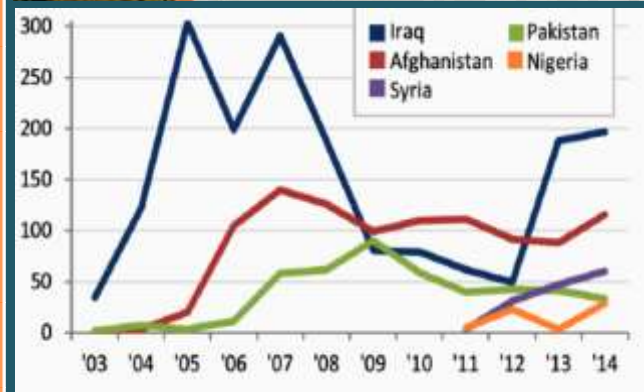


2015

Introduction to Standoff IED, Person-Borne & Vehicle-Borne Attack Detection



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August 2015

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1 Key Facts

- ❑ IEDs, PBIEDs and VBIEDs are the weapons of choice for terrorists worldwide, requiring limited skills and giving them the ability to conduct spectacular attacks for a relatively small investment. Terrorists from insurgent groups have discovered that the public relations benefit of explosive attacks far outweigh those attacks using more conventional weapons. With easy access to commercial technologies, training via the Internet, and the ability to either manufacture or otherwise procure explosive materials, IEDs, PBIEDs and VBIEDs continue to provide the enemy with inexpensive, standoff, precision weapon systems that often provide the attacker with near total anonymity. The current global IED, PBIEDs and VBIEDs threat is not limited to land-based emplacements and person-borne suicide devices, but also includes the possibility of diverse delivery systems such as water-borne and air-borne IEDs. Future IED, PBIED and VBIED operations and tactics may also be increasingly conducted or supported by both state and non-state sponsors.
- ❑ Improvised Explosive Devices, Person-Borne & Vehicle-Borne Explosives are persistent threats that manifest themselves in almost innumerable forms. Their detection and safe disposal is a formidable challenge.
- ❑ More than 60,000 people have lost their lives as a result of IED blasts since 9/11.
- ❑ A report published by the University of Chicago on global trends in suicide terrorism shows that during 2014 more than 4,300 people in more than fifteen countries were killed in 504 PBIED and VBIED suicide attack bombings. Out of the fifteen countries, Afghanistan and Iraq led the world last year in suicide attacks with an increase in Iraq. The report indicates that the key global hot spots for attacks and also shows that with the exception of Nigeria, the majority of suicide bombers were males. The researchers also found that car bombs were the most prevalent weapons, and the targets were overwhelmingly security forces.
- ❑ The asymmetric, global IED, PBIED and VBIED threat requires a multi-faceted response. Out of these, three directly carry out their mission: Attack the Network, Defeat the Device, and Train the Force.

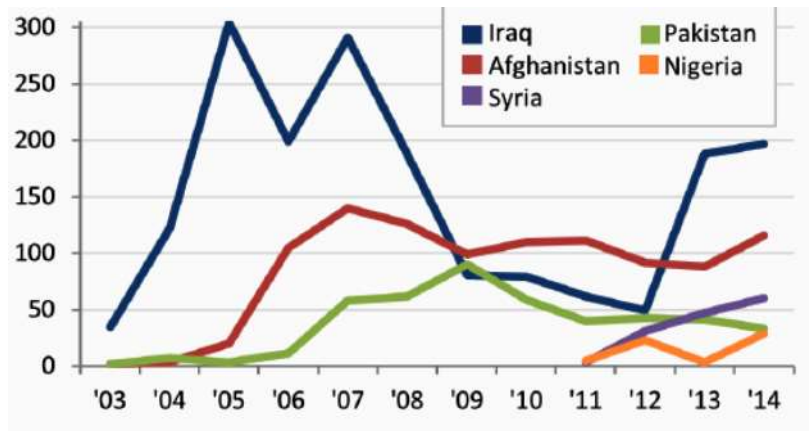
Figure 1 - Global PBIED and VBIED Suicide Attack – 2003-2014



(Source: Chicago Project on Security & Terrorism 2015)

- ❑ Over the past two decades, a lot of progress has been made to address this challenge with the development of technologies with ever-increasing levels of sophistication. These range from indirect methods to detect packaging, wiring, or fusing to more direct detection methods.

Figure 2 - PBIED and VBIED Suicide Attacks in 5 Countries – 2003-2014



(Source: Chicago Project on Security & Terrorism 2015)

- ❑ The IED, Person-Borne & Vehicle-Borne Explosives threats has become a household term evoking a sense of dread and fear in the hearts of many.
- ❑ IEDs are nonstandard explosive devices used to target soldiers and civilians.

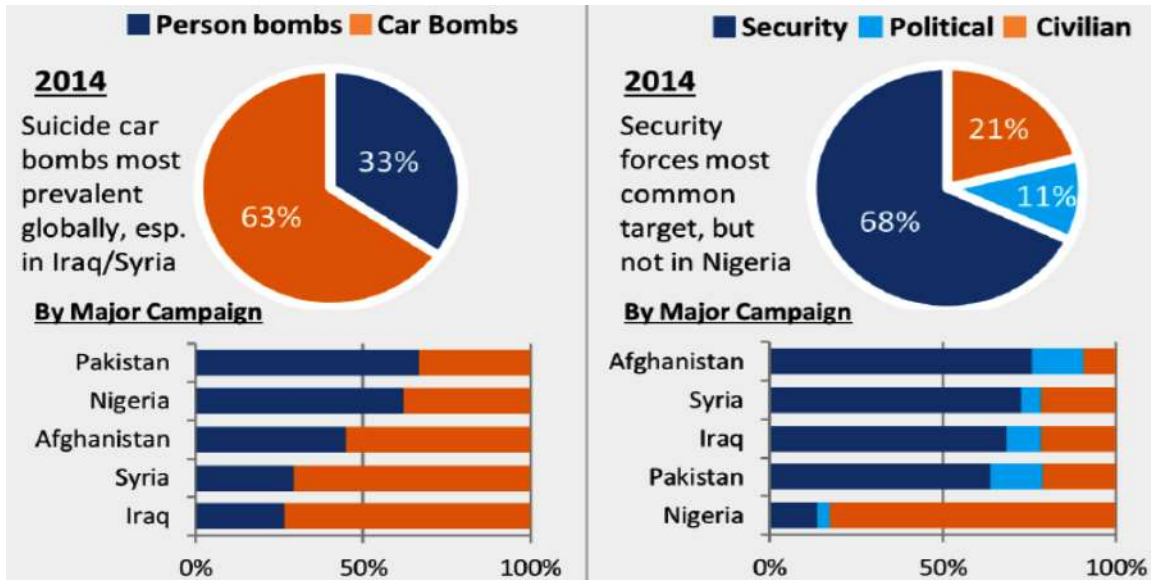
Figure 3 - Global Distribution PBIED and VBIED Suicide Attacks, 2014



(Source: Chicago Project on Security & Terrorism 2015)

□ In 2014, 63% of the suicide attacks have been PBIED attacks

Figure 4 - 2014 PBIED & VBIED Suicide Attacks by PBIED or VBIED (left) and by Targets (Right)



(Source: Chicago Project on Security & Terrorism 2015)

- ❑ IED, PBIED & VBIED's range from crude homemade explosives to extremely intricate remote-controlled devices
- ❑ Over the last 30 years, suicide attacks have emerged as one of the most effective methods used on a large scale by terrorist organizations
- ❑ The devices are used to instill fear in soldiers and the local civilian population. Their employment is intended to diminish national resolve with mounting casualties. The sophistication and range of IED, PBIED & VBIED's continue to increase as technology continues to improve and as terrorists gain experience.
- ❑ The lethality combined with the simple construction of IED, PBIED & VBIED's has made them the single most difficult foe on the modern battlefield, and as their employment increases, the risks to innocent civilian populations also increases. The human and financial toll of IED, PBIED & VBIEDs has become a staggering reality the world over.
- ❑ IED, PBIED & VBIED's are generally classified by how they are triggered, the type of explosive accelerant used and by the means of delivery.
- ❑ Military forces and law enforcement from India, Canada, UK, Israel, Spain, and the U.S. are at the forefront of counter-IED efforts, as all countries have direct experience in dealing with IEDs used against them in conflict or terrorist attacks.

“Even the best intelligence can't identify in advance every individual who would do us harm.”

President Obama

Figure 5 - Improvised Explosives Device Kill Chain

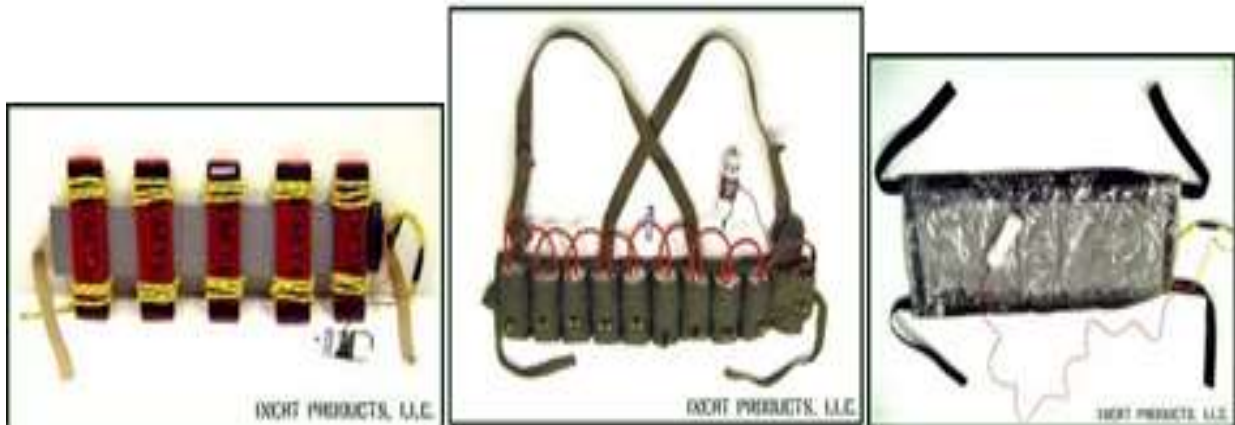


- ❑ The U.S. military organization that was formed to fight the IED threat, the Joint Improvised Explosive Device Defeat Organization (JIEDDO), is being reorganized and severely cut back, the victim of reduced American involvement in Afghanistan and a constrained defense budget. JIEDDO won't go entirely away, and neither will the IED threat. Thousands of IEDs

are set off each year around the globe, and there is no certainty that the United States will not be involved in another intervention where the bomb-makers practice their calling.

- ❑ Standoff detection range is classified into 3 ranges:
 - Distant targets (30 m to >100 m): Far away enough to minimize threat
 - Mid-range targets (3 to 30m): Enhanced sensing discrimination not explicitly surrounding target
 - Intimately Near targets (<3 m): Non-invasive examination, mainly walk-by sensors
- ❑ Victim-activated IED, Person-Borne & Vehicle-Borne Explosives, those that employ devices such as trip-wires, passive infrared receivers (PIR), crush-tubes, pressure-plates, or crush-wires to initiate the device, are often hard to detect and pose a tremendous threat to dismounted troops.
- ❑ Victim-activated IEDs also threaten civilian populations because they are in no way selective and can be activated by small children, herding animals, or anyone unfortunate enough to come in contact with the initiating device. Stacked conventional landmines can be used as part of the victim-activated IED, PBIED & VBIED group, threatening dismounted and mounted troops or civilians.
- ❑ Command-detonated devices relying on signals from devices such as telephones, two-way radios, garage door openers, and remote control optical links allow terrorists to be more selective in initiating an attack. These remotely controlled initiation devices are hard to detect and prevent, requiring that their signal be interrupted in some way.
- ❑ Command-wire initiated devices, requiring that a terrorist close to the IED, PBIED & VBIED simply touch wires to a battery to initiate the explosive, are resistant to electronic counter-measures but pose less of a threat because of the terrorists' proximity to the IED, Person-Borne & Vehicle-Borne Explosives.

Figure 6 - Suicide Vest PBIEDs Configurations



- ❑ Suicide terrorist acts and fatalities associated with such acts have increased dramatically throughout the world over the last two decades.
- ❑ The purpose of Standoff Person-Borne Explosives & Weapon Detection technologies is to determine at a safe distance if a human subject who is carrying no visible load on the body is actually carrying a concealed load under his/her clothes.
- ❑ In several theaters, including Iraq, Afghanistan, the Middle East, India and Pakistan, people-Borne & Vehicle-Borne terror including suicide attacks is and will be the preferred insurgency tactics.
- ❑ Suicide terrorist organizations are not only socially isolated groups with socially unacceptable goals, but go to great lengths to embed themselves into their surrounding communities and to pursue socially acceptable political objectives. This give rise to circumstances under which an individual who wishes to sacrifice himself for the community can be confident that his act is understood in this way.
- ❑ In the absence of an altruistic motive, many suicide attacks would probably not occur and many suicide attackers might well seek other opportunities to contribute to their community.
- ❑ This finding has the following implications:
 - 1] It suggests that the number of people who would engage in suicide terrorism is potentially much greater than the number of those who are suicidal in the ordinary sense. One should expect that suicide attackers are likely to come from a broad cross section of the society. There may be no limit on the potential number of suicide terrorists.
 - 2] The role of altruism in suicide terrorism suggests that there may be a geometric multiplier built into the process of suicide terrorism. The

trajectory of suicide terrorism is often an upward slope. Suicide terrorist campaigns tend to gather pace and attract more walk-in volunteers – over time

3] The role of altruism means that any attempt to profile suicide terrorists based on the known profiles of ordinary suicides is likely to miss a substantial portion of it.

- Nations under fire may have little choice but to deal with the root causes of suicide terrorism.
- Conditions of personal anomie may well have influenced some individuals to carry out suicide terrorist attacks.
- Anomic suicide is probably not the principal basis for individual suicide terrorism for three reasons:

A] Some suicide terrorist campaigns target an enemy who is not inflicting heavy violence on the terrorists' homeland territory (e.g. the U.S. forces stationed on the Arabian Peninsula during the 1990s did not kill any citizens of Saudi Arabia or other states in the Persian Gulf, but more than half of all al-Qaeda suicide attackers came from these countries)

B] Some suicide terrorist campaigns begin and escalate after the damage inflicted by the foreign forces has peaked and then waned to much lower levels (e.g. When Israel invaded Lebanon in June 1982, most of the damage that its forces inflicted on the local Shia community took place in the following several months. However, the first Hezbollah suicide terrorist attack against the Israelis did not occur until November 1982, and the vast majority of attacks did not occur for years after that)

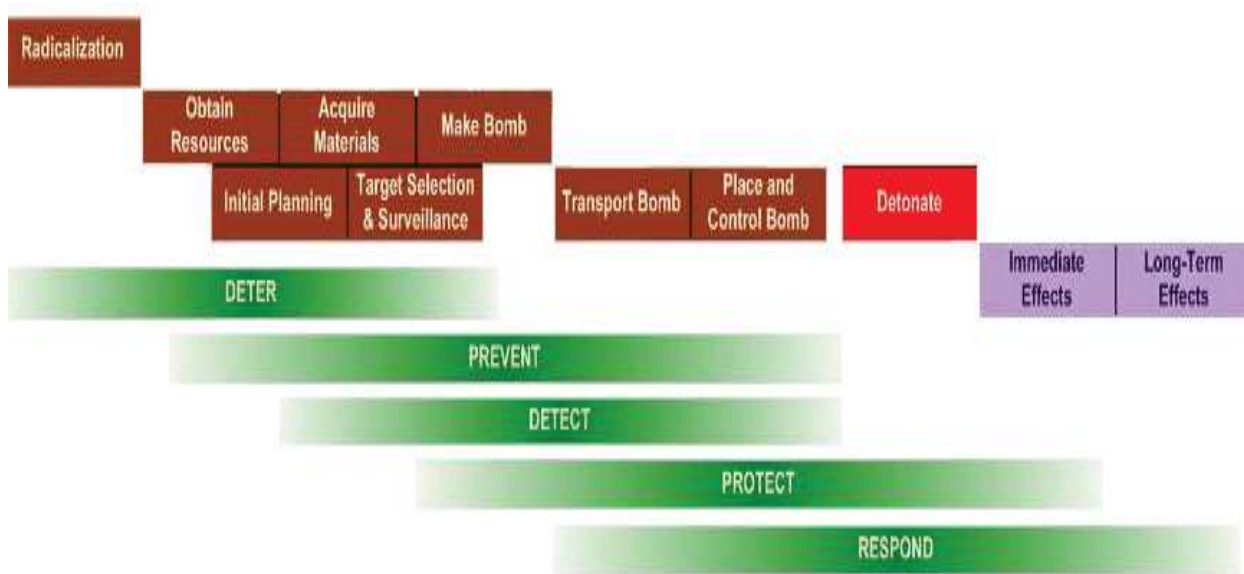
C] There is at least one case in which the rate of suicide attacks rose and it was so quick that it could not be accounted for by an increase in anomic suicide (e.g., from late 2000 through 2003, Palestinian terrorist groups carried out more than 30 suicide attacks per year, compared to an average of fewer than 4 per year during the 1990s. At the same time, the number of ordinary suicides among the Palestinians hardly changed; it actually declined slightly from 36 in 2000 to 29 in 2003)

- Suicide terrorism often occurs in teams. Team suicide attacks by their nature are based on extensive social interaction and require unity of purpose; features that are more likely altruistic than egoistic.
- Team suicides or "suicide pacts" are extremely rare among ordinary suicides. Suicide pacts account for less than 1 percent of all suicides in the U.S., Western Europe, and elsewhere.
- Suicide terrorists commonly operate in squads.
- Over the past 25 years, there have been approximately 1200 suicide terrorist attackers who completed their mission. Of these, 46% carried out

suicide attacks in which they were part of a joint mission against the same target or targets in close proximity.

- ❑ Some groups use team suicide attacks more than others: Al-Qaeda (89%), the Chechens (73%), the Tamil Tigers (64%), the Palestinians (21%) and the Lebanese (20%).

Figure 7 - Suicide Attack Sequence



- ❑ Checkpoint screeners and other security personnel need to have the right standoff systems to quickly identify persons who appear to be concealing suspicious objects and to perform subsequent manual inspections. This screening technology must have the ability to detect explosives, weapons and other concealed objects made of metal, gels, liquids, ceramics, powders, and plastics.
- ❑ Despite the considerable investment made in these technologies, there is no “silver bullet” Standoff IED, PBIED & VBIED Detection technology on the horizon. Aside from the technical challenges, issues of privacy present additional challenges to developing a highly effective system.
- ❑ There is a need for a non-invasive capability to detect vehicle-borne improvised explosive devices (VBIEDs) at a sufficient distance, and sufficient time to allow actions to be taken to safely deal with the threat posed by those devices.
- ❑ False alarms are an operational and financial obstacle. Unable to identify the composition of a suspicious object, current systems sound a general alert thereby requiring the security officer to manually inspect the object. This causes delays and increases the overall cost of the procedure.

- ❑ Concealed weapons detection is perceived as one of the greatest challenges facing the counter-terror and law enforcement communities today.
- ❑ The PBIED, VBIED & IED Detection market is in transition and augmenting “old”, legacy, off-the-shelf people screening portal technologies with a wave of new technologies and detection protocols.
- ❑ The necessary changes and advances in Standoff Explosives & Weapon Detection technologies were slower in implementation than originally anticipated by analysts, industries and users. As a result, new technologies are only now beginning to make serious inroads into the market and these new developments will probably face another competitive wave before the end of the next decade.
- ❑ Most available Standoff IED, PBIED & VBIED Detection technologies are capable of detecting one or at best two threats (e.g., weapons and explosives). Most available technologies require the detection system or some part of it to be in close proximity to the person being examined, thus increasing the operator’s vulnerability and considerably slowing the rate of processing.
- ❑ The following standoff technologies and market sectors underwent remarkable development and are ready to be deployed at high-risk locations.
 - Pass-through threat detection corridors
 - Walk-by threat detectors
 - Vehicle standoff threat detection
- ❑ There is significant demand for cost-effective products for public events and secure facilities protection.
- ❑ One of the main advantages of the technology is its capability to “see through” clothing and other materials and therefore enabling the detection

“Standoff suicide terror detection include both covert and overt methods for sensing the presence of suicide terrorists when vital assets and those individuals monitoring, operating, & responding to the means of detection are physically separated from the terrorists. The physical separation should put the individuals and vital assets outside the zone of severe damage from a potential detonation of the device or weapon”

(Source: NSF)

of metallic and non-metallic weapons and explosives. The systems and devices are able to perform PBIED, VBIED & IED Detection and providing a solution at checkpoints and compound gates where the chance of suicide bomber attacks is high.

- ❑ Standoff systems have been proven to have a triple use: HLS, defense and law enforcement.
- ❑ HLS issues are top government priority.
- ❑ Military related force protection: Driven by the high rate of casualties at the Afghanistan and Iraq GWOT inflicted by suicide bombers, military-related force protection issues are of considerable concern.

2 Conclusions

- The threat and fear posed by suicide bombers is real, persistent and will continue to be the key to the market's development. It will shape the strategy, tactics and market of the Standoff IED, PBIED & VBIED Detection market sector throughout the report period.
- Technological countermeasures are only part of the solution in the effort to defeat IEDs; experience, training, and awareness remain key factors in combating them. For example, there are visual signs that may suggest the presence of an IED, VBIED and PBIED. Recognizing these telltale signs may be as valuable as having sophisticated standoff detection equipment.
- Individuals who carry bombs on their bodies and detonate those bombs in public places are a major security problem.
- Suicide bombings currently done extensively in the Middle East, Afghanistan and India may spread to the United States if the organized terrorist groups operating in the United States are not identified and the cell members are not arrested.
- The IED threat will not end after NATO left Afghanistan. Across the globe, IEDs will remain the weapon of choice, and the asymmetric threat they pose challenges conventional doctrines and requires special skills.
- Although attacking the networks is the best way to minimize the threat, the first answers must be found on the ground by the operational and logistical troops who are challenged daily by the 'creative' skills of those who are determined to put obstacles in their way.
- Their work must therefore be compensated with an international mindset that provides better solutions to the problem. The reduction of RDT&E budgets should not be seen as the end of technology development, but rather as the beginning of a new era of cooperation between the C-IED community and industry.

- While IED's in vehicles is the primary method currently used to spread terror in Iraq, U. S. warfighters are starting to face suicide bombers. This situation can be controlled if a standoff detection capability is developed for vehicle bomb cases.
- Standoff IED, PBIED & VBIED Detection will be a major counter-terror market sector with a shifting focus depending upon perceived vulnerabilities and new technologies.
- Concealed weapons and explosives will continue to be a major market and technology driver.
- The aviation community is a primary target for terrorist organizations and PBIED's are a weapon of choice for these groups.
- Terrorists continue to improve their PBIED capabilities in an attempt to circumvent traditional security measures.
- In spite of the economic slowdown and government deficits, funding for state-of-the-art standoff systems will accelerate.
- Ever-improving terrorist tactics to defeat preventive measures will require continuous standoff detector RDT&E.
- Standoff, open space, people screening systems will become a market reality. Such systems will be designed to facilitate the simultaneous screening, covertly and unobtrusively, of large numbers of people.
- Standoff technologies will provide advanced, close proximity and remote people screening capabilities.
- Covert and overt standoff threat detection technologies will be used extensively in many security environments, including:
 1. Perimeter security
 2. Force protection
 3. Homeland and military IED attacks surveillance
 4. Protection of geographically dispersed infrastructure such as power grids, oil-gas pipelines and rail networks
 5. Secured facilities
 6. Public gathering venues and events security
- Protection of infrastructure perimeters like power stations, nuclear reactors, sensitive government and private sector perimeters.
- It appears that the only solution that may hold a promise of improved cost-effectiveness and performance will be the integration of multiple, standoff threat detection technologies in semi-automatic and automatic feature extraction software.

- The industry is in the process of moving from existing (e.g., legacy CCTV surveillance) systems to a new set of technologies, including infrared, MMWave, terahertz radiation.
- Triple-use (HLS, defense and crime prevention) Standoff Explosives & Weapon Detection products will evolve to enable both anti-terror and civilian law enforcement deployment of the same technologies (i.e., immigration control, contraband smuggling detection).
- Standoff Explosives & Weapon Detection technologies will enable several levels of security processing (e.g., integrated fast lane for frequent/trusted users and a detailed screening lane for suspect individuals).
- Future systems will use computer-aided threat detection algorithms to reduce the dependence on human operators.
- The Standoff IED, PBIED & VBIED Detection market and technology will evolve to include a plurality of advanced performance, hand-held devices and an additional line of portable systems.
- Labor costs are, and will remain (for the forecast period) a key factor. As long as high unemployment rates persist in major markets, governments will deploy labor intensive systems. Once unemployment stabilizes, labor (specifically the related costs and inefficiencies) will be the Achilles heel of standoff systems. Developing less labor-intensive methodologies will become a major industry challenge.
- Demand will increase for the use of Standoff IED, PBIED & VBIED Detection Systems at public venues such as casinos, amusement parks, sports arenas and possibly shopping malls.
- The need for better Standoff IED, PBIED & VBIED Detection technologies will drive the deployment of premium and high priced products and services.
- Embedded software will be developed to simplify the operator interface, reduce training time and costs, and minimize the “human” factor in assessing the presence of a potential risk.

More information can be found at:

Standoff IED, Person-Borne & Vehicle-Borne Explosives & Weapon Detection: Technologies & Global Market – 2015-2020