

## **Rise in Suicide Attacks in Iraq Propels Search for Better IED Detection**

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### **LOOKING FOR THE SILVER BULLET**

The quest to find concealed explosives in Iraq is making progress, but the pace is so slow that both military and aerospace industry officials openly fret about the lack of a definitive solution.

Nevertheless, both continue searching furiously for new ways to find, incapacitate and remove improvised explosive devices (IEDs) that are inflicting a steady toll on coalition forces and, increasingly, Iraqi civilians. In fact, some participants say the search for countermeasures has become chaotic and they worry that there's not enough discrimination in funding technologies with the most promise.

A SINGLE PENTAGON announcement inquiring about IED detection technology recently drew more than 200 bidders. And in a move to hasten the transfer of possible solutions to the battlefield, many of the initiatives are also being pursued by warfighting organizations instead of through traditional acquisition channels.

Meanwhile, the military is pushing hard to find solutions by better linking and fusing information that's already being collected on the battlefield.

"In Iraq, it's definitely a game of cross-cueing sensors and intelligence data," says a veteran UAV builder and operator. For example, the Air Force's high-flying U-2 radars, with their relatively wide field of view, are being used to cue radars on tactical aircraft that are more narrowly focused. The U-2's radar has an "agile" spot mode with a roughly 1-ft. resolution that allows it to scan a series of 2 X 2-km. areas for suspicious objects as it flies along.

From a U.S. base north of Baghdad, the Army is operating a small number of "Horned Owl" C-12 aircraft. The aircraft they fly have a ventral radome carrying a Sandia/General Atomics-developed Lynx radar that's also carried on some unmanned aerial vehicles. The standard Lynx radar operates in part of the Ku band (15.2-18.2 GHz.) and has a 3-4-in. resolution within its small field of regard. However, the Horned Owl's radar has been upgraded for even greater resolution. The aircraft also carries a stabilized gimbal sensor ball with an infrared camera. Each night, the aircraft fly convoy routes and send the information to a facility on the ground so that analysts can search for any changes that would indicate IED activity.

Horned Owl is just one of a number of projects that are assigned "Horned" as part of their code-name

designation. Moreover, the Pentagon is rushing a larger version of the system--Horned Owl II--into service that can fly higher to cover greater areas and stay up longer with a larger payload. Aircrews wear a patch showing a black owl's head with bright green eyes.

Some military officials contend the Horned Owl has an earth-penetrating capability to find IEDs and, possibly, hidden weapons caches. But radar specialists believe the high water table in Iraq and the radar's frequency would limit penetration.

"There are lots of salts in the water and the sand is not dry," confirms a Pentagon radar specialist. "To get ground penetration, you need to use L-band frequencies [of 1 GHz. or lower]."

They propose that a much more effective use of the radar is to look for disturbed earth and to detect changes in reflectivity from material that was originally a foot or more below the surface but has been exposed through digging.

Radar also penetrates softened ground more readily than harder, undisturbed soil, and different layers of visibility are offered by different radar frequencies. Several years ago, low-frequency, space-based radars were able to detect ancient ruins at depths of 5-10 ft. underground, but the material penetrated was extremely dry sand--conditions that aren't replicated in Iraq's areas of primary interest.

"ONE THING that [Horned Owl and other radar systems] are doing is coherent change detection," the radar specialist says. "While the capability has been around for about a decade," the algorithms for detecting small changes, and the ability of the radars to see such detail and improvements in processing speed, are only now making it a practical, operational system.

Radar specialists say that work also is proceeding rapidly on the introduction of ladar and lidar sensors that operate in the terahertz frequency range, just short of the visual-light frequency range. These devices are expected to offer extremely refined 3D analyses of disturbed or redistributed earth patterns and changes in materials once they become operational. It can also be used for hyperspectral measurements to determine the nature of materials being observed. It looks at thousands of bits of frequencies for certain combinations that indicate different kinds of metals, vegetation, soil or other materials.

New detection capabilities are expected to be part of an upgraded sensor suite when Northrop Grumman's RQ-8B Fire Scout helicopter-like UAV is eventually deployed to support Marine Corps ground forces in Iraq.

Fire Scout will carry the Airborne Standoff Minefield Detection System (Astamids), which is being expanded to include reconnaissance, surveillance and target acquisition applications. In addition, the Army is developing change-detection algorithms to locate IEDs and single, on-route mines through

processing Astamids imagery. The 75-lb. payload is also adaptable to other UAVs, say Northrop Grumman officials. The payload includes multi-sensor as well as electro-optical, infrared and multi-spectral imaging to detect recently buried and randomly scattered mines or camouflaged targets.

The Air Force has been using its EC-130 Compass Call electronic attack aircraft to jam remote triggering devices--such as cell phones or garage door openers--that detonate IEDs. There also has been emergency supplemental funding requested to upgrade the Navy and Marine Corps EA-6B Prowler aircraft to broaden the frequency they can jam (also an anti-IED measure).

Interestingly enough, congressional language suggests that the transmitter upgrades are "deemed essential in IED identification [and] detonation operations."

In fact, the Navy has instituted a "Manhattan Project-like" effort at the Office of Naval Research that involves dedicating 10% of the organization's budget and 75 scientists to the search for solutions.

But military officials say that lots of problems remain. For example, the infantry has plenty of jammers, but many don't work in the right frequencies. Also, when insurgents realize they are being jammed, they may switch from radio-controlled devices to hard-wired connections that can't be jammed. Moreover, as a defensive measure, insurgents change tactics every 7-10 days.

However, Pentagon officials say they can point to some successes. They contend that better intelligence collection and its rapid fusion have produced a noticeable effect in reducing the number bomb makers and cutting insurgents' time to set up IEDs. Both bomb-making equipment and inventory have been captured at a greater (but unspecified) rate, they say. One consequence is that more bombs are being detected and defused. Another is that they are less sophisticated but made larger to compensate for their lack of precision.

More intractable than IEDs are suicide bombers in IED-rigged vehicles, which are considered the hardest problem to solve. Progress often depends on local leaders' willingness to turn in bombers in substantial numbers to avoid major combat in their cities.

The Army formed an IED task force in late 2003 and began examining commercial equipment. "There's no silver bullet at this time," says Gen. Richard A. Cody, vice chief of staff. "We have teamed with industry, with the national laboratories, with all the research labs. The casualties have gone down over 40% since we started.

"We're working against a very adaptable, innovative and insidious enemy," Cody says. "We track every IED--whether it detonated in place, whether we were able to disable it, whether it caused a problem or not. We also track what type of IED it was. What we've seen over time is that we've got great predictive pattern analysis. But they're still out there. A vehicle-borne IED with a suicide driver will be absolutely

lethal. We have to deny him the opportunity to get to that point. So, jammers are not the only answer. We're taking a holistic view of how to tackle this problem."