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# Improvised Explosive Devices (IEDs) in Iraq and Afghanistan: Effects and Countermeasures

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## Summary

Since October 2001, Improvised Explosive Devices (IEDs, or roadside bombs) have been responsible for many of the more than 2,000 combat deaths in Iraq, and 178 combat deaths in Afghanistan.[1] IEDs are hidden behind signs and guardrails, under roadside debris, or inside animal carcasses, and encounters with these bombs are becoming more numerous and deadly in both Iraq and Afghanistan. The threat includes vehicle-borne IEDs, in which extremists drive cars laden with explosives directly into a target. DOD efforts to counter IEDs have proven only marginally effective, and U.S. forces continue to be exposed to the threat at military checkpoints, or whenever on patrol. IEDs are increasingly being used in Afghanistan, and DOD reportedly is concerned that they might eventually be more widely used by other insurgents and terrorists worldwide. This report will be updated as events warrant.

## Background

Improvised explosive devices, also known as IEDs or roadside bombs, have caused about half of all the American combat casualties in Iraq, and about 30% of combat casualties in Afghanistan, both killed and wounded.[2] Some observers speculate that much of the munitions for constructing IEDs in Iraq may have come from large Iraqi military ordnance deposits looted by insurgents or stockpiles scattered in secret locations

[1] Albert Eisele, "Improved Explosives Becoming More Deadly in Iraq," *The Hill*, Mar. 28, 2005, [http://www.hillnews.com/thehill/export/TheHill/News/Iraq/explosives1.html].

[2] DOD Personnel and Procurement Statistics, Defense Manpower Data Center, *Casualty Reason, October 7, 2001 through September 16, 2006*, online at [http://siadapp.dior.whs.mil/personnel/CASUALTY/gwot_reason.pdf].

throughout that country before the war.[3] In Afghanistan, the munitions supply is supported by funds from an expanding opium trade.[4]

IEDs can utilize commercial or military explosives, and often the bomb is constructed in a home using materials at hand.[5] Triggering methods include using a cell phone, a garage door opener, or a child's radio-controlled toy, or may be as simple as running over a rubber hose to produce enough air pressure to activate a detonating switch. The typical IED terrorist cell can consists of six to eight people, including a financier, bomb maker, emplacer, triggerman, spotter, and often a cameraman. Videos of exploding U.S. vehicles and dead Americans are distributed via the Internet to win new supporters. Foreign radicals see these images as confirmation that the American and coalition forces are vulnerable. Increasingly, however , vehicle-borne IEDs are used in Iraq and Afghanistan to strike police stations, markets, and mosques to kill local citizens as well as U.S. troops. Recent news reports indicate that insurgents in Iraq have now resorted to kidnaping victims for the purpose of secretly booby-trapping their cars. The unknowing victims are then released, and their vehicles are detonated by remote control when they reach a certain location.[6]

In Afghanistan, more than 40 suicide bomb incidents have been reported in 2006. Observers have indicated that the Taliban forces in Afghanistan appear to have learned some IED techniques from the Iraqi insurgents. Although these attacks have not yet been as deadly as those in Iraq, because of increasing violence and the growing number of IED incidents, many areas of Afghanistan are reportedly becoming too dangerous for reconstruction efforts to continue.[7]

Over time, the insurgents in Iraq have adapted to U.S. countermeasures, and IEDs have grown more lethal. IEDs have been used to draw U.S. soldiers into a coordinated ambush. For example, in Iraq when first responders arrive to give aid to initial IED victims, or when a medevac helicopter touches down on a nearby temporary landing zone, the insurgents sometimes then trigger other pre-placed bombs, or begin a follow-on attack with rifles or grenades.[8] Recently, insurgents in Iraq have deployed IEDs with shaped charges that can penetrate even heavy vehicle armor. Also, in response to the use of heavier armor on High-Mobility Multi-Purpose Wheeled Vehicles (Humvees) and other

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[3] James Glanz, Jim Dwyer, *Looting Spree Gutted Ammo Dump*, San Francisco Chronicle, October 28, 2004. Byron York, *Remember Al Qaqaa?*, National Review Online, Feb. 28, 2005, [http://www.nationalreview.com/york/york200502280821.asp].

[4] Peter Bergen, *The Taliban, Regrouped and Rearmed*, The Washington Post, Sept. 10, 2006, B1. Helen Cooper, *NATO Chief Says More Troops Are Needed in Afghanistan*, New York Times, Sept. 22, 2006, p.10.

[5] Definition from Global Security.org, at [http://www.globalsecurity.org/military/intro/ied.htm].

[6] Times Wire Service, *Italian Troops End Iraq Mission*, Los Angeles Times, Sept. 22, 2006.

[7] Peter Bergen, *The Taliban, Regrouped and Rearmed*, The Washington Post, Sept. 10, 2006, B4.

[8] The Army has reportedly lost multiple helicopters in such medevac ambushes. Greg Grant, *Aerial IEDs Target U.S. Copters*, Defense News, January 16, 2006.

combat vehicles, insurgents have developed IEDs that are simply more powerful.[9] In one incident in 2004, after a 22-ton Bradley Fighting Vehicle ran over a large IED, the armored bottom plate of the vehicle was reportedly found some 60 yards from the site of the explosion.[10] In contrast, military units equipped with the 19-ton Stryker medium-weight armored vehicle, have reportedly suffered a lower number of catastrophic vehicle losses in Iraq due to enemy attack. With a maximum speed of more than 60 mph, the Stryker can dash past ambushes and roadside IEDs that might catch the slower moving Abrams tank and Bradley.[11] Between December 2003 and October 2004, news reports show that Strykers deployed in Iraq have successfully withstood 56 attacks by IEDs. Even when vehicles were rendered inoperable by the attacks, there was reportedly no loss of life among the Stryker crews.[12]

## Countermeasures

To evaluate countermeasures, DOD has set up the Joint IED Defeat Organization (JIEDDO), directed by retired Army Gen. Montgomery Meigs, to work with various national laboratories, the Department of Energy, contractors, and academia. Countermeasures are tested at the National Training Center at Fort Irwin, California. The technologies being evaluated include electronic jammers, radars, X-ray equipment, robotic explosive ordnance disposal equipment, physical security equipment, and armor for vehicles and personnel.[13]

Examples of electronic jamming systems mounted on military vehicles include the IED Countermeasures Equipment (ICE) and the Warlock, both of which use low-power radio frequency energy to block the signals of radio controlled explosives initiators, such as cell phones, satellite phones, and long-range cordless telephones.[14] The Army has recently ordered thousands of these radio-frequency jammer devices. However, experts reportedly caution that the jammers may only be partially effective because they must be set to operate within the right frequency range in order to stop an IED.

Other IED countermeasures being explored include technology that can first detect IEDs from afar, and then generate a pulse of directed high-power electromagnetic energy to prematurely detonate them, or burn out and destroy their circuitry. An example is the

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[9] John Anderson, Steve Fainaru, Jonathan Finer, "Bigger, Stronger Homemade Bombs Now to Blame for Half of U.S. Deaths," *The Washington Post*, Oct. 26, 2005, p. A1.

[10] Daniel Goure, *The Power in a Single Picture*, Oct. 14, 2004, Lexington Institute, [http://lexingtoninstitute.org/432.shtml].

[11] Daniel Goure, *Better than an Abrams*, May 28, 2004, Lexington Institute, [http://lexingtoninstitute.org/38.shtml].

[12] Daniel Goure, *The Power in a Single Picture*, Oct. 14, 2004, Lexington Institute, [http://lexingtoninstitute.org/432.shtml].

[13] Bruce Lieberman, "SDSU professor focuses laser research on finding killer explosives in Iraq", *SignOnSanDiego.com*, Dec. 27, 2005, [http://www.signonsandiego.com/articlelink/sdsufoundation4/sdsufoundation4.html].

[14] Sgt. Stephen D'Alessio, 2nd Marine Division, *Marines schooled in new bomb protection*, July 7, 2005, [http://www.marines.mil/marinelink/mcn2000.nsf/0/b89628064c45144e85257056003871f1?OpenDocument].

Neutralizing Improvised Explosive Devices with Radio Frequency (NIRF) which produces a very high-frequency field at very short range that can neutralize an IEDs electronics.[15] A Pentagon microwave project, code-named PING, and now deployed in Iraq, has reportedly been successful at helping locate insurgent weapons. The machine, which fits inside a Humvee, sends out electromagnetic waves that can penetrate the walls of a building to detect IEDs.[16] Other sensors, such as the Laser-Induced Breakdown Spectroscopy system (LIBS), are being developed to detect traces of explosives used for IEDs from as far away as 30 meters.[17]

However, much of the Radio Frequency (RF) spectrum in the Iraq combat theater is un-managed and can sometimes cause dangerous interference with radio communications on the ground. Sometimes IED radio jammers can lock onto other new electronic combat systems because of a lack of coordination for spectrum usage. Other times, when a jammer is on, a soldier cannot use his radio for communications. The soldier must shut off the jammer to send and receive, thus opening a window of vulnerability for extremists to use. Also, Unmanned Aerial Vehicles (UAVs) can sometimes lose their radio control links due to ground-based radio interference once they are far away from their control base. Therefore, DOD is now developing an "Electronic Warfare Coordination Cell" to help sort out problems that can impede friendly operations, or endanger Explosive Ordnance Teams as they disable IEDs on the ground.[18]

The "Talon" is a bomb-disposal Unmanned Ground Vehicle (UGV), or robot, that comes equipped with a mechanical arm to inspect and relocate suspected IEDs. More than a hundred of the remote-control robots are now being used in Iraq and Afghanistan, with an equal amount on order. Another robot, called the "PackBot" has also been used by the Army to clear bombs and explore suspected terrorist hideouts.[19]

Threat data about IEDs is tightly controlled by DOD to avoid giving feedback to the enemy about the effectiveness or ineffectiveness of different IED designs. Also, proprietary rights must be protected for those companies who produce IED countermeasures. However, these controls may sometimes limit access by other companies to important information about the effectiveness of anti-IED systems as they are tested or used in battle.[20] As a result, some industry officials say they are not getting

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[15] Christopher Castelli, "General: Ability to Prematurely Detonate Enemy Bombs Badly Needed," *Inside the Navy*, Aug. 22, 2005, at [http://www.insidedefense.com/].

[16] Loren B. Thompson, *Iraq: Stop the Bombers, Win the War*, June 10, 2005, Lexington Institute, [http://www.lexingtoninstitute.org/defense.asp?aid=616].

[17] Sebastian Sprenger, "U.S., NATO Research Could Help Troops Detect IED Threats from Afar," *Inside the Pentagon*, May 26, 2005. Noah Shachtman, "Improvised Bombs Baffle Army," *Wired News*, Jan. 26, 2005, [http://www.wired.com/news/technology/0,1282,66395,00.html].

[18] David Fulghum, "Jamming Jam-Up", *Aviation Week & Space Technology*, Nov. 7, 2005, Vol. 163, No. 18, P.32.

[19] Noah Shachtman, "Improvised Bombs Baffle Army," *Wired News*, Jan. 26, 2006, [http://www.wired.com/news/technology/0,1282,63036,00.html?tw=wn_story_related].

[20] Michael Moss, "Many Missteps Tied to Delay Of Armor to Protect Soldiers," *The New York Times*, Mar. 7, 2005, online at [http://www.globalsecurity.org/org/news/2005/050307-armor-missteps.htm].

access to all the information they need to help them create the most effective new solutions to counter IEDs, and suggest that relaxing some of the controls might lead to more solutions.[21]

## Acquisition of Countermeasures

A recent GAO report indicates that acquisition delays may have increased the vulnerability of U.S. forces to the IED threat, stating "... specific problems delayed DOD's acquisition of three important items we reviewed (Interceptor body armor, lithium batteries, and up-armored High-Mobility Multi-Purpose Wheeled Vehicles). DOD's acquisition decision did not maximize available capacity to produce up-armored High-Mobility Multi-Purpose Wheeled Vehicles and add-on armor kits nor did it give Congress visibility over the basis for its acquisition solution. These acquisition challenges impeded DOD's ability to respond to rapidly increasing demands."[22]

Actions taken by DOD to minimize future acquisition delays include implementing a "Rapid Fielding Initiative" (RFI) intended to ensure that soldiers have the latest available equipment. The RFI has reportedly reduced some acquisition cycles to weeks or days.[23] Additionally, the DOD Quick Reaction Special Projects (QRSP) program now supports the Combating Terrorism Technology Support Office (CTTSO).[24] The CTTSO solicits proposals to identify technologies for near and long-term solutions to terrorism threats. The Technical Support Working Group within the CTTSO seeks to prioritize and coordinate interagency and international research and development (R&D) for combating terrorism.[25] Also, on April 30, 2005, the Army was granted "rapid acquisition authority" by Defense Secretary Donald Rumsfeld, meaning that the traditional DOD acquisition process could be set aside, allowing a manufacturer of a special, man-portable IEDs jammer device to be chosen within only a 15-day time period.[26]

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[21] Anne Plummer, "Deadly Threat of Explosive Devices in Iraq Prompts Secrecy Debate," *Inside the Pentagon*, Nov. 18, 2004, vol. 20, no. 47.

[22] *Defense Logistics: Actions Needed to Improve the Availability of Critical Items during Current and Future Operations*, GAO-05-275, Apr. 8, 2005.

[23] Testimony of Claud M. Bolton, Assistant Secretary of the Army, Acquisition, Logistics and technology, before the House Committee on Armed Forces, Nov. 2, 2005, p.2.

[24] Testimony of Kenneth Krieg, Undersecretary of Defense, Acquisition, Technology and Logistics, before the House Committee on Armed Forces, Nov. 2, 2005, p.7.

[25] The TSWG uses the CTTSO Broad Agency Announcement (BAA) Information Delivery System (BIDS) to disseminate BAA information and collect proposals. TSWG operates under the policy oversight of the Department of State (DOS) Coordinator for Counterterrorism and under the management and technical oversight of the Department of Defense (DOD) Assistant Secretary of Defense for Special Operations and Low-Intensity Conflict (ASD(SO/LIC)), [https://www.bids.tswg.gov/tswg/bids.nsf/Main?OpenFrameset&6M8J6A].

[26] Glenn Maffei, "Defense Officials Worry Insurgents Will Change IEDS Tactics, Tech," *Inside the Army*, May 9, 2005.

## Funding for IED Countermeasures

From 2004 to 2006, approximately $6.1 billion has reportedly been spent on U.S. efforts to defeat the threat from IEDs.[27] In 2006, DOD directed the services to fund several counter-IED initiatives, including (1) the Global Anti-Terrorism and Operational Readiness Course, (2) Counter Radio Controlled IED Electronic Warfare, and (3) Robotic Systems.[28] DOD also reportedly has plans to upgrading Navy P-3 aircraft to assist in the search for roadside bombs. Funding for this was included in a transfer of $217.8 million from a funding account for defeating IEDs, into the Navy aircraft procurement budget line.[29] In addition, DOD has proposed spending $617 million to build new supply roads in Iraq that bypass urban centers where convoys are exposed to IEDs.

Funding to purchase IED countermeasure equipment has traditionally come through congressional plus-ups and reprogramming actions, and not through ordinary line-item funding in the fiscal year budget.[30] On May 24, 2005, Congress approved a transfer of $129.7 million from the Iraqi Freedom Fund to purchase mobile Warlock jammers.[31] On July 13, 2005, a reprogramming action transferred $10 million from the Iraqi Freedom Fund for two new anti-IEDs systems: $3.5 million for 50 Small, Lightweight Advanced Modular Digital Electronic Protection Systems (SLAM-DEP), and $6.5 million to purchase 187 low-cost, expendable robots for explosive ordnance disposal.[32] On December 5, 2005, DOD reprogrammed an additional $278,000,000 from the Iraq Freedom Fund to be used to detect and neutralize IEDs.[33] The Department of Defense Appropriations Act, 2006, (P.L. 109-148), signed December 30, 2005, states that $1,360,000,000 from the Iraq Freedom Fund is available for the Joint IED Defeat Organization.

According to sources in the Joint IED Defeat Organization, total funding for IED countermeasures administered through the JIEDDO for FY2005 was $1.3440 billion, and $3.4871 billion for FY2006.[34] The FY2007 Defense Appropriations bill, as approved by the House and Senate conference committee, provides $1.9 billion in funding for the JIEDDO.

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[27] Associated Press, *U.S. Spending Billions to 'Defeat' IEDs in Iraq*, MSNBC.Com, Mar. 13, 2006.[http://www.msnbc.msn.com/id/11813983/print/1/displaymode/1098/].

[28] Keith Costa, "England Wants Counter-IED Funding in Services' Outyear Budget Plans", *Inside the Army*, Sept. 18, 2006.

[29] Jason Sherman, "Navy Planes to be Upgraded, Modified to Hunt for Roadside Bombs", *Inside the Army*, Sept. 18, 2006.

[30] Jen DiMascio, "Pentagon Transfers $160 Million to Buy Protection Equipment," *Inside the Army*, Jan. 17, 2005.

[31] Jen DiMascio, "Congress OKs $129.7 Million Transfer to Fund IEDS Countermeasures," *Inside the Army*, May 30, 2005.

[32] Glenn, Maffei, "Order Made for Final "Warlock" Batch to Tackle IEDS Problem in Iraq," *Inside the Army*, July 25, 2005.

[33] Reprogramming Action FY 06-09 IR.

[34] Personal communication, Joint IED Defeat Organization, Sept. 25, 2006.