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In Air, on Land, through Navigable Waterways, Robots are the Corps' Best Friend

ALEXANDRIA, VIRGINIA. Move over *Bobber* (The Corps' Water Safety Dog), robots are becoming the Corps' newest best friend. The U.S. Army Corps of Engineers (Corps) is utilizing land, water and air-based robots to complete a variety of missions. These robots can gather imagery and measurements, collect or drop-off items, conduct inspections, and more! New robots and functions are being explored throughout the federal government to advance Corps missions further.



The "Yeti," at ERDC's Cold Regional Research Laboratory in Hanover, New Hampshire.
(Photo: Vanessa Niño-Tapia)

Check out *Yeti*, a robotic rover developed at the Engineer Research and Development Center (ERDC) - Cold Regional Research and Engineering Laboratory (CRREL). This rover conducts ground-penetrating radar (GPR) surveys to characterize the terrain in order to identify any potential safety hazards.

What other kinds of information can these robots collect? Working with the San Francisco District, a team of students from Vallejo High School trained their rover to inspect the toe drain on the Coyote Valley Dam and assess conditions of the pipe. *Charles* comes in weighing at 7 pounds, about the same size as a Chihuahua.

"We want a device that can crawl up the pipe and provide some data about conditions such as rust, dents, or cracks,"

Derrick Dunlap, San Francisco District's Operations & Readiness Division Deputy said. *"So we we're open to seeing what the kids' robot could do."*

In the Sacramento District, remotely operated vehicles (ROVs) are a huge asset to their program. At both New Hogan Lake and Pine Flat a half-dozen park rangers have been trained to use and maintain [high-tech underwater robots](#). These bots have served a variety of purposes from conducting dam inspections, investigating invasive species, and assisting in the emergency search and rescue operations. Similar ROVs are used by the U.S. military for underwater security inspections.

Additionally, the Corps Seattle District's Engineering Division maintains a [Deep Ocean Engineering Phantom model submersible ROV](#) (legacy model) normally used by trained USACE operators to perform condition inspections of underwater structures at many operating projects (such as stilling basins and related features). This ROV is normally deployed by boat and connected to the control system on the boat by security, power, and control cables. Over the many years of service life, the Phantom ROV has been tasked to provide critical inspection video records to project delivery teams in Operations and Engineering Divisions.

“One significant role for the ROV is to support routine or emergency Dam Safety inspections” said Joe Marsh, Environmental Program Specialist, Seattle District. *“In the event of a significant earthquake, the ROV could be quickly deployed to perform video inspections of underwater structures for analysis on site and back in the District office to ensure the region’s infrastructure was not adversely impacted.”*

There are ROVs with wings, also known as unmanned aircraft systems (UAS) or vehicles (UAV). In Jacksonville District, a lightweight UAV, is used for geospatial data collection. The NOVA UAV is a fully autonomous, hand-launched airplane with onboard global positioning system (GPS), inertial navigation system (INS), camera, and computer. It supports various Corps infrastructure and natural resource monitoring efforts in both land and aquatic environments, providing high resolution aerial imagery as well as detecting infrastructure problems along levees and dikes such as areas of erosion.

Other federal agencies are also finding that robots can fulfill a need within their organization. The Defense Advanced Research Projects Agency (DARPA) funded Boston Dynamic to create a *Cheetah* robot which holds the record for fastest robot on earth at 29.3 mph. DARPA is also working on robots to amplify “human effectiveness in Defense operations” and towards the development of a more anthropomorphic emergency response robot. Like the Cheetah, the humanoid robots will be used to conduct humanitarian, disaster relief and related operations and can use basic and diverse tools, according to Boston Dynamics. This offers potentials to agencies like the Corps who often assist during disasters.

What about invasive species? The United States Agency for International Development (USAID) has since 2014 launched a challenge to innovators to help with the Ebola crises response. The [NASA Centennial Challenge winner AERO](#) is a robot with the potential to help address the Ebola crisis by helping with the decontamination process. This robot may one day explore space or remote landscapes and presently can help fight Ebola by providing a mechanism for the decontamination process. This same type of robot could potentially be applied to treat invasive and exotic species on Corps lands. It could also more effectively survey and analyze lands for Corps activities.

Also, the National Science Foundation awarded a \$1 million grant to address aquatic invasive species, through the development of a robotic fish at Michigan State University to address the problem of invasive species. Robotic fish also are being utilized to help better understand endangered species such as salmonids, thus providing information on how to develop effective fish passage. This type of technology could be very beneficial for a Corps study such as the Yuba Ecosystem Restoration Feasibility Study.

One day robots could be assisting us even further within our offices, out in the field for any monitoring and assessment, and even at home with cleaning and collecting items. With the manner in which technology is moving, it is fair to say that robots do not just have the capacity to change our lives at work and at home, they will have the capability to expand them. The possibilities are endless for this type of technology for the Corps and are only limited by our creativity.

This article was written by Ms. Vanessa Niño-Tapia, U.S. Army Corps of Engineers - Sacramento District and edited by Ms. Erin Rooks, U.S. Army Corps of Engineers – Institute for Water Resources (IWR). This article was written for the IWR’s Planning Technologies Program, managed by Ms. Erin Rooks (IWR).

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"Flying" the underwater robotic vehicle to surface near the work boat, Ranger John Chapman, U.S. Army Corps of Engineers Sacramento District
(Photo: Robert Kidd)