



IMPROVISED EXPLOSIVE DEVICES (IEDs)

AN NPS RESEARCH UPDATE

1 November 2005

COUNTERING IMPROVISED EXPLOSIVE DEVICES: NPS AND USMC INNOVATIONS

Remote-controlled improvised explosive devices, or RC-IEDs, are the weapon of choice for terrorists and constitute a substantial threat against coalition forces. Though special tactics and procedures have enjoyed some success in protecting convoy operations, there is a need for developing systems which can counter convoy-directed RC-IED attacks.

The need for a long-term look at the counter-IED problem is unfortunately self-evident as the statistics (often mentioned in counter-IED meetings) illustrate: the current overall counter-IED success rate is approximately 50%, and of all US casualties in Iraq about 50% are caused by IEDs. Therefore, significant savings of life and prevention of serious injury can be achieved by increasing the effectiveness of our counter-IED techniques.

A team of electrical engineering researchers with extensive R&D experience, as well as USMC and USN students, is dedicated to advancing counter-IED protection. The team's prior experience has focused on providing electronic attack solutions to support the operational needs of the DoD services in network centric warfare, from airborne platforms to UUVs to ground vehicles. The team is currently focusing on the development of the counter-IED electronic attack system.

The system design, based on commercially available, off-the-shelf components, is built for high flexibility and easy upgrade so as to capitalize quickly on technological improvements and stay ahead of the threat. The objective is to detect and prevent attacks coming from a wide and ever-changing array of technologies, including the different types

of IEDs. The team notes that the goal in building both defensive and offensive systems is that they fulfill their protective purpose while presenting technical stumbling blocks to the enemy in his attempts to overcome them. However, the target is not just moving; it is evolving and responding. Therefore, the system development considers not only current IED countermeasures, but also anticipates current and future adversaries' potential responses to such countermeasures.

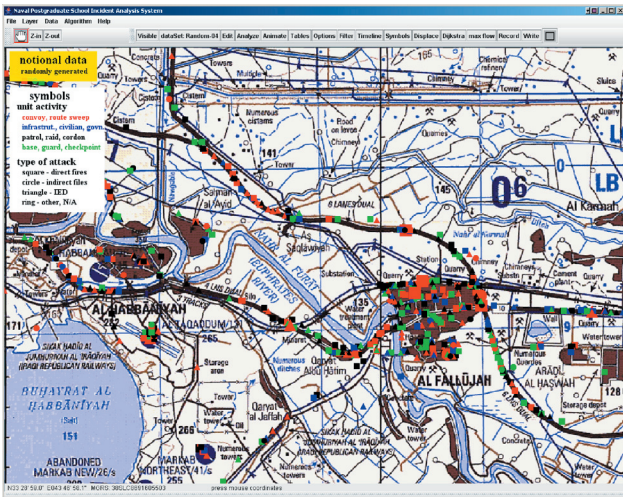
It is anticipated that the system will be tested by the USMC in operational scenarios later in 2006. The counter-IED system approach and progress was briefed to Pentagon and USMC representatives in 2005.

Contact Richard Adler, rwadler@nps.edu, for information.

OTHER NPS/USMC IED EFFORTS

- Gordon Bradley, professor of operations research and a government advisor to the Defense Science Board IED Task Force, is continuing to work with a former student, Capt. Paul Schneider, USMC (now an OR analyst at MCCDC), on a system for dynamic IED-incident analysis and mapping. He is also part of the complex Systems 90-day pilot sponsored by JS/J3 and JIEDDTF. The project is combining data on US and insurgent actions with cultural data (religion, ethnic, tribal) from the Diyala province to test models to guide the IED fight in Iraq.
- David Olwell (systems engineering) is continuing to work with Capt. Paul Schneider, USMC, to identify change points in Iraqi incident data.
 - Ravi Vaidyanathan (systems engineering) is investigating small unmanned-aerial-vehi-





IED incidents (notational) displayed in the NPS Incident Analysis System

cle robots that fly, land, crawl, see, or sniff IEDs.

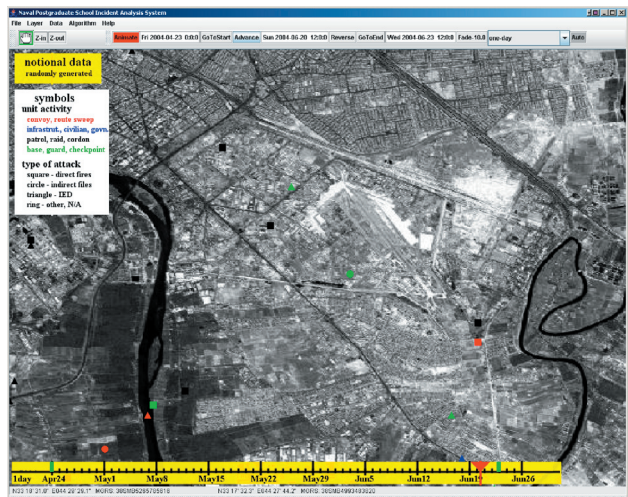
- John Hiles (computer science and MOVES) is working on Red Team Intent, combining NPS work on “focus of attention” with sensory data from the SONOMA camera developed by Lawrence Livermore National Labs. The aim is to better provide smart surveillance (backward tracing, forward watching, automated behavior recognition) to the IED problem.
- Lonnie Wilson (electrical and computer engineering) has assembled a commercial, off-the-shelf laboratory version of a smart defensive jammer developed and evaluated against RC-IED-coded car alarms. The new jammer has the potential to detect, identify, and jam using precise, low-power methods. It prevented an RC-IED car-alarm receiver’s operations in lab evaluations and was tested in a convoy experiment in August 05.
- Ron Brown (physics) has investigated armoring vehicles against IED blasts.
- NPS participates in a weekly IED video teleconference hosted by Hriar Cabayan of JS/J3, in conjunction with the Joint IED-Defeat Task Force. CENTCOM is the primary customer, along with over fifteen participating agencies. This effort supports DDRE/CTTTF (Defense Research and Engineering Combating Terrorism Technology Task Force).

IED-RELATED THESIS WORK

- LT Chris Lepore, USN (joint C41 systems) is implementing a dynamic, online, knowledge-management system that would help consolidate all IED informa-

tion and databases into a continually upgraded online system that can handle customized queries and help predict probability of attacks, methods, and techniques. The system will provide an archive of IED data for reference.

- Capt. Rob Lantz, USMC (operations research), looking at available data, will develop a prior-probability distribution of IED placement (both spatial and temporal) using data analysis and parametric or non-parametric techniques. The goal is to find an underlying distribution that would fit in to a larger effort underway with thesis advisors Moshe Kress, Kyle Lin, Roberto Szechtman, and Gordon Bradley.
- LT Harrison Schramm, USN (operations research), is looking at the Iraqi insurgency as a probabilistic decision-making model with two active participants (the US/Iraqi forces and the insurgents) and one pas-



Animation of IED incidents (notional) in the NPS Incident Analysis System

sive partner, the Iraqi public. The problem is to determine US/Iraqi actions that maximize Iraqi public support. This project involves aspects of dynamic programming and game theory. Thesis advisors are Kress, Lin, and Szechtman.

- LT Rob Damsky, USN’s (electrical and computer engineering, graduated September 2005) thesis concerned an upgrade to current antennae systems with the hope that it would later become an IED jammer. Advisors were Lebaric and Adler.
- MAJ Christopher Nannini, USA (operations research), is working with NATO Supreme Allied Commander Transformation, Norfolk to develop models and simulations to detect or mitigate the effects of IEDs. Thesis advisor is Gordon Bradley.

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- MAJ Mike Hammerstrom, USA (defense analysis) is investigating the use of scout dogs to sniff IEDs. Advisors: Anna Simons, George Lober

IED COURSE PROPOSED FOR ONR FUNDING

Following RADM Jay Cohen's expression of need at the October 2005 NPS advisory board meeting in Washington, Gordon Bradley has developed an IED course at NPS. The initial offering will be in January 2006. Faculty and students from several departments will participate in the course, which will describe IED hardware, IED use in insurgencies, a systems-analysis approach to countering IEDs, and a number of models to evaluate the effectiveness of counter measures. The focus of the course will be a total systems approach to defeat the IED system. See http://www.nps.edu/Research/documents/IED_course.pdf. Contact Gordon Bradley at gbradley@nps.edu for information.