

Detecting heartbeats in rubble: DHS and NASA team up to save victims of disasters

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In June 2013, Urban Search and Rescue team tested the FINDER's human-finding abilities at the Fairfax County Fire Department training center. Credit: US Department of Homeland Security

When natural disasters or man-made catastrophes topple buildings, search and rescue teams immediately set out to recover victims trapped

beneath the wreckage. During these missions, time is imperative, and quickly detecting living victims greatly increases chances for rescue and survival.

A new [radar](#)-based technology named Finding Individuals for Disaster and Emergency Response (FINDER) has been developed by the Department of Homeland Security's Science and Technology Directorate (S&T) and the National Aeronautics Space Administration's Jet Propulsion Laboratory (JPL) to detect a human heartbeat buried beneath 30 feet of crushed materials, hidden behind 20 feet of solid concrete, and from a distance of 100 feet in open spaces. In the past several months, S&T and JPL have been testing and developing several FINDER prototypes. Last June, DHS and first responders used the prototype to conduct more than 65 test searches with two Urban Search and Rescue (US&R) teams: the Virginia Task Force One (VA-TF1) at the Fairfax County Fire Department training center and Virginia Task Force Two (VA-TF2) in Virginia Beach, Va.

"Testing proved successful in locating a VA-TF1 member buried in 30 feet of mixed concrete, rebar, and gravel rubble from a distance of over 30 feet," said John Price, S&T program manager. "This capability will complement the current Urban Search and Rescue tools such as canines, listening devices, and video cameras to detect the presence of living victims in rubble."

In disaster scenarios, such as earthquakes and tornadoes, the [wreckage](#) is made up of twisted and shattered materials. Radar signals bounce back so signals are complex. "Isolating the relatively weak signal of a heartbeat within the noisy signals becomes a difficult task," said Edward Chow, JPL program manager. "JPL's radar expertise helps in this challenge."

JPL uses advanced data processing systems to pick out faint signals. The

microwave radar technology is sensitive enough to distinguish the unique signature of a human's breathing pattern and heartbeat from other living creatures. The advantage of this technology is in allowing first responders to quickly ascertain if a living victim is present in the debris. The technology is sensitive enough that victims, whether conscious or not, can easily be detected, which helps responders decide the most efficient course of action.

"It is anticipated that a commercialized technology could be ready to be used in [search and rescue](#) operations as early as spring 2014," Price said.

The earlier tests have resulted in design changes being incorporated into the new version of the device, including a revised user interface and increased battery life of up to 14 hours. The mechanical and electronic design has evolved with the core being a lightweight 3"x3"x1" sensing module that uses a USB interface to integrate an antenna, radar electronics and digital processing.

With a wealth of practitioner input and recommendations following the test searches, the research partners have continued development efforts to construct a final prototype. Future phases of development will focus on a more specific locator function which will help determine, not only the presence of a victim, but also more precisely where in the rubble the victim is located. The latest version will be demonstrated in late September with the Virginia Task Force One at the Fairfax County Fire Department training center.

Provided by US Department of Homeland Security

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