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NPS Pioneers Advanced Course on Defeating the IED System

*by Barbara Honegger
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On Jan. 24, Deputy Secretary of Defense Gordon England called on “some of the best minds in the country” to come up with new solutions to countering Improvised Explosive Devices (IEDs), the leading cause of death and injury to U.S. troops in Iraq. Insurgent attacks involving IEDs, most of them remote-controlled and vehicle-triggered roadside bombs, nearly doubled from 2004 to 2005 -- from 5,607 to 10,593 -- causing over half of all U.S. and Coalition combat deaths. (1)

As the Deputy SECDEF spoke to 600 leaders from academe, industry and the military, the Naval Postgraduate School was already rising to the call with a pioneering course on the ‘homemade’ bomb threat from a systems perspective. Beginning Jan. 9, the Navy’s corporate university began offering “**Improved Explosive Devices (IEDs)-Defeat the System**,” a classified 11-week interdisciplinary Operations Analysis intensive seminar for U.S. military officers. The course uses modeling, analysis, systems technology, information technology, and fresh data from the ground in Iraq to defeat the total insurgent IED attack chain. Prerequisites are probability theory, U.S. citizenship, and a SECRET clearance. The first participants -- some of the “best minds” England spoke of -- hail from all four military services.

“Technical solutions alone won’t solve the IED problem,” the Deputy SECDEF stressed, echoing the Pentagon’s Joint IED Defeat Organization, just elevated to permanent status under the command of retired four-star Army General Montgomery Meigs, former commander of U.S. Army Forces Europe and NATO’s Bosnia peacekeeping force. “Because the enemy is so adaptable in using these devices, the technologies, tactics, techniques and training designed to counter them have to be adaptable, too.”

Enter the Naval Postgraduate School’s new course focusing on the ‘systems side’ of Counter-Insurgency Operations -- the ‘other side’ of COIN -- with special emphasis on the use of IEDs by insurgents in Iraq.

Access to Near-Real-Time On-the-Ground Classified IED Data

“This new NPS course, where many of the students have been in the IED fight and will return to it, is a perfect example of major military value that can’t be duplicated by any other academic institution,” said Prof. Gordon Bradley, the course coordinator and a member of the Defense Science Board IED Task Force that reports to England. “We’re unique because we can provide them with access to classified IED-related information streamed in from on-the-ground data-fusion centers in Iraq to the Joint IED Defeat Organization at the Pentagon, and from there to the NPS Battle Lab, where students and faculty can access it via the SIPRNET. The course is also unique in that it brings together officer students, NPS faculty members, and high-ranking guest lecturers, many of whom have had high-level operational experience on the ground in Iraq and other theaters where IEDs are a significant threat, so this information and experience can be synergistically shared.”

“Feedback from the field can be almost instantaneous,” said NPS President Rear Adm. Richard Wells, who championed the course. “And it goes both ways. New ideas for countering IEDs generated by NPS faculty-student teams can go from our Battle Lab to the field in Iraq literally overnight.”

On Jan. 27, for instance, students heard from guest lecturer Marine Corps Col. William Hix, recently returned from Iraq where he was Chief of Strategy, Multi-National Force Headquarters-Iraq.

“You can’t get a more inside track on what’s happening with IEDs on the ground, or at a higher level, than from the man who supervised all counterinsurgency operations for the Multi-National Forces-Iraq commander himself, Gen. Casey,” said a Naval C4I student doing his thesis research on a dynamic online IED-information knowledge management system. Another student, a Marine Corps captain who ran logistics convoys in Iraq, is doing his operations research masters thesis on predicting the distribution of replacement IEDs. Another, an Air Force major, is working on guided IEDs. Yet another, an Army major, is working with NATO Supreme Allied Command on IED modeling.

“This course provides a good venue for a number of different disciplines to come together with real synergy tied into the DoD IED Task Force office,” said Hix, who came to NPS expressly to share his hands-on experience with the students.

“We need to walk the dog backwards,” he told the participants. “The vast majority of the current effort is to counter detonations, nanoseconds from the explosion. We have to shift our entire thinking, and move up our points of entry into the system. This is a major challenge, and it’s one that this new NPS course is designed to address.”

“Defeating the *entire* IED system is critical to counterinsurgency operations because insurgents are constantly evolving their tactics, devices and trigger mechanisms,” said Prof. Mark Stevens, who covers the physics of IEDs in the classified NPS Systems Technology Battle Laboratory. “If we continue to focus on detecting and defeating IEDs after they’re already in place, as we’ve been doing with 90 percent of our effort and funding to date, we’ll never be able to get ahead of the enemy.”

Counterinsurgency operations would also get a lot more bang for the buck if they took a systems approach, Stevens said. “There are many points in the IED chain that can be disrupted -- the people who know how to build them, the materials used to build them, the places where they’re built, the logistics supply route, the people who put them in place, etc. In the systems approach, we identify vulnerabilities all along the chain and devise ways to exploit those vulnerabilities so as to best employ our own scarce resources.” (*Graphic here: “Functional Flow Diagram for IED Attacks*).

The faculty team for the seminar consists of Prof. Bradley, course coordinator; Capt. Tim Doorey, NPS Senior Intelligence Officer, covering intelligence; Air Force Col. Brian Greenshields, NPS SOCOM Chair who has just returned from Iraq, on Air Force special operations; Prof. Robert Harney, on a functional decomposition of the larger counterinsurgency system and identifying counter-measure opportunities; Lt. Col. Andy Hernandez, on wargaming; Prof. Moshe Kress, on logistics and stochastic modeling; Prof. David Olwell, on statistics and systems engineering; Prof. David Schrady, on logistics; Dr. Lonnie Wilson, on IED jamming; Prof. Stevens, on the physics of IEDs; Prof. Alan Washburn, on game theory and lessons from mine warfare; and Senior Lecturer Gene Paulo, on the relationship of systems engineering to the IED problem.

Though only in its fourth week, the IED course is clearly a major success.

“There’s already discussion of expanding the present seminar to three courses,” said Prof. Bradley. “If so, the first of the three would be the existing NPS full-quarter Seminar in Guerilla Warfare, SO3802, recommended for all students and taught in Winter/Summer. A student early in his or her NPS curriculum might want to take SO3802 instead of, or in addition to, OA4910, in anticipation that there will likely be a full systems engineering course on IEDs and a full course on using models to address IED questions later on.”

Background of a Paradigm Shift Whose Time Has Come

At a recent Naval Postgraduate School Board of Advisors meeting, Gen. Michael Hagee, Commandant of the Marine Corps, stated that defeating IEDs is one of the highest priorities of the Marines (2), and Chief of Naval Research Rear Adm. Jay Cohen asked that a new course be created to address the topic from a systems point of view.

Answering this call has been a unique challenge.

“The challenge is to create and teach a course on an issue for which there is no coherent literature, no good article or book, and only an emerging narrative to organize the materials that have been written. The problem is too important and too many people are dying to wait for materials to be developed. The students -- who have been in the IED fight and will return to it -- are joining with the faculty to develop this narrative and the methods to address the problem today.”

One major trigger for the shift to a systems focus for countering IEDs is the groundbreaking work of another NPS faculty member, Prof. Moshe Kress. In May of 2005, Kress and Yale University operations research professor Edward Kaplan published a study that got the attention of both the Pentagon and the Department of Homeland Security, as well as the mainstream media. Contrary to expectation, they found, using statistical modeling and analysis, that warning a crowd of a suicide bomber, so that individuals can take evasive action, usually increases -- not decreases -- the number of deaths and casualties. Even though suicide bombers are not normally considered IEDs, the study’s ‘bottom line’ -- that last-minute defenses, even with perfect fore-knowledge, are too expensive in both blood and treasure -- led to the realization that bringing intelligence assets to bear at every phase of the IED system is a superior strategy.

“A result is that today the new director of the Pentagon’s Joint IED Defeat Organization, Gen. Meigs, realizes the only way to get ahead of the problem

is for the effort to be intel-*driven*, and intel is going *into* the insurgency,” said Capt. Tim Doorey, NPS Senior Intelligence Officer who was recently with the Joint Staff J2 at the Pentagon. “We’re going to go after the insurgents where they live.”

Don’t Shoot the Arrow, Shoot the Archer

“The ‘bottom line’ of the IED challenge from an intel perspective is ‘Know thine enemy,’” Doorey stressed. “IEDs are just weapons. We need to go after the adversary, not the weapon. You can study the bullets, or you can study the killer. Too much of our effort has been focused on the bullets. Intel, also, goes to *how* IEDs are used.” Indeed, a recent study by Prof. Stephen Biddle, Elihu Root Chair of Military Studies at the U.S. Army War College Strategic Studies Institute, showed that *how* force is used, as much if not more so than the level of force or its technological sophistication, makes a major difference in the outcome of a conflict, especially between asymmetric adversaries, as is the case in Iraq.

“The IED problem is a lot like the land mine problem, and many of lessons learned in countering land mines are applicable here as well,” Doorey added. “But my favorite analogy is with sea mines. In the first Gulf War, Iraq dropped 1,200 sea mines off its shores and two Navy ships were hit. In the last Gulf War, Saddam never got them off his boats. We need to stop the bad guys *before* they plant the IEDs.”

Quiet Revolution in Bomb/IED Bio-detectors

Still, individual Improvised Explosive Devices matter, especially if you’re close to one.

Col. Hix referred to interfering with the IED systems chain as early as possible as “walking the dog backward.” While the NPS course focuses on IEDs as part of a larger system, detecting in-place IEDs is still a key goal, and major breakthroughs are being made in this area as well.

Despite all the technical advances, though, the best detector of explosives, which have chemical components, is still “Man’s Best Friend.” Dogs, whose sense of smell is at least a thousand times more sensitive than a human’s, have been used to locate buried and hidden landmines for decades. One NPS student, an Army major, is investigating the use of scout dogs to sniff out IEDs, and one of the Defense Advanced Research Projects Agency’s main goals is to develop a high-tech version of the dog’s nose-brain system. Other “biological system detectors” are the classic

canary in the mine detecting toxic gases in closed spaces; specially-trained rats and mice with implanted Global Positioning System chips trained to ‘work’ manholes, sewers and other underground areas; and even trained bees, wasps, moths, and butterflies. Wasps, in fact, have proven so successful at detecting the vapor signatures of explosives that there is a pending patent for a “Wasp Hound” -- a hand-held, wasp-containing bomb/IED locator-identifier with a software component.

As a high-tech response to such biological detection systems, NPS researchers have developed a miniaturized remotely-controlled robotic UAV that looks a lot like a large wasp for detecting chemical weapons and chemical fumes given off by explosives. *(Photo of Assistant Prof. of Systems Engineering Ravi Vaidyanathan with ‘winged micromorphic air-land vehicle’ with photo overlay of bomb-vapor-detecting wasp).* And one of the IED course instructors, Dr. Lonnie Wilson, is working on smart low-power defensive signal jammers to prevent IEDs from being detonated, under the NPS Center for Defense Technology and Education for the Military Services (CDTEMS).

NPS also participates in the weekly IED video teleconference hosted by JS/J3 in conjunction with the Pentagon’s Joint IED-Defeat Task Force.

For more information on the Naval Postgraduate School counter-IED course, go to http://www.nps.edu/Research/documents/IED_course.pdf or contact Prof. Gordon Bradley at gbradley@nps.edu. For information on IED research at the Naval Postgraduate School, go to <http://www.nps.edu/Research> and click on “Improvised Explosive Devices (IEDs): An NPS Research Update.” For information on all NPS academic and research programs, go to www.nps.edu.

Notes:

- (1) “Insurgent Attacks in Iraq Jumped in 2005, U.S. Says”, Reuters, William Dunham, Jan. 23, 2006.
- (2) Also in Special Operations Technology Magazine, Vol. 3, Issue 8, 2005.

Boxed Pull-out Quotes:

“You can’t get a more inside track on what’s happening with IEDs on the ground, or at a higher level, than from the man who’s overseen all counterinsurgency operations for the Multi-National Forces-Iraq commander himself,” said a Naval C4I student taking the NPS course ‘IEDs-Defeat the System.’

For more information on the Naval Postgraduate School's counter-IED course, go to http://www.nps.edu/Research/documents/IED_course.pdf or contact Prof. Gordon Bradley at gbradley@nps.edu. For information on IED research at the Naval Postgraduate School, go to <http://www.nps.edu/Research> and click on "Improvised Explosive Devices (IEDs): An NPS Research Update."
For information on all NPS academic and research programs, go to www.nps.edu.