



CENTER FOR SECURITY POLICY

Israeli Innovators in National Security Technology

Case Studies for US and International Technology Transfer

2013

**Israeli Innovators in National Security Technology:
Case Studies for US and International Technology Transfer**

The Center for Security Policy

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Foreword

Israel's deserved reputation as a source of groundbreaking innovations in both pure and applied science and engineering, for both military and civilian applications, is known world-wide. Many US-Israel partnerships at both the governmental and private levels have fostered a two-way transfer of research and development expertise as well as investment and marketing support. This 21st Century pioneering effort has been captured in best-selling books, supported by incubators in Israel and in the US, and amplified through an expanding network of websites and associations. The last decade has seen expanded cooperative agreements forged by individual offices in many US state governments with Israel, as well as agreements at the federal level, to encourage technology innovation and entrepreneurship in both countries.

The Center for Security Policy presents "Israeli Innovators in National Security Technology: Case Studies for US and International Technology Transfer - 2013" as part of the Center's Occasional Paper series. The paper is the first of an intended annual series, and is intended to provide a sample of important innovations to better inform the public of emerging technologies. The paper features ten case studies of innovative and potentially game-changing technologies that are currently improving national security or homeland security capabilities in Israel or that have a significant potential to do so. Most are from small companies, though not all, the significant exception being the Iron Dome missile defense system. All are noteworthy for their potential applications for protecting the national security and homeland security of the United States and our allies.

The Appendices include sample lists of associations and websites that both enable and educate the public on Israeli innovation or the Israeli-US technology partnerships, and a list of key cooperative agreements at the federal level and for numerous states.

Table of Contents

BETH-EL INDUSTRIES	7
<i>Defining the problem:.....</i>	<i>7</i>
<i>Solving the problem:.....</i>	<i>8</i>
<i>About the company:</i>	<i>9</i>
CAMERO TECHNOLOGIES LTD.	11
<i>Defining the problem:.....</i>	<i>11</i>
<i>Solving the problem:.....</i>	<i>13</i>
<i>About the company:</i>	<i>13</i>
DSIT SOLUTIONS LTD.	15
<i>Defining the problem:.....</i>	<i>15</i>
<i>Solving the problem:.....</i>	<i>16</i>
<i>About the company:</i>	<i>17</i>
FLOW-INDUSTRIES LTD.	20
<i>Defining the problem:.....</i>	<i>20</i>
<i>Solving the problem:.....</i>	<i>21</i>
<i>About the company:</i>	<i>21</i>
IRON DOME	24
<i>Defining the problem:.....</i>	<i>24</i>
<i>Solving the problem:.....</i>	<i>25</i>
NOWFORCE	28
<i>Defining the problem:.....</i>	<i>28</i>
<i>Solving the problem:.....</i>	<i>29</i>
<i>About the company:</i>	<i>31</i>
PLASAN SASA.....	33
<i>Defining the problem:.....</i>	<i>33</i>
<i>Solving the problem:.....</i>	<i>34</i>
<i>About the company:</i>	<i>34</i>

RADA ELECTRONIC INDUSTRIES LTD.	37
<i>Defining the problem:</i>	<i>37</i>
<i>Solving the problem:</i>	<i>38</i>
<i>About the company:</i>	<i>40</i>
ROBOTEAM LTD.	41
<i>Defining the problem:</i>	<i>41</i>
<i>Solving the problem:</i>	<i>41</i>
<i>About the company:</i>	<i>44</i>
SERAPHIM OPTRONICS LTD.	46
<i>Defining the problem:</i>	<i>46</i>
<i>Solving the problem:</i>	<i>47</i>
APPENDIX	50
<i>Foundations and Organizations:</i>	<i>50</i>
<i>Websites and Publications:</i>	<i>51</i>
<i>Key Cooperative Agreements between Israel and the United States</i>	<i>51</i>
<i>Cooperative Agreements between Israel and Individual States</i>	<i>53</i>

Beth-El Industries

Beth- El Industries produces air filtration and ventilation systems, for bomb shelters, military vehicles and medical isolation and transportation facilities. The company provides clean air to those in harm's way.

Defining the problem:

When you're looking for a new house or apartment, what are the first questions you ask? How much square footage is there? Does the stove run off of gas or electric? What are the schools like in the area? Which room is the safe room?

Like most people in America you're probably confused by the question regarding a safe room. But, in Israel this is one of the most common questions a realtor will hear. Today's threats posed by chemical and biological weapons are very real and an attack can happen in your backyard. Rogue states and terrorist groups are making serious efforts to obtain chemical and biological weapons. Given the uncertainty of these dangerous terrorists, it would be irresponsible not to prepare for the dangers at hand and a safe room is one way to prepare.

The starting point at Beth-El is the consideration of the many and diverse threats to the air that are sadly available in the world today. Asymmetric threats are now the norm, not just for troops on the battle field but also for the general population. Homeland security is not a new idea but it has a new meaning. Sadly, it should be assumed that terrorists groups have, or will have access to agents of unconventional warfare. The possibility of attacks using such agents is very real. The main feature and danger of such threats would be the surprise effect, which would leave insufficient warning time for protective measures and would probably be intended

to affect the air breathed by millions. In addition, industrial chemicals released intentionally or unintentionally, create a further threat.



With this in mind from the beginning, Beth-El dealt with the development and

manufacture of complex collective protection filtration systems for bomb-shelters for the Israeli Civil Defense Command. It has now installed hundreds of thousands of systems in the bomb-shelters of private homes, hotels, hospitals, schools, day-care centers, homes for the elderly and many other civilian and military facilities. These systems have been tested not merely in exercise scenarios, but have also been proven in times of actual crisis.

In Israel, when warning sirens go off and an NBC (Nuclear, Biological or Chemical) attack is announced, civilian populations are required to put on gas masks and seek shelter until the warning has been called off. This leads to people hunkered down in sealed rooms wearing gas masks for hours on end. The main advantage of using a collective protective system as opposed to the old style gas masks is the level of protection offered to the complete person and not just to the person's respiratory system. Protective suits and gas masks are difficult for disabled and frightened children to put on and prolonged periods of time in sealed areas wearing gas masks - with no fresh air- can lead to high levels of anxiety as well as respiratory difficulties but with a safe room equipped with a filtration unit you can avoid this.

Solving the problem:

When the warning sirens go off you can quickly grab your family and head to your safe room. Once you make sure the room is closed you can turn on the filtration system and know that your family is breathing clean air - without the need for gas masks or protective gear. The **“Beth-El Rainbow 36 filtration system”** is most used for families of up to 6 members. If the power goes out the blower has a rechargeable battery that will allow it to function for approximately 10 hours. The system also comes with a hand pump in the case of battery depletion. For larger rooms, holding more people, Beth-El offers protective systems ranging from the Rainbow 36 to large scale filter batteries offering collective protection for over 100 people.



Beth-El may have started with offering collective protection in buildings but the need for this type of protection is not just for the civilian population. Using the same idea of 'complete protection', Beth-El has developed systems which offer solutions for modern armed forces. The biggest challenge here is to construct a filtration system that can operate on a continual basis in vehicles, as well as in stationary and mobile infrastructure over a period of months. This goal has been achieved through various patented technologies, for example, through the development of a cyclone filter whose dust- and fine-dust separation capability has been developed to such an extent that it prevents the clogging of the downstream protection filter, even in the most adverse weather conditions. Filters were commonly said to "age" due to degradation by humidity. By their special impregnation of the active charcoal, Beth El has minimized such "ageing", making its filters suitable for continuous operation.



About the company:

Although the company has only exported its products since 2001, today it is the world's leading company for collective protection in armored vehicles. Beth-El has been resolved to assess and understand evolving threats in dynamic operational scenarios; and to take this



understanding as the foundation for the design of its novel products, products which are technologically sophisticated, yet simple to operate.

These systems are based on an entirely new conceptual approach and are therefore not directly comparable to conventional systems. As a result of this development, the company has become the main supplier to almost

all NATO armies in just 3 years.

After the SARS and Swine flu epidemics that we have experienced recently throughout the world, a series of special, portable isolation chambers and compatible filtration systems have been developed by Beth-El to offer the same protection and comfort-of-use for use in ground and airborne ambulances.

Founded in 1977, Beth-El Zikhron Yaaqov Industries, a subsidiary of the Beth-El Group, is just one of many companies established on Kibbutz Beth-El. Over the years the Beth-El Group has grown to include numerous companies - most of which involve filtration technology of some kind but also delving into areas such as fine cuisine, chocolates and goose down comforters.

Camero Technologies Ltd.

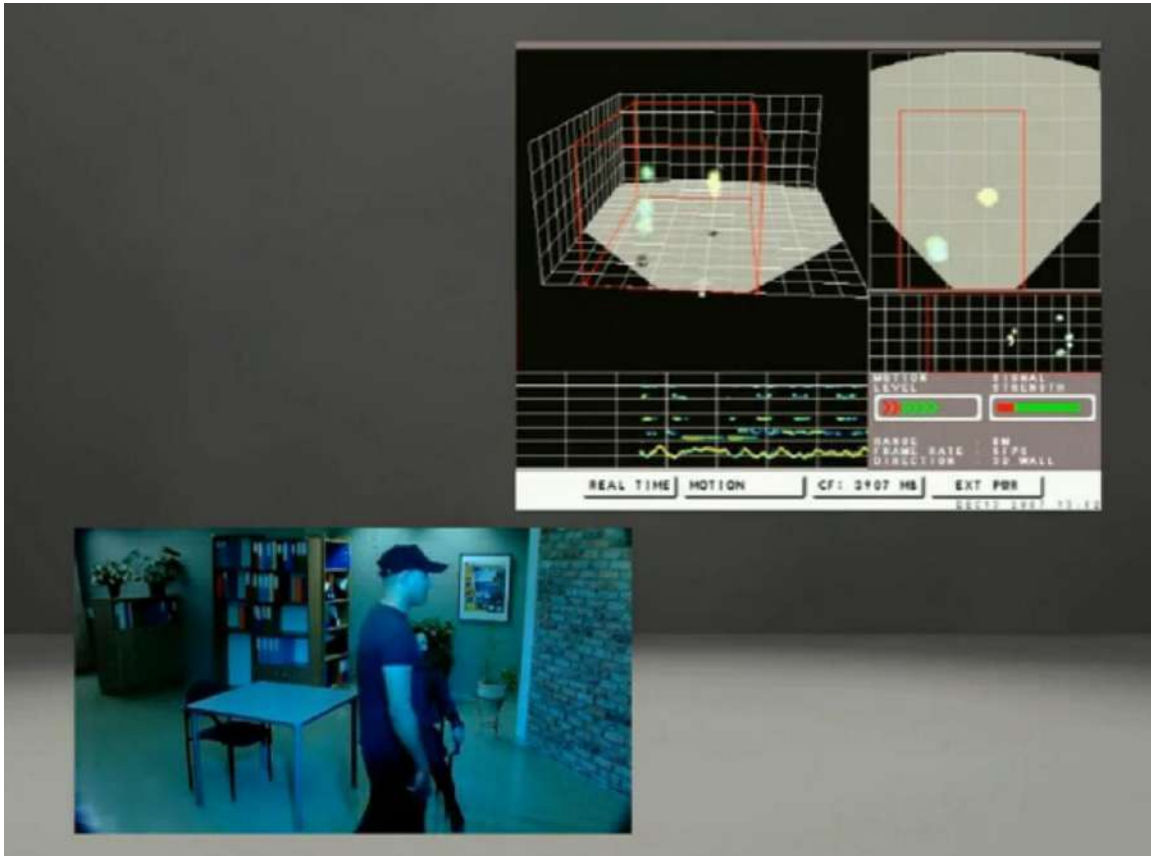
Founded in 2004, Camero (Camero-Tech Ltd.) develops and markets Radio Frequency (RF) imaging systems for 'Sense through the Wall' (STTW) applications. Camero's Xaver family of products includes the Xaver 800, 400 and tactical Xaver 100 hand-held sensors.



Defining the problem:

Intelligence operatives recently received information pertaining to the location of a hostage who was taken captive a few weeks ago. It is your job to deploy a Special Forces team to safely extract the hostage. Unfortunately intelligence on the hostages' location is limited. This means your extraction (ex-fil) team is entering with a low level of situational awareness. Your team successfully executes a surreptitious approach to the back of the building. However, a one foot concrete wall and an unknown number of insurgents separate you and rescuing the hostage. If only there was a way to know what's going on inside without being detected.

Luckily, a member of the ex-fil team is carrying the “Xaver 800” the 35lbs. system is designed to fold up for easy portability, and conveniently fits in a backpack. With two hours of battery life, the system is able to penetrate all standard building materials including concrete, wood, brick plaster and drywall. The Xaver is a radar system that utilizes sound and ultra-wide radio waves to produce a 3-dimensional image of what is happening on the other side of walls. The system’s range is accurate up to 20 meters from the target.



“[W]e find ourselves more and more in urban settings doing different operations and the need to know exactly what's beyond the wall has become very, very apparent.” said Josh Levontin, Director of Business Development for Camero technology.

Military and law enforcement would be far safer if each team had the powers of Superman. Being faster than a speeding bullet and leaping tall buildings in a single bound would be helpful for any law enforcement and military unit. While we may not be more powerful than a locomotive; ballistic vests are allowing our military to take a bullet and now with the help of the Xaver series by Camero Technology your team is able to see through walls.

Solving the problem:

The Xaver uses micro-power pulse radar technology that emits a broad range of radio signal pulses and then analyzes the wave data to instantly produce an image on the screen. These images enable your ex-fil team to discern figures of combatants guarding a seated hostage.



According to Mr. Levontin, *“The Xaver line of products is a radar-based technology that allows us to actually sense through the wall and provide some wartime fighters ... with a very interesting approach to their tactical environment.”* It allows operators, who receive little training, to know exactly where the bad guys are, and with that information, your team is able to go in; neutralize the threat, and rescue the hostage.

Camero Technology created the Xaver family of products to address needs for Intelligence, Surveillance and Reconnaissance (ISR) Platforms

utilizing Sense-Through-The-Wall (STTW) solutions. If you’re looking for a smaller tactical system, Camero makes two additional model Xavers; the **“Xaver 400”** and most recently the **“Xaver 100”**. Both of these smaller, lighter devices are perfect for portable and rapid ISR needs such as locating combatants behind a doorway. The Xaver 100 is designed as a quick, hand-held, pocket-sized tool for providing critical tactical information.

Using the same core Ultra Wide Band (UWB) radar technology found in the Xavier systems Camero is developing a Concealed Weapons Detection (CWD) system. With the goal of providing real time imaging of potential threats through non-evasive means.

About the company:

Camero-Tech Ltd. was founded by Aharon Aharon and Amir Beerli in July of 2003, when Mr. Beerli, who was working for the Jerusalem Global venture capital fund (JVG), developed a way to



emit and analyze Ultra-Wideband (UWB) radio waves. Mr. Beerli has since been named the company's CEO and Mr. Aharon has left the company to lead the new development center for Apple Inc. in Herzliya.

The Xaver products are currently being used in more than 20 countries around the world for both law enforcement and military use. The company has an ongoing contract with U.S. Special Operations Command (SOCOM), as well as several law enforcement agencies throughout the US.

Recently, the company was acquired by a consortium of Defense and Security companies known as the SK Group. Based in Kfar Netter, the company now boasts over 20 employees, and will operate under its original name. With the development of the Xaver 100, Camero-Tech continues to develop smaller more effective units. They are truly a company worth setting your sites on.

DSIT Solutions Ltd.

DSIT Solutions Ltd. provides sonar systems for harbors, ships and underwater assets such as energy terminals. The system developed by DSIT is able to detect some of the smallest underwater threats including individual swimmers.

Defining the problem:

Like much of the world, the shipping industry in your city is probably one of the largest employers in the area and is critical for your local and national economic well-being. You're probably not even must be aware of how important underwater assets are to your livelihood. As much as 90% of intercontinental trade is moved by sea - from the phone in your pocket to the fork you're using to eat dinner. There are approximately 3,500 energy terminals, throughout the world's waterways, bringing power to your home and business. Ships, harbors, oil and gas terminals, underwater pipeline and cables, offshore platforms and nuclear power facilities and many other critical coastal offshore facilities are susceptible to underwater attacks.

One attack on a harbor could destroy vital infrastructure to your city and cost billions to repair. Numerous potential underwater terrorist plots have been discovered over the past few years. In March 2005, the Philippine military, after interrogating a captured bomber, found that two of Southeast Asia's most dangerous terrorist organizations linked to Al Qaeda were said to be jointly training militants in scuba diving for various attacks at sea. Additionally, the *Wall Street Journal*, on November 2nd, 2011, described the world's vast undersea energy infrastructure; oil and gas platforms, wellheads, pipelines, and pumps, as vulnerable to attack by cheap submarines and unmanned vehicles.

Although detecting small boats or other small crafts in a large area of water is difficult, it is nearly impossible to detect an individual swimmer or scuba diver (also known as frogmen), who, with the



assistance of a Swimmer Delivery Vehicle (SDV), can easily enter an open body of water. Passive sonar cannot detect everything; in particular it cannot easily detect divers and surface swimmers; and while it can detect direction, it cannot detect distance unless you link the readings from two or more listening stations. DSIT Solutions has developed a sonar system to detect threats of this nature that are small in size. *“[T]he smarts of the system lies a lot in the algorithms which enable high probability of detection and classification and on the other hand local mobility of false alarm”* said DSIT CEO Benny Sela.

Solving the problem:

In the field of Homeland Security DSIT provides a line of underwater security systems including its flagship **AquaShield Diver Detection Sonar** (DDS) system for fixed installation and



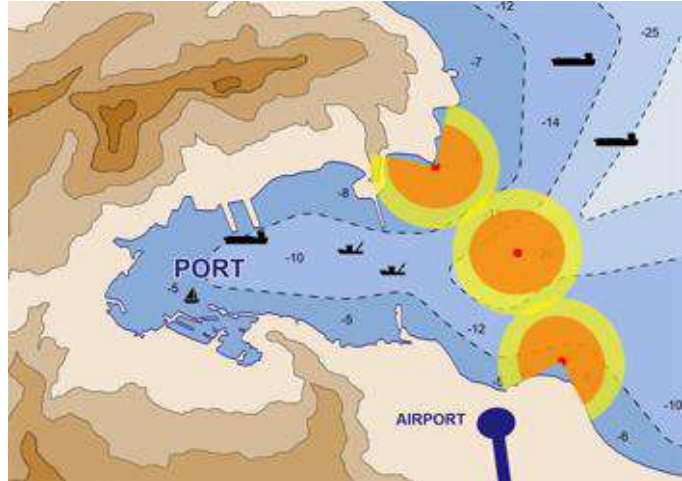
the **PointShield** (Portable DDS) for the protection of ships at anchor or small underwater areas. These systems are designed to protect critical coastal and offshore sites against unauthorized intrusion such as divers and mini submarines. A terrorist frogman interested in placing limpet mines on a naval vessel docked at port would most likely approach the port on a small surface vessel and then scuba dive the rest of the way to the vessel. As he approaches

the harbor, the terrorist would be detected at a distance great enough to enable the security team to launch a response. The AquaShield and the PointShield are completely automatic systems that do not require a trained sonar operator. Targets are detected, tracked, classified as a threat and an alarm sounded at the moment of classification with a low false alarm rate.

Multiple sensors can be employed together in a single system to cover very large underwater areas. Each AquaShield node is able to detect up to a thousand of targets (of any size) at a time at distances upwards of 1,500 meters from the sensor. If the region requiring protection is smaller and requires less range or if there is a need for a system to be deployed off of a ship, the **PointShield** provides the same accurate automatic operation as the DDS with the advantage of light weight and portability. The PointShield can also be installed permanently, just

as the AquaShield, for the protection of smaller areas. This system only requires one person to man the command center and removes the need for trained sonar operators.

DSIT's expertise in the field of acoustic signal processing and analysis is also applied to a number of other military applications including the company's Underwater Acoustic Signal Analysis (UASA) system which processes and analyzes all types of acoustic signals radiated by various sources and received by passive sonar systems (submarine sonars, towed arrays and fixed bottom moored sonar systems). The UASA applies advanced processing algorithms to derive identification parameters of the signal source. A chiefly maintenance system, the company's "**Portable Acoustic Range (MAR)**" measures the radiated noise coming from ships and submarines. This enables navies and shipyards to monitor and control this noise and silence their vessels. The MAR's unique design enables rapid deployment at any sea depth. The MAR system enables real time noise processing, investigation and display through continuous tracking of the measured vessel and wireless communication of data to a measurement ship.



Throughout the last decade the company has gained extensive experience simulating different active and passive sonar systems. DSIT has developed a wide range of Generic Sonar Simulators (GSS) for all types of sonar systems both land and ship based. DSIT's flagship sonar trainer "**The Submarine Tactical Trainer**" accurately simulates all sonar and weapons systems present on board a submarine. It will enable submarine crews to train in conditions that are indistinguishable from those of a submarine at sea.

About the company:

DSIT Solutions Ltd. specializes in sonar and underwater acoustic technologies for defense, commercial and homeland security markets. It has operated as a subsidiary of Acorn Energy, Inc. ([NASDAQ: ACFN](https://www.nasdaq.com/markets/stocks/ACFN)), a holding company focused on energy infrastructure asset management, since 2005. Acorn invests in and develops small companies with promising energy technologies. They developed an interest in DSIT because of their security solutions for energy infrastructure.

Mr. Benny Sela has been the CEO of DSIT Solutions Ltd. at Acorn Energy, Inc. since July 1, 2007. Mr. Sela has worked with DSIT since 1989 having previously been the Executive Vice President and Head of the company's Real Time Division, since 1996.

Founded in 1985, DSIT develops sonar and acoustic solutions and acts as a system integrator for advanced Security Command and Control (C2) systems. Their systems serve navies, shipyards, and commercial energy companies in Israel and internationally from its headquarters in the Tel Aviv district of Givat Shmuel, Israel. DSIT's main field of technological expertise is sonar and underwater acoustics, which is the method of addressing any active or passive, transmission and/or reception of sound waves traveling through the water. DSIT systems' applications are wide-ranging in order to meet the specifications of naval forces and other clients.

DSIT has a constant goal of improving the proficiency of underwater threat detection, as well as growing its business and they have shown solid performance. DSIT systems have been so successful at protecting underwater assets that the company's system was installed in the world's first major underwater security system at the large Naftoport oil terminal in Gdansk, Poland.

DSIT successfully demonstrated the PDDS at a U.S. energy facility, and is looking to take advantage of Homeland Security opportunities in the U.S. market. In December of 2011, DSIT announced that it received its largest order ever for underwater security systems, from an undisclosed Asian buyer. DSIT received an order for equipment to protect off-shore oil platforms, and high value vessels against potential acts of terror and sabotage. The value of the contract totaled \$12.3 million. This sale has established DSIT as the world leader in underwater security systems for the energy sector.

Though, established to provide energy infrastructure security, DSIT has recently obtained major military contracts and, may develop into a defense contractor as opposed to an energy service provider. The company has been increasing both personnel and manufacturing capabilities to meet the growing number of orders for their underwater security systems. They provided DDS and PDDS systems to the Israeli Navy following a comprehensive review and evaluation process in which the Navy investigated competing systems and competitively selected those of DSIT.

Acorn Energy invests in and develops small companies with promising energy technologies and, from time to time, sells a successful operation at a substantial profit. In 2011, Acorn sold

its subsidiary CoaLogix for \$101 million and after several recent defense contracts; DSIT's financial numbers are not all that dissimilar to those of CoaLogix before it was sold. These facts allow market experts to speculate an acquisition value of DSIT at approximately \$100 million.

Flow-Industries Ltd.

Flow Industries: Producer of the AIRSHOCK Impulse Generator (AIG), a tool designed to clean water wells in an eco-friendly manner, may be able to help make hydraulic fracturing a little bit greener and more efficient. Additionally, this innovation can lead to an increase in the production of oil and natural gas.



Defining the problem:

“End Fracking Now, End Fracking Now” is the chant that can be heard from an environmental protester at the sight of a new natural gas well. When you approach one of the activists and ask him what’s going on, he says *“They’re fracking here, and we need to stop it”*. Immediately, the first thought to go through your mind is, what is fracking? The activist proceeds to explain to you that Hydraulic Fracturing, also known as ‘fracking’, is a process that extracts shale oil and natural gas from the ground. He describes in detail how companies drill

between 6,000 and 9,000 feet into the ground and injects a highly pressurized mixture of water, sand and chemicals, also known as 'fracking fluid', into rock and literally fractures the bedrock in order to more easily extract the fossil fuel and gas in the ground.

So, what's wrong with fracking? The activist goes on to describe the risks of groundwater contamination and surface spills. He discusses how fracking fluid requires a concoction of hazardous chemicals and uses an exorbitant amount of water. Additionally, once that water is used; it is contaminated with salt, chemicals and even radioactive materials.

As an individual who cares about the environment as well as, energy independence, your thoughts lead you to wonder, if there possibly a way we can make fracking more eco-friendly? The answer is; YES!

Solving the problem:

The **"AIRSHOCK Impulse Generator (AIG)"** gun developed by Flow Industries is making great strides in the effort to clean up fracking and make it a "greener" prospect. *"Our proposition is not to replace fracking, but to make it more efficient, less costly and to reduce the need for the fluid"* Said Oded "OD" Rose, CEO of Flow-Industries.



The AIG is used all over the world to rehabilitate water wells with dropped capacity. The design consists of the patented impulse generator, high pressure hose reel, control panel and one or more compressed nitrogen or air cylinders. As the compressed gas feeds through the hose and into the Impulse generator, pressure builds

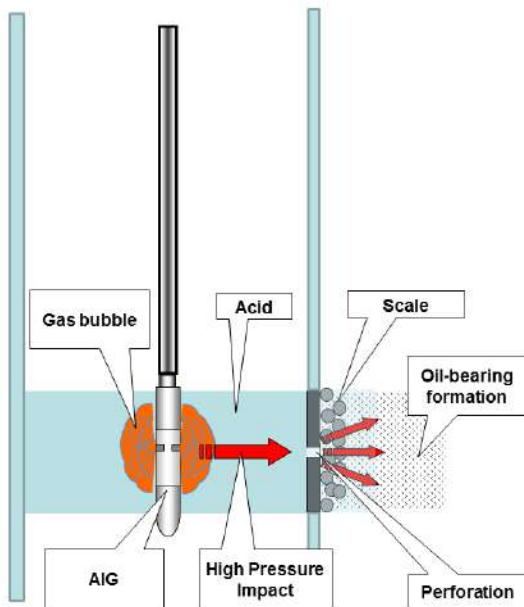
up and a pulse of compressed air creates a shock wave. This shock wave is used to remove mineral deposits that accumulate and clog up the screen, gravel pack and surrounding area of a well. In many places, hydrochloric acid is often used for the purpose of cleaning blocked water wells, but this caustic agent can leak into water sources, as well as prove dangerous to workers handling the material. So, what does this have to do with fracking technology?

About the company:

Flow Industries Ltd. (which changed its name in 2010, from Prowell Technologies) was created in 1997 to offer water capacity increasing technology in water wells. At present, the

water management company Layne Christensen utilizes the AIG to rehabilitate water wells in America under the name Bore Blast II. Currently, Flow Industries is in the testing phases of using the AIG generator for stimulation of oil and natural gas. Using the same principles, the AIG can be utilized for the enhancement of fracking.

By using the AIG, a company can create an effective pre-fracking or "mini-fracking" procedure which creates short but intensive net of fractures around a well. In case of low-production wells this can be much more cost-effective solution than regular hydro fracturing. *"If you use our technology to help the fracking process you need to use less water and less water pressure than the regular fracking process"* said Mr. Rose. By replacing part of the process of fracking with high pressure repeated shock waves from the AIG it may be possible to significantly reduce the need for fracking fluid and energy spent to pump it.



The AIG is able to function at depths of approximately 2000 ft and the company is in the final stages of testing depths a few thousand feet deeper. Flow Industries has had some success in shallow oil wells of up to 2000ft. By cleaning paraffin and other deposits and stimulated the oil wells it was able to increase oil production in those wells. In one situation, the company boasts that it stimulated a clogged oil well, and in doing so, increased production 7 fold for at least 6 months.

That success behind, the current step for Flow-Industries getting the AIG working at

depths of up to 6000 to 9000ft., which covers most of the oil wells in America. The next step is to reach a minimum of 12,000 ft. which covers most deep wells and where the fracking for shale oil and natural gas predominantly occurs.

While the AIG technology has been proven in multiple industries, it is not yet clear how it will perform in wells and channels for oil companies drilling 3,200 to 16,000 ft. underground. At the moment AIG is a leading technology in water where drilling goes between 300 to 1000 ft. deep.

Flow Industries other products address tough clogging problems in heavy industry such as cement, chemical and power plants throughout the world. The company is also expanding its applications with a patented technology to stimulate heavy oil wells such as those in Alberta, Canada,

The next time you walk past a fracking protestor, you may see him carrying a jug of dirty water and asking “would you drink this?” Your first thoughts are; heck no! Then you realize that with the AIG being tested to aid in fracking, that problem won’t exist anymore.

Iron Dome

Iron Dome is a missile defense system, designed by the company Rafael, to defend against threats from short range projectiles. The system has been responsible for shooting down over 400 rockets aimed at Israel's population centers and has a success rate of approximately 90% (A higher success rate than any previous anti-missile system).



Defining the problem:

Operation pillar of defense lasted just over a week in November of 2012. Throughout that time, the sound of sirens wailed through the streets of Tel Aviv and pictures of Israelis crouching on the ground seeking shelter protecting their children filled the news. During this same time over 1500 rockets were fired into Israel. The operation played itself out in the news and online.

You may even have been watching from your computer as a veritable 'twitter war' was taking place and videos of the violence were going viral. Tweets by the Israeli government announced the use of the Iron Dome system when Hamas terrorists fired Iranian Fajir-5 and Qassam rockets over Israel's civilian population. Watching the videos of the Iron Dome at work wasn't that exciting. When watching it you heard several popping noises and saw small light flashes that looked like a bad fireworks display coming from several small explosions in the sky.

While the small light display might not be impressive to some; Iron Dome intercepted an estimated 400 rockets and reportedly held an accuracy rating of approximately 90%. But what exactly is the Iron Dome system?

Worrying about whether or not a rocket is going to land in your backyard or your child's school is a constant terror. The asymmetric threat from short range rocket attack on civilian populations is a growing problem. *"No nation should have to live in fear of these kinds of attacks,"* Said Secretary of Defense Leon Panetta, and this is exactly why the Iron Dome system was designed; to specifically address the problems posed by these rocket threats.

Solving the problem:

Iron Dome allows for instantaneous predictions of a rocket's point of fire as well as its landing point, it is able to intercept a threat within 15 seconds of its launch, sometimes even before the warning sirens go off.

The system was developed by Rafael Advanced Defense Systems and has been described as a bullet hitting another bullet in mid-air. It took only 4 years to develop and is comprised of 3 separate components working together in concert with each other; a radar system, control center and a missile firing unit.



The Iron Dome radar, designed by ELTA Systems Ltd. - a subsidiary of the government owned Israeli Aerospace Industry Ltd. - is a variation of their Multi-Mission Radar (MMR) family of

radars. When a Hamas terrorist fires a rocket into Israel, the radar system is able to locate, track the threat, then assess the trajectory of the incoming rocket.



The information gathered by the radar system is then sent to the Battle Management & Weapon Control (BMC) Center. This control center built by mPrest systems - a privately owned software company (half owned by Rafael) - is designed to synchronize the systems and utilize the information received

from the MMR to launch an advanced missile with electro-optic sensors called the Tamir interceptor missile. The missile, designed and built by Raphael, launches from the Missile Firing Unit, to intercept the threat.

The Tamir interceptor missile is affixed to a launcher containing 20 interceptors. With each battery comprised of 3 launchers, the system can hold 60 missiles capable of targeting rockets from ranges of approximately 75 kilometers away.

The company Rafael, originally founded in 1948 was the National Defense R&D Laboratory for Israel's Ministry of Defense before becoming Rafael in 1958. After financial losses in the 1990's, Rafael restructured and in 2002, formally incorporated.

Israel has deployed 5 batteries throughout the country. Each defense missile costing somewhere between \$50 to \$90 thousand and a full battery estimated at \$50 million each, you might ask, is it worth it, to fire a \$90 thousand missile at an unsophisticated homemade rocket costing between \$200 to \$500?

Hamas has the intention - with the acquisition of larger more destructive weapons - to expand their power and influence. With the acquisition of longer range Fajr-5 missiles from Iran, Hamas is attempting to increase their power and influence by threatening an even larger range of Israel's population.

The Iron Dome system severely limits the threats posed by Hamas, as well as other potential attackers. This system greatly handicaps the bargaining power that Hamas enjoyed in the past through perpetrating long-range terror attack campaigns.

Rafael created and developed the first batteries used in the Iron Dome system. Israel was set to construct several new Iron Dome batteries but budgetary shortfalls delayed construction. The system was expanded after the United States President and the Congress approved nearly \$900 million in funds to further develop the system.

While the development was costly, manufacturing the missile is actually very low. The price tag for the missiles reflects the cost of the systems development. The cost is spread over the small amount of missiles that are actually in existence and the cost will decrease with the production of additional missiles.

With the price tag to the American taxpayer at nearly \$1 billion dollars, and the success of Iron Dome, the U.S. has shown renewed interest in Missile defense including a considerable interest in deployment of the Iron Dome system to military installations located in forward areas.

Numerous missile defense systems, such as tactical lasers as well as other missile to missile systems are currently under development by major defense companies. In 2011, Rafael teamed up with the U.S. company Raytheon to market the Iron Dome system to the United States. Raytheon is now teaming up with Rafael to jointly develop a longer range system to handle medium range missile threats from ranges between 70 and 250 kilometers, known as David's Sling. This system is set to be operational in 2013.

The Iron Dome system has saved countless lives and was openly credited as the reason you never read about Israeli troops being deployed into Gaza. Because of the effectiveness of the Iron Dome, Israel's government had the luxury of negotiating a cease fire with the Palestinians instead of launching an immediate offensive as it would have done in the past.

NowForce

NowForce is an emergency response system which utilizes smart phones to respond to emergency situations. The cloud-based solution shortens response times and allows for greater situational awareness during emergency situations.

Defining the problem:

Imagine sitting in a coffee shop and the gentleman next to you has a heart attack. You call 911 and the dispatcher calls responders - on a closed system radio – to respond to the emergency. An ambulance is dispatched but it takes 11 minutes from the time the call was made until the EMT arrives. In life and death situations such as this, every second counts. The amount of time the man spends waiting for help to arrive directly determines if he lives or dies. This situation is an example of the so-called “last mile” problem and is the challenge with which emergency response organizations struggle on a daily basis.

The “last mile” is that final interaction point between recipients of emergency assistance and emergency responders. ***“The desire to decrease response times, increase situational awareness and bridge communication gaps are universal priorities among all public safety executives.”*** - Jason Goldberg, sales manager, North America, for NowForce.

Eleven minutes is a very long time when dealing with a life and death situation. Getting the right emergency responders to the scene in the quickest manner possible is the highest priority for emergency response organizations. Many of the major challenges for emergency organizations occur exactly in this “last mile.”



United Hatzalah, a volunteer emergency medical service in Israel, tried to find a way to improve their response times and ensure that the proper emergency responders arrived at incidents as quickly and efficiently as possible. To address this issue in 2008, Anshel Pfeffer, a long-time volunteer EMT, developed the Life Compass project for United Hatzalah which led to the creation of NowForce.

NowForce is placed on users' smartphones and assists emergency response organizations in overcoming the last mile problem, which has remained a challenge even in the age of Computer-Aided Dispatch (CAD) systems. Initially called SNAP (Send Nearest Available Person), NowForce aims to find the closest available, relevant person to dispatch to the scene.

NowForce utilizes smart phones and a simple web-based browser to create an on-demand cloud-based emergency response network for fire departments, EMTs, police and private security organizations. This system allows dispatchers to pinpoint the closest emergency responder in the area available to arrive at the scene of an incident as rapidly as possible. Sending the closest available responder to the scene allows response times to be faster, which enables emergency responders to handle more events quickly and efficiently.

With this system, not only is an ambulance dispatched to the man having a heart attack but the dispatcher can see the location of all nearby responders and then send the off-duty EMT who happens to be down the block, obviously a much faster response than an ambulance that takes 11 minutes.

Solving the problem:

NowForce solves a problem that exists with standard voice radio communication - Computer-Aided Dispatch (CAD) - systems. These systems allow organizations to communicate

with fixed resources. But if a responder leaves his vehicle or is on a day-off, he is considered "off-network" and inaccessible. If the responder is without a radio communication system, which is typically the case when off duty, he is unable to be reached and can no longer be part



of a critical lifesaving emergency response.

NowForce runs on the emergency responders' existing GPS-enabled mobile phones, eliminating the need to purchase additional hardware or software. This allows a wider reach to responders. Whether they're on-foot or off-duty, they remain connected to the network. An advanced privacy feature enables the responders to remain anonymous to the dispatcher until they choose to identify themselves.

NowForce offers a designated web-based command center enabling dispatchers to identify the closest relevant responders and notify them through their phones. **"NowForce Mobile Responder"** is a portable mobile application that can be downloaded from any app store. NowForce Mobile Responder offers several different modules to help in emergency situations. Integrated into that is a personal application for citizens known as **"NowForce SOS"** (also offered as a separate solution), an around-the-clock personal safety application. This equips users to instantly transmit distress signals by simply pressing a button on their cell phones. When the panic button goes off the system automatically notifies the organization's call center. Using the **"NowForce Dispatcher"** application, the call center enables the emergency dispatcher to quantify the emergency and notify emergency responders' through their phones to ensure qualified responders are dispatched based on location, availability, and skills required to the event scene. The NowForce solution simplifies the distribution and administration of emergency responders with faster, increasingly efficient and more accurate results. Additionally, responders will now always be on-network and can be tracked by dispatch.

Dispatchers use the **"NowForce Interface"**, which identifies new events from a variety of existing dispatch sources, allowing full real-time command of hundreds of concurrent missions. It automatically logs critical information about each mission for ongoing reporting and record keeping.

To continuously assure mission quality and responder performance, NowForce offers an add-on module for business intelligence called **"NowForce BI"**. The BI Reporting Engine provides analytic tools to allow



for detailed evaluations of event data. Incident and response statistics are given to organizations to show key performance areas and allow for more effective decision making. Responder performance may be reviewed on both an individual and aggregate basis in order to focus on areas that would benefit from organizational improvement.

During major emergencies (such as Hurricane Sandy) connectivity problems can occur. More than likely phone capabilities are diminished, in the majority of these cases, state and local municipalities request that civilian devices be limited in their functionality so public safety officials can use the phone communication channels as a secondary mode of communications in addition to their voice radio. In situations such as Hurricanes Sandy or the earthquake that hit Washington DC in 2010, voice and text communications were impaired but people were making Facebook updates from their phones because data connections were still operational.



NowForce is not a replacement for a voice radio system, but during emergency situations that bring down cell coverage, since data and voice/text are transmitted in different pipelines, the application may continue to work if voice/text is no longer available or if the user is connected to an active wifi Internet connection. The NowForce software is capable of deploying on an ad-hoc network or

even on a simple Wi-Fi connection, while terrestrial communications infrastructure is down.

About the company:

Day in, day out, lives are being saved around the world by first responders using NowForce.

A comprehensive mobile solution for emergency response and security organizations, NowForce enables reduced response times, full situational awareness, and enhanced communications. The NowForce mobile application keeps first responders connected, even when off-duty or away from their vehicles. NowForce is an affordable, user-friendly solution for agencies of any size, available either as Software-as-a-Service (secured cloud) or as an on-site installation.

Founded in 2008 with headquarters in Israel, NowForce's expanding global presence includes a US office and representatives in EMEA, APAC and South America.

In the United States, NowForce is currently running a large scale pilot with the Boone County Missouri, Fire Protection District, which houses the largest volunteer fire department in the United States. Already showing its worth, the system has recently boasted an unprecedented 3 minute 12 second response time to a patient suffering from a cardiac event in Boone County.

NowForce is expanding globally, with a presence in Asia, Australia, North Africa, South America, and is beginning to make its presence known in North America. The company's on-demand emergency response mobile applications have thousands of active users, with the goal of getting all emergency responders on the NowForce cloud based system in the future. NowForce is truly going to save lives.

Plasan Sasa

Plasan Sasa, a Kibbutz owned company, founded in 1985, develops and manufactures composite materials used in production of armor for military vehicles, airplanes, and ballistic vests for soldiers.



Defining the problem:

It's 3:00am and you're driving a Mine Resistant Ambush Protected (MRAP) Oshkosh M-ATV just outside of the Arghandab District of Kandahar, Afghanistan. You are on high alert because Arghandab is considered one of the most heavily mined districts in the region and you need to transport supplies all the way to the Kandahar Airfield. The roads are littered with Improvised Explosive Devices (IED's) but you feel pretty confident after having driven almost the full way to the airport without incident.

You're a few minutes from the airfield when suddenly; an explosion surrounds your truck. The shock wave throws your head back leaving you disoriented. Feeling the need to get out of the area, you hit the accelerator. The MRAP is moving along slowly, smoke is coming out of the hood but it's getting you to safety. After reaching the airfield you inspect the damage.

The M-ATV's front tire ran over the number 1 killer of U.S. troops in Afghanistan - an IED, with your M-ATV sustaining heavy damage. Insurgents have planted cheap and simple IED's in mass numbers along the roads. It is at this point that you realize that the only thing that kept you alive was the V-shaped Plasan armored hull of the M-ATV. While inspecting the vehicle, you notice a piece of the armor is falling off the side of the truck and when you pick it up you realize how light it is. In a bit of disbelief regarding the light weight of the armor, you sit there for a while and try to figure out just what type of life-saving material it's made of.

Solving the problem:

The V-shaped armor hull of the vehicle was built to protect its occupants and vital parts by discharging the blast energy exerted from an explosive device. The floor in the crew compartment is isolated from the chassis and is connected to the walls and roof *"It's actually a composite that – which we call metal composite, and also ceramic composite,"* says Dani Ziv, CEO of Plasan Sasa. *"Basically, if you make an armor based on ceramic and you'd like to defeat armor piercing threats, you're actually dealing with half of the weight that the people in steel armor will defeat."* All of this is designed to reduce the destruction caused by the blast.

About the company:

Plasan Sasa, which was founded in 1985, as a manufacturer of hard plastic containers, such as garbage bins, snow sleds, and tubs, now designs, develops, and manufactures customized armor systems for military applications. Plasan Sasa develops products for commercial ground vehicles, fixed and rotary wing aircraft, and is a major supplier of personal protection armor.



The company, located on the 200 member Kibbutz that it's named after, boasts over 1,200 employees. After a few years of operation as a plastics factory, which wasn't doing very well, the Kibbutz owned company changed course and began working with ceramics to make armored vests. They signed their first deal to make ballistic vests with the Israel Defense Forces

in 1989 and now; Plasan's equipment performs on a large variety of civilian, law enforcement and military vehicles all over the world.

The company focused their work in the Israeli defense market throughout the 90's, supplying body armor and armor protection for jeeps, buses, and the Israeli military's Abir 4x4 patrol vehicle. Plasan was propelled onto the world stage when the United States went to war with Iraq. The company says it was simply in the right place at the right time having the ability to offer cost-effective tools to protect special mission vehicles, in addition to patrol and reconnaissance vehicles, Mine-Resistant Ambush Protected (MRAP's), logistical and transport vehicles, Armored Personnel Carriers (APCs) and tactical vehicles.



As a means of improving relationships with customers and winning American and European contracts, Plasan has opened seven plants around the world, including locations in France and the United States. According to CEO Dani Ziv, the company does not sell directly to governments, outside of Israel, but instead acts as a subcontractor. The company has done an extensive amount of work with the United States especially for the Marine Corps through the vehicle manufacturer Oshkosh.

The Kibbutz itself (Kibbutz Sasa) shares in the dividends and receives a handsome chunk of the net profits of the company. And while there are more people working at the company than belonging to the Kibbutz, agreements made by the company place partial ownership of the company to the Kibbutz. Plasan plans to continue producing products to ensure the survivability of soldiers. Even though the company is boasting massive profits, especially since

the onset of the Afghanistan and Iraq wars, the employees (including their CEO) receive only modest salaries. Most of them choose to a very humble kibbutz lifestyle - with the hopes of maintaining a simple way of life.

RADA Electronic Industries Ltd.

RADA Electronic Industries Ltd. is an Israeli electronics defense contractor. The Company specializes in the development, production, and sale of Avionics Systems and Upgrades, Inertial Navigation Systems for air and land applications, and Tactical Land Radars for Force and Border Protection.



Defining the problem:

After numerous rocket assaults on coalition troops in Kirkuk, Iraq the decision has been made that in order to help protect troops on patrol it is necessary to send a tank unit in to assist. Late in the evening while on patrol, everyone goes on high alert as an eerie calm fills the air. Suddenly, an explosion! A rocket-propelled grenade (RPG) hits the Abrams armor and small arms fire surrounds the patrol. The patrol needs to know where the RPG came from but the only information that can be determined is that it came from an area about 300 yards west of your location. You fire your .50 caliber turret gun in the direction the RPG came from to provide

covering fire. Unless you pinpoint the exact location where the RPG was fired from you won't be able to fire your tank's large cannon to neutralize the threat, out of risk of collateral damage. Your main goal is the safe evacuation of the patrol from the area. When you get back to the camp you notice only minor damage to the tank but you realize that you were completely blind to the attack.



In order to better prepare for this situation in the future, command decides to fit the tanks with several Compact Hemispheric Radars (CHR's)

along the outside hull of the tank. You have been informed that the equipment being placed on all four corners of the tank is the RADA RPS-15 Radar System designed to counter assaults such as the one your patrol just faced. It was designed by RADA Electronic Industries Ltd., founded in 1970 and based in Netanya, Israel. The company designs systems such as aircraft avionic systems, Inertial Navigation Systems (INS) and radar systems, including the Active Protection System (APS) tactical radars for tanks and other armored vehicles.

Several weeks after the first attack you're told to go on patrol again in the same region on an especially disconcerting night operation. . While accompanying troops on patrol you are again attacked and your convoy gets hit by small arms fire. While patrol troops are firing at the insurgents a signal is sent to a command and control (C2) system in the tank. An RPG is fired at your tank but almost immediately the C2 unit notices the threat and an active protection



system stops the RPG from hitting the tank. The C2 unit also provides a set of coordinates 247 meters northwest of your location, allowing you to turn your cannon to the target. You fire with pin-point precision, effectively neutralizing the threat.

Solving the problem:

RADA has developed two radar hardware

platforms: the Compact Hemispheric Radar (CHR), which is tailored to combat vehicles and short-range protection applications, and the Multi-mission Hemispheric Radar (MHR), which can be tailored for various force and border protection applications; several operational applications are implemented on each radar platform by changing the radar software.

RADA created a family of Compact Hemispheric Radar's (CHR) to be placed on combat vehicles. The “**RPS-15 radar system**” is a member of the CHR family of radars, designed to provide protection to vehicles by detecting the direction of the threat and the Point-of-Origin (POO). The system is designed to provide real-time knowledge of where hostile fire is being fired, detect all relevant threats from multiple firing angles (including very high angles), discriminate among threats and provide the needed intelligence for any course of action. The performance-over-price ratio of these radars makes them the ideal solution to the requirements imposed in the asymmetric-conflict arena.



If you're located in a stationary base, the Multi-Mission Hemispheric Radar (MHR) can be quickly deployed for base and perimeter protection. The “**RPS-40 radar system**” incorporates up to 4 radar panels, each covering a 90 degrees view. You can mount the radar panels on posts on each corner of your base, effectively providing you with full 360 degree coverage of the area. The system will detect any rockets, mortars or RPG's fired upon your location. It is then able to

determine the point of origin -- for ranges up to 10 km's away -- to provide a rapid assessment of the threat.

About the company:

RADA has been traded on the NASDAQ stock exchange since 1985. RADA appointed Major General (Ret.) Herzl Bodinger as President and CEO in 1996 after his retirement from the Israeli Air force, where he served as the IAF Commander with an impressive resume of having flown over 450 sorties during his 35 years in the Israeli Air Force; logging over 6,000 hours in the air and downing two Syrian jets. Maj. Gen. Bodinger stepped aside as CEO in the summer of 2007. While he remained the company's Chairman, Mr. Zvi Alon took the position of CEO.

RADA sells its products to air forces around the world. RADA also works extensively as a subcontractor, selling their products to prime integrators such as Lockheed Martin, Boeing, General Electric, and Rafael Advanced Defense Systems.

Despite showing mild financial gains and a few quarterly losses over the past several quarters, the most recent quarterly revenues for FY2012 have shown solid growth. With the debut of several new tactical radar products, the company is looking to have a strong year in 2013. RADA is a company that truly hits the bulls-eye when it comes to defense.

RoboTeam Ltd.

RoboTeam develops and manufactures military robots and control systems. They have been innovative in a field swarming with competition by producing small robots with more maneuverability than their competition.

Defining the problem:

I don't know about you but when I think of robots the image of R2D2 wheeling towards a doorway - making numerous whistling noises - and extending a tool that will open a door, pops into my mind. In some respects this is not too far off from what the robots used by our military are doing.

The use of robotics in warfare is becoming increasingly significant among various security forces throughout the world. Robots are being featured on battlefields and in emergency situations all over the world from the aerial drones conducting missions in the Middle East to bomb squads that use robots with arms to dismantle bombs. Troops on foot patrol are particularly vulnerable to hidden bombs which have been the leading cause of casualties among U.S. troops in Afghanistan. Primitive roads and mountainous terrain require Marines and soldiers to spend a lot of time walking and the possibility of using robots for complex missions can greatly reduce the danger to soldiers in the field.

The primary goal of integrating robots into combat situations is to save human lives. With dozens of applications for military robots and numerous manufacturers producing them the primary challenge faced by robot manufacturers is to innovate and stand out in the crowd.

Solving the problem:

Roboteam created a family of robotic systems designed to handle numerous and unique payloads in multiple operation scenarios such as intelligence gathering, dismantling of Improvised Explosive Devices' (IED's), riot control and the handling of hazardous materials.

Roboteam Ltd. specializes in Unmanned Ground Vehicle (UGV), control unit, and robotic software development & implementation. Roboteam Ltd. designs, develops and manufactures advanced & multi-purpose robotic solutions for defense, Homeland Security and public safety purposes.

If you need to confirm the presence of hostages or the layout of a room you can take the “**Individual Robotic Intelligence System (IRIS)**” from the pouch carried on your thigh.



Weighing less than 2 lbs. and made from an extremely strong composite material the IRIS was designed to be thrown behind walls and withstand large drops thereby making it easy for you to deploy. The robot even includes a sling on its side (a wire that allows the IRIS to be flung great distances). The IRIS is one of the smallest military robots around and was designed to support military forces in locations deemed dangerous or inaccessible to humans or military dogs. Its high maneuverability and rugged design make it an excellent tool to assist you during urban warfare and anti-terror missions. It runs on simple AA batteries, and has an operating time of approximately 4 hours.



If you were on a tactical team and needed to know what is up a flight of stairs you could easily take the “**Micro Tactical Ground Robot**



(MTGR)” out of your backpack and sends it up the stairwell. Weighing 13lbs. the MTGR is the lightest UGV around with the capability of climbing stairs. MTGR has been developed for intelligence gathering and counter-IED (C-IED) operations. It stands out due to its light weight, high maneuverability (can climb stairs), and its abilities to overcome 60 degree obstacles.

Powered by a standard US military battery, it can carry up to 10lbs of payload, whether it’s a camera, additional sensors or a tactical manipulator arm to diffuse IED’s. It’s outfitted with a primary color video camera as well as four low-light Complementary Metal–Oxide–Semiconductor (CMOS) Sensors embedded around its frame to provide 360-degree film footage - day and night - and can be used to either deliver or disassemble a bomb or an improvised explosive device.

If a soldier gets wounded on the battlefield and needs to be evacuated in an area that is too dangerous for medics to enter, in order to evacuate the wounded soldier, you can send in the **“Probot”** - the largest of Roboteam’s UGV. It features a semi-autonomous application with a maximum speed of 22mph and payload capacity of up to 507lbs. The Probot was designed to perform a large range of operations and functions such as, carry soldiers’ gear, evacuate wounded soldiers under fire and disperse non-lethal demonstrations by firing tear gas and rubber bullets and broadcasting a high frequency sound. The system runs on a US military battery and features a secure Mobile Ad Hoc Network (MANET) Data Link, to ensure that the robot is not able to be hacked.



With an easy to use controller (similar to one used for video games) the **“Ruggedized Operator Control Unit (ROCU)”** was designed as an integrated generic controller for the unmanned systems. The ROCU controller comes in both 5-inch (ROCU-5) and 7-inch (ROCU-7) touchscreen size models. Both models can operate for up to four hours on a single charge using a U.S. Military Battery.



About the company:

Established in 2009 and based in Tel Aviv, the company was founded by Yosi Wolf and Elad Levi who served together in the Israeli Defense Force (IDF), commanding a Special Air Force unit. In 2005, after studying engineering and physics, Yosi and Elad began working together in a small electro-optics company. During their time there, they were the first to deliver a miniature throwable robot to the IDF. In 2009, Yosi and Elad's robots had the opportunity to support a real operational campaign with the IDF's Special Forces. From that experience they developed an understanding of the need for robot systems in the field. By the end of 2009, Yosi and Elad decided to establish Roboteam.

Roboteam set out with a goal of improving 4 areas of military robot technology:

1. Intuitive Operations.
2. Increased Reliability.
3. Greater Mobility versus Weight and.
4. Affordability for both Government and Commercial Customers.

Roboteam has developed a variety of robotic platforms, controllers and tactical and situational application assemblies that you can attach to the robots in order to respond to various situations.

The war in Iraq is over and the war in Afghanistan is ending. The battlefield robots are having an easier transition to peacetime than some human veterans. The robots are simply trading their camouflage in for the blue uniforms of American police all without having to go through the burdensome interview process. Today's military technology is very often tomorrow's civilian police technology. Any police or homeland security department with a counterterrorism or anti-drug mission and the ability to execute an arrest warrant would potentially be interested in getting its own robots.

Roboteam works closely with over 100 federal agencies, state and local governments, and various law enforcement organizations including: U.S. Border Patrol, General Dynamics, Joint Improvised Explosive Device Defeat Organization, Asymmetric Warfare Group and the U.S. Department of Energy. In order to fulfill the demand created by the orders from United States agencies, Roboteam established a plant in Mississippi in addition to their main Tel Aviv location.

Roboteam military robots stand out in the crowd as the lightest and smallest robots in their class. The US Department of Defense has signed a contract with Roboteam and the IRIS will be used in operations in Afghanistan.

Seraphim Optronics Ltd.

New risks & global threats are emerging on a continuous basis. Governments are requiring a higher level of security at borders in order to protect the homeland. Prevention of unlawful, cross-border activities and the fight against criminal organizations require the implementation of watchful, all-encompassing, and covert surveillance and control systems.

Defining the problem:

Covertness means a total blending of an object into the surrounding by use of a small “natural” opening. It involves no movement, no glare, no noise and small overall size. The covertness of the system allows the surveillance equipment to be unattended, and unanticipated.

Seraphim Optronics located just outside of Haifa Israel, focuses on situations where covert-imaging surveillance is needed, such as: special operations, intelligence gathering, technical ambush, border control and force protection.

Mr. Israel Kasher, President and CEO since the company's establishment in 1993, served previously with a technical unit of the IDF's Intelligence Corps. With a background in intelligence gathering, Seraphim has developed a unique approach to covert imaging surveillance systems primarily specializing in electro-optic surveillance, additionally it has established itself as a leader in Unattended Ground Sensors (UGS).

The Israeli company developed a family of ground sensors including the Unattended Gap Filler (UGF) and the Mini Unattended Ground Imager (MUGI) which are integrated with a radar system. These are used for border protection application, as well as the Chameleon urban persistent covert surveillance system, with enhanced capabilities in communications and day-and-night camera.

Watching remote border areas is an arduous task as these areas offer ideal settings for people intending to illegally cross a border. Amassing border patrol agents along an area for extended periods of time is a costly and impractical venture.

Solving the problem:

Fixed radar surveillance sites allow border patrols to focus on potentially prime crossing points for illegal traffickers. The biggest problem with fixed radar surveillance is radar beams are relatively straight and fixed while surveillance towers tend to have gaps due to topography. The “**Unattended Gap Filler (UGF)**” system is designed to seal these gaps in border areas, which are typically the first choice for border infiltration. A UGF system combines EO/IR (electro-optical/infrared) with tactical radar for total wireless control of a 2 km² area with automatic detection, alerts and video communications. The UGF is covert, solar powered, and can be deployed quickly in fixed locations for long term tactical reconnaissance and force protection.

Persistent Covert Surveillance is the ability to gather visual intelligence without being detected, from within a few meters for long periods of time. Since terrorists operate in the shadows, we must develop covert, constant, and persistent means of tracking and targeting them. In the past, a skilled



clandestine operator would have to infiltrate hostile areas to provide visuals for a fixed period of time. Eventually, even the best of operators succumbs to their physiological limitations. After two to three days, elite operatives must be relieved or replaced, and each hour they spend in the field carries added risk of exposure. The UGF's can act as an autonomous police stakeout without the necessity of taking a bathroom break. It provides around the clock monitoring of a particular region for extended periods of time. This is in stark contrast to surveillance provided by individuals, which has time limitations.

Autonomous sensors do not get tired, bored, or take bathroom breaks. Sensors simply watch until something of interest happens, whether it's converging vehicles, a person placing an Improvised Explosive Device (IED) under a bridge, or anything else that may rouse suspicion. For example, several cars can meet at a location behind a particular building all within a few minutes of one another. Taken in isolation, this is simply moving vehicles or groups of people. Nothing really unusual; but put these incidents in the context of the events that occur before and after, and sometimes a coherent picture emerges.



Persistent-surveillance systems such as the “**Mini Unattended Ground Imager (MUGI)**” a multispectral medium range surveillance system, (integrated with state-of-the-art tactical radar), and the “**Chameleon**”, an urban reconnaissance covert surveillance system can indicate where the converging cars came from and where they went afterwards. This forensic pattern analysis could lead authorities to

important terrorists and criminals. Using its IR Imager or CCD camera, a single MUGI can monitor an area of two square

kilometers. The radar continuously scans a section, delivering persistent surveillance, with an automatic detection range of up to 2 km.

The Chameleon is designed to be camouflaged and versatile in order for it to be used in a variety of urban security, military, paramilitary, police and homeland security missions. The Chameleon operates automatically to gather real time visual Intelligence through the use of Internal Video Motion Detection (VMD) which remotely monitors hostile target movement and supplies early warnings to troops. Employing the same wireless remote control (C2) station as the MUGI, the Chameleon is capable of identifying and responding to human targets at 120m, and sending full motion video for immediate or future action.



The MUGI was originally designed to be camouflaged. The system can be buried; its periscope design enables only a small part of it to protrude above ground.

These forward-deployed ground-based sensors provide a level of imagery not possible with unmanned aerial vehicles, enabling the detection of hidden groups, identifying, tracking and alerting law enforcement to an important meeting of high-ranking terrorists, a drug deal going

down, the planting of improvised explosive devices (IEDs) or attempts to cross into a border illegally.

The MUGI and the Chameleon can remain in the field for months — working either on batteries or solar panels. Additionally, they can be outfitted with the **“Wake Up Radio Module (WRM)”**, a control radio link between the command-and-control (C&C) unit and the system. The “WRM transmitter” is part of the C&C unit and the “WRM receiver” is an integrated module inside the system. The WRM was designed to wake up the MUGI system from its sleep mode. The sleep mode allows the MUGI and Chameleon to self-activate based on movement, thereby allowing longer endurance of the system and electronic silence between times of operations.

The **“Remote Video Transmitter (RVT)”** is a lightweight video router and transmitter which includes an internal energy source for up to 30 hours and various communication options for tactical use. The RVT enhances the capabilities of the MUGI, Chameleon or any other video source, by enabling tactical forces to take the C2 station with them anywhere they go, with no need for external power sources.

The U.S. is the largest customer for Seraphim’s MUGI sensor, but the company works on an ongoing basis with various other military, police, and Special Forces customers, around the globe. With thousands of border areas in need of protection, Seraphim continues to improve its products. The current baseline MUGI is limited to visual surveillance, but future versions are expected to receive updates from Global Positioning System satellites and include a laser designator and rangefinder. This would lead to enhanced targeting capabilities for UAV’s.

Seraphim Optronics Ltd. customers vary from Special Forces to border protection forces. Ultimately desiring to have their products used along borders all over the world, the US-Mexico border is said to be the first goal location to have its products implemented.

Appendix

A Sample of Foundations and Organizations:

The Israel Tech Transfer Organization (ITTN) - Umbrella organization for Israel's technology transfer companies - <http://www.ittn.org.il/index.php>

The BIRD Foundation: *Israel-U.S. Binational Industrial R&D* – Foundation which encourages and supports R&D collaboration between Israeli and American companies - <http://www.birdf.com/>

Israel Innovation Center – Foundation created to bridge Israel and Japan in industry and technology - <http://israelinnovationcenter.com/en>

The U.S. Israel Business Initiative - Formed by the US Chamber of Commerce as an effort to advanced and strengthen US-Israel commercial relations at all levels - <http://www.usisraelbusiness.com/>

The U.S.-Israel Science & Technology Foundation (USISTF) - Founded by a joint initiative of the U.S. Department of Commerce and the Israel Ministry of Industry, Trade and Labor with a mission of strengthening the scientific and R&D relationship of the U.S. and Israel to promote economic growth through innovation - <http://www.usistf.org/>

SIBAT - Israel Ministry of Defense - Division at the Israeli Ministry of Defense established to promote Israeli Defense & Homeland Security exports and joint ventures - <http://en.sibat.mod.gov.il/Pages/home.aspx>

The Israeli National Pavilion (Organized by SIBAT) - Spotlights Israel's Defense and Homeland Security technologies at various exhibitions and trade shows around the world - <http://en.sibat.mod.gov.il/Events/Pages/MeetUs.aspx>

Israel Up Close - Non-profit organization provides a look at Israel's contribution to the world through humanitarian projects, medical and hi-tech innovations, as well as creativity in other areas - <http://www.israelupclose.org/index.html>

A Sample of Websites and Publications:

Innovation Israel: *Startup Nation Community* – A community for Israeli startups, entrepreneurs, investors, venture capitalists, angels, developers, researchers and recruiters - <http://www.innovationisrael.com/>

Israel21c - Online news magazine offering diverse news and information about Israel, its people, its institutions and its contributions to the global society in the 21st century - <http://israel21c.org/>

Israel Innovation 2.0 –Online blog dedicated to highlighting Israel-related technology news and companies - <http://www.israelinnovation20.com/>

Israel Science and Technology Homepage - National database and directory of science and technology related sites in Israel - <http://www.science.co.il/>

The Technologies Group - Professional magazine aimed at providing technological information for the electronics industry in Israel - <http://www.technologies.co.il/beta/en-us/Conferences.aspx>

Senor, Dan, and Saul Singer. *Start-up Nation: The Story of Israel's Economic Miracle*, New York, Grand Central Publishing, 2009

Key Cooperative Agreements between Israel and the United States

February 19, 1950 - Exchange of Notes between Israel and the United States constituting an agreement for the exchange of official publications.

May 4, 1950 - Exchange Of Notes between Israel And USA concerning the agreement on copyright regulations.

February 26, 1951 - Point four general agreement for technical cooperation between Israel and the United States. (amended June 21, 1954)

August 23, 1951 - Treaty of Friendship, Commerce and Navigation between Israel and the United States.

August 7, 1952 - Exchange of Notes constituting an agreement between Israel and the United States relating to the industrial investment guaranty program.

September 27, 1972 - Agreement on the USA - Israel Binational Science Foundation with Exchange Of Letters.

June 22, 1962 - Agreement for financing certain educational exchange programs (with Memorandum Of Understanding).

March 3, 1976 - Agreement establishing the Israel-United States Binational Industrial Research and Development Foundation (BIRD).

April 6, 1979 - Creation of the Joint Political Military Group and Joint Security Assistance Program.

November 30, 1981 – US-Israel Memorandum Of Understanding on strategic cooperation.

July 30, 1982 - Exchange Of Notes constituting an agreement concerning general security of military information

August 19, 1985 - Agreement on the Establishment of a Free Trade Area between the government of Israel and the government of the United States

May 24, 1988 - Agreement relating to mutual defense assistance.

April 1989 - Memorandum of Agreement between the Strategic Defense Initiative organization and Israel's Defense Ministry to develop a \$35 million computer facility as part of the arrow missile program.

June 1991 - Agreement pertaining to Arrow continuation experiments (aces) the second stage of the joint US-Israel Arrow Missile Program.

September 12, 1994 - Agreement on Encouragement of investment.

July 18, 1996 - Memorandum of Agreement concerning the Tactical High Energy Laser (THEL) Advanced Concept Technology Demonstration (ACTD).

September 3, 1996 - Agreement for technology research and development projects.

April 4, 1996 - Counterterrorism cooperation accord between Israel and the United States.

March 15, 1999 - Agreement between the government of Israel and the government of the United States regarding the application of their competitions laws.

February 22, 2000 - Agreement between the Ministry Of National Infrastructure of Israel and the Department of Energy of the United States concerning energy cooperation.

September 10, 2009 - Agreement amending the agreement of March 31, 2001 for the Arrow System Improvement Program (ASIP).

November 24, 2010 - Memorandum of Cooperation relating to technical assistance in developing and modernizing Israel's civil aviation security infrastructure.

Cooperative Agreements between Israel and Individual States

ALABAMA

1997: Signed a formal Memorandum of Intent to promote and improve trade relations, encourage investments and technology transfers and promote the exchange of ideas and company representatives, engineers, scientists and other specialists.

CALIFORNIA

1998: Memorandum of Intent to encourage the growth of trade and investment relations with the prospect of expanding the growing economic cooperation between California and Israel.

1999: Memorandum of Understanding for cooperation in the area of biotechnology, bio-informatics and bio-agriculture so as to create an increased commercial and research linkages.

2008: The city of Los Angeles signed a Memorandum of Understanding with the International Institute for Counter-Terrorism (ICT) in Herzliyah, Israel to tighten cooperation and existing relations between ICT and the City of LA's homeland security apparatuses.

2009: Memorandum of Understanding between California and Israel to foster technology development, business development and educational opportunities in solar energy and the environmental technology industries.

COLORADO

2010: Memorandum of Understanding with the Jacob Blaustein Institutes for Desert Research (BIDR) in Israel's Negev desert with the stated goal being to "encourage voluntary interaction and cooperation and to promote friendship between the two parties for their mutual benefit."

2010: Memorandum of Understanding with the Desert Agro Research Center in Israel that is focused on water and agriculture research and development in arid and semi-arid climates.

2010: Colorado School of Mines established workforce-development ties with the Israel Institute of Technology (Technion) to help develop the discovery of a vast natural gas reserve off Israel's coast.

FLORIDA

2011: City of Orlando signing of a Memorandum of Understanding for international collaboration and strategic relations between the Florida Hospital and Sheba Medical Center at Tel HaShomer. Among the many areas of collaboration are robotic surgical training, medical simulation, and stem cell transplant.

HAWAII

2004: Memorandum of Understanding between the state of Hawaii and Israel to encourage cooperation concerning agriculture and aquaculture research and development.

2008: of Understanding centered on a plan to bring an electric-car network to Hawaii.

ILLINOIS

1988: Memorandum of Intent that created the Illinois-Israel Initiative, which calls for projects of mutual economic benefit through improved trade, technology development, science, agriculture and tourism.

2006: Memorandum of Understanding committing between Illinois and Israel to enhancing joint technology research and development in the homeland security sector.

MARYLAND

1988: The Maryland-Israel Exchange established to develop and expand ventures in the fields of trade, tourism, science and technology, communications, agriculture, aquaculture and transportation.

2003: Partnership with the Israeli Ministry of Agriculture to establish the Collaborative Marine Biotechnology R&D Program.

2003: Cooperative agreement to establish the Maryland-Israel Homeland Security Partnership allowing homeland security professionals from Maryland and Israel to share "best practices" used to respond to terror threats.

2004: Memorandum of Understanding to create the Maryland-Israel Development Fund (MIDF) that supports collaborative technology development and commercialization conducted in partnership between Maryland and Israeli businesses.

2006: Memorandum of Understanding with the Israeli Ministry of Industry, Trade and Labor that focuses on bilateral cooperation in private sector industrial research and development.

MASSACHUSETTS

1987: General accord with the State of Israel to stimulate trade, investment, education and medicine collaboration between the two regions.

2008: \$1 million life sciences initiative that would authorize joint academic and industrial research and business exchanges with Israel and calls for the creation of trade facilities for pilot projects with the Government of Israel and the Boston Haifa International Life Sciences Institute.

2011: Memorandum of understanding that will allow for further collaboration in research and development (R&D) programs between Massachusetts and Israeli companies.

2011: Collaboration between UMass Lowell's NanoManufacturing Center of Excellence and Shenkar College of Engineering and Design in Israel. Researchers at both institutions will investigate fabrication processes for materials with potential to reduce costs for maintaining and servicing aircraft.

MICHIGAN

1988: The Michigan-Israel Technology Venture was established to foster exchanges of information and technology, and an Economic Development Cooperative Agreement was signed the same year to promote trade and investment.

2008: Memorandum of Understanding with Israeli Deputy Prime Minister Eli Yishai to establish a working group between the two governments that will focus on energy efficiency and technology that will improve water quality and increase water re-use.

2011: Memorandum of Understanding with the Emek Medical Center in Haifa that encourages collaborative research and the sharing of scientific knowledge between the two institutions and leveraging the medical expertise of both institutions to advance the science and practice of medicine.

MINNESOTA

1987: The Minnesota-Israel Exchange (MNIX) is established to foster cooperation and promote trade, investment, science and industry.

MISSOURI

1988: Memorandum of Intent that created the Missouri-Israel Initiative calling for projects of mutual economic benefit through improved trade, technology development, science, agriculture and tourism.

NEBRASKA

1993: Governor Ben Nelson signed a Memorandum of Understanding to promote trade and exchanges related to agriculture.

NEW JERSEY

1996: The New Jersey-Israel Cultural Cooperation Committee Memorandum of Intent.

1996: Memorandum of Intent concerning a joint Israel-New Jersey Program to Promote the Establishment of Environmental Management Systems.

1996: Memorandum of Understanding between the Commission on Science and Technology of the State of New Jersey and the Ministry of Science of the State of Israel.

2003: Memorandum of Understanding officially declaring collaboration in the Life Sciences.

NEW MEXICO

2008: Agreement of cooperation with Israeli Minister of Industry Eli Yishai that spells out a process to create strategic partnerships to cooperate on the advancement of joint water and energy technologies.

NEW YORK

1989: Creation of the International Partnership Program to promote exchanges with Israel in culture, tourism and economic development.

2009: Memorandum of Understanding on industrial R&D cooperation in the areas of nanotechnology, biotechnology, and public and internal security.

NORTH CAROLINA

1993: Agreement establishing the North Carolina-Israel Development Centers in both places as well as an Israeli center for people with autism based on a North Carolina model.

1994: Establishing an International Commission that includes task forces to stimulate trade and exchanges with Israel in business, academia, arts and culture, education and social services. The North Carolina-Israel Partnership (NCIP) was created in 1996 to manage the cooperative projects.

NORTH DAKOTA

2008: The Energy & Environmental Research Center (EERC) at the University of North Dakota announced the development of a long-term partnership with Israel to address critical energy security issues facing both Israel and the United States.

OHIO

2006: The city of Akron earmarked a \$1.5 million investment from local public and private sources in a Netanya-based technological incubator. In exchange for the investment, any companies that are created from the incubator will then base their US headquarters in Akron, a move which will provide local jobs and income tax to the city, plus dividends from part ownership in the companies.

2009: The Dayton region and the Israeli city of Haifa signed a memorandum of understanding aimed at boosting economic development in both locations.

2010: Memorandum of Understanding with LN Green Technologies Incubator in Haifa which outlines a plan for Ohio Clean Technologies and LN Green Technological to cooperate and share resources with the objective of bringing new alternative energy technological applications to market in the United States.

OREGON

2010: Memorandum of Understanding with Israel "to develop and strengthen economic, industrial, technological and commercial cooperation".

PENNSYLVANIA

1997: Cooperative agreement with Israel to "seek to enhance technological research and economic development as well as to increase cultural awareness in order to promote a deeper understanding of shared values through the economy, arts, technology and education."

SOUTH CAROLINA

1992: Memorandum of Intent to establish a South Carolina-Israel Exchange to promote trade, investment, agriculture, education and tourism.

SOUTH DAKOTA

2009: Memorandum of Understanding with the Israeli weapons manufacturing company, TDI Arms, to open a plant in the city and create a number of new full time positions for South Dakota residents.

TENNESSEE

1996: Tennessee-Israel Cooperation Agreement to promote cooperation between the two countries in trade, arts, culture, education, tourism and university/industry alliances.

TEXAS

1985: Texas-Israel Semi-Arid partnership was created after the signing of an Memorandum of Understanding between the Texas Department of Agriculture and the Ministry of Agriculture of the State of Israel to work together on projects of mutual agricultural benefit to the peoples of Israel and Texas.

1992: Memorandum of Intent was signed to broaden the Texas-Israel SemiArid Fund (see 1985), encourage greater participation and to prove, through applied research, that the similarities in agriculture between Texas and Israel can be a lesson for both partners.

2002: Memorandum of Understanding was signed to foster collaborative practical and applied research between agricultural scientists' areas of high priority to both Texas and Israel.

2010: University of Texas Southwestern Medical Center entered into a cooperative agreement with the Rabin Medical Center in Israel to collaborate on faculty and student exchange programs, as well as the development of joint studies, research and training activities, and other educational programs of mutual interest.

VIRGINIA

2008: Agreement to strengthen bilateral cooperation between the Commonwealth of Virginia and the State of Israel on private sector industrial research and development.

WISCONSIN

2009: Memorandum of understanding and a bilateral cooperative trade agreement with the hopes of promoting collaboration and a strong working relationship between Wisconsin and Israel in research and development.