Corps recognizes."

Coordination and collaboration of this sort is especially critical in the Everglades, where various federal, state and county authorities, as well as private landowners, own chunks of property.

Southern Florida is a hotbed for invasive species. As many as approximately 25,000 non-native species have set up shop there, astoundingly comprising more than a third of all plants in the state. Four targets are the Melaleuca tree, the Brazilian pepper tree, the Australian pine and the Old World climbing fern.

In Davie, Fla., near the Everglades, the Corps has just completed and transferred to local administration a facility that raises and releases so-called biocontrol agents. These agents — small insects such as beetles and moths — exclusively eat or degrade some of the worst invasive offenders, reducing their numbers and impact.

Yet the chief focus for the Corps in south Florida is, as Lane said, "getting the water right." As communities in Florida developed in the 20th century, the Corps and other groups drained swamps, dug canals and erected levees, fundamentally altering the original habitat. Now, the goal is to restore what once was while promoting

sustainable water resource usage.

A good example is the Picayune Strand Restoration Project, part of CERP. The 55,000-acre project area sits in Florida's southwest corner, between Interstate 75 ("Alligator Alley") and U.S. Highway 41 (the Tamiami Trail).

The Corps is backfilling 48 miles of local canals that were once intended to provide flood protection for a residential district that never developed. Meanwhile, the Corps is removing 260-miles-worth of crumbling roads and installing three new canals and pump stations to send water into drained wetlands and

control flooding.

In the Picayune Strand area, the benefits of restoration are already clear.

"Bird species and animal species who used to be in the area are now returning with the restoration," said Howard Gonzalez Jr., ecosystem branch chief for the Jacksonville District. "If you build it, they will come." ●

**"We are taking a holistic approach to complex water issues."**

— Robert Sinkler,  
The Nature Conservancy



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## ENVIRONMENT

**Lygodium microphyllum**, also known as Old World climbing fern, takes over the trees in Loxahatchee, Fla.



USACE

## THE USUAL SUSPECTS

The Corps fights invasive species all over the country. Here are the worst of the bunch.

**1 ASIAN CARP.** The bighead and silver varieties of these large fish eat voraciously and reproduce quickly, crowding out native animals. The Corp's Chicago District has installed electric barriers in the artificial waterway connecting the Mississippi River Basin to the Great Lakes to keep the carp out of the lakes.

**2 BURMESE PYTHONs.** A real headline-maker, these snakes can grow to more than 20 feet in length and weigh as much as 400 pounds. Rampant in the Everglades, thanks to pet owners releasing too-big-to-handle snakes into the wild, they devour native species, up to and including crocodiles. Because the camouflaged pythons are so hard to spot and thus catch, the Corps has turned to dogs and heat sensors onboard unmanned aerial vehicles (drones).

**3 PHRAGMITES.** The thick, impenetrable stands formed by these tight-growing grasses prevent virtually anything else from inhabiting affected areas. The so-called common reed has invaded waterways nationwide. An example of its dominance: The Buffalo District is mowing down and chemically killing phragmites in the Times Beach Nature Preserve in New York, a 56-acre site along Lake Erie. The reeds blanket nearly 30 acres of the park.

**4 ZEBRA MUSSELS.** These small, usually striped mussels, hailing from Russia, can grow so densely that they clog municipal water pipes and power station intakes. A big problem in the Midwest and Great Lakes, the mussels are now moving as far south as Texas. Six lakes there are now documented to have infestations, owing to recreational boaters' contaminated hulls or equipment. The USACE's Fort Worth District is promoting boater awareness campaigns to slow the mussels' spread.

**5 PURPLE LOOSESTRIFE.** Looks deceive: The pretty purple flowering plant is a major marshy nuisance across most of the U.S. Annually, purple loosestrife degrades an estimated 800 or so square miles of wetlands by spreading aggressively, harming biodiversity.

**6 OLD WORLD CLIMBING FERN.** Also known as *Lygodium microphyllum*, it's native to Africa, Asia, Australia and the Pacific Islands. The plant invades open forest and wetland areas in Florida and Alabama.



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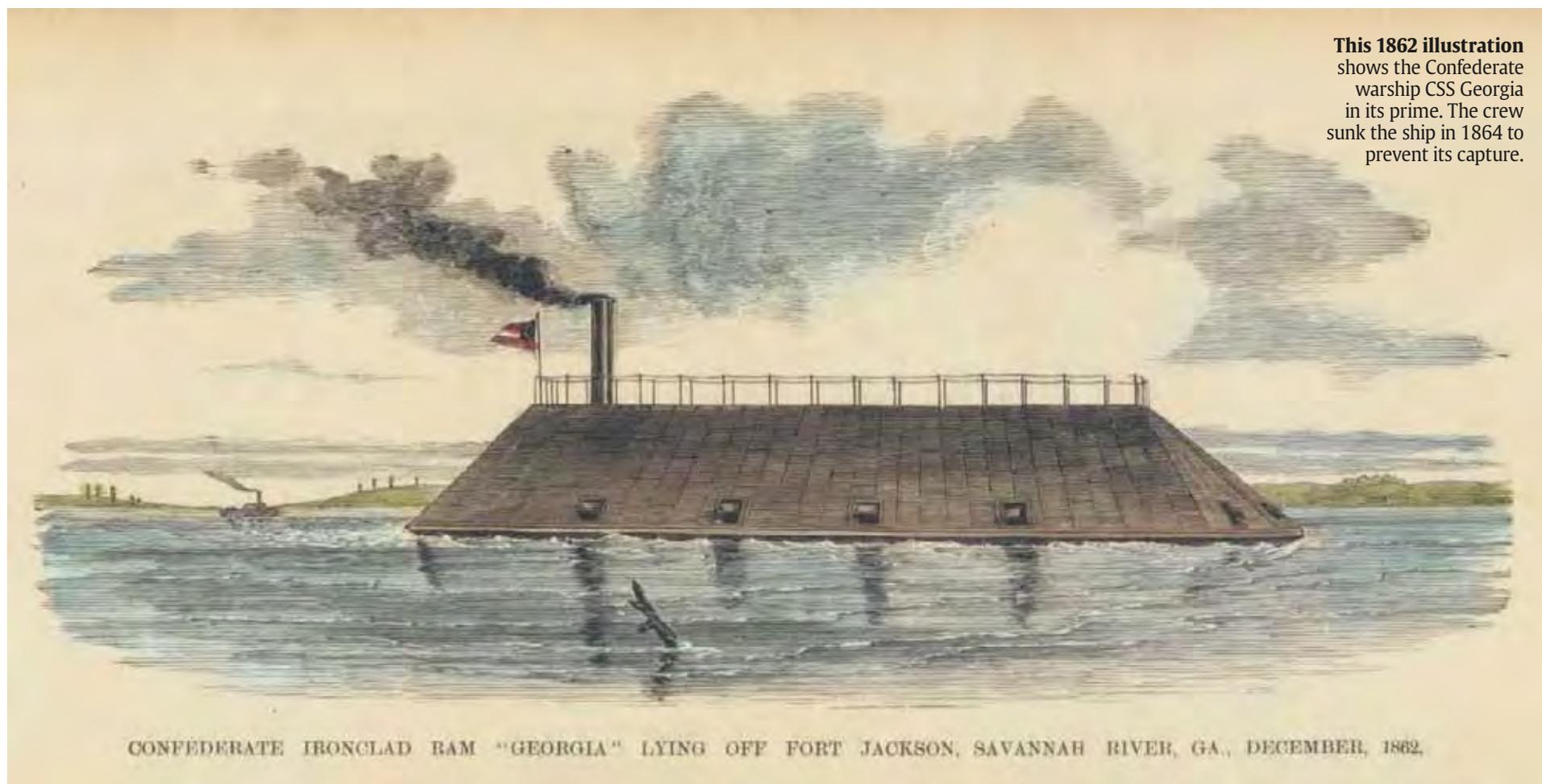
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## PRESERVATION

# WHEN THE PAST SURFACES



**This 1862 illustration** shows the Confederate warship CSS Georgia in its prime. The crew sunk the ship in 1864 to prevent its capture.

CONFEDERATE IRONCLAD RAM "GEORGIA" LYING OFF FORT JACKSON, SAVANNAH RIVER, GA., DECEMBER, 1862.

USACE

## While maintaining vital waterways, USACE protects and preserves America's submerged history

By Pam George

**B**UILT IN 1862, the CSS Georgia was designed to protect Savannah during the Civil War. But it never fired a round, and on Dec. 21, 1864, its crew scuttled the gunboat to prevent its capture.

Nearly 150 years later, the gunboat is still making headlines. It rests in the path of the Savannah Harbor expansion, which will deepen the channel from 42 feet to 47 feet. Consequently, the Confederate icon must leave its grave.

The process is painstaking. "This is an archaeology data recovery project," said

Julie Morgan, an archaeologist with the U.S. Army Corps of Engineers Savannah District. "We're looking at three months of archaeological field work even before the first piece is recovered, and the recovery phase might be three or more months."

That's business as usual for the Corps, which maintains waterways for commercial and recreational use. On rivers and in ports that have experienced centuries of traffic, echoes from the past often rise to the surface.

The Corps routinely surveys waterways to pinpoint potential obstacles. Dredging — which brings up silt, sand and sediment during routine maintenance, channel-

deepening or beach-replenishment projects — can be a first indication that there's something unexpected directly below.

Even a documented shipwreck can undergo changes. In 2003, for instance, Hurricane Isabel exposed more of a known wreck in Lynnhaven Inlet in Virginia Beach, Va. "It could have caused (a) potential hazard to navigation," said Keith Lockwood, an environmental scientist with the Norfolk District.

Dredging in 1983 first impacted the Georgia, raising it about 10 feet towards the surface. Its top elevation went from 28 feet in 1980 to 38 feet.

When the unexpected appears, work halts for surveys. Tools might include side-scan sonar, which creates images of the seafloor; magnetometers, which detect ferrous metal; and a high-resolution multi-beam sonar survey, which can identify objects and features within inches of their actual location.

Surveys are also conducted before major projects. "Every time we make alterations, widen or deepen the channel, we go through the same drill," said Brian Williams, project manager for the Charleston Harbor Post 45 deepening feasibility study,

**CONTINUED »**



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## PRESERVATION



U.S. NAVY

**A piece of the** Civil War ironclad warship CSS Georgia was retrieved by Corps archaeologists, aided by divers and salvage operations teams from the U.S. Navy in 2013. The warship rests in the path of the Savannah Harbor, Ga., expansion.

which found 420 anomalies during surveys, including possible debris from a bridge replacement.

If the site isn't a threat, it might remain untouched or receive a buffer zone of protection. For the Folly Beach (S.C.) Storm Damage Reduction Project, the Charleston District and the state historic preservation office established a 300-foot "no dredge" area around what surveys suggested was a wooden-hull shipwreck.

Other sites, though, are obstructions. While conducting surveys for the Texas City Ship Channel widening project in 2005, the Galveston District found the USS Westfield, a Civil War-era ferryboat-turned-gunboat. The ship, which ran aground during the Battle of Galveston, was sunk on New Year's Day 1863 to avoid capture.

Using divers, an electromagnet and a clam dredge, which scooped up artifact-laden sediment, the USACE removed items in 2009. "Cannonballs were identified in all phases of the discovery," said John Campbell, an archaeologist in the Galveston District. Also recovered: a 10,000-pound cannon and massive boiler parts. The site is now exhausted, but there is "still much we can learn from artifacts that were recovered," he said.

The Lynnhaven Inlet wreck, which belongs to the Commonwealth of Virginia, required removal because the channel had to dogleg around it. Artifacts from what

**"Most (of) the time, visibility is very limited; it's black."**

— Burt Moore, Corps diver for the CSS Georgia project

was likely an 18th- or 19th-century sloop or schooner included ballast stones, the wooden hull and keel, a pewter spoon, cannon and cannonballs.

The Corps often works with contractors for surveying and artifact retrieval since not all districts have divers on site. Universities may also get involved. Preservation experts at Texas A&M University worked on the Westfield retrieval. The university conducted an initial investigation of the Georgia site in 1979 and 1980. At that time, they found the vessel was largely intact.

Raising the Georgia will cost an estimated \$9.5 million, part of the mitigation effort on the \$652 million harbor expansion project.

In November 2013, Navy divers working with Corps archaeologists retrieved a 64-square-foot, 5,000-pound section of the ironclad warship to help determine the ship's condition and develop a retrieval strategy.

It won't be easy. The current is swift. "Most (of) the time, visibility is very limited; it's black," said Burt Moore, chief of the dredging system for the Savannah District, who dove as part of the Corps dive team for the Georgia project.

Despite the challenges, it's exciting. "Raising the CSS Georgia is unique," said archaeologist Morgan. "There were no existing drawings or plans. We're bringing up a puzzle." ●



USACE

**Keith Lockwood, environmental scientist** with the Norfolk District, poses with a Civil War cannon retrieved from the Lynnhaven Inlet in Virginia.

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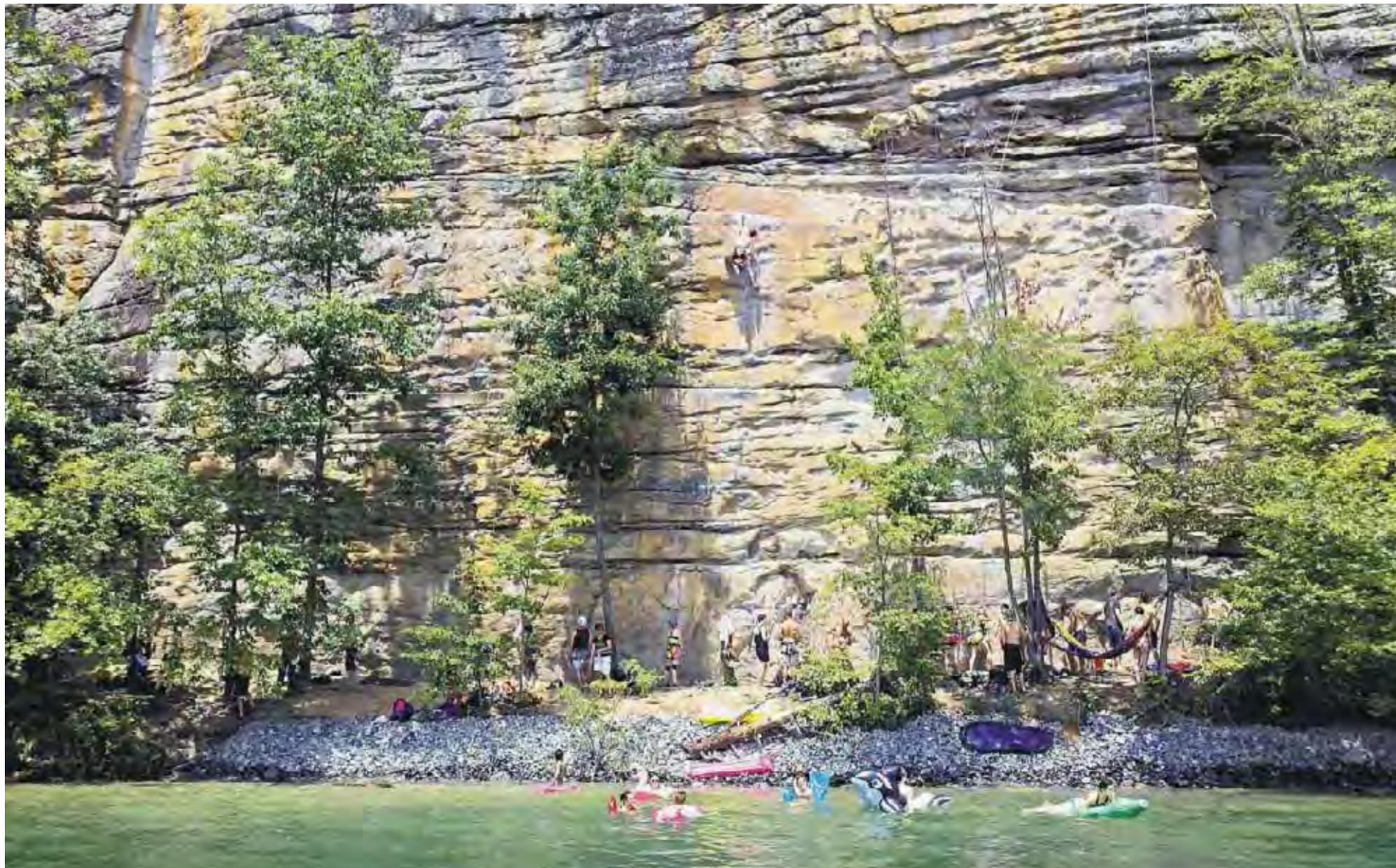
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## RECREATION



USACE

**Rock-climbing opportunities** abound along the cliffs that line parts of Summersville Lake in West Virginia. Most of the climbs are accessible year-round, but summer is a favorite season.

# GREAT GETAWAYS

## Relax and reconnect at a USACE recreation facility near you

By Stacy Chandler

**WHEN YOU THINK** of great places to escape the grind and get back to nature, a state or national park may come to mind. But you might be able to get away even closer to home.

Chances are there's a U.S. Army Corps of Engineers recreation facility near you. Ninety percent of the Corps' lakes and rivers with recreation sites are within 50

miles of a metropolitan area. And even if you have to make a longer trip, Corps recreation areas are worth your while.

Dams built in the 20th century created lakes that offer boating, fishing, swimming and more — all while providing flood control and hydroelectricity to surrounding communities.

On land, visitors enjoy beautiful views and easy camping. On the water, they can often swim, boat and fish — and it doesn't cost a dime to get in. (Campsites,

boat launches and other services do require a fee, however.)

"Initially, a lot of our efforts were for flood damage reduction, for navigation, for hydropower, and those were the main purposes and still play a very large role in what the Corps of Engineers does," said Heather Burke, manager of the Natural Resources Management National Partnership Program.

"But when you create levees and you create dams and locks, you also create

recreation opportunities, and people love to play on the water. So that's kind of how our recreation program got started; we created these really great resources for people to come out and play."

Water — in the form of lakes or rivers — is what all Corps recreation sites have in common. But beyond that, there's great diversity in what each site offers. Here are five that offer a little something special:

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## RECREATION

## SUMMERSVILLE LAKE



**Location:** Summersville, W.Va., 65 miles east of Charleston, W.Va.; 40 miles north of Beckley, W.Va.

**Date established:** 1966

**Info:** [www.lrh.usace.army.mil/Missions/Recreation/WestVirginia/SummersvilleLake](http://www.lrh.usace.army.mil/Missions/Recreation/WestVirginia/SummersvilleLake)

[army.mil/Missions/Recreation/WestVirginia/SummersvilleLake](http://www.lrh.usace.army.mil/Missions/Recreation/WestVirginia/SummersvilleLake)

Most of the time, Summersville Lake is a peaceful place, featuring cliff-top vistas and shimmering, clean water. But for six weeks each fall, things get a little wild.

That's when the Corps lowers the lake water level as part of its flood control and water storage mission, releasing a gush into the

Gauley River that transforms it into one of the best whitewater rafting sites in the world.

"When you talk whitewater, Class 5, Class 6 rapids — the ones that give you the big rush, that everybody kicks and screams — it's right here," said park manager Toby Wood. The water releases, in late August to October, draw 35,000 visitors to the river each year, he said.

For those who prefer life at a slower pace, Summersville Lake offers camping, boating, swimming, hiking and rock climbing. It's also popular with scuba divers who love the pristine mountain water.

"What really makes Summersville special is you have four of the most pristine, clean rivers in this part of the state that feed this reservoir," Wood said. "You end up with this awesome water quality, crystal-clear water. You can look down into the lake and see sometimes 30 feet down through there."



USACE

The National Great Rivers Museum's location on the Mississippi River lets visitors connect with the river and, in some cases, get out on the water and experience it firsthand.

## NATIONAL GREAT RIVERS MUSEUM



**Location:** Alton, Ill.; about 30 miles north of St. Louis

**Date established:** 2003

**Info:** [www.mvs.usace.army.mil/Missions/Recreation/RiversProjectOffice/NGRM](http://www.mvs.usace.army.mil/Missions/Recreation/RiversProjectOffice/NGRM)

The location of the National Great Rivers Museum makes perfect sense: it's near the confluence of the Illinois, Missouri and Mississippi rivers. And just like the merging of those mighty waters, the museum aims to show how our nation's rivers are woven into the fabric of America.

"The focus is to reconnect people to rivers," said Mike Petersen, a spokesman for the Corps' St. Louis District.

Inside the museum, which charges no admission fee, you can learn about navigation (you can even try your hand at piloting a towboat on the museum's simulator), how locks and dams work and how rivers have shaped our history and culture.

After you've soaked up all that knowledge, you can go outside and see it in action. The Melvin Price Locks and Dam are right next door, and so is the Riverlands Migratory Bird Sanctuary, a partnership with the National Audubon Society. Recently expanded trails and green spaces provide plenty of opportunities to enjoy the landscape as you marvel at the Mighty Miss.



USACE

Visitors to the Bonneville Lock and Dam can peek inside the Powerhouse II complex to see the hydroelectric plant at work.

## BONNEVILLE LOCK AND DAM



**Location:** Cascade Locks, Ore., and North Bonneville, Wash. (on the Oregon-Washington border); 45 miles east of Portland, Ore.

**Date established:** 1937

**Info:** [www.nwp.usace.army.mil/Locations/ColumbiaRiver/Bonneville](http://www.nwp.usace.army.mil/Locations/ColumbiaRiver/Bonneville)

Bonneville Lock and Dam spans the Columbia River, with attractions on both the Oregon and Washington sides. While the dam's two powerhouses generate electrical power, the lock system,

which can fill or empty in a speedy 10 minutes, helps ships navigate the river.

But it's not just people and goods that need to get by — fish are an important part of the area's ecosystem and economy, too. Fish ladders use steps and pools to gradually lift salmon, trout and other species over the dam.

Visitors to Bonneville can watch one of the complex's two hydroelectric powerhouses at work or see fish heading upstream via underwater viewing rooms adjoining the fish ladders. The busiest traveling season for fish is April through October, with a peak during the first two weeks of September.

There's plenty of nature to take in above the Columbia River's waters, too. Osprey soar by in the summer, and eagles can be spotted in winter.




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## RECREATION

## RAYSTOWN LAKE



**Location:** Hesston, Pa., about 100 miles west of Harrisburg, Pa., and 125 miles east of Pittsburgh

**Date established:** 1962

**Info:** [www.nab.usace.army.mil/Missions/DamsRecreation/Raystown](http://www.nab.usace.army.mil/Missions/DamsRecreation/Raystown)

Environmental stewardship is a major component of any Corps mission, but a new trail completed last summer at Raystown Lake's Seven Points Recreation Area really drives that point home.

The 2.3-mile trail is paved with bits of 38,000 used tires and was designed both as a visitor attraction and a way to relieve traffic congestion at Seven Points, which is the Corps' top revenue-generating campground and home to Pennsylvania's largest marina.

Elsewhere at Raystown, the Comprehensive Raystown Chestnut Program, a Corps partnership with The American Chestnut Foundation, has created a "living laboratory" of two chestnut arboretums, which are open to the public and feature an information kiosk that lets visitors learn more. The aim is to help restore American chestnut trees, once dominant in eastern U.S. woodlands.



F.T. EYRE/USACE

**Officials cut the ribbon** on the Greenside Pathway at Raystown Lake in June 2013. The 2.3-mile path is made of 38,000 recycled tires.

## RECREATION AREAS BY THE NUMBERS

**370 million**  
visitors per year

**4,248**  
recreation sites

**10 percent**  
of the U.S. population visits a Corps site at least once a year

**12 million**  
acres of land and water managed by the Corps

**54,879**  
miles of shoreline

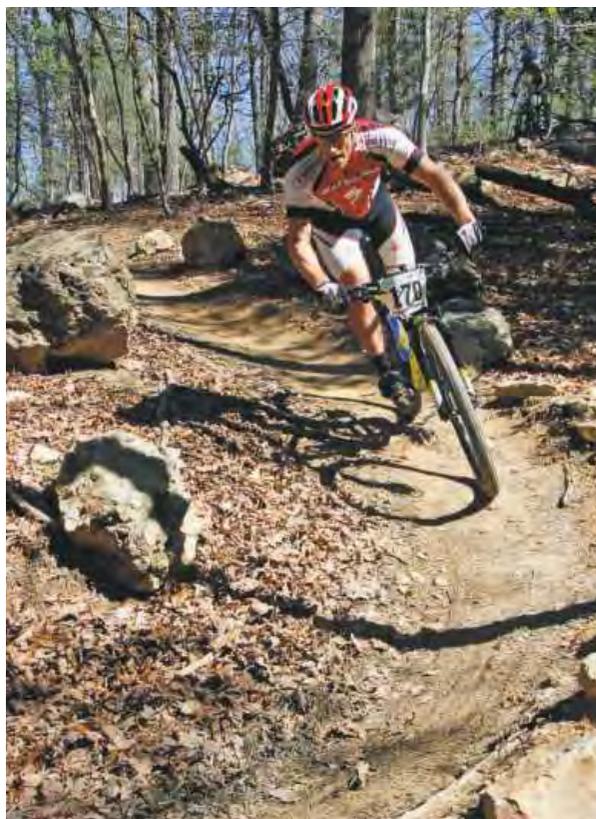
**7,700**  
miles of trails

**92,844**  
campsites

**33 percent**  
share of all U.S. freshwater fishing

**53,000**  
volunteers, who provide 1.94 million hours of service annually, a \$43 million value

SOURCE: U.S. Army Corps of Engineers. Numbers current as of March 2013.



HANK HEUSINKVELD/USACE

**A bicyclist maneuvers** through a technical section of the Warrior Creek Trail at W. Kerr Scott Lake. The recreation area has 25 miles of mountain biking trails.

## W. KERR SCOTT RESERVOIR



**Location:** Wilkesboro, N.C., 60 miles west of Winston-Salem, N.C.; 85 miles northwest of Charlotte, N.C.

**Date established:** 1962

**Info:** [www.saw.usace.army.mil/Locations/DistrictLakesandDams/WKerrScott](http://www.saw.usace.army.mil/Locations/DistrictLakesandDams/WKerrScott)

The W. Kerr Scott Reservoir might be one of the strongest testaments to the power of partnerships in the Corps' recent history.

The 13-mile Overmountain Victory National Historic Trail winds through woodlands with steep hillsides and stunning views of the lake and the Blue Ridge Mountains. And it, like many other miles of trail around the reservoir, was built and is maintained through a partnership with the local Brushy Mountain Cyclists Club.

Another partnership, with the Friends of W. Kerr Scott Lake, has resulted in more than \$1 million in grant money, which has helped fund an environmental education center for K-12 students, a 900-seat amphitheater, a waterfowl impoundment and a shower house.

With North Carolina's temperate weather, camping is a popular option most of the year. The campground offers amenities like hot showers, toilets, playgrounds, basketball courts, swimming area, grills and plentiful RV hookups.

## BUDGET CUTS INSPIRE PARTNERSHIPS

In austere budgetary times, play doesn't get a lot of priority. As lawmakers seek to slash spending, the Corps, like other federal land management agencies, has faced deep budget cuts. The Corps has had to make some tough decisions, cutting staff and services in some parks, and in some cases, closing them temporarily or permanently.

To keep its properties and services afloat, the Corps has gotten creative. "We're turning to our partnerships to try to mitigate some of those potential losses," Heather Burke, manager of the Natural Resource Management National Partnership Program, said.

The Corps works with more than 60 nonprofit cooperating organizations nationwide. Volunteers help with tasks like outreach and running bookstores and visitors centers. Scout troops, schools and other groups also pitch in, and they don't ask for much in return.

"We'll get people who'll come and volunteer and work at these recreation areas in exchange for a campsite," said Brian Maka, public affairs officer for the Corps' Huntington District, which covers parts of West Virginia, Ohio, Kentucky, Virginia and North Carolina. "They do functions we don't have the manpower to do, and the only payment they receive is the ability to camp there."

For his district alone, Maka said, volunteers saved the Corps more than \$2 million doing work formerly handled by employees.

— Stacy Chandler

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## OUTREACH



In 2013, Corps volunteers helped make this dirt road in Nahuaterique, Honduras, passable — one of many projects done in the community.

# VOLUNTEER SPIRIT

USACE

## Corps skills serve communities around the world

By Jaime Netzer

**H**OW DO THOSE who serve our country as a profession give in their free time? Generously, it turns out.

"I think it's part of that public servant attitude of being a servant-leader," said Crystal Markley, an engineering technical lead in the U.S. Army Corps of Engineers' Jacksonville District said.

"If we have skills and strengths, then we should share them through our job, through service to the country or through volunteer opportunities outside of work. I think a lot of people in the Corps hold those values."

Neil Ravensbergen, a resident engineer for the Corps in Wiesbaden, Germany, certainly does.

He has helped out with everything from school field trips to post-Katrina relief efforts. "Volun-



USACE

**Jacksonville District members** joined a group of volunteers with Agua y Desarrollo Comunitario to construct a water storage tank for Caimán, Honduras, in October 2013. Crystal Markley is pictured in the front center.

teering is important because you help others who really need your help — it's honest work," Ravensbergen said. "I get great satisfaction from being able to do for others what they can't do for themselves."

Markley volunteers for Engineers Without Borders, building water projects in Central American countries. Volunteering, she said, improves her quality of life. "Even after the worst day of work, when you make the time to volunteer, it makes it all worth it," Markley said. "It's stress management and probably self-esteem management, really."

Both Markley and Ravensbergen said the Corps has a strong spirit of volunteerism running through its ranks. "I think we're doing great things at the Corps ... and our leadership is inspiring it," Ravensbergen said. ●

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## OUTREACH

**USACE Europe District** engineers spend time helping students understand practical applications of STEM skills.



JENNIFER ALDRIDGE/USACE

# TEAM STEM

## Corps encourages future engineers by showing the way

By Mallie Toth

**I**N HIS STATE of the Union address this year, President Obama acknowledged the need to increase STEM participation among the nation's youth. "The problem," he said, "is we're still not reaching enough kids, and we're not reaching them in time. That has to change."

The U.S. Army Corps of Engineers has been keen to take on the challenge. Through outreach, the organization strives to increase the number of students interested in STEM fields (science, technology, engineering and math) and decrease the attrition rate as students advance into high school, college and graduate-level courses.

Judy Phillips, an equal employment opportunity officer in the Corps' Buffalo District office in New York, recalls the day her second-grade daughter came home from school and declared that she hated science.

"It made me think that there must be some way we could more actively work with schools and teachers to get kids more excited about and engaged in STEM," she said.

Phillips' district maintains ongoing outreach to keep students engaged as they advance through school. Outreach includes a job-shadowing program that lets students take a peek at what an environmental biologist, civil engineer or a similar employee does on a daily basis.

"I think that one of the problems, both in high school and in college, is students do not consider certain careers because all they know about them is based upon their classes," she said. "(This) gives the students a chance to see the practical applications of a STEM major and to envision themselves working in a particular career."

David Conley of West Virginia's Huntington District agrees. "From my perspective, I think

the most motivating experience a middle- or high-school student can have is direct exposure to STEM professionals and their careers. This can be a special teacher, a parent or an engineer or scientist down the street ... I think the passion for what we do comes through. The students pick up on that."

The Fort Worth District has been working to develop a formal relationship with local colleges and universities. Students are being recruited as interns, brought along on site visits and challenged to develop networks of colleagues through conferences and other events. These relationships extend to graduate students in STEM fields. At the district's annual high school workshop, the college students present alongside Corps officers, sharing their passion for the STEM fields.

**CONTINUED »**

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## OUTREACH

These mentoring relationships are invaluable, according to Rebecca Ward, an engineer in the Fort Worth District. “As a mentor, sometimes just being empathetic toward the students in regard to the dedication and hard work needed to complete a degree in a STEM field goes a long way,” she said.

Internship and recruitment opportunities vary by region. The Buffalo District reports that internship opportunities are strong and growing in their area. Stephanie Zuckerman-Ailes, director of the Career Development Center at Buffalo State College, said that internships are on the upswing. “At the current time there are more engineering internships than there are candidates,” she said.

Despite efforts to increase overall participation in STEM professions, women and minority groups continue to be underrepresented in most of the fields, according to a 2013 report by the National Science Foundation.

Unintentional biases can influence how a child feels about STEM studies and careers, said Phillips. “I think we underestimate the impact that having a role model who reflects a student’s gender and/or race/ethnicity can have. Job shadowing, internships, and sending female and minority STEM professionals out to schools to talk to students is a subtle but important way of sending the message that STEM careers are not simply for white males,” she said.

Sue Engelhardt, the national lead of STEM outreach with the Corps, said, “We

need diversity. Not just (with respect to) gender and ethnicity, but educational background, technical expertise and personal experience as well.”

Jason Cade, a senior project manager in the Europe District, was the only African-American student to graduate from his university’s STEM program in 2004. If STEM studies are effectively invisible, he said, “how do students know where to find them?”

Marilyn Lewis, chief of the engineering division of the Louisville District, agrees that STEM careers often fly under the radar.

“While there is virtually no aspect of daily life that is not impacted by engineering in some way, many students don’t know what engineers do.”

— Marilyn Lewis, chief of the engineering division of the Louisville District

She referred to engineering as the “stealth profession,” even though the work done by engineers surrounds all of us, every day.

“While there is virtually no aspect of daily life that is not impacted by engineering in some way, many students don’t know what engineers do and therefore don’t see themselves as future engineers,” she said.

And so the Corps pushes forth. Districts continue to reach out to more schools and more universities, and Corps employees try to have a greater influence on students than ever before.

“A teachable moment, an event you can use to inspire or help a child learn can be random, but often can be created,” said Andrew Kornacki of the Buffalo District. “Every time an employee goes into a classroom, reads to a student, shows them an experiment or presents a child with a certificate for being great, they create a moment that will inspire that child forever, regardless of outside influences.” ●



GEORGE JUMARA/USACE

Members of the Dekalb County Fire Rescue Explorers Program watch as Bill Rutlin, regulatory specialist with the Corps’ Savannah District in Georgia, explains wetland functions.



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## OUTREACH

# SO YOU WANT TO RAISE AN ENGINEER?



USACE

Students at the U.S. Army Garrison in Ansbach, Germany, design structures using marshmallows and pasta as part of a lesson on STEM skills.

## Tips for instilling STEM skills at any age

By Katherine Reynolds Lewis

**WE ALL KNOW** how important science, technology, engineering and math education will be for the careers of the future and how critical it is to instill those so-called STEM skills in our children. Especially the “T,” technology.

“There’s no escaping technology and it’s only going to be more and more a part of our lives and part of our jobs, regardless of what we do,” said Kim Moldofsky, publisher of The Maker Mom blog ([themakermom.com](http://themakermom.com)), which

helps parents raise STEM-loving kids. “You want kids who are able to not just use technology, but be leaders in technology to create with it so they can stay ahead of the curve.”

Here are some ways to do that at any age:

### PRESCHOOL

Math and science can be part of your interaction with children before they enter school. “We were interested in raising chickens so we incubated the eggs, built a chicken cage, learned how to take care of animals, learned about the different breeds,” said Elaine

Sillivant, whose husband, Stan, is an electrical engineer in Huntsville, Ala., with the U.S. Army Corps of Engineers. “Integrate it into your everyday life.”

For city-dwelling families, lessons in engineering can be found all around you: The bridge you cross or the skyscrapers down the street can be a springboard for conversations about how structures are built. “Observe the world around you and encourage your child to do that,” Moldofsky said. “Bring it alive and talk about engineering in our daily lives.”

There’s no need to spend lots of money on

## OUTREACH



ANDREW KORNACKI/USACE

**Female STEM professionals** with the Corps' Buffalo District visit a high school to talk about their jobs and education tracks.

science kits or the latest STEM-inspiring toy. Turn to your cupboards and trash: straws and marshmallows, cereal boxes, Q-tips, egg cartons, empty paper towel tubes and the like. "There are plenty of things parents already have on hand that can be used as building supplies," she said. "If you are going to buy one toy, spend your money on Legos, because those will last years."

### ELEMENTARY SCHOOL

The golden age for STEM could be elementary school, when children are eager to learn about the world. At this age, they love science and haven't learned that it's "cool" to hate math. After-school programs offer robotics, Lego engineering and creative problem-solving.

"Every kid today is glued to technology but when they see that they can create it too, maybe they can take their ideas and build it in a website or an app. It's so empowering," said Roxanne Emadi, grassroots strategist for Code.org, a nonprofit working towards universal computer science educa-

tion and the sponsor of Hour of Code. (The group aims to get 100 million students to complete one hour of software coding by the end of the year, and is already more than 25 million towards that goal.)

Parents can help by carving out time for their children to experiment with building, learning about science, coding, robotics or STEM-related interests. Make it just as much of a priority as Girl Scouts or the soccer team, and emphasize the importance of learning from your mistakes.

"Culturally it's expected that sports and arts need a lot of practice, but the same mindset isn't there for science or engineering," said Tara Chklovski, chief executive of Iridescent, a nonprofit advocating science and engineering education based in Los Angeles. "The feedback that you give to children is that

they've got to try again."

### MIDDLE SCHOOL

The critical time for supporting your

**STEM-oriented jobs tend to be the best paying and fastest growing in the workforce, one reason that the White House has committed to train 100,000 new STEM teachers in the next decade and has gathered \$700 million in public-private partnerships related to STEM education.**

children's interest in STEM is middle school, when peer pressure or adolescent insecurity can steer students away. Fortunately, there are a slew of clubs and activities aimed at this age group, from Science Olympiad, VEX Robotics, FIRST LEGO League and Future City to Iridescent's

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own Technovation, an after-school club for girls that challenges them to create a software application to solve a real problem and possibly win seed funding for the invention.

The Army Corps reaches out to children in this age group with science fairs, mentoring, competition and other engaging activities.

Rebecca Ward, a project coordinator in the Fort Worth District, has organized four daylong Viva Technology workshops for 100-plus students at a time.

"It's like a science fair on steroids," Ward said. "We try to give them real-life experiences within a day. It's very energetic. The students just love it."

### HIGH SCHOOL

Mentoring is a core part of the Corps' outreach in the high school years. In north-east Florida, students meet with mentors a few hours every week, learning about careers and working on a project to design a building. They present their proposal to

judges, competing for the chance to "win the job," just as professionals would.

Through partnerships with organizations like Engineers Without Borders, students in Florida can also participate in projects to bring clean drinking water to communities in Honduras and Guatemala.

Mentoring is about making students "feel comfortable and confident that there are opportunities and doors to be opened to them," Ward said. "USACE is adamant about giving back to the community. There's no way I would be able to do what I'm doing and making the impact without the support of USACE." ●

## OUTREACH



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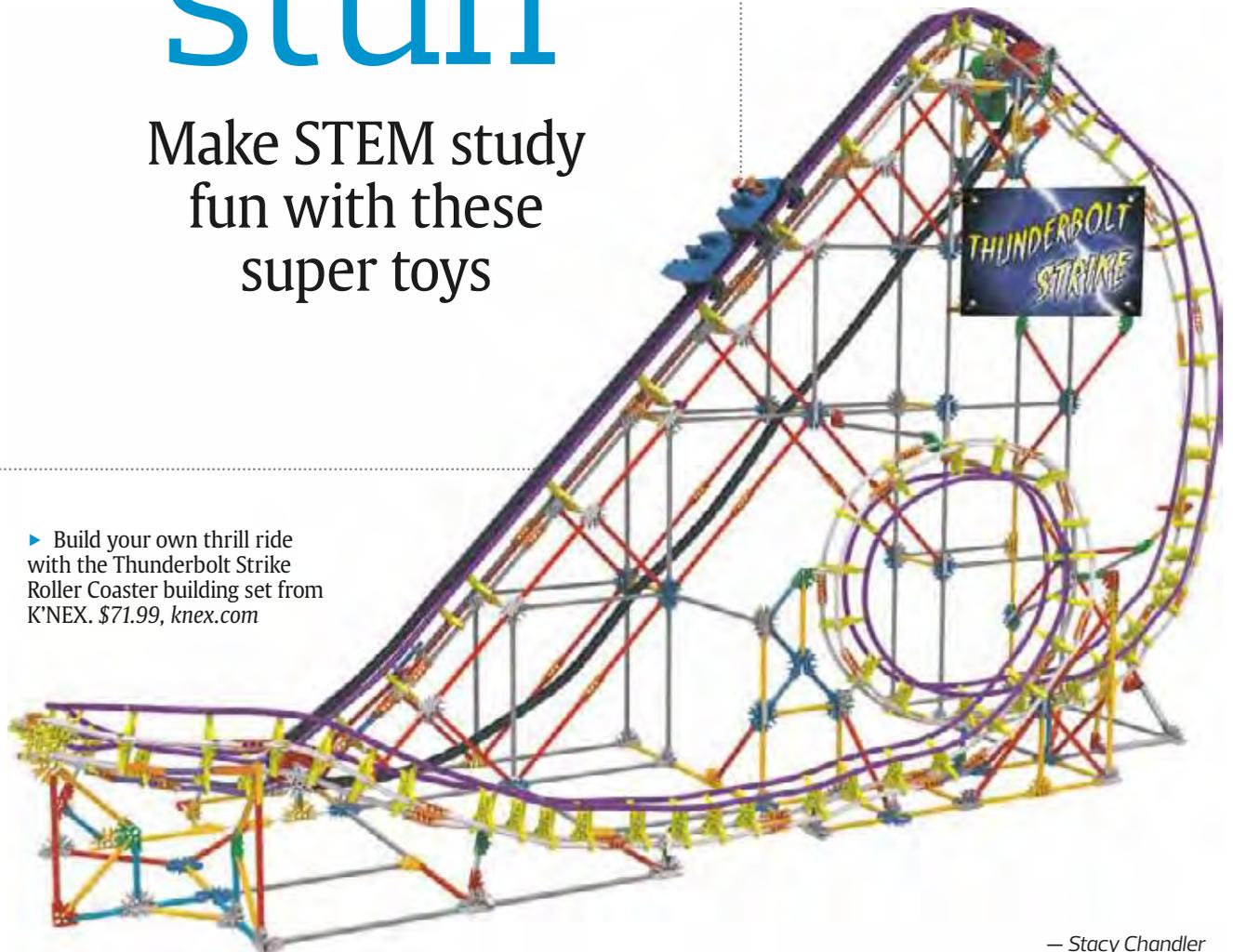
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— Stacy Chandler

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## TECHNOLOGY



# FLYING FARSIGHTED

USACE uncovers new,  
beneficial uses for drones at home

UNIVERSITY OF FLORIDA/IAIS

By Clay Dillow

**F**LORIDA IS HOME to more than 1,800 miles of levees and 75 dams that qualify as “high hazard,” meaning lives could be lost if the dams fail to operate correctly. But even now, the method used to inspect this critical infrastructure for signs of deterioration — a job that falls largely to the U.S. Army Corps of Engineers — remains decidedly quaint.

“Right now you put at least three engineers on a levee and then you walk every single mile of it,” said Victor Wilhelm, an engineer for the Jacksonville District. “And I think to myself, there’s got to be a more efficient way to do this. I look at the UAS (unmanned aerial system) and I see the perfect tool for that.”

Wilhelm is the geomatics technology lead for the district’s UAS program. His team experiments with novel applications for

small unmanned aircraft that can provide on-demand, high-resolution geospatial imagery to engineers and scientists on the ground.

Commonly referred to as drones, these small, hand-launched aircraft have evolved into a regular part of the U.S. Army’s battlefield tool kit over the last decade. Increasingly, the Corps has turned UAS technology to its advantage, not just abroad but at home. Everything from aerial mapping of construction projects, ordnance cleanup and disposal, wetlands management and infrastructure inspection can be done with drones.

“The shooting army has a mission to defend the nation from our enemies,” Wilhelm said. “The Corps of Engineers has a mission to defend the nation’s infrastructure, and we’re going to use whatever tools we can use as a part of the Army to defend that infrastructure. This is one of those tools.

It lets us be more efficient, more accurate, safer, less expensive — I can only see this technology getting into more areas of the work that we do.”

## LESSONS FROM WAR

While the domestic use of unmanned aerial systems is still in its infancy, the Corps can draw on a decade of experience supporting the Army in combat environments overseas.

“The genesis for this entire program was the lack of high-fidelity terrain information in both Iraq and Afghanistan,” said Mike Harper, chief of the tactical source and enterprise solutions directorate at the U.S. Army Geospatial Center (AGC).

To produce the kind of high-resolution map data that soldiers need to fight in complex terrain and urban environments,

CONTINUED »



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## TECHNOLOGY

AGC teams deployed to Iraq in 2004 and Afghanistan in 2007. They collected tens of thousands of square kilometers of geospatial data using sensor-laden manned aircraft. But the King Air B100 turboprops they flew were antiquated and, in some cases, dangerous. Harper and his team started working toward an unmanned solution.

“The whole idea was, ‘How do we do this over denied areas?’” Harper said. “And can we reduce the size of the commercial, off-the-shelf sensors enough to build a decent payload for an unmanned system?”

They found their solution via Special Operations Command (SOCOM), which had converted a small Sky Arrow light sport aircraft into an unmanned airplane. AGC’s engineers took that concept and went to work to create what’s now known as BuckEye. The drone is outfitted with light-detecting and ranging (LiDAR) sensors and a high-resolution mapping camera. The equipment can produce both aerial imagery and detailed, high-resolution terrain maps for operators working on the ground.

BuckEye has been supporting ground troops in Afghanistan since 2010. Since last summer a second BuckEye platform has been operating in Jordan. Initially part of a joint Special Operations exercise, the Jordan-based UAS now serves as a tool to map both existing and planned United Nations refugee camps, demonstrating non-combat potential for platforms like BuckEye.

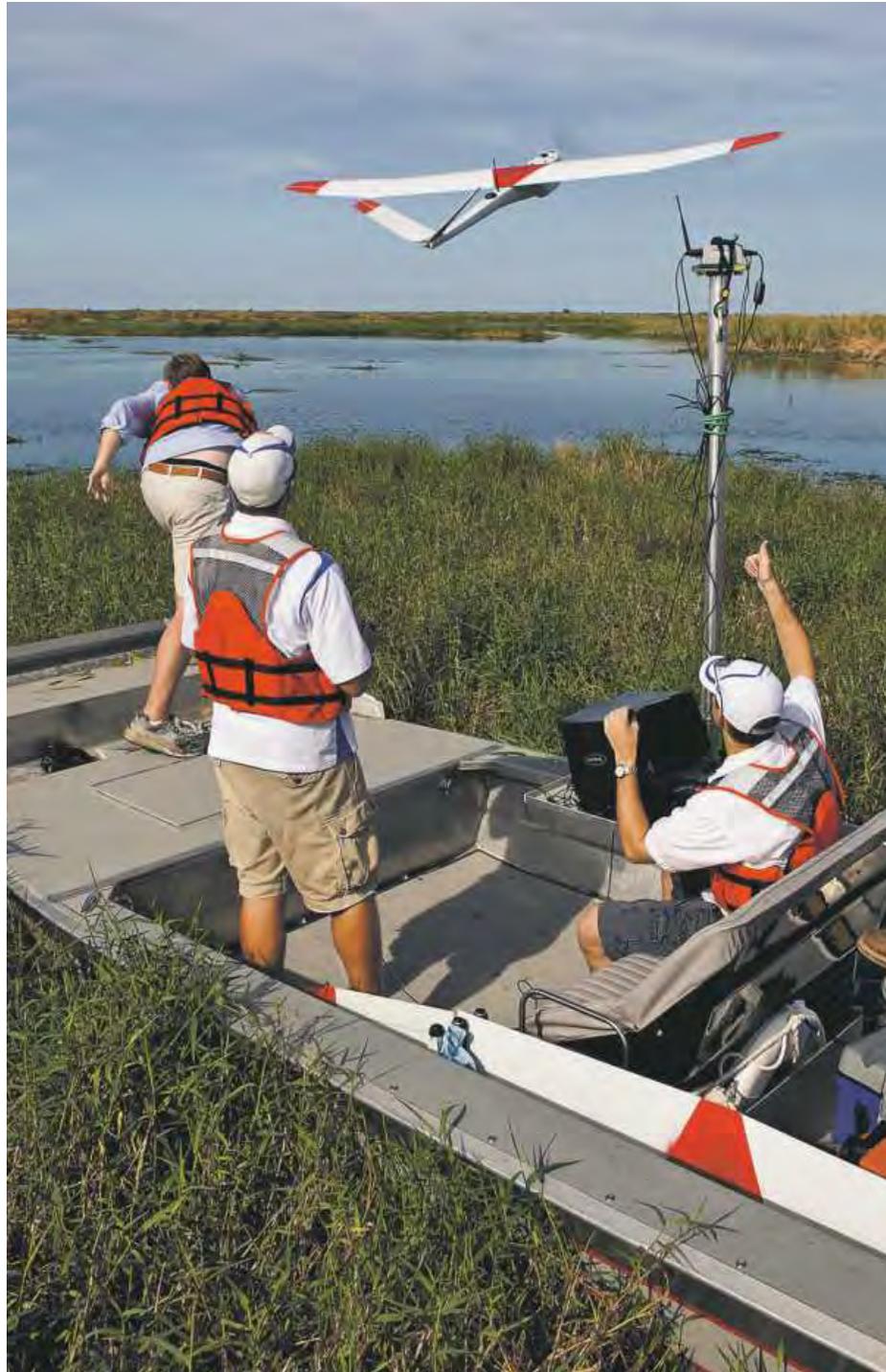
“I can envision them being used more and more in civil works applications, for assessing infrastructure and things like that,” Harper said. “But we’re not quite there yet.”

## TESTS AT HOME

To move the Corps closer to that future, the UAS program in the Jacksonville District has developed its own novel unmanned aircraft — known as NOVA — to take aerial imaging beyond mapping and into the realms of biological study, engineering and environmental science.

Though smaller and more limited in range than BuckEye, NOVA can be launched by hand from just about anywhere, including the bow of an airboat. A standard mission generally lasts for an hour. During that time, the camera can snap 3,200 images and stitch them together into huge maps and topographical models.

The impetus for the project came from Florida’s unique ecology, which requires extensive management of wetlands, invasive species and the region’s hydrology. The team has produced vegetation maps for biologists and elevation maps and 3-D models for engineers working on dredging and infrastructure projects. It has also helped environmental scientists observe change over time by producing



University of Florida researchers launch a drone as part of a USACE study on herbicides.

Though smaller and more limited in range than BuckEye, NOVA (drones) can be launched by hand from just about anywhere.

inexpensive, frequent and readily available overhead imagery.

But for both the Corps and civil engineers in general, some of the greatest potential lies in infrastructure inspection, which could be done more accurately and more efficiently — and therefore more frequently — with the help of UAS.

“UAS technology gives us this new lens that we really haven’t had,” said David Totman, public works industry manager for geospatial technology firm Esri and

chairman of the spatial data applications committee of the American Society of Civil Engineers. “The ability to fly a dam face, or check out the oblique angle of a bridge where it’s really hard to get the right perspective — this will become a very valuable tool for engineering diagnostics for both built infrastructure and the creation of new infrastructure.”

## RULES FOR DRONE USE

While most civil engineers are at least somewhat constrained by Federal Aviation Administration (FAA) rules regarding the use of drones for commercial purposes, the Corps’ stature as a federal entity and part of the armed forces allows it to be something of a trailblazer in the space.

To that end, the Jacksonville District team is exploring several applications that could change the way civil engineers do their jobs. This year it’s providing aerial imagery to engineers replacing culverts at the Herbert Hoover Dike on Lake Okeechobee in Florida and flying the recently completed Portugués Dam in Ponce, Puerto Rico.

Safety standards set by the U.S. Army and FAA won’t allow the Corps to operate UAS in densely populated areas — the very places where they could do the most good. But successes may encourage officials to consider changing the regulations and allow the use of UAS in urban areas.

Researchers at the U.S. Army Engineer Research and Development Center’s environmental lab are training with and testing small quadrotor drones to assist in biological and environmental work. And the Corps’ New Orleans District is hoping to slowly earn the trust of regulators so it can begin using UAS for levee inspection around the populated, flood-prone areas surrounding New Orleans.

“Their plan of action is to start out in the rural areas and make their way in toward the populated areas,” said Mike Hensch, the UAS program manager in the Jacksonville District. That should help the team build a safety record that will allow it to move closer and closer to the critical infrastructure in the city of New Orleans itself, he said. “The more missions we do, the more we’re showing we can do this in a safe and efficient manner.”

That’s especially important as the FAA wrestles with the regulatory framework that will govern the integration of civilian and commercial unmanned systems into the national airspace sometime before 2020.

“Right now, with the FAA restricting this technology on the commercial side, government entities are really the only groups that are able to pioneer this technology, and we’re really fortunate to be in the position to develop this tool for the nation,” Wilhelm said. “We’re at the front of this technology, and that’s what the Corps is supposed to be about.” ●



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## TECHNOLOGY

## IDEA CENTRAL

## Special center produces cutting-edge research, sometimes at petaflop speed

By Erik Schechter

**G**AZING AT A BRIDGE, Mihan McKenna, a geophysicist with the U.S. Army Corps of Engineers and trained violist, was struck by how the structure resembled a string instrument.

This got her thinking about sound and buildings. Most structures, she knew, put off vibrations in the infrasound passband — a range of frequencies below 20 Hz. The sound cannot be heard by the human ear but can travel great distances. With the aid of special acoustic sensors, she wondered,

could bridges, dams and buildings be remotely monitored for signs of damage?

Thus began McKenna's pioneering work at the Corps' Engineer Research and Development Center (ERDC).

ERDC, a network of labs in Mississippi, New Hampshire, Illinois and Virginia, plays host to programs that help both warfighter and civilian. The center also has the largest non-classified supercomputer within the Department of Defense (DOD), a machine that can model events such as storm surges, oil spills and blast effects on new armor at blinding petaflop speed. And it's where one finds engineers repurposing

off-the-shelf technology in clever new ways.

In short, ERDC is idea central.

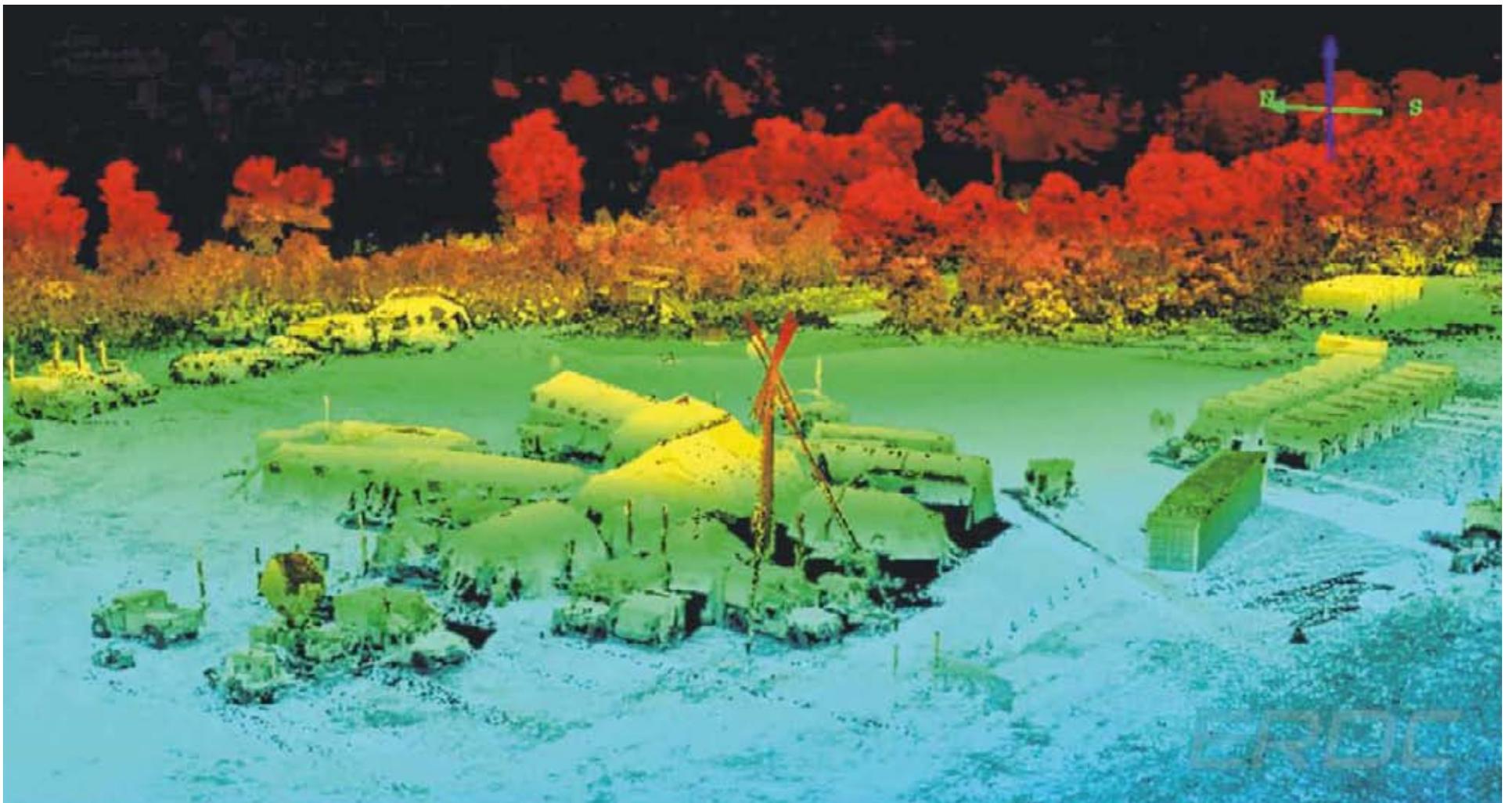
When McKenna joined the center's Geotechnical and Structures Laboratory in Vicksburg, Miss., in 2005, researchers were trying to crack the "route reconnaissance" problem. If, say, the U.S. military wanted to move troops across a bridge, it would first have to inspect the structure. A soldier would have to do it, or planners would need to look at up-to-date satellite imagery.

"And despite what Hollywood tells you, satellites are not all-seeing all the time,"

McKenna said.

In search of a less laborious alternative, McKenna tapped into her musical background and previous work experience as an adviser to the Comprehensive Nuclear Test Ban Treaty Organization. She knew that when a nuclear bomb explodes, it releases a subacoustic wave that can be detected thousands of kilometers away. A vibrating bridge may not generate as powerful a signal, but the same principle holds, she hypothesized.

In a 2007 field test at Fort Leonard Wood, Mo., her team was indeed able to detect one of the garrison's rail bridges



The mast-mounted deployable LiDAR system developed by USACE's Engineer Research and Development Center takes a 360-degree picture and creates a 3-D view of the environment.

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## TECHNOLOGY



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**Mihan McKenna, far left,** applies infrasound experimental techniques to remotely assess critical infrastructure. Above, the ERDC supercomputer, Garnet, has 1.8 peak petaflops of computing capability, ensuring that scientists and engineers across the nation have access to high-performance software. Left, John Anderson tests the mast-mounted deployable LiDAR system that offers real-time, 3-D topographic info.

from a distance of 30 kilometers. Engineers have since learned to use infrasound as a complementary technique to remotely check the integrity of assorted buildings and structures.

The ultimate goal is to develop a round-the-clock remote monitoring system that will automatically alert authorities about transportation infrastructure deficiencies. "We're making this applicable to the average American citizen," McKenna said.

In conducting her research, McKenna was supported by the Scientific Computing Research Center (SCRC) within ERDC's Information Technology Laboratory. The center is home to Garnet, a monster of a supercomputer that has more than 150,500 cores and runs at 1.8 peak petaflops. It can store the informational equivalent of 1.11 million HD movies. Garnet's power makes it the largest non-classified computer in the DOD.

According to SCRC chief Robert Hunter, the key advantage of Garnet, which is actually a combination of three Cray XE6 supercomputers, is that it saves research-

ers time and money by, wherever possible, replacing physical experimentation with very high-fidelity modeling. Hunter said the switch has been especially helpful in the rapid development of newer and stronger under-armor for Humvees and in the creation of the Modular Protection System, a collection of portable, blast-resistant panels that can be built in the field to protect troops from improvised explosive devices (IEDs).

"In the past, they (researchers) would go out in the field and set detonation charges, build a prototype of what they thought would work, set off an explosion and see what the results were," and then do it all over again, he said.

However, not all of Garnet's comput-

ing time is devoted to defense-related research and development. There are also civil works applications. "When we see tropical storms or hurricanes approaching U.S. coastlines, we can provide the resources to model the potential storm surge and flooding impact," Hunter said. His team also provided computational support during the Gulf oil spill of 2010 to model the flow of the oil.

Besides running complex computer calculations and creating new fields of research, ERDC engineers also take existing technologies and give them a novel twist. John Anderson

at the Topographic Engineering Center in Alexandria, Va., is doing this with LiDAR. His team uses laser scanning to create an ultra-accurate, mast-mounted sensor that

gives troops at remote bases in Afghanistan a 3-D map of their surroundings, helping them track nearby insurgents and IEDs.

When deployed, this system "will be as critical as a firearm," he said.

LiDAR collects range information by bouncing beams off a target. Returning beams form a point cloud, which can be used to create a 3-D "video game-type rendition" of the scanned area. This model can then be combined with GPS information and imagery for increased accuracy.

One question that remains is just how far the sensor can be extended. "The Holy Grail for us is 2 to 5 kilometers of scanning," Anderson said.

The U.S.-based Bridger Photonics will build the prototype. The first of three units are scheduled for delivery at the end of 2015.

The strength of the center is in its technological diversity, said Anderson.

"You have all these brilliant people coming from different fields and supporting one another. I think that's ERDC's key to success." ●

The center is home to Garnet, a monster of a supercomputer that has more than 150,500 cores and runs at 1.8 peak petaflops.

## A LOOK BACK



# Panama

URNS 100

# Canal

This man-made wonder may never have been built had the Corps not stepped in to finish the job

By Steve Bittenbender

**T**HE PANAMA CANAL is a 48-mile-long man-made wonder. World leaders sought its development for centuries. And even once construction started (and stopped and started again), it took nearly a quarter-century to finish.

This year marks the 100th anniversary of the completion of the canal. The marvel transformed how ships sail across the Western Hemisphere, improved trade between countries and changed how the U.S. defends itself in times of war.

While officers for the U.S. Army Corps of Engineers managed the project during the final seven years of construction, the canal never became a Corps project. But the officers' leadership proved invaluable. Without the Corps, the completed canal would have looked vastly different — if it would have been completed at all.

The biggest change the Corps brought was the shift from a sea-level canal, which essentially required digging a 50-mile-long ditch through Panama from the Atlantic to Pacific oceans, to a series of locks, with a central freshwater lock buffering the two ocean locks.

At the time, the shift in construction was controversial. French and American efforts under civilian engineers John Findley Wallace and John Frank Stevens, both of whom had worked as railroad engineers, supported the sea-level canal. But U.S. Army Maj. George Washington Goethals, who would eventually take over the Panama project in 1907, had experience building canals. He knew a lock and dam system was the best way to go.

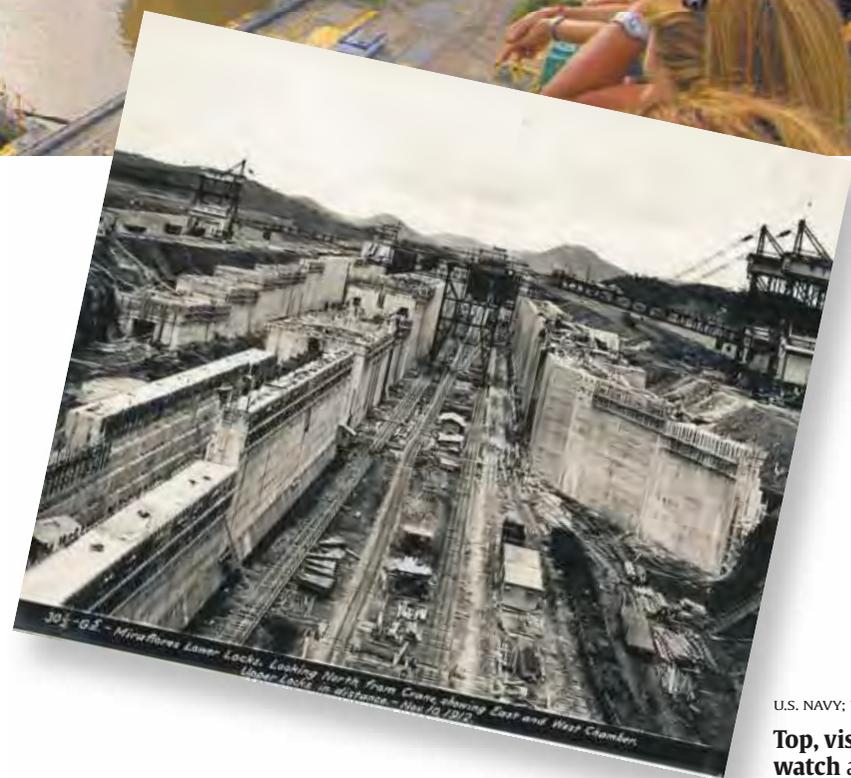
"There was nothing about the Panama Canal that was new," said James T. Garber, a Corps historian. "All of this they had been doing on America's waterways. These guys knew exactly

what they were doing. The only difference was the scope."

Without the Corps intervention, a sea-level canal may have been finished eventually, though it would have required the building of dams to block rivers.

The project might have had disastrous economic and ecological effects, too. Currents flowing through a sea-level canal could have been too fast at times for boat traffic, which would have hurt the economy. And, because sea life from the Pacific and Atlantic oceans would have intermingled, intruding species could have caused major environmental damage.

Interestingly, the debate around a sea-level canal in Panama didn't die with the Corps involvement. In the decades since, federal agencies and independent organizations have proposed building a new sea-level passage, only to have the same concerns surface. ●



U.S. NAVY; USACE

**Top, visitors watch** as a tanker moves through the Miraflores Lock at the Pacific Ocean end of the Panama Canal. **Bottom, a look** at the Miraflores Lock in 1912.

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