



**MISSILE DEFENSE TECHNOLOGIES
TOOLS TO COUNTER TERRORISM
2002**



**Technology Applications
Program**

“Our Nation has been put on notice: We are not immune from attack. We will take defensive measures against terrorism to protect Americans. Today, dozens of federal departments and agencies, as well as state and local governments, have responsibilities affecting homeland security. . . . We will come together to improve air safety, to dramatically expand the number of air marshals on domestic flights, and take new measures to prevent hijacking. We will come together to promote stability and keep our airlines flying, with direct assistance during this emergency. We will come together to give law enforcement the additional tools it needs to track down terror here at home. We will come together to strengthen our intelligence capabilities to know the plans of terrorists before they act, and find them before they strike...”

President George W. Bush
Address to the Joint Session of Congress and the American People
United States Capitol, Washington, D.C.



Table of Contents



Introduction

Chemical and Biological Countermeasures

Entrap Harmful Particles	8
Provide a Solid-State Alternative to PMTs	9
Pinpoint Substances from a Distance.....	10
Identify Contaminants in Near Real Time	11
Identify Contaminants in the Ground	12

The anthrax attacks that followed September 11 brought a long-time fear crashing into reality.

Although biological and chemical agents have been used on civilians before, the anthrax attacks brought the issue into the forefront of the American psyche. Developing reliable chemical and biological agent identification and detection systems has become a priority in security measures. These systems consist of various imaging and sensing technologies, each with unique capabilities.



Surveillance

is another point of interest in the fight against terrorism.

Human intelligence, or HUMINT as DOD calls it, is the intelligence discipline that uses human beings as both collectors and sources, and where the human being is the primary collection instrument. Airports across the country are searching for innovative technologies that will answer security concerns and achieve a higher degree of safety. Reliable facial recognition technologies and voice extraction technologies can detect wanted terrorists and uncover information that may prevent further attacks.

Surveillance and Information Collection

Identify Faces in 3-D	16
Obtain Enhanced Infrared Images.....	17
Inspect Luggage for Nuclear Material	18
Identify Unrecognized Contraband.....	19
Separate Extraneous Noise from Data	20
Isolate the Voice of Interest	21
Precisely Position Surveillance Equipment	22
Extend the Wavelength of Normal CCDs	23

Cyber Warfare

Trace Money Trails to Terrorists26
Identify Suspicious Travelers27
Coordinate Information Resources28
Extract Important Intelligence Information29
Learn Information and Generate Solutions30



Capturing terrorists and preventing future attacks require meticulous combing through tips, video and audio tapes,

handbooks, papers, and interrogations. Neural networks offer innovative data mining and fusion capabilities that can highlight evidence of a link between terrorists or trace money to its source. The information collected from terrorist camps, houses, and hideouts must be processed with cutting-edge software and coordinated between government organizations.

Introduction

Before September 11 there was Khobar Towers, Oklahoma City, the USS Cole...

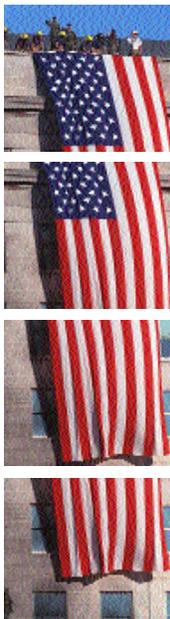
Before Osama Bin Laden there was Timothy McVeigh, Terry Nichols, Ted 'Unabomber' Kaczynski...

Timothy McVeigh has been executed; Terry Nichols and Ted Kaczynski are in prison; and Osama Bin Laden is at least in hiding if not dead. But after the capture or death of Osama Bin Laden, and even the destruction of Al Qaeda, terrorism will not necessarily be a thing of the past. The world is not a perfect place. History has shown us there will always be anger and injustice, and it takes only one person to make a suicide bomber.

Newspapers and magazines are full of critics and analysts who wonder if technology has made the United States vulnerable. Technology makes the country too accessible, too much information is available through the Internet, and people are too dependent on technology for protection. These are all valid criticisms of today's society. However, technology is not the enemy, nor is it the solution. It is a tool to be used in combination with human intelligence efforts, military action campaigns, and homeland security strategies.

The following report contains technologies funded by the Missile Defense Agency (formerly the Ballistic Missile Defense Organization) that have counter-terrorism applications. MDA's mission is to build a missile defense system. However, the construction of this system has led to the development of innovative technologies that can advance different fields. This report covers technologies that can be applied towards three areas of the counter-terrorism effort: Chemical and Biological Countermeasures, Surveillance and Information Collection, and Cyber Warfare. Some of the technologies are available today and others need to mature; none will be the solution that solves all of our security problems. But the use of these technologies in combination with the human effort may make covert surveillance operations safer and more effective; chemical and biological detection faster and more efficient; and data collection and mining a streamlined and reliable process.

The Missile Defense Agency offers support and funding to many scientists, engineers, and innovators on the cutting-edge of technology. Many of these technologies, such as neural networks, lasers, and ground-penetrating radar are applicable in the war against terrorism and protection of the homeland.





Chemical and Biological Countermeasures

“In the wake of a bioterrorist attack, medical professionals will have to act quickly to recognize the signs and symptoms of exposure to a biological weapon. Hospitals and public health laboratories will need to identify the pathogens used in the attack. Public health agencies must monitor the disease outbreak and mobilize the medical resources to contain it. The special skill of federal health agencies must be ready to supplement state and local efforts.”

Edward Kennedy, United States Senator, Joint

Announcement with Senator Bill Frist of Public Health

Threat and Emergencies Act 29 November 2000



Carbon-Metal Composite

Entrap Harmful Particles

THE FALL OF THE WORLD TRADE CENTER BUILDINGS CREATED A SMOG OF DUST, DEBRIS, AND SMOKE.

IntraMicron manufactures foldable, pocket-size gas masks that provide protection against airborne threats, including chemical and biological agents.

During September 16-23, 2001, the U.S. Geological Survey with the help of the Jet Propulsion Laboratory, the Environmental Protection Agency, and Analytical Imaging and Geophysics, LLC, conducted a study of the WTC area to determine the makeup of the surrounding atmosphere (“Environmental Studies of the World Trade Center area after the September 11, 2001 attack,” U.S. Geological Survey, OFR-01-0429). Their results found that most particles were construction materials such as gypsum and cellulose with minor asbestiform minerals. However, they did conclude that there were localized concentrations of chrysotile asbestos reaching volumes up to 20 percent, based on a coating sample from a steel beam. Scientific studies have indicated that chrysotile asbestos is not as carcinogenic as amphibole asbestos, however this is not a universally accepted finding. And, it still makes breathing hard to do.



with a high-speed roll-to-roll paper-making process, MMT results in a carbon-metal composite that is a porous interlocking composite network with high electrical conductivity and a surface area of approximately 1,000 square meters per gram. High electrical conductivity, when combined with the large surface area, allows for effective entrapment of harmful particles.

Its Status

The BMDO IS&T program originally funded Auburn University to develop smaller and lighter capacitors for weapons systems. IntraMicron is currently developing the gas masks, which should be available for use within a year. It is also developing collective protection systems, which include regenerable filter and sorbent canisters to stop and mitigate chemical and biological threats. Animal identification as well as chemical and biological agent collection tags are being developed for use in the meat production and processing industries.

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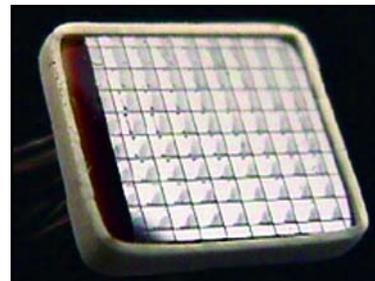
The Tool

IntraMicron, Inc. (Birmingham, AL), a spinoff of Auburn University, is currently developing foldable, pocket-size gas masks based on the school’s microfibrinous materials technology (MMT). These masks provide protection against airborne threats, including chemical and biological agents. They are small, flexible, and lightweight, allowing law enforcement personnel, first responders, and civilians to carry hundreds of them for distribution to others if necessary. MMT is an enabling technology that allows sustained chemical reactions to occur more efficiently than with other commercial products. When combined



Provide a Solid-State Alternative to PMTs

THE POST-SEPTEMBER 11 ANTHRAX ATTACKS AWAKENED AMERICA'S AWARENESS TO THE UNPREPAREDNESS OF THE U.S. INFRASTRUCTURE FOR CHEMICAL AND BIOLOGICAL WARFARE.



Avalanche Photodiodes

Since then, scientists and engineers have been developing advanced chemical and biological agent detection and warning systems that can be implemented all over America. Chemical sensors have been installed in two Washington, D.C., Metro subway stations to begin preparing the U.S.



infrastructure for a new fight against weapons of mass destruction, according to a Washington Post article ("Metro Set to Initiate Chemical Sensors," December 25, 2001, Lyndsey Layton). But the shoebox-size sensors identify only chemical agents. Biological sensors currently being used by the military are bulky, expensive, and unreliable. For widespread monitoring, future systems must be smaller, more reliable, and conducive to mass-production.

The Tool

Radiation Monitoring Devices (RMD; Watertown, MA) has developed planar avalanche photodiodes (APDs) and photodiode arrays for use in spectroscopic chemical and biological sensors. These highly sensitive photodiode arrays offer a solid-state alternative to photomultiplier tubes (PMTs). RMD's compact and effective planar APDs have good noise immunity, require less power, and have fast response times using standard semiconductor manufacturing processes that

result in higher yields and lower costs. The company also can manufacture APDs that have an area of more than 13 cm² with a gain of more than 10,000 allowing for more effective and reliable detection and identification of harmful agents.

Its Status

The BMDO SBIR program funded RMD to develop methods to produce low-cost APDs and APD arrays for lidar, optical communications, and radiation monitoring. The company is currently selling its APDs and is working with Tufts University to develop a sensor array prototype.

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Quick and quiet avalanche photodiode arrays developed by Radiation Monitoring Devices are a solid-state alternative to photomultiplier tubes for manufacturing spectroscopic chemical and biological sensors.





Spectroradiometer

Pinpoint Substances from a Distance

ENGLAND, SPAIN, GERMANY, BULGARIA, AUSTRO-HUNGARY, TURKEY, ITALY, JAPAN, SOVIET UNION, IRAQ—ALL HAVE GONE TO WAR AGAINST THIS COUNTRY.

Physical Sciences' multi-spectral imager can detect chemical agents on the battlefield and at home.

All are nations with borders, flags, and military. Al Qaeda has none of these things. Its citizens are nomads who move from country to country, and its terrorist cells are scattered throughout the world. Without stable financial backing and government resources, it is more likely that Al Qaeda will acquire chemical and biological weapons of mass destruction than working nuclear weapons. "The relative low cost and simplicity of [chemical and biological weapons] design and technology, in comparison to nuclear weapons, make them the weapons of mass destruction choice for a variety of rogue states and terrorist, non-state organizations" (Defense Threat Reduction Agency, 9 April 2001, "Chem-Bio Defense"). "Only by centralizing and focusing DOD efforts in chem-bio defense can the United States confidently pursue proper preparation and response in the event of a chemical or biological weapons attack against U.S. forces or territory, or those of our allies." Today, it is not always apparent where the battle will take place or what kind of weapons will be used against the U.S. military forces.



be associated with the suspicious substance or signature. AIRIS collects only the essential information reducing the amount of time needed for data analysis. The imager can detect and monitor the spread of chemical agents not only on the battlefield but also for first responders answering a chemical proliferation threat.

Its Status

The multispectral imager is currently in limited production and is used by the U.S. Army. BMDO originally funded PSI with internal funding when the company designed the Fabry-Perot filter. BMDO then awarded the company SBIR funding to build a prototype. The product was the first significant effort to demonstrate the concept of a tunable filter. The Army added follow-up funding for further development and testing.

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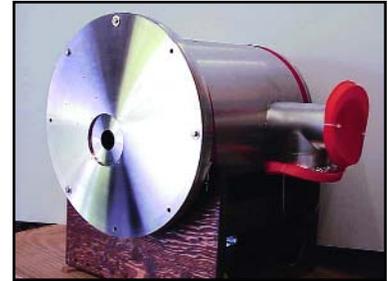
The Tool

Physical Sciences, Inc. (PSI; Andover, MA), has developed a multispectral imager that can detect chemical agents on the battlefield. The basis of the multispectral imager is the adaptive infrared imaging spectroradiometer (AIRIS), which is an electronically tunable spectral filter that samples only the wavelengths known to



Identify Contaminants in Near Real Time

IN THE EVENT OF A CHEMICAL WARFARE ATTACK, FIRST RESPONDERS MAY HAVE AS LITTLE AS 15 MINUTES TO DETERMINE THE TYPE OF CHEMICAL AND ADMINISTER MEDICAL CARE. AFTER THAT, TREATMENT CAN BE FUTILE.



Ultraspectral Imager

The Tool

The ultraspectral imager, developed by Kestrel Corporation (Albuquerque, NM), generates spatially distributed wavelength resolution data that contains surface contaminant and chemical cloud detection capabilities. The imager can identify most solids, vapors, and aerosols by their molecular absorption spectra over a very wide range of the infrared spectrum. The sensors will work as passive remote observers or, with an active illumination source, they can observe infrared molecular absorption or emission signatures with their spatial distribution. The data can be processed in near real time to create a non-intrusive monitoring system.



program funded Kestrel to develop an application that would allow ballistic missile defense systems to identify a missile by the chemical composition of its emissions. The system is expected to specifically type the missile, know its full capabilities, and develop intercept procedures.

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Its Status

The ultraspectral imager is currently being validated in laboratory measurements and will be ready for field demonstrations during late summer 2002. The BMDO SBIR

Kestrel Corporation's ultraspectral imager is a nonintrusive monitoring system that can identify most solids, vapors, and aerosols in near real time.





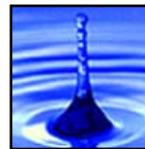
Diode Laser

Identify Contaminants in the Ground

CHEMICAL AGENTS THREATEN MORE THAN THE AIR PEOPLE BREATHE; THEY THREATEN THE WATER PEOPLE DRINK AS WELL.

Process Instruments' high-power frequency diode laser uses raman spectroscopy to identify contaminants in the ground.

According to the U.S. Geological Survey, approximately 79 billion gallons per day (23 percent) of America's water in 1990 came from the ground. Surface water is the country's major supplier with 259 billion gallons per day. However, roughly 64 percent of the ground water supply is used for irrigation. Imagine if that water becomes contaminated by a chemical agent. It will affect people whether or not it is used for drinking. Because of irrigation, it will threaten the food people eat as well. Chemical detectors are needed in places besides subways, airports, and office buildings—they are needed to monitor the country's natural resources as well.



Its Status

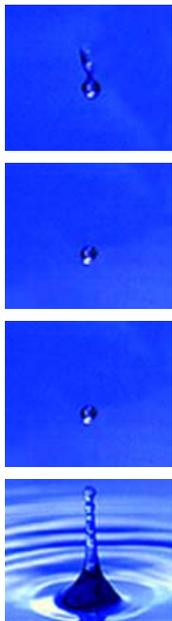
The BMDO SBIR program funded Process Instruments to develop a raman spectroscopy system for quality control and process monitoring during the manufacture of key components for terrestrial and space-based ballistic missile defense systems. Process Instruments is currently developing the chemical detecting application of its high-power frequency diode laser, which should be available in 6 to 12 months. The company is preparing a proposal for the U.S. Army.

The Tool

Process Instruments, Inc. (Salt Lake City, UT), developed a high-power frequency stabilized diode laser that utilizes a compact and highly sensitive raman spectroscopy system to identify contaminants in the ground. The system is compatible with a multitude of diode lasers that allow detection using excitation wavelengths between 640 nanometers and 1 micron. It is suitable for field use because it is simple, rugged, and has low maintenance requirements. Plus, the system can simultaneously monitor multiple samples.

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Surveillance and Information Collection



"This is an anomaly. This is a strange circumstance. The main perpetrators obviously perished and it's not in most crimes—in previous terrorist attacks, those who perpetrated the attacks sought to escape, did escape, left a trail, created evidence after the fact. In this situation, we have a little tougher circumstance, but we're beginning to develop an understanding of who these people were, who their associates were, how these attacks were perpetrated. And beginning to develop links of evidence that indicate the source of the attack against the United States."

John Ashcroft, Attorney General, Department of Justice.

Interview with Larry King, 18 September 2001



3D FaceID System

Genex Technologies' portable 3D FaceID captures facial images in two and three dimensions simultaneously in real time.

Identify Faces in 3-D

TERRORIST CELLS ARE HARD TO IDENTIFY BECAUSE THE GROUPS INTEGRATE INTO THE SURROUNDING COMMUNITIES AND CULTURES.

These terrorists may have criminal records with agencies such as the FBI, CIA, or Interpol. For example, one of the September 11 hijackers had a criminal record on file at the FBI before the events of that day. Facial recognition technology linked to a database of wanted criminals and suspected terrorists may have prevented at least one of the September 11 terrorists from getting on a plane.



Its Status

BMDO funded Genex Technologies to design a high-speed 3-D camera and monitoring system suitable for real-time 3-D image acquisitions and visualizations. Genex's 3D FaceID prototype is in testing and will be available for use in 6 to 12 months.

The Tool

To answer the need for micron-level accurate 3-D facial recognition technology, Genex Technologies, Inc. (Kensington, MD), developed the 3D FaceID™ system. Based on Genex's Rainbow 3D® Model 250 camera, 3D FaceID captures facial images, in two and three dimensions simultaneously in real time. The 3D FaceID system is portable, weighing 12 pounds, and can be integrated with different computer software. The system works on a structured-light process and captures more than 440,000 data points of information, which are then circulated through a database of photographs, looking for a match. Initially, the company is marketing the 3D FaceID system for airport security, but its long-term goal is to equip visa and passport offices with the technology as well.

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Obtain Enhanced Infrared Images

PEOPLE UNDER SURVEILLANCE OFTEN SHIELD THEMSELVES
AND THEIR ACTIVITIES WITH DARKNESS.



QWIP Camera

However, surveillance professionals have the aid of infrared imaging technology, which allows the human eye to see the heat radiating from human bodies and objects, even in the dark.



The Tool

NASA's Jet Propulsion Laboratory (JPL) has improved on infrared camera technology by using long-wavelength quantum well infrared photodetectors (QWIPs). Atom-sized quantum wells can be packed together in extraordinary densities, allowing them to capture infrared radiation with good efficiency. The QWIP camera has greater sensitivity, resolution, and stability than competing infrared cameras and has many applications in surveillance, including night vision, navigation, flight control, and early warning radar. QWIP cameras would be useful in surveillance areas such as airborne national border patrol.

Its Status

JPL's QWIP camera is available for use in surveillance applications, and improvements are currently being developed in

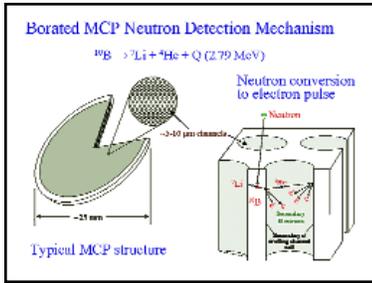
collaboration with Indigo Systems, Inc. BMDO funded JPL to develop imaging cameras for ground-based and space-based infrared surveillance at long wavelengths.

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NASA's Jet Propulsion Laboratory packed atom-sized quantum wells together in extraordinary densities to develop the QWIP camera, which has greater sensitivity, resolution, and stability than competing infrared cameras.





Microchannel Plate Imaging
Neutron Detector

NOVA Scientific's family of imaging neutron detectors can determine the elemental composition of an item at a highly precise location.

Inspect Luggage for Nuclear Material

CONVENTIONAL AIRPORT SCANNERS USING X-RAY RADIOGRAPHY TO CHECK LUGGAGE CANNOT EFFECTIVELY IMAGE LIGHT ELEMENTS, MAKING SCREEN INSPECTIONS INEFFECTIVE.

The Tool

NOVA Scientific, Inc. (Sturbridge, MA), has developed a family of imaging neutron detectors that can be used to non-destructively inspect for nuclear material and other contraband at airports and other security check points. Although explosive substances can be shaped into something that appears non-threatening, neutron techniques can determine the elemental composition of an item, like nitrogen, boron, and lithium, at a precise location. This prevents the suspicious material from being lost through the spatial averaging of many different substances, which is often what causes a "failure to detect" in non-imaging techniques. The x-ray and highly penetrating neutron scanning techniques therefore complement each other as a security measure in airports.



imagers have proven to be successful tools in research and industry and are effective at radiography with low-energy neutrons. The company is now developing imagers that can work with high-energy neutrons.

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Its Status

BMDO funded NOVA Scientific to develop a neutron imager for non-destructive evaluation applications. The neutron

Identify Unrecognized Contraband

AIRPORT SCANNERS UTILIZE X-RAY TECHNOLOGY TO SEARCH PASSENGERS' BAGGAGE FOR CONTRABAND.



ImSyn

In this case, the scanner uses one technology source to detect prohibited items so officials can prevent them from getting on a plane. Multiple references of data strengthen the reliability of information rather than depend on the accuracy of only one source.



Its Status

BMDO funded Essex to develop a wideband range-Doppler imager for ground-based radar applications. Essex is still developing ImSyn and projects it will be ready by 2004. The optical processing technology has been developed and is currently being marketed for medical imaging.

The Tool

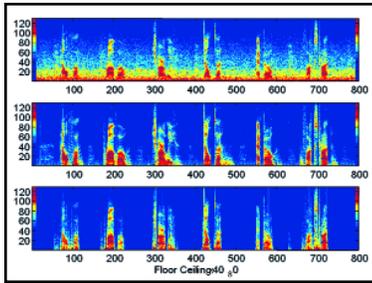
Essex Corporation (Columbia, MD) is developing a product that may be more effective than current technology in scanning airport luggage by gathering information from a variety of sources to form an image. ImSyn, or image synthesis, is the result of combining several technologies. Essex coupled high-speed digital processing with optical processing and combined it with 3-D data collection, computation algorithms, and optical correlation techniques to produce ImSyn. The technology can find objects normally not detected by conventional airport scanners. And it does it in real time.

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Essex Corporation's ImSyn, or image synthesis, gathers information from a variety of sources to create a more accurate image and find objects not normally detected by conventional airport scanners.





Digital Signal Noise Processing System

Frontier Technology's digital signal noise processing system separates extraneous noise from needed data by transferring analog acoustic signals to digital format.

Separate Extraneous Noise from Data

EVER HAVE A CONVERSATION IN THE BACK OF AN AIRPLANE?
ENGINE NOISE DURING TAKEOFF CAN MAKE THE CONVERSATION
NEARLY INAUDIBLE FOR THE PARTICIPANTS.

Covert investigators recording a conversation in high-noise environments, such as airplanes, will find it hard to understand as well. Nothing can be done about the noise of the plane engines during the recording, so it must be extracted from the soundtrack.



Its Status

Frontier's DSNP system is available and ready for use today. The BMDO SBIR program funded Frontier to develop automatic recognition of partially obscured targets.

The Tool

Frontier Technology, Inc. (Goleta, CA), has developed the digital signal noise processing (DSNP) system to separate extraneous noise from needed data. The system is based on Frontier's target nearest encryption (TNE) algorithm, which can be used to search for voice patterns in heavy background noise once the sounds are in a digital format. The system transfers acoustic signals from analog to digital format, allowing temporal and frequency filtering, separately or in combination, for highly accurate results. The data sifting is orders of magnitude faster than current techniques, which are normally a 1:1 ratio with the size of the data set under analysis. The system facilitates large, real-time data searches on modest processing software.

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Isolate the Voice of Interest

ONE OF THE MAJOR TURNING POINTS IN FILM HISTORY WAS THE ABILITY TO ADD A VOICE TRACK TO THE IMAGES.

The addition of sound allowed film's earliest pioneers to add more information, feeling, and depth to the genre. The collection of intelligence is similar in that an image or video is effective, but even more so when the conversation can be heard. However, the interference of background noise can often make the comprehensibility of a conversation impossible.

The Tool

IC-Tech, Inc. (Okemos, MI), developed the Clarity Clear Voice Capture (CVC) system for noise reduction and speech signal enhancement. Originally based on blind signal separation algorithms, CVC has evolved into a complete toolbox for isolating the voice of interest from interfering sounds and noise. Competing technologies require unwanted noise to come from different directions or to contain different frequency components. CVC relaxes constraints instilled by conventional voice extraction technologies, allowing intelligence officials to obtain information from real-world, indoor and outdoor, noisy environments.



Its Status

BMDO funded IC-Tech to develop an integrated voice processing device for real-time separation, localization, and recognition of speech. CVC is now owned and marketed by Clarity, LLC, as a commercial product for use in automotive telematics, cellular hands-free kits, industrial wearable computers, and hearing aids.

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Clarity Clear Voice Capture™

IC-Tech utilized blind signal separation algorithms to develop the Clarity Clear Voice Capture system, which separates audio signals from a mixture of background noises.





Roto-Lok® Rotary Drive

The Roto-Lok Rotary Drive, developed by Sagebrush Technology, precisely positions any type of sensor, camera, antenna, or optical component using less powerful motors than conventional transmission and positioning systems.

Precisely Position Surveillance Equipment

SOPHISTICATED TECHNOLOGY IS NOT ALWAYS IN THE CAMERA.

SOMETIMES THE SOPHISTICATION IS IN THE OTHER TECHNOLOGIES

ENABLING THAT CAMERA TO WORK.

These technologies contribute in a more subtle way to the counter-terrorism effort.

The Tool

Sagebrush Technology's Roto-Lok® Rotary Drive is a rotary drive system that precisely positions any type of sensor, camera, antenna, or optical component to the area of interest. Very precise positioning permits more accurate imaging and longer ranges. The Roto-Lok system can be assembled to fit the individual needs of each application and can replace power transmission systems that use gears, pulleys, or chains. Its high efficiency, accuracy, and torsional stiffness surpass conventional transmission and positioning systems because the Roto-Lok system can be connected to less powerful motors.



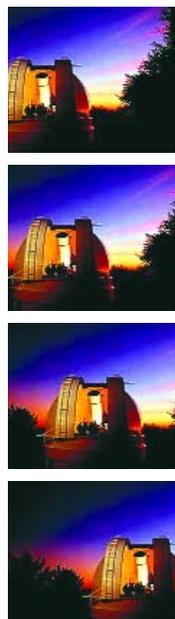
shelf solutions, and custom original-equipment-manufacturer designs. BMDO funded the Roto-Lok Rotary Drive to control astronomical telescopes, which require extremely precise pointing of large, heavy structures.

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Its Status

The Roto-Lok system is on the market and already being utilized in military and commercial applications through standard products, customized commercial-off-the-



Extend the Wavelength of Normal CCDs

A PICTURE SPEAKS A THOUSAND WORDS, WHICH IS WHY AN IMPLICATING PHOTOGRAPH CAN TURN THE TIDES OF PUBLIC OPINION.

When doing surveillance, obtaining a good photograph can be a challenge, considering the people being observed probably do not want to be seen. The smaller, lighter, and more efficient the equipment, the better the chances of obtaining the desired information.



The Tool

Materials and Technologies Corp. (MATECH; Poughkeepsie, NY) has developed a process for fabricating wafers with a thickness as low as 50 microns. The company uses its dynamic confinement and linear scan system to achieve a cost-effective, high-yield approach for single-sided thinning of large-area, high-quality substrates. MATECH provides these technologies to fabricate high-performance charge-coupled devices (CCDs), which can also be used for infrared imaging. With these CCDs, the thinner the substrate, the more photons it allows through and the higher the device efficiency.

The CCDs generated using MATECH's system require lower lighting conditions to obtain an image than a conventional CCD. Using this system, MATECH can extend the wavelength of normal CCDs making

them high-performance CCDs that can capture visible and near invisible infrared laser aiming devices, for instance. Another possible application of MATECH's wafer thinning system is the production of smart cards. People could carry valuable identification information on a driver's-license-size smart card.

Its Status

The BMDO SBIR program funded MATECH to produce wide bandgap silicon carbide substrates for high power, high frequency radar applications.

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Wafer Thinning System

Using MATECH's wafer thinning system can extend the wavelength of normal charge-coupled devices making them high performance with the capability to capture visible and near infrared images.





Cyber Warfare

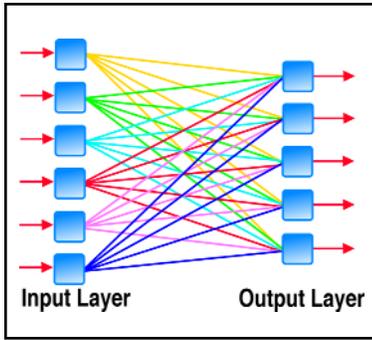
“...virtually every vital service—water supply, transportation, energy, banking and finance, telecommunications, public health. All of these rely on computer and fiber-optic lines, switchers and routers that connect them. Corrupt those networks, and you disrupt this nation.”

Condoleezza Rice, National Security Advisor

The Partnership For Critical Infrastructure

Annual Meeting, U.S. Chamber of Commerce,

Washington, D.C. 22 March 2001



Risk Manager for Money Laundering

Trace Money Trails to Terrorists

INCREASINGLY SOPHISTICATED TACTICS AND ADVANCED TECHNOLOGY ARE MAKING MONEY LAUNDERING MORE DIFFICULT TO DETECT.

HNC Software's Risk Manager system provides a flexible framework for detecting money laundering activity and tracing a money trail to its source.

A successful counter-terrorism strategy is to trace the money trail leading to a terrorist cell's financial support.

The Tool

HNC Software, Inc. (San Diego, CA), has developed the Risk Manager for Money Laundering, a risk-scoring system based on HNC's Falcon Fraud manager technology. Risk Manager provides a flexible framework to utilize profiling analysis to examine transactions and detect money laundering activity, meet regulatory requirements, manage operational risk, and provide greater insight to objectively know customers. The technology profiles transaction patterns at the account, customer, and peer group levels, including type of customer, geographical area, branch, and other categories. These profiles provide a baseline for normal behavior, against which each transaction is evaluated during the monitoring process. The technology then builds on the customer profiling information with intelligent statistical models to identify high-risk customers and accounts. Risk Manager can evaluate millions of transactions a day for potential money laundering activity



based on established automated money laundering models and rules. It enables immediate access to all data for a case.

Its Status

HNC's Risk Manager technology is currently available for use. The BMDO SBIR program funded HNC to develop a neural network capable of compressing and decompressing data in real time using low-cost hardware.

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Identify Suspicious Travelers

THE SEPTEMBER 11 HIJACKERS TRAVELED FREQUENTLY. MOHAMED ATTA TRAVELED FROM HIS BIRTHPLACE IN EGYPT TO GERMANY, WHERE HE WENT TO COLLEGE, AND THEN TRAVELED TO THE UNITED STATES.

Zacarias Moussaoui, the “20th hijacker,” is a native of France who moved to the United States to take pilot lessons and frequently visited Malaysia to meet with an alleged Al Qaeda representative. Suspicious activity can be highlighted by a neural network capable of monitoring a person’s travel patterns and contrasting them with profiles of normal behavior in real time.



The Tool

Knowledge Based Systems, Inc. (KBSI; College Station, TX), has developed the integrated data experimentation and fusion system (IDEFS), which is data mining and fusion software that leverages numerous sources of information and integrates it to make an informed decision. KBSI is developing two IDEFS technology systems aimed at counter-terrorism efforts: Pattern Characterization and Analysis System (PCAS) and Integrated Port of Entry Security Screening (IPSS). Both systems contain applications in airport security. PCAS can monitor travel patterns and create profiles of normal and suspicious behavior. It fuses information gathered by various law enforcement agencies with current communications gathered from the Internet, foreign intelligence sources, news, etc., to create terrorist profiles and indicators of potential threats. Individuals or emerging situations would then be compared with these profiles to generate real-time threat esti-

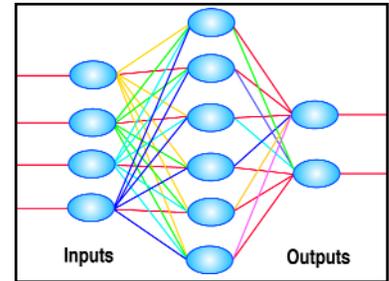
mates. IPSS can be applied to the screening process when boarding airplanes. This system would fuse the data gathered from x-ray images with other information such as biometric indicators. IPSS integrates passenger profile information with baggage threat assessment and utilizes intelligent information processing algorithms to create a real-time risk evaluation at the baggage screening checkpoint.

Its Status

PCAS and IPSS are ready for use. The BMDO SBIR program funded KBSI to develop technology that will result in the increased use of data fusion technology to solve a variety of problems in the defense, government, and industrial communities.

Contact

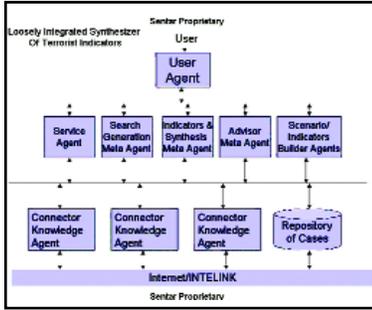
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Integrated Data Experimentation & Fusion System

Knowledge Based Systems, Inc., is developing two data mining and fusion software systems capable of monitoring travel patterns, screening people at the airport, and creating profiles of normal and suspicious behavior.





Synthesizer of Terrorist Activity Indicators

Sentar, Inc., is developing a solution engine that will respond to questions with answers based on numerous knowledge sources that are continuously provided input by subject matter experts.

Coordinate Information Resources

THE CIA, FBI, U.S. MILITARY, LOCAL AND STATE LAW ENFORCEMENT AGENCIES, MEDIA, AND NUMEROUS FOREIGN GOVERNMENTS ARE CONDUCTING INVESTIGATIONS INTO TERRORIST ACTIVITIES.

These ongoing investigations and intelligence gathering operations will generate an enormous amount of information. As a result, the government is facing the challenge of coordinating the information among agencies in the United States and around the world.



Its Status

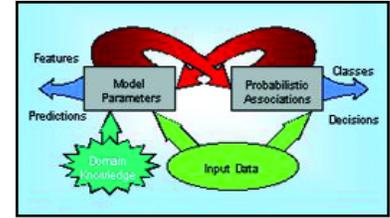
The BMDO SBIR program funded Sentar to develop knowledge-based systems capable of managing the decisions and logistics of deploying a ballistic missile defense system. Sentar is currently marketing KnoWeb products to dynamic decision making, customer relationship management, and portal markets. The counter-terrorism version of the technology may be available in less than a year.

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Extract Important Intelligence Information

ANYONE IS A POTENTIAL TARGET OF TERRORISM. THERE IS NO GUARANTEE OF SAFETY IN THE CIVILIAN OR MILITARY SECTORS.



ACUMEN

However, the threat can be lessened through timely identification of abnormal events or activities, which offers the potential to immediately intercept terrorist activities. The Internet, intelligence activities, and civilian tips are just a few of many sources of data. An application in which to store and compare the collected information is vital.



extract intelligence from data to identify possible terrorist action, make better decisions for asset protection, and manage operations more effectively. Potential application areas include: terrorist activity prediction, disease outbreak detection, network optimization and intrusion detection, accident trending, and crime pattern detection.

The Tool

Torch Concepts (Dulles, VA) uses its ACUMEN algorithms for data mining to investigate and develop information that will identify and/or predict terrorist activities. ACUMEN can identify previously unknown relationships in collections of structured and unstructured data using machine-learning algorithms to discover unknown patterns and apply high-speed pattern matching tools to uncover hidden trends, relationships, and behaviors. The information is then analyzed and significant patterns in the data reviewed with visualization tools that interpret the results and highlight unusual features that might otherwise be missed. The results are refined using additional data sources or variables, which lead to the best model. Human expertise guides the data analyses. Once patterns are established, potential terrorist activities can be quickly identified, appropriately classified, and tracked. Using these techniques, the technology can

Its Status

ACUMEN is still in its early stages of demonstration but can be ready for use within a year. The BMDO SBIR program funded the research because of a need for automatic target recognition, sensor fusion, and data analysis, compression, and archival.

Contact

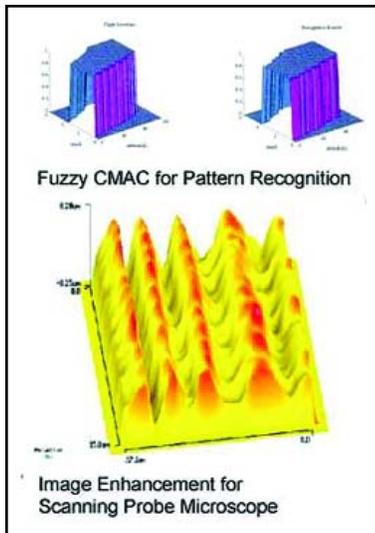
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Torch Concepts' ACUMEN technology uses machine-learning algorithms to identify previously unknown relationships in collections of structured and unstructured data.



Learn Information and Generate Solutions

NEURAL NETWORKS, WHICH CAN LEARN OR ADAPT TO CERTAIN CONDITIONS AND ENVIRONMENTS, HAVE APPLICATIONS IN THE MILITARY AND COMMERCIAL SECTORS, FROM FLIGHT CONTROL TO TRAFFIC MANAGEMENT.



Fuzzy CMAC

Intelligent Automation, Inc.'s, Fuzzy CMAC is a neural network that can simplify the design of real-time control systems and improve the speed and precision of pattern recognition systems.

The Tool

Intelligent Automation, Inc. (IAI; Rockville, MD), developed the Fuzzy Cerebellar Model Arithmetic Computer (CMAC), a hybrid technology that learns ten times faster than conventional neural networks. The Fuzzy CMAC could simplify the design of real-time control systems and improve the speed and precision of pattern recognition systems. It combines the ease of coding and flexibility of fuzzy logic controllers with the self-learning capability and flexibility of neural networks. These technologies enable the system to learn and generate output faster than other learning control approaches. Compared with conventional neural networks, Fuzzy CMAC is also much easier to implement in hardware.



ballistics analysis system developed and marketed by Mnemonic Systems, Inc. The DRUGFIRE system is currently being used by the Federal Bureau of Investigation and domestic and foreign crime labs. The BMDO SBIR program funded IAI to explore potential applications of Fuzzy CMAC in missile control, target classification, and satellite control.

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Its Status

Fuzzy CMAC has been implemented in the RotoScan, a tool IAI developed to digitize and compare striations. RotoScan is contained in the DRUGFIRE[®] system, a

“I respectfully suggest the way of life of present and future terrorists has changed forever. The future of organized terrorist cells is about to welcome the 21st century in a way they never anticipated, for in this dastardly act they may have done what no other group of people could possibly have done, and that is to unite the civilized world, unite our allies in Europe who share our values, unite our Russian friends, our Chinese friends, unite the world, because that image of that plane smashing into the second tower has reverberated around the world and every leader in every country can picture the same thing happening in their nation.”

Joseph Biden, United States Senator, Press Release
12 September 2001

This report has been written and produced for MDA by the National Technology Transfer Center-Washington Operations.

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