SOLDIERS AS SENSORS

Evolution of a battlefield-proven solution for reducing casualties

by
GRANT HABER

IT WAS IN 2006 when I first heard soldiers and United States Department of Defense (DoD) subject-matter experts mentioning the operational need for a force-multiplier training and equipping program to enable "soldiers as sensors" to choke the flow of bomb-making materials used on the battlefield. Casualties from homemade explosives (HME) and their resulting IEDs were surging, and the traumatic brain injuries (TBI) reported to Veteran Affairs (VA) since 2001 was on a fast trajectory toward 100,000.

Army Engineers have an integral role in shaping requirements and building strategic capacities; assisting and empowering them to make informed decisions makes a big difference to soldiers on the battlefield. Without relevant and approved requirements to satisfy operational needs, helping soldiers timely can be reduced to birthday candles, wishes, and a prayer. Teamwork and action is vital for their success.

In 2009, I volunteered at the United States Military Academy (USMA) to train 200 cadets on how wet chemistry is being used to detect and identify explosives residues on the battlefield, to attack bomb-maker networks, and to differentiate urea fertilizer from urea nitrate, an HME.

In 2012, I volunteered again at USMA, this time to train 1,600 cadets (8 cadet companies) on bulk HMEs precursor identification, explosives trace detection, and lessons learned with regard to the detection tools fielded into Afghanistan and Iraq.

The Military Training Branch at USMA incorporated into their summer Cadet Field Training (CFT) the American Innovations, Inc. (AI) bulk HME precursor identification kit (AI-HME) being supplied to joint forces for Afghanistan operations. This first-generation kit was battlefield proven in 2010, contributed to the 440 tons of HME materials seized in 2012, and was highlighted by U.S. Army Center for Army Lessons Learned (CALL) as a best practice for U.S. and coalition forces.

A cadre of Army Engineers from the Joint Readiness Training Center (Fort Polk) reported to USMA to set up IED training lanes during the summer CFT. The IED training spanned five days over two weeks in July 2012. I taught the HME breakout sessions ranging in size from approximately 30 to 100 cadets per class. U.S. Army Forces Command (FORSCOM) Counter IED Integration Cell (CI2C) assisted with some classes.

These 1,600 cadets came from throughout the United States and many foreign nations; their input provided many perspectives. The pace at which these young adults processed vast amounts of information was truly impressive.

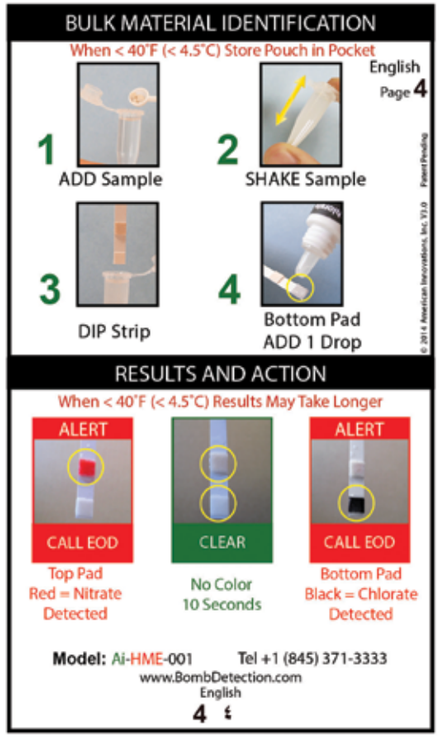
In the HME breakout sessions, cadets were provided four unknown bulk materials. These included calcium ammonium nitrate, diammonium phosphate, urea fertilizers, and potassium chlorate. They were tasked to determine which materials were targeted bomb-making materials and which were not.

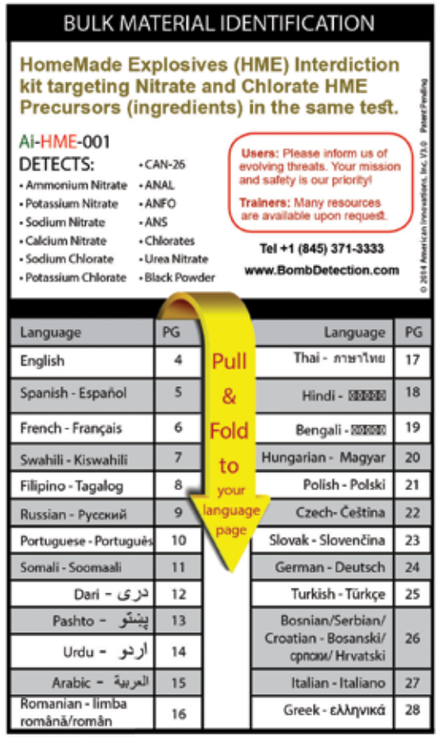
As the cadets ran tests and interpreted results, their challenges, comments, and suggestions were being analyzed and considered for inclusion into the development of a next-generation bulk HME precursor identification kit being developed to better support the transition of Afghanistan combat operations to an Afghan forces lead. The cadets wanted "smaller, faster, simpler, fewer steps, more sustainable, evidence collection and preservation means included, and multi-language picture instructions."

During the next six months, these desired enhancements became suggestions and/or requests from U.S. Central Command (CENTCOM), Joint Improvised Explosives Device Defeat Organization (JIEDDO), FORSCOM, NATO Explosives Ordinance Disposal Centre of Excellence (NATO EOD COE) personnel in Afghanistan, and soldiers who used the first-generation kit during deployments. Despite unprecedented success in the hands of U.S. and coalition forces, Afghan forces experienced many operational challenges while utilizing the AI-HME test kits to analyze unknown bulk materials.

The cadets' questions were equally impressive, highly strategic, and proactive in nature, and with the foresight of delivering fast wins with measurable gains. Their questions stimulated good discussions. Eradicating enduring HME threats became not only the desired outcome but an achievable sustainable outcome. Based on comments during the discussions, eliminating soldier casualties and civilian collateral damage also was of high importance for these future Army officers.

GRANT HABER *founded American Innovations, Inc., in 1995. Haber supports joint services, government labs, and Congress on matters pertaining to national security, foreign relations, and capacity building. Haber is an inventor, instructor, writer, facilitator, and strong believer in giving back and teaming. Haber advocates investing heavily in research, development, and testing in order to stay ahead of evolving threats and to ensure vendors are held to high ethical standards.*





THE CADETS' *entire wish list became the deliverables for the next-generation bulk HME precursor Identification Kit (AI-HME-001) delivered to JIEDDO (DEC 2012), validated by JTF-Paladin (JAN 2013), requested by U.S. forces in Afghanistan for Afghan forces (FEB 2013), piloted in Kandahar after creating a train-the-trainer program of instruction in Pashto and Dari (MAY 2013), and first requested by the Afghanistan Ministry of Interior for countrywide integration (SEP 2013). The NATO EOD COE (Slovakia), NATO C-IED COE (Spain), FBI Hazardous Device School (Alabama), and DHS Federal Law Enforcement Training Center (Georgia) have since incorporated this tool into their training.*

NEXT-GENERATION BULK HME PRECURSOR IDENTIFICATION KIT ENHANCEMENTS:

Smaller – *Pouch size decreased 60% to 4x4x2 inches.*

Faster – *Analysis time decreased 80% to < 20 seconds.*

Simpler – *11 steps decreased to 4.*

Evidence Collection and Preservation – *Added: 5 evidence bags, designated pocket, 1 marker.*

Multi-Language Instructions – *Added: Picture instructions standard in 25 languages.*

More Sustainable – *Tests increased 30% to 33 tests. Shelf life increased 400% to 5 years.*

The top 10 questions (& answers) relevant for the "soldiers as sensors" program:

Q1. What is the fastest way to reduce HME production output in combat zones?
Enable coalition and partner nation forces to become "sensors" of the nitrate and chlorate oxidizers being used to mass produce homemade explosives. This will choke the flow of HME precursors supply and simultaneously disrupt the entire bomb-maker support network through lawful arrests and public shaming.

Q2. Can partner nation forces be enabled to effectively stop HME precursors flow?
Yes, providing a whole-of-government approach mandates the analysis of unknown bulk materials, and providing that detection tools issued are simple to use, strategically targeted, effective, and sustainable. Do not provide non-specialists with tools that attempt to accomplish too much; it's important to manage expectations. Keep it simple, reward success, and track results.

Q3. Are HME precursors detectable without hindering legal fertilizer distribution?
Yes, providing the detection tools issued target the right materials. For example: Ammonium nitrate, a targeted HME precursor, and diammonium phosphate (DAP), the world's most widely distributed legal phosphorous fertilizer, both contain ammonium. DAP is not used to make HME. If "ammonium" is targeted, seizures of legal DAP fertilizer and unwarranted arrests will result; this was a 2010 lessons learned. If "nitrates" are targeted, ammonium nitrate seizures will result and legal DAP fertilizer will be able to flow freely. Urea nitrate (HME) also will be detected and legal urea fertilizer will be able to flow freely.

Q4. How can we aggressively screen for HME precursors without violating civilian trust?
Eliminate swab sampling (trace detection) for "primary" screening by non-specialists in highly contaminated combat zones where invisible residues of target materials "often" transfer from surface to person and from person to person unknowingly. The majority of people in combat zones are not bomb makers, despite what most trace-detection tools lead many to believe. Learn customs in culture. For example, Muslims are offended if touched by a person's left hand, and men touching women (outside of marriage or in pubic) is forbidden. In Afghanistan and Iraq, shifting trace-detection tools use for secondary screening will reduce arrests from cross-contamination detections, will show respect for customs in Muslim culture, and will reduce trust violations that often result from inappropriate touching during swab sampling.

Q5. How can we ensure detection kits issued to partner nation forces are used?
Kits should attach to belts or molle gear to remain top of mind and should be trainable in minutes with picture instructions to overcome literacy challenges. Integrate the targeted bomb-making materials and non-targeted legal fertilizers into the training and mandate every trainee runs his own tests and interprets his own results. Afghans and Iraqis have pride; if a detection kit is too complicated to learn or requires hand-holding for reliable use, they will not use it. If analysis takes 2+ minutes per test and many tests are required to clear each donkey cart, jingle truck, facility, etc., they will cut corners or not use it.

Q6. How can we ensure detection kits issued to partner nation forces are sustainable?
Kits should be reusable after first use, provide many tests, and be refillable. Single-use kits become impractical for carrying and sustainability given the mere numbers of tests required when analyzing unknown bulk materials. Consumables should have a shelf life of many years, regardless of first-use date.

Q7. What has been the worst HME attack on U.S. soil and what have we learned from it?
The most casualties, destruction, and monetary damages from an HME attack remain the 1995 Oklahoma City bombing: 168 killed, 680 injured, and $652 million in damages. We learned that bomb makers will use the bomb-making materials easiest to obtain and most stable to transport in bulk.

Q8. What are we not doing today that can make a huge impact tomorrow on the battlefield?
We are not enabling partner nation forces to target and seize the most-often–used bomb-making materials. This is a capacity gap. Integration of the "Soldiers as Sensors" program would overpower enemy capability and capacity. The Army with lead on capacity building can enable host-nation soldiers (and police) to aggressively disrupt the flow of nitrate and chlorate oxidizers and decrease bomb-maker networks.

Q9. How long would it take to train and equip every soldier to become a sensor?
With current production capacity and battlefield-proven train-the-trainer program of instruction in the most relevant languages, one million soldiers could be trained and equipped within 12 months. Two million additional soldiers could be trained and equipped each year thereafter.

Q10. What is the cost to enable each soldier to become a sensor of chlorate and nitrate oxidizers?
Utilizing the most effective available commercial off the shelf (COTS) solution today, the "turnkey cost" for training and equipping every soldier is $150 per soldier. With a 5-year shelf life and 33 tests per soldier, this breaks down to an initial cost of $30 per year or $4.50 per test. This applies to U.S. soldiers in the United States, Afghan soldiers (and police) in Afghanistan, Iraqi soldiers (and police) in Iraq, and so forth. Resupply cost is $100 per soldier; this breaks down to $20 per year or $3.00 per test.

HMEs and their resulting IEDs are an enduring threat expanding beyond Afghanistan, Iraq, Syria, Yemen, Libya, and Somalia. In the United States, terrorists have used HME in all the following historic bombings; 1970 University of Wisconsin-Madison, 1993 New York City World Trade Center, 1995 Oklahoma City, and 2013 Boston Marathon bombing. Nitrate oxidizers were used to make the main explosive charges in all these attacks.

During the Afghanistan and Iraq wars, IEDs made with HMEs have contributed to countless casualties (killed, wounded, and TBI). When U.S. and coalition forces led combat operations, they were sustaining high casualties from HME and the resulting IEDs. When combat operations transitioned to partner nation forces, the casualties exponentially increased, only now sustained by Afghan and Iraqi troops.

Roadside bombs, car or truck bombs (VBIEDs), and suicide vests are IEDs and imminent threats to military, police, and civilians. Today, roadside bombs are not only under the ground; terrorists integrate IEDs into dead animals and place them on the roads. VBIEDs can come in many forms: donkey carts, motorcycles, jingle trucks, and much larger vehicles. Suicide vests are being made for men, women, and children. The bomb maker's IED disguises are endless, however; their main explosive charges are mostly made with ammonium nitrate or potassium chlorate (one of two oxidizers) and a wide variety of fuels.

In Afghanistan, before transitioning to an Afghan lead, more than 90 percent of IEDs were made from nitrate and chlorate oxidizers. Calcium ammonium nitrate (CAN) fertilizer—originating in Pakistan and flowing into Afghanistan from Southern and Eastern borders—was used to make about 85 percent of IEDs. The bomb makers would boil off the calcium and the remaining ammonium nitrate was mixed with fuels to make the main charges. Potassium chlorate was used in less than 10 percent of the IEDs at that time. Once word spread that potassium chlorate was half the price of CAN fertilizer and that it came ready to covert into HMEs, its use surged to 60+ percent of the IEDs.

In Iraq, a similar yet more extreme transition took place. Urea fertilizer used to be converted into urea nitrate (HME) for use in most IEDs. Ten years ago, urea nitrate was responsible for most U.S. military casualties in Iraq. Converting urea to urea nitrate is a tedious process. When bomb makers realized they could use ammonium nitrate fertilizer—which comes ready to convert into HME—urea fertilizer stopped being used and urea nitrate disappeared from the Iraq war.

Ammonium nitrate and potassium chlorate remain the bomb maker's oxidizers of choice due to their low cost, widespread distribution, and ease of converting into powerful explosives. These oxidizers (HME precursors) also are relatively safe to handle, transport, and store even after they are converted into explosives. Nitrate and chlorate oxidizers are flowing virtually unabated to IED factories and Jihad training camps under disguise of flour, sugar, cement, legal fertilizers, among other bulk materials.

The need to train and equip Afghan and Iraqi forces to detect these bomb-making materials before they can pose a threat to military, police, civilians, and critical infrastructure could not be any higher today. This capacity gap and the resulting fallout have contributed to the need for U.S. forces to redeploy to Iraq and to reenter combat operations in Afghanistan. This capacity gap can fuel another surge in U.S. and coalition forces casualties as our role in combat operations steadily increase.

Explosives Ordnance Disposal (EOD) units are spread thin and taking high casualties. Due to the surge in HME/IED production, EOD has no spare time for callouts on unknown bulk materials. Callouts for actual IEDs keep them going day and night. Soldiers can no longer afford to be guarding unknown bulk material for days, sometimes weeks, often to learn that the suspect materials are harmless.

Deteriorating economic conditions have further increased the risk to U.S. and coalition forces; the present-day high-value targets for suicide bombers. In impoverished countries where basic necessities like food and water are scarce, suicide-bomber recruiting is high. Given the steady increase in women and children being exploited for suicide missions, warfighter and peacekeeper missions are continuing to get riskier, especially village stability operations and humanitarian aid. As engineers, you have the unique opportunity to help shape requirements and build the capacities needed to prevent the next surge in U.S. and coalition forces casualties from HME.

This article is meant to stimulate discussion on the HME threats that will continue to plague our nation and joint partners for the foreseeable future. The TBIs reported to the VA surged past the 100,000 mark to nearly 400,000 in the last 10 years. U.S. and coalition forces are being pulled back into combat operations where HME and IEDs remain an imminent threat.

EOD cannot be everywhere to analyze bulk materials. The "Soldiers as Sensors" whole-of-government approach closes that gap with non-specialists and other specialists. By analyzing tiny samples of bulk materials instead of swabbing for invisible residue, and by targeting the chlorate and nitrate oxidizers used to make most IEDs, independent testing confirms 100% detection with 0 false alarms is achievable.

This program is not intended to make non-specialists into EOD. Choking the flow of commonly used bomb-making materials, reducing bomb-maker support networks, building civilian trust, and creating a foundation that helps close any remaining explosives detection gaps are the achievable objectives. Currently, there are no requirements to train and equip non-EOD personnel to detect potassium chlorate, ammonium nitrate, and the other chlorates and nitrates being used to build endless bombs.