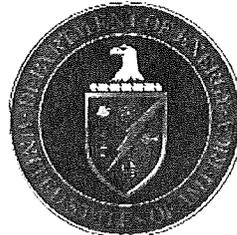


# THE TECHNICAL SUPPORT WORKING GROUP

# T S W G

*Developing Advanced Technologies for Combating Terrorism*

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ORGANIZATION

PROGRAM OVERVIEW

ACCOMPLISHMENTS



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# INTRODUCTION

“...I call on all our allies and peace-loving nations throughout the world to join us with renewed fervor in a global effort to combat terrorism.”

*President Bill Clinton  
January 1995*

The frequency and severity of terrorist incidents—both within the United States and around the world—have increased dramatically over the last two decades. Incidents of national and international terrorism were once limited to the hijacking of commercial aircraft, hostage-taking actions, and incidents involving the use of simple explosive devices. In more recent years, however, they have become actions of such extreme destruction and loss of human life as to threaten global stability, the national security of the United States and other nations, and individual personal safety and well-being on a grand scale. This disturbing pattern of mass

casualty terrorist incidents dating back to 1983 bombings at the U.S. Embassy and Marine Corps Barracks in Lebanon—with subsequent incidents including attacks in New York and

Oklahoma City, in the Middle East, and most recently in Africa—must be expeditiously and irreversibly ended. Major advances in our capabilities to combat terrorism on all fronts must be achieved, and significant efforts directed toward meeting this objective have been underway for much of the last decade.

The escalating terrorist threat reflects a post-Cold War new world order wherein numerous adversarial nations and extremist organizations with objectives directly counter to the interests of the United States and other nations have embraced the calculated use of violence or threatened violence in the pursuit of often obscure political, religious, or ideological goals. The increasing ability of terrorists and terrorist groups to perpetrate such incidents over the last two decades has been facilitated by the emergence of a readily accessible global travel network and greater access to modern technology enabling the development and proliferation of

**THE TSWG MISSION:** To conduct the National Interagency R&D Program for Combating Terrorism through rapid research, development, and prototyping of advanced technologies.



As technological progress has inadvertently facilitated growth of the terrorist problem, so must technology become a more decisive factor in its resolution and eradication. The pre-eminent military strength of the United States today is attributable to the development and fielding of a vast array of weaponry and support systems enabled by technology maturation in many diverse areas.

political sensitivities and bureaucratic requirements have compromised attempts to develop an efficient, integrated approach, a problem long recognized.

To provide a firm foundation for developing a comprehensive and more effective national effort for addressing the growing threat, in 1986 President Reagan established a task force on combating terrorism. The group, headed by then Vice President Bush, conducted an extensive review of government policies and programs relevant to terrorist activities. One important observation of the task force was that U.S. capabilities for responding to terrorist threats and

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“Terrorism in all of its manifestly evil forms—cyberterrorism, chemical, biological, indeed nuclear—is destined to present as serious a challenge to the West as anything we faced during the Cold War.”

*William Cohen*  
*Secretary of Defense*  
*April 20, 1999*

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advanced weaponry and sophisticated destructive devices. In the hands of terrorists and rogue nations, weapons of mass destruction—whether nuclear types or incorporating deadly agents of chemical and biological warfare—may constitute a more serious threat than we have ever previously encountered. *Cyberterrorism*, the use of computer-generated attacks against critical elements of our communications and control and information systems infrastructure, is also emerging as a troublesome new threat with potentially far-reaching consequences of a different nature.

Formidable technological capabilities in many areas that contribute to our military strength, including surveillance, threat detection and identification, communications and warning, protection, and response, must be exploited and further developed as necessary to expediently address a wide variety of technical and other issues encountered in combating terrorism. Responding to this challenge has been complicated by the large number of U.S. government agencies and responsible international organizations engaged in relevant technology development activities. Complex

incidents were limited by the lack of a well-coordinated, focused, and comprehensive research and development (R&D) effort critical to achieving technical capabilities commensurate with established policies.

In response to the findings of the task force, the National Security Council (NSC) established the Interagency Working Group on Counter-Terrorism (IWG/CT), chaired by the Department of State's Coordinator for Counterterrorism, and designated the Department of State (DoS) as the lead government agency



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We are engaged, through the State Department - chaired Technical Support Working Group, in a vigorous research and development program to improve our ability to detect explosives, counter weapons of mass destruction, protect against cyber sabotage and provide physical security. In the technological race with terror, we are determined to gain and maintain a decisive strategic edge.”

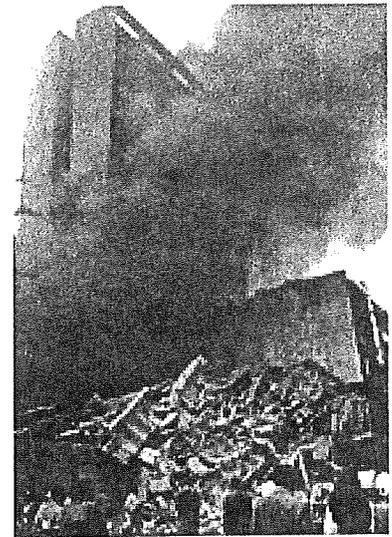
*Testimony by Secretary of State  
Madeleine K. Albright before the  
Senate Appropriations Subcommittee  
on Commerce, State, The Judiciary,  
and Related Agencies (February 4, 1999)*

for combating terrorism. Under the guidance of the NSC and DoS, the IWG/CT assumed responsibility for focusing and coordinating national research and development activities in this arena. The Technical Support Working Group (TSWG) was subsequently established by Executive Order in 1987 as the technology development component of the IWG/CT. **The TSWG mission: To conduct the National Interagency R&D Program for Combating Terrorism through rapid research,**

**development, and prototyping of advanced technologies offering significant promise for enhancing U.S. antiterrorism and counterterrorism capabilities.<sup>1</sup>**

Current TSWG program thrusts include technology development and prototyping efforts in the areas of blast mitigation, standoff detection of explosives, large vehicle bomb countermeasures, entry

point screening, advanced surveillance equipment, and vulnerability analysis tools. Other high-priority activities involve infrastructure protection, improved means for responding to threats posed by terrorist use of chemical and biological agents in urban environments, and technical support to first responders to terrorist incidents. ■



U.S. Embassy bombing (Kenya, 1998)

<sup>1</sup> As defined by DoD Joint Publication 1-02, Department of Defense Dictionary of Military and Associated Terms: *Antiterrorism* actions are defensive measures that reduce the vulnerability of individuals and property to terrorist acts. Such measures include limited response and containment by local military forces. *Counterterrorism* actions are offensive measures taken to prevent, deter, and respond to terrorist acts.



# TSWG ORGANIZATION AND STRUCTURE

The TSWG operates under the auspices of the Department of State, Office of the Coordinator for Counterterrorism; and the Department of Defense, Office of the Assistant Secretary of Defense for Special Operations and Low-Intensity Conflict (OASD (SO/LIC)). Program direction is provided by an Executive Committee chaired by a DoS representative, who

in 1998 in recognition of its long-standing lead role in responding to and investigating terrorist incidents and its expanding involvement in the TSWG forum over the last several years. DoD serves as the executive agent for TSWG activities and also provides program management and support.

TSWG membership includes representatives from eight Federal departments<sup>2</sup> and more than 50 government agencies. A comprehensive listing of TSWG member organizations is provided in the Appendix. The organization is structured to maximize participation by numerous government organizations in steadfast and continuing efforts to identify high-priority technical requirements for joint users and to develop responsive new projects leading to enhanced capabilities in the field. Participation in TSWG activities provides numerous benefits:

- ✓ It supports the efficient leveraging of resources among the member agencies;
- ✓ It promotes the timely and effective exchange of information on a wide range of topics of importance and concern to the combatting terrorism community;
- ✓ It facilitates the development of complementary activities; and
- ✓ It helps to avoid unnecessary and undesirable duplication of effort.

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“The FBI encourages support for existing proven interagency efforts like the TSWG to help us meet the challenges posed by new and emerging threats.”

*Louis J. Freeh*  
*Director*  
*1999 Congressional Testimony*

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also affords oversight on behalf of the IWG/CT. Executive Committee membership is comprised of designated representatives from the Department of Defense (DoD) and the Department of Energy (DOE), members since TSWG inception, and the Federal Bureau of Investigation (FBI). The FBI joined the Executive Committee

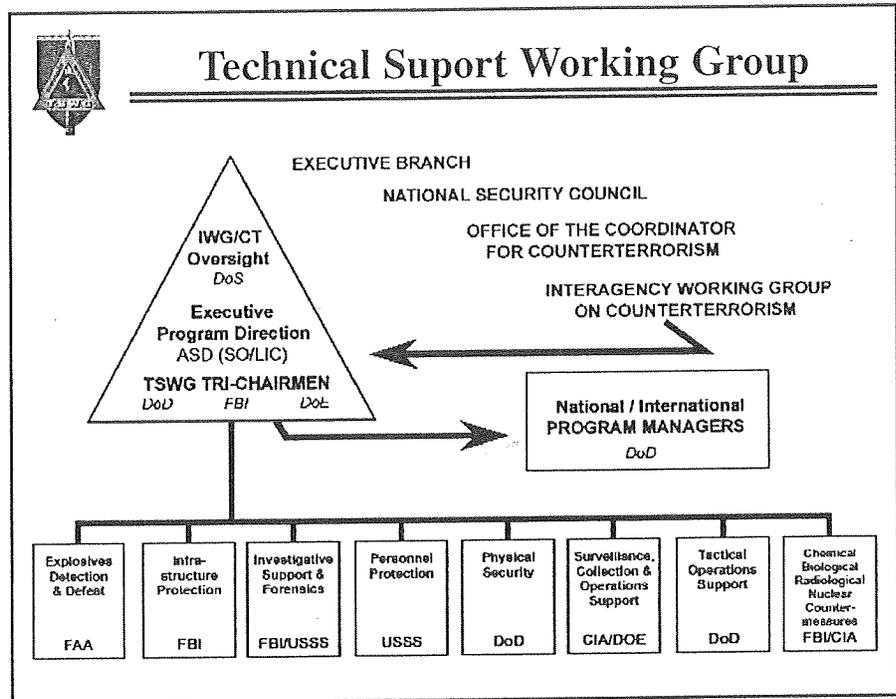
<sup>2</sup> Department of State, Department of Defense, Department of Energy, Department of Justice, Department of Commerce, Department of Health and Human Services, Department of Transportation, and Department of the Treasury.



## TSWG SUBGROUPS

The TSWG maintains broad and effective participation by its member departments and agencies through a functional area structure that includes eight subgroups:

- Explosive Detection and Defeat (ED&D)
- Infrastructure Protection (IP)
- Investigative Support and Forensics (IS&F)
- Personnel Protection (PP)
- Physical Security (PS)
- Surveillance, Collection and Operations Support (SC&OS)
- Tactical Operations Support (TOS)
- Chemical, Biological, Radiological and Nuclear Countermeasures (CBRNC)



TSWG Organization and Structure

Each subgroup is chaired by a representative from a Federal department or agency having a lead responsibility for activities consistent with the technical matters addressed by that group. Individual subgroups meet periodically to review progress on current projects, identify and prioritize new user requirements, solicit and review proposals for new projects, and forward selected proposals through TSWG program managers to the Executive Committee for final approval. Rigorous selection guidelines are applied:

- ✓ Proposed new projects must have identified operational users;
- ✓ Proposed work must address multi-agency requirements to receive highest priority;

- ✓ Proposed work must be amenable to rapid prototyping and produce a tangible product;
- ✓ Proposed work must not duplicate other TSWG efforts or work being pursued in technology development programs supported by other agencies;
- ✓ Proposed work must include a viable transition plan to help ensure that successful results can be rapidly exploited in the field.

In addition, successful proposals must be responsive to an overarching TSWG philosophy that emphasizes *smarter, faster, and cheaper* as important descriptors for its aggressive fundamental approach to advancing U.S. technological capabilities for combating terrorism.



Effectively promoting discussion and information transfer among its member agencies is a key objective of the TSWG forum and an important contributor to its overall success. The frequent interactions and deliberations of representatives from member organizations at the subgroup level are important to achieving that objective. It is further supported by an annual program review that addresses activities being carried out under the direction of all subgroups. In addition, focused interactive discussion important to program planning and the development of new capabilities for combating terrorism is also promoted through TSWG sponsorship of workshops and conferences on special topics of widespread interest to the community. Such events bring users/operators, subject matter experts and technologists, and sponsors of various projects together in forums to discuss various user requirements, explore the opportunities and challenges associated with various technological approaches, and consider when and how emerging new capabilities might best be utilized. They thus serve to sharpen the focus of the TSWG investment strategy and provide insights regarding “a way forward” toward achieving technical goals. Prior workshop/conference topics have

included vulnerability analysis tools, detection of explosives by canines, non-intrusive inspection methods, and long-range surveillance.

Since its establishment in 1987, the TSWG program has initiated and supported several hundred projects through its subgroup structure. The number of new starts each year is typically in the range of 15 - 20, with the number and distribution among the various subgroups dependent on current program priorities and available resources. Flexibility is a key feature of overall TSWG program planning and management, and resources can quickly be re-allocated to address urgent new requirements. The success of the program to date is reflected by the fact that results from over 70% of completed projects have been operationally deployed or transitioned to other, related programs for further development. The TSWG program currently includes more than 100 active projects.

Short summaries of the TSWG subgroups and representative recent and current program activities are provided in the following paragraphs.

## *Explosives Detection and Defeat*

The Explosives Detection and Defeat (ED&D) subgroup was formed to identify, prioritize, and respond to the technological requirements of the greater law enforcement and security forces community responsible for the detection and defeat of a wide variety of improvised explosive devices (IEDs) assembled and used by terrorists. Improved capabilities for detecting various types of IEDs—and advanced technical means for disabling such devices and rendering them harmless—are of critical importance to achieving a high level of protection for personnel and facilities that

may be subject to attack. Prototype hardware and advanced techniques developed under the purview of this subgroup provide major operational benefits to numerous Federal, state, and local law enforcement agencies, as well as military explosive ordnance disposal (EOD) personnel. The subgroup also develops training aids designed to assist users in performing various missions.

ED&D subgroup projects currently place particular emphasis on the development of advanced technological means for detecting, assessing, and





disabling large car and truck bombs in a safe and efficient manner. Another area of considerable activity involves the detection of concealed explosives that constitute a major threat to the airline industry worldwide. Specific recent or ongoing efforts supported by this subgroup include developments involving a portable threat characterization system for diagnosing IEDs or large vehicle bombs, standoff detection of explosives, canine detection of explosives, improved methods for detecting explosive residues, a three-dimensional X-ray baggage inspection system, and advanced explosive marking agents. Other work includes the development of special equipment for use by EOD technicians, studies of airframe vulnerability, and the development of improved sensors for detecting contraband materials, including both explosives and chemical warfare agents.

The ED&D subgroup currently manages the largest number of tasks within the TSWG program, and it is a major participant in the international cooperative R&D arena. The subgroup is chaired by a representative of the Federal Aviation Agency (FAA). Subgroup membership comprises more than 20 government departments and agencies, including the DoD, DoS, DOE, FBI, U.S. Secret Service (USSS), Defense Intelligence Agency (DIA), U.S. Army Technical Escort Unit (TEU), and the Naval Criminal Investigative Service (NCIS). ■

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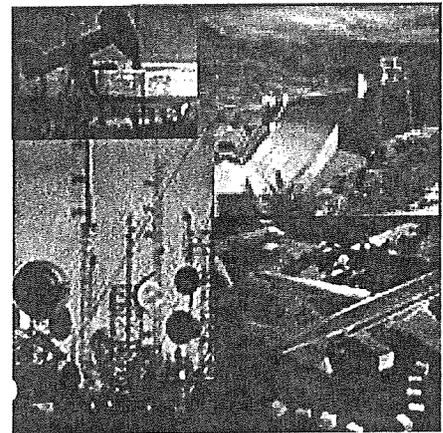
## *Infrastructure Protection*

The Infrastructure Protection (IP) subgroup is responsible for identifying and addressing user requirements pertinent to the protection and uninterrupted service of critical government, public, and private infrastructure systems. These systems include distribution systems for electric power, natural gas, petroleum products, and water; telephone, radio, and television communications systems; ground, rail, and air transportation facilities; and cyber communications networks. All of these systems are vital to maintaining the national and economic security of the United States—and to our everyday way of life.

The IP subgroup, previously part of the Physical Security subgroup, was established as a separate entity within the TSWG structure in 1996. This action was taken to provide those Federal departments and agencies having defined responsibilities for pro-

tecting elements of the national infrastructure with an effective mechanism for rapidly pursuing promising new technologies and developing useful, novel prototype hardware and software pertinent to their mission. The subgroup sponsors selected R&D projects that reflect the multivariate threat to the complex and often interdependent systems, subsystems, and components comprising the national infrastructure, from both physical and electronic/cyber realms. Solutions involve both the more effective application of conventional security measures as well as those offered by emerging technologies.

Subgroup activities are closely coordinated with related efforts being pursued in other TSWG projects to ensure that results relevant to infrastructure protection are effectively leveraged. In addition, the partnerships and cooperation fostered by the



President's Commission on Critical Infrastructure Protection have enabled the IP subgroup to work toward common solutions with many other public and private sector organizations supporting the development of technologies that address common problems and vulnerabilities. Recent and current IP projects include efforts involving facility vulnerability evaluations for various potential threats; the development of a common encryption stan-



dard for use by the “commodity transport” infrastructure networks (electricity, natural gas, petroleum, water) for automated communications; and the development of improved tools, techniques, and protocols for software/computer security, reliability, and dependability.

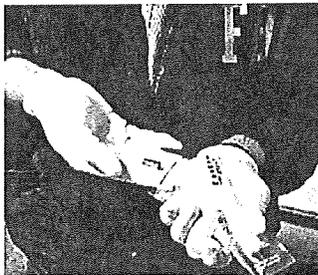
The IP subgroup is chaired by a representative of the FBI. Member departments and agencies include the Department of Commerce, Department of the Treasury, Department of Transportation, Federal Aviation Administration (FAA), Defense Logistics Agency (DLA), Federal Emergency Management Agency (FEMA), and the Environmental Protection Agency (EPA). ■

## *Investigative Support and Forensics*

The Investigative Support and Forensics (IS&F) subgroup supports research and development projects of multi-agency interest intended to provide new capabilities to law enforcement personnel and forensic scientists responsible for investigating terrorist incidents. Work conducted under the auspices of this group has had a major impact on forensic investigations throughout the world of law enforcement. Particularly remarkable have been major advances in the area of latent fingerprint recovery, including work conducted under an international cooperative project; significant progress continues to be made in this area. Capabilities developed under this subgroup that have been used successfully by various government investigative agencies include databases on bomb formulations and explosive incidents, efficient DNA recovery methods, improved

technical means for determining the source of evidence, and novel tags for long-range tracking.

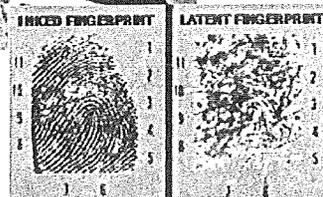
Other recent or current projects supported by the IS&F subgroup include efforts involving characterization of the effects of IEDs,



development of an Automated Information Retrieval System of Terrorist Explosive Devices (AIRSTED), extraction of information in operational video recordings, advanced software tools for analyzing the effects of vehicle

bombs, and document/handwriting analysis. A number of the technological advances supported by this subgroup were deployed to Atlanta in support of the 1996 Olympic Games. New capabilities enabled by subgroup activities also were utilized in the investigation of the Unabomber case, as well as in several cooperative efforts with U.S. allies.

The work of the IS&F subgroup involves representatives from more than a dozen government departments and agencies, including the Bureau of Alcohol, Tobacco, and Firearms (ATF), Drug Enforcement Agency (DEA), National Forensic Science & Technology Center, National Institute of Standards and Technology (NIST), U.S. Customs Service (USCS), and the U.S. Postal Inspection Service (USPIS). The subgroup is co-chaired by the FBI and the U.S. Secret Service. ■



## Personnel Protection

The Personnel Protection (PP) subgroup is responsible for identifying high-priority user requirements and developing new capabilities for protecting high-ranking government officials at home and abroad, visiting foreign dignitaries, and other VIPs against possible attacks by terrorists and other criminals. The R&D projects supported by this subgroup include systems designed to prevent attacks as well as systems able to provide a high level of protection to both the subject(s) of an attack and the accompanying security personnel if prevention fails. Priority projects include efforts focused on life-safety technologies—such as protective armor for limousines, other vehicles, and personnel—

and emergency response equipment and methods. More fundamental efforts supported by the subgroup directed toward an improved understanding of certain attack mechanisms have proven to be of considerable value in designing better methods and equipment important to individual security.

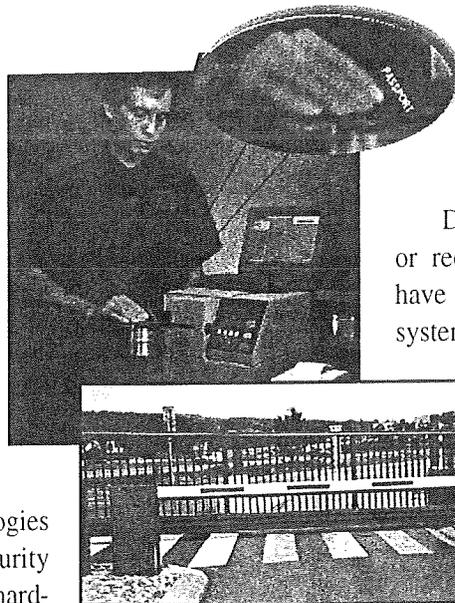
The PP subgroup is chaired by a representative of the U.S. Secret Service. Other member organizations include the DoD Joint Staff,



Department of State, and the Supreme Court of the United States. ■

## Physical Security

Technology development projects supported by the Physical Security (PS) subgroup address elements of security concerned with safeguarding personnel and their equipment; preventing or delaying unauthorized access to facilities, installations, and materiel; and protecting against terrorist actions, sabotage, and purposeful damage—both within the United States and internationally. The subgroup identifies multi-agency physical security requirements or deficiencies, selects advanced technologies with potential to advance physical security state-of-the-art, and develops prototype hard-



ware, software, or systems for technical and operational evaluation by appropriate user agencies.

Development tasks currently underway or recently completed under this subgroup have ranged from advanced security access systems to new tools for assessing the potential vulnerability of various facilities and installations. Major areas of emphasis include structural blast mitigation, vehicle and personnel inspections systems, and modeling tools for blast



effects. Other activities have involved the development of mobile equipment for inspecting vehicles and large cargo containers, intruder detectors and perimeter protection systems, an automated light survey system, and a vehicle video detection system for enhanced security of physical facilities. Military user requirements for Force Protection, an area of high priority for U.S. armed forces, are also addressed by the work of this subgroup.

More than 20 government departments and agencies are members of the PS subgroup, including the DoS, DOE, Department of Transportation, Defense Threat Reduction Agency (DTRA), Federal Bureau of Prisons (FBOP), U.S. Capitol Police, and all of the military departments. The subgroup is chaired by the DoD. ■

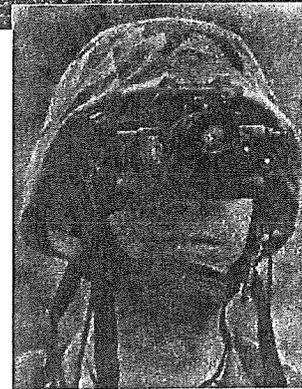
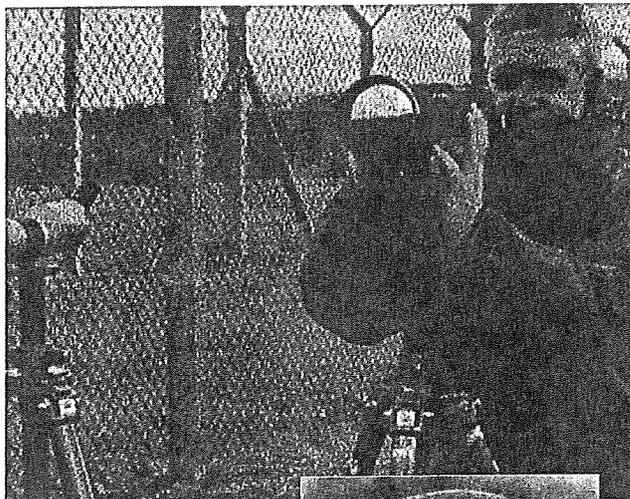
## *Surveillance, Collection and Operations Support*

The Surveillance, Collection, and Operations Support (SC&OS) subgroup is responsible for identifying and responding to technical requirements of member agency users that support important intelligence-gathering activities and various special operations directed against terrorist activities. Research and development projects supported by this subgroup typically focus on the development of specialized equipment and techniques for intelligence collection, advanced tagging methods, tracking and locating devices, unique methods of communication, effective search and recognition systems for individuals and terrorist groups, and automated tools for analyzing intelligence data. Prototype capabilities and systems developed under the purview of this subgroup are used by a number of government intelligence agencies and centers, as well as Federal law enforcement organizations.

Specific projects supported by the SC&OS subgroup include efforts to

develop a special programmable digital camera able to compress, store, and transmit images; passive tags for marking buildings (targeting aids) or vehicles (for tracking or targeting functions); and an advanced GPS cellular tracking device. Some of the technical requirements and projects supported by this subgroup are sensitive and disclosure is therefore limited.

The SC&OS subgroup is co-chaired by representatives of the Central Intelligence Agency (CIA) and the DOE. Other member organizations include the DoD, DoS, Central MASINT Technology Coordination Office, DEA, FBI, U.S. Customs Service, and the U.S. Secret Service. ■





## *Tactical Operations Support*



The Tactical Operations Support (TOS) subgroup is responsible for identifying and addressing user requirements pertinent to supporting tactical operations against terrorists, particularly offensive operations by special forces. Projects supported by this subgroup include both technology development activities, which provide a foundation for subsequent advances,

and the development of prototype special equipment designed to facilitate more effective execution of various tactical missions. Principal users of the technology and systems developed by this subgroup include U.S. military special forces, DOE security teams, and the FBI Hostage Rescue Team. Some of the prototype hardware developed in TOS projects is transitioned to commercial production to help ensure its availability for use by state and local law enforcement organizations.

R&D projects supported by the TOS subgroup include activities involving the development of improved imaging and targeting equipment, systems that facilitate safer

ingress into terrorist-occupied facilities, and specialized command and control technologies. Specific subgroup developments that have already demonstrated or are expected to provide significant value in the execution of successful field operations include enhanced diversionary devices, specialized breaching tools, improved watercraft for use by special operations forces (SOF), chemical and radiation detectors, enhanced night vision goggles, and sniper support equipment.

The TOS subgroup is chaired by the DoD. Other member organizations include the FBI, Naval Special Warfare, Army Special Forces, The Joint Staff, and the DOE. ■

## *Chemical, Biological, Radiological and Nuclear Countermeasures*

One of the greatest threats to the national security of the United States is the continuing proliferation of nuclear, chemical, and biological weapons. The TSWG Chemical, Biological, Radiological and Nuclear Countermeasures (CBRNC) subgroup has major responsibilities for responding to that threat through its efforts to identify critical interagency user requirements and develop new technological capabilities for dealing with the challenging problems it presents.

Projects supported by this subgroup include work involving personal protection, and the detection, identification, containment, mitigation, and disposal of chemical, biological, and radiological materials that might be encountered in terrorist incidents, including the detection of nuclear materials prior to any possible involvement by NEST personnel. Until recently, this subgroup was called Weapons of Mass Destruction Countermeasures (WMDC).





TSWG R&D efforts in these areas was underway well before counter-proliferation became an international priority. Recognition of the lead role played by this subgroup in early government efforts to address the threat posed by terrorist use of chemical and biological weapons was provided by the U.S. Congress Office of Special Technology Assessment in 1991. Recent and current projects supported by the CBRNC subgroup include important developments involving advanced devices and systems for detecting chemical, biological, and radiological materials; new methods and materials for mitigating the effects of and neutralizing areas contaminated by C/B agents; parametric modeling of C/B incidents to support decision-making by responders; improved protective masks and suits for responders to incidents involving the use of C/B agents; and urban agent dispersion modeling and effective countermeasures.

CBRNC subgroup membership includes some 40 government departments and agencies, reflecting the far-ranging concern regarding the threat posed by the hazardous materials being addressed. These organizations include the DoD, DoS, Department of Transportation, Department of Health and Human Services (HHS), Defense Threat Reduction Agency (DTRA), Federal Emergency Management Agency, United State Capitol Police, U.S. Customs Service, and the U.S. Postal Inspection Service. The subgroup is co-chaired by representatives of the FBI and the CIA. ■

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## INTERNATIONAL COOPERATIVE R&D ACTIVITIES

An important element of the overall TSWG program to develop technology for combating terrorism involves collaborative R&D efforts with selected international partners.

International projects provide important opportunities for drawing on the experiences of our allies in dealing with terrorism.

Direction to develop such cooperative efforts was provided by Congress in 1993, which specified that the work was to include activities with both NATO and major non-NATO allies. Bilateral agreements with United Kingdom (UK), Canada, and Israel were established in 1994 and 1995, and a number of new projects were subsequently initiated. Highest priority was given to efforts pertinent to the detec-

tion and neutralization of terrorist weapons; the detection, identification, and surveillance of known or suspected terrorists; and hostage rescue.

TSWG international program projects are executed as an integral part of the overall program. In terms of resources, they currently represent about 15% of the TSWG program. The projects are developed and managed under the established subgroup structure, and the process for reviewing and initiating new projects is essentially the same as that followed for projects being carried out in the United States. Important supplemen-



tal considerations in establishing new international projects include: (1) the evident benefit to the United States in developing a capability not obtainable—or obtainable as rapidly—without collaboration, and (2) potential cost benefits. These criteria are consistent with the previously noted TSWG commitment to develop and field new capabilities for combating terrorism following a process that emphasizes a *smarter/faster/cheaper* approach. International TSWG projects provide numerous additional benefits, including:

- ✓ The opportunity to share knowledge in many areas of common interest (e.g., to gain access—under terms of the bilateral agreements—to blast, casualty, and bomb damage data that does not exist in the United States;
- ✓ The ability to use unique facilities and expertise in executing project technical work, and to conduct certain experiments and tests that cannot be conducted in the United States;
- ✓ The ability to draw on a broader technology base by including the expertise of foreign scientists, engineers, and analysts; and
- ✓ The opportunity to draw on the greater experiences of our allies in dealing with terrorists and terrorist incidents.

“Terrorism constitutes a serious threat to peace, security and stability that can threaten the territorial integrity of States. We reiterate our condemnation of terrorism and reaffirm our determination to combat it in accordance with our international commitments and national legislation.”

*Excerpt from the Washington Summit  
Communique Issued by the Heads of State  
and Government participating in the  
meeting of the North Atlantic Council in  
Washington, D.C. on 24th April 1999*

More than 50 projects involving international cooperative R&D projects have been initiated with organizations in the UK, Canada, and Israel over the last few years. Notable successes have involved projects concerned with the detection of trace amounts of explosives, latent fingerprint recovery, and specialized equipment for responding to terrorist incidents involving C/B threat agents.

In another international cooperative activity, TSWG also provides U.S. representation to the trilateral (CAN/UK/US) Conference on the Response to Chemical and Biological Terrorism through its CBRNC subgroup. ■



# PROGRAM FUNDING

Funding for TSWG core program activities is currently provided by the Department of Defense, Department of State, and Department of Energy. Beginning in FY 2000, program funding is expected to also include a significant contribution from the FBI, reflecting its new role as a member of the TSWG Executive Committee. Core program funding is augmented by cost-sharing on selected projects by TSWG member agencies, and project co-funding has increased significantly in recent years.

The sources and levels of funding for TSWG program activities have varied to a considerable degree since the organization was established in 1987. Early program efforts were supported by the DoS at a level of about \$10 million for the two-year period FY 1986-1987. Funding then declined from about \$7 million in FY 1988 to \$2 million in FY 1990 and FY 1991 due to budget constraints and then-current perceptions regarding the terrorist threat. In 1991, DoD interest in the work of TSWG increased as several prototypes developed under the program were deployed in successful military operations. This interest was reflected in a major shift in the source of funding for the TSWG program beginning in FY 1992. DoD became the principal supporter through the Office of the Assistant Secretary of Defense for Special Operations and Low Intensity Conflict (OASD(SO/LIC)), and total program funding increased to about \$8 million. Core program funding remained at about that level through FY1995, but augmented by Congressionally mandated funding for the development of collaborative programs with select international partners in FY 1993 (\$3 million) and FY 1995 (\$2 million).

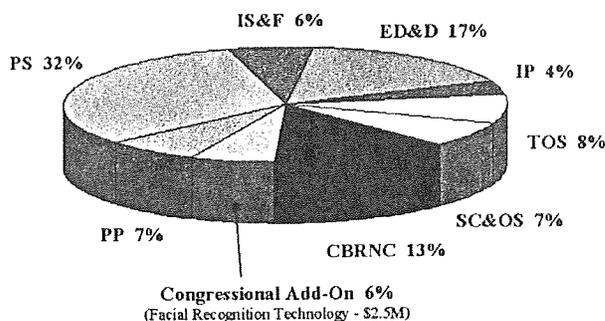
Funding for the TSWG program has increased significantly since 1995, reflecting increasing terrorist activity and the recognized need to accelerate the development of new technological capabilities for effectively dealing with the problem. Beginning in FY 1996, funding for TSWG

international projects was increased to a level of \$6 million per year, and total program funding was about \$14 million. Total program funding for FY 1997 was approximately \$19 million, and for FY 1998 and FY 1999 committed resources were close to \$40 million per year.

Each year, TSWG program resources are allocated to support continuing activities and selected new starts according to priorities established by the TSWG Executive Committee. Budgeting flexibility is considered a significant factor important to the success of many TSWG program activities. The amount and percentage of total program funding each subgroup receives varies from year to

## TSWG FY 1999 PROGRAM PLAN

Resource Allocation by Subgroup  
Budget: \$38.2M



year depending on critical user requirements and overall budget considerations. For FY 1999, the Physical Security (PS), Explosives Detection and Defeat (ED&D), and Chemical, Biological, Radiological, and Nuclear Countermeasures (CBRNC) subgroups together received more than 60% of total program resources, reflecting recent incidents and experiences, as well as concerns regarding future terrorist activities. Particularly noteworthy is the fact that current funding for the PS subgroup includes \$8 million for blast mitigation testing, a comprehensive and unique program to assess the effects of blasts on structures and building materials. The work will also include systematic evaluations of the effectiveness of various countermeasures intended to reduce the severity of explosive detonations. ■



## PROGRAM ACCOMPLISHMENTS

The significant and continuing success of many of the projects developed and executed under TSWG direction since its establishment is reflected in the numerous advances in technical capabilities that have transitioned from the development stage to successful use in the field. Over the last decade, TSWG has supported several hundred research and development projects important to the continuing fight against terrorism. Results and prototypes from more than 70% of these projects have been operationally deployed or integrated into related user programs for further development. Representative examples of TSWG program accomplishments are described in the following paragraphs.

### TIPOFF WATCH LIST SYSTEM

Restricting the freedom of movement of known or suspected international terrorists, particularly their entry into the United States through any of hundreds of established entry points, is an important aspect of the continuing struggle to prevent terrorist incidents. Important work supported by TSWG to develop a comprehensive computerized personnel screening system has made a major contribution to U.S. capabilities in this area. The system greatly facilitates the rapid identification of undesirable individuals applying for visas or attempting to enter the country using conventional routes associated with international travel.

the U.S. Department of State (DoS). It was developed in response to increasing demands from the intelligence community for faster, more reliable information management capabilities to support anti-terrorist activities and enhance border security. TIPOFF is a computerized database containing collected information on more than 40,000 known or suspected international terrorists. Its prime function is to make effective use of the collective information-gathering resources of the intelligence community by helping to identify known or suspected terrorists and other criminals, thereby restricting their entry into the United States. An important feature of the system is its ability to deal with significant linguistic differences in various national groups, including Arabic and Spanish.

The system, known as TIPOFF, is a multi-cultural name-matching system developed and operated by the Bureau of Intelligence and Research (INR) within

Information incorporated into the TIPOFF database has been compiled from a variety of sources, including the National Security





Agency (NSA), the CIA, and the FBI. Additional data have been obtained from international intelligence organizations. All of these agencies maintain detailed information on known or suspected international criminals and terrorists. Individual TIPOFF records include names, name variations, aliases, biographical data, and supplemental details on terrorists and other known felons, including hijackers, intelligence agents, and assassins. Although the database is designed to provide information that is current, extensive historical records are also maintained. Continuing proactive data collection activities enable updating and expansion of the database as new information, including photographs and fingerprints, become available.

TIPOFF provides a vital link between the secret world of the intelligence community and the unclassified work environment of visa and immigration officers. Strict operating protocols approved by intelligence and law enforcement agencies, however, ensure that access to available information is restricted to properly cleared personnel. A principal use of the classified TIPOFF system is to support screening efforts by U.S. officials stationed at embassies and other overseas sites responsible for processing applications for entry into the United States. This is accomplished by watch-listing suspected terrorists in the DoS Consular Lookout and Support System (CLASS), an unclassified watch list system available on-line to all visa-issuing posts around the world. When a visa applicant's name is queried in CLASS and produces a "hit," a diplomatic cable is promptly forwarded to the DoS in Washington for further checks using the TIPOFF system. The database is rapidly searched using intelligence search criteria and a return report providing

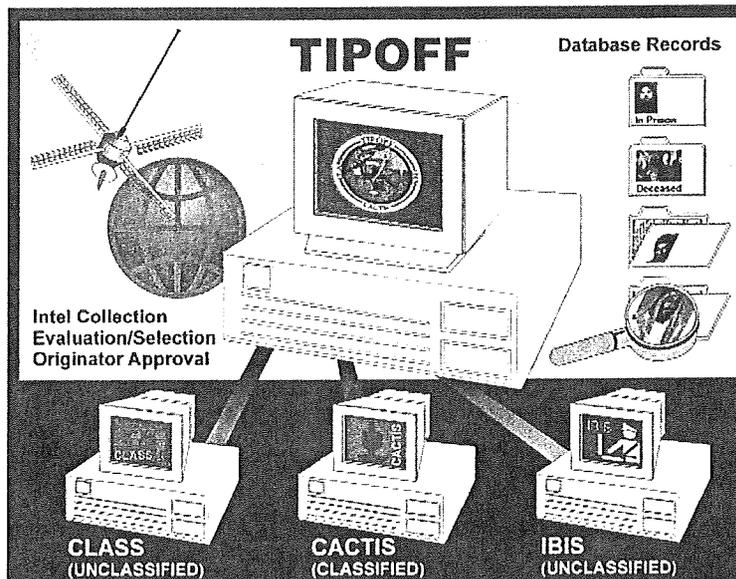
instructions relevant to acceptance or denial of the requested visa is transmitted. The FBI and the intelligence community are also alerted to support operational opportunities that may arise.

Hundreds of known or suspected terrorists and other criminals have been denied access to the U.S. over the last few years as a result of TIPOFF queries. TIPOFF data provided to the Interagency Border Inspection System (IBIS) operated by the Immigration and Naturalization Service (INS) and the USCS have also provided numerous operational opportunities leading to the interdiction or arrest of

identified terrorists at many different U.S. points of entry. TIPOFF began sharing watch list data with all Canadian embassies and ports of entry throughout Canada in April of 1998. The system has demonstrated significant additional utility in dealing with matters related to the fraudulent use of lost or stolen passports. At a highly classified level, the TIPOFF system also provides continuing support to the counterterrorism community through

its link to the Community Automated Counterterrorist Information System (CACTIS), which supports the activities of some 30 U.S. government agencies.

Recognition of the importance of the TIPOFF database and system as a counter-terrorism tool was reflected in its nomination for the prestigious Killian Award in 1998. The award, presented annually by the President's Intelligence Advisory Board, provides special recognition "for excellence in performance of foreign intelligence activities of particularly crucial importance to the national security of the United States." ■



Elements of TIPOFF operations and data sharing



EXPLOSIVE  
MARKING  
AGENT  
DETECTOR  
ENHANCEMENT

Significant progress in advancing U.S. and international capabilities to detect concealed explosives that might be used or transported by terrorists has been achieved as a result of continuing TSWG efforts to develop improved means for detecting such materials. A key early accomplishment in this area was the identification of a special organic material (DMNB; 2,3-dimethyl-2,3-dinitrobutane) as an effective explosives marking agent.

Marking agents are unique chemical substances that — when physically mixed with explosive materials during their manufacture — enable

enhanced detection of concealed plastic explosives. The most promising substances identified in studies supported by TSWG were materials capable of emitting very low concentrations of detectable vapors with well-characterized chemical signatures for many years. The work, led by scientists at the U.S Army Armament Research Development and Engineering Center (ARDEC), concentrated on finding a vapor marking agent that could be readily and reliably detected using standard gas chromatography systems fitted with a high-sensitivity electron capture detector. DMNB was the result. The

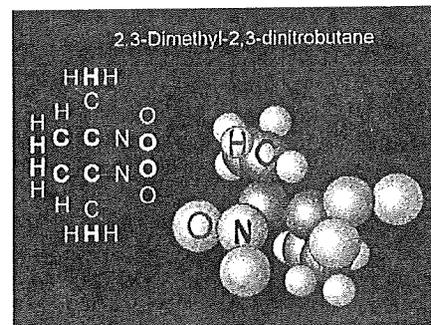
agent met all specified detectability requirements and showed no adverse effects on the performance of the host explosives.

The identification of DMNB, coupled with concurrent advances in marking agent technology in other countries, led to the establishment of the *Convention on the Marking of Plastic Explosives for the Purpose of Detection* by the International Civil

Aviation Organization (ICAO) in 1991. The convention, an international treaty intended to expedite exploitation of emerging technical capabilities for detecting explosives that

might be linked to terrorist activities, was subsequently enacted into United States law by Congress as part of the Anti-Terrorism and Effective Death Penalty Act of 1996. The use of DMNB as a marking agent is now required for all plastic explosives manufactured in the United States.

Subsequent work supported by TSWG focused on the development of improved means for detecting DMNB and other marking agents identified in the ICAO convention that could be incorporated into existing explosive detection systems designed to detect and analyze chemical vapors. A key



DMNB explosive marking agent



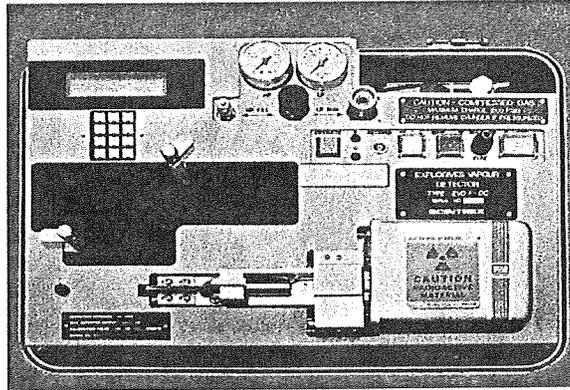
requirement was that the necessary modifications have no adverse impact on the current explosive-detection capabilities of the system. Several commercially available systems were modified and tested by the Naval Explosive Ordnance Disposal Technology Division of the Naval Surface Warfare Center. Successful results have been transitioned into competitive production systems, and operational deployment of selected systems that meet international treaty requirements is expected soon.

Additional efforts to exploit the utility of DMNB as a marking agent is continuing in related TSWG projects that address the detection of explosives in thin sheet or detonation cord (DETCORD) forms. The high surface area of explosives manufactured into these geometries results in a higher rate

of vapor release than characteristic of bulk materials. Maintaining the reliability and the effectiveness of the marking agent over extended periods in sheet and DETCORD explosives is thus a significant issue. For

DETCORD applications, the effects of DMNB content on detectability and the potential benefits of applying coverings to the cord are being investigated. Detectability studies include accelerated aging tests. For applications of DMNB in sheet explosives, microencapsulation of the marking agent is being studied. The work includes examination of issues related to the compatibility of selected polymer coatings and explo-

sives, DMNB vapor emission rates, safety, and long-term storage of the materials. Efforts to develop a lower cost manufacturing process for DMNB are also being pursued. ■



Marking agent detection instrument

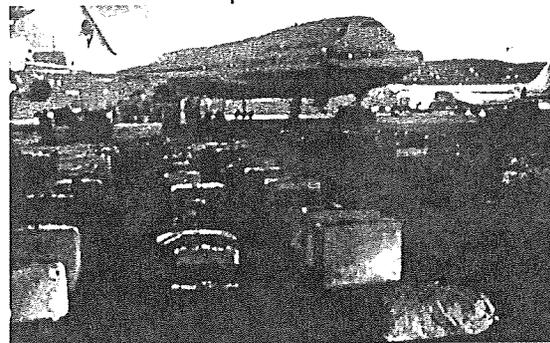
Enhanced capabilities for detecting explosive devices concealed in luggage and cargo aboard commercial and other aircraft are of critical importance in helping to avoid catastrophic terrorist incidents at airports and in flight. Such capabilities are essential to ensuring the safety and security of both passengers and crew, as well as to maintaining the overall stability of national and international air travel and commerce.

Significant progress has recently been achieved in TSWG efforts to develop a unique system for the reliable detection of bulk explosives in a variety of concealment modes. The

work was conducted in cooperation with an international partner having extensive prior experience in the development and use of special chambers for examining airline cargo under variable barometric pressures.

Bomb-ignition devices sensitive to altitude-induced changes in barometric pressure were once viewed as a major threat to aircraft. The new system integrates proven low-pressure, bomb activa-

## BULK EXPLOSIVES DETECTION



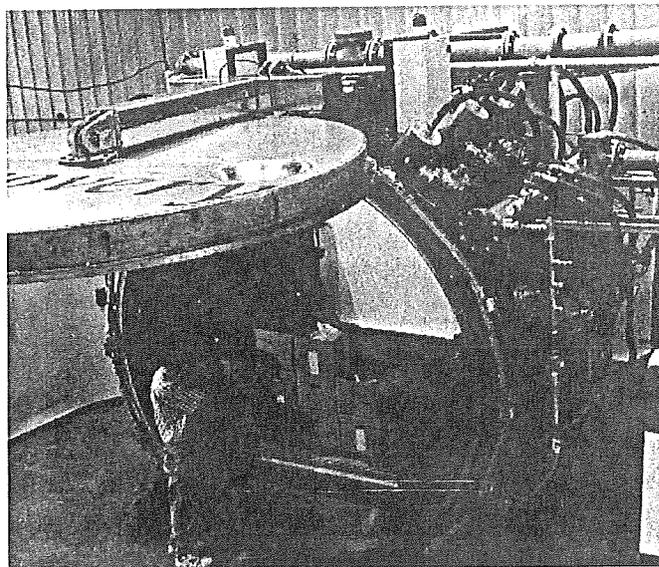
Luggage set out for manual inspection



tion chamber technology developed and used successfully for many years to address that threat with a commercially available, off-the-shelf particle/vapor explosives detection and analysis system called EGIS (Thermedics Detection, Inc.; Woburn, Massachusetts). EGIS uses advanced detection technologies and high-speed chemical analyses to identify trace amounts of explosive materials, including plastic explosives that have proven difficult to detect using conventional inspection methods.

The new system is based on a "shake and bake" approach to explosives detection. Large quantities of luggage are placed in an evaluation chamber and subjected to moderate heating, vibration, and variations in air flow and air pressure. These actions induce the release of vapors or particles from concealed explosives that might be present. Rapid, automated analysis by EGIS then alerts system operators to the likely presence of explosives or provides an indication that the contents of the chamber are suitable for transport.

Optimal treatment conditions for the system were established through systematic testing conducted as part of the TSWG project. Prime considerations in designing the system were throughput rate and detection reliability. The ability to inspect large quantities of luggage safely, rapidly, and reliably was a key requirement important to overall system viability and airline industry acceptance. An explosives detection system able to minimize the impact of the inspection process on normal commerce was desired. Such a capability has not previously been available. Currently practiced state-of-the-art inspections of airline baggage rely on canine searches of individual pieces of luggage, which are laborious and time-consuming. They also place both humans and dogs at risk.



Automated luggage inspection system for detection of explosives

A prototype explosive detection system was installed at an international airport in the summer of 1998 for long-term operational evaluations, particularly to assess issues related to system reliability. Results of these evaluations are expected to provide a basis for potential system refinements and facilitate widespread deployment at airports around the world within a few years. It is likely that similar equipment will find use in the inspection of sea cargo and incoming shipments at military installations. Other important applications are also expected to be identified. ■

*Improved methods for bulk explosives*

*detection will help to avert*

*catastrophic terrorist incidents at*

*airports and in flight.*



New capabilities for detecting trace amounts of explosive residue on aircraft boarding passes have recently been developed in a TSWG project intended to help identify potential terrorists and enhance security within the airline industry. A prototype boarding pass examination system able to detect very small amounts of explosives transferred from the hands of individuals who have recently been in contact with such materials has been designed, constructed, and successfully demonstrated in both laboratory and airport environments. Commercialization efforts are currently underway, and widespread use at U.S. and international airports is anticipated within the next few years.

The work was conducted in collaboration with an international partner having a highly developed technology base in the area of trace detection of explosives. This expertise enabled the project to be executed in a rapid and cost-effective manner. Specific activities leading to the successful system demonstrations included: (1) systematic investigation of key parameters affecting the detection of explosive residues on paper surfaces, intended to advance basic understanding of explosive residue transfer and detection phenomena; (2) optimization of a simple and reliable physical technique for removing residues or decomposition by-products for analysis; and (3) in-situ chemical analyzes using tandem mass spectrometers to establish detection limits for a variety of explosive residues. The theory—supported by

## BOARDING PASS EXAMINATION SYSTEM



Prototype boarding pass analyzer

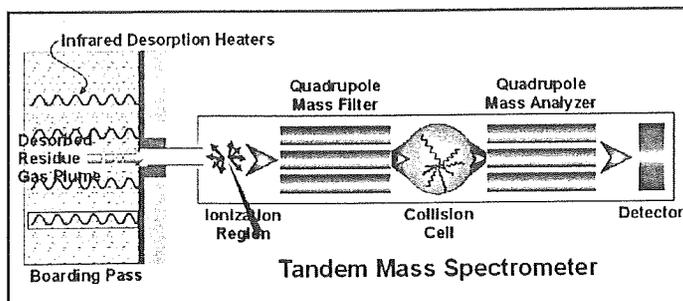
earlier forensic investigations—that people who have recently handled explosives transfer sufficient quantities to items subsequently handled to enable later detection was proved. The ability to detect residues as low as 20 picograms (only 20 *trillionths* of a gram) was demonstrated. Such high sensitivity enables detection of explosive residues even in cases where individual contact with a boarding pass or

some other object being inspected was only cursory in nature.

Key features of the system include rapid, efficient, automated operation; high detection reliability and reproducibility; applicability to a range of explosive types; and minimal cross-contamination from one card to the next. The analyzer unit is a compact, stand-alone device (having a volume of less than one-third of a cubic foot and weighing about five pounds) that is easily integrated with standard boarding pass readers. Required power for the on-board electronics and desorber sub-unit is provided by a standard ac connection.

System operation involves a two-step process. When the operator inserts a boarding pass into the reader, the card is rapidly but moderately heated using a low-power laser, causing vapors to be released (desorbed) from any residue material. The vapors are then passed into the source of a tandem mass spectrometer for chemical analysis and reporting in real time. The entire process is unobtrusive and takes only a few seconds to complete.

Continuing efforts to exploit the technology and capabilities developed in this TSWG project for similar applications (e.g., inspections of security and visitor badges at military sites, government buildings, and other installations; passports at U.S. points of entry; train tickets; and tickets to various types of special events) are in progress. ■



Schematic illustration of Laser Desorption Spectroscopy

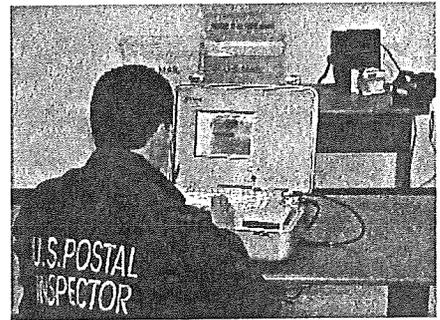
**REAL-TIME  
PORTABLE  
X-RAY  
INSPECTION  
SYSTEM**

There are numerous scenarios where the ability to conduct rapid and reliable inspections of sealed envelopes, small packages, and other objects that might be used to conceal explosive devices or many other types of contraband materiel during transport is of critical importance. Other situations requiring similar capabilities include instances where it is unsafe or impossible to move a potentially threatening object for examination (e.g., abandoned luggage, bomb threats, items hidden in furniture or walls). Capabilities for conducting such inspections, which address both safety and law-enforcement requirements, have recently been enhanced through efforts supported by TSWG to develop a highly portable, real-time, electronic-imager X-ray inspection system.

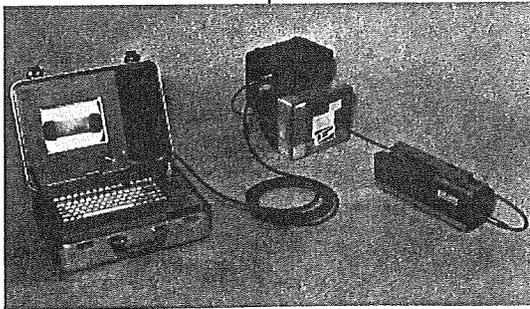
The work was initiated in response to a request from the U.S. Postal Inspection Service (USPIS) for assistance in developing an easy-to-use, man-portable X-ray system for examining the contents of suspect parcels or other items being handled by the U.S. Postal Service. The new system was needed to replace a traditional Polaroid® film-based X-ray interrogation system that had been in use for many years and involved a cumbersome and time-consuming inspection process. Critical system

design considerations in achieving a much more efficient inspection process included image quality, image processing time and effort, system size and weight, operator interface, and cost.

The TSWG project was executed by Science Applications International Corporation (SAIC) to effectively leverage ongoing work by the compa-



USPIS use of RTR-3 X-ray system



RTR-3 portable X-ray system

ny to re-engineer an existing Real-Time Radiography system (designated the RTR-2). The effort was concentrated on reducing the size, weight, number of subsystems, and cost while simultaneously enhancing overall system operation. The resulting system, designated the RTR-3, met a wide range of required specifications in a smaller, better, cheaper product. Excellent test results were obtained with prototype systems evaluated by the USPIS and the Naval Explosive Ordnance Disposal Technology Division (NEODTD). Inspections of various types of packages yielded high-resolution images of many different contraband items. Prototype systems were also used successfully by the FBI at the 1996 Olympic Games in Atlanta.

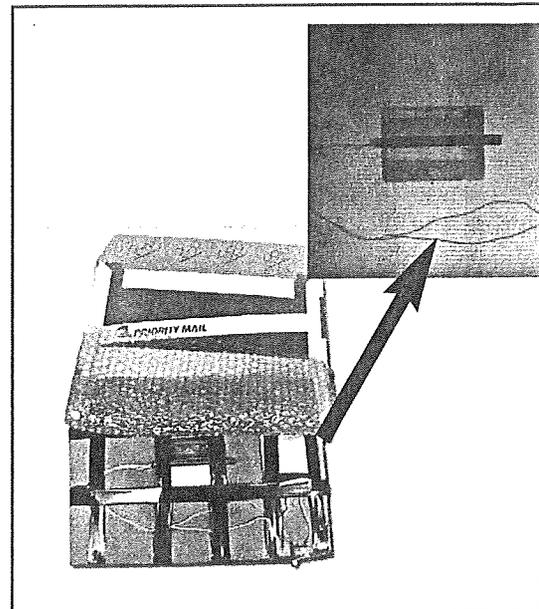


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The RTR-3 is a rugged, man-portable X-ray inspection system that consists of a lightweight, compact electronic imager with an 8x10-inch X-ray sensor; a portable, lightweight integrated control unit (a personal computer with keyboard and a flat-panel image display); and a single package portable X-ray source. It is a fully digital, battery- or powerline-operated system capable of acquiring, enhancing, and archiving radioscopic images in the field with comparative ease of operation. Images can be viewed on-screen within seconds after object exposure and easily manipulated by the operator in a familiar Microsoft Windows® environment to facilitate interpretation. They can also be quickly transmitted from the field to other remote locations via modem for examination and assessment by other analysts. The complete system can be stored and transported in two suitcase-sized containers, each weighing less than 40 lbs when loaded.

Following successful development and prototype testing, the RTR-3 system transitioned to production and commercial availability. The most immediate user was the Forensic and Technical Services Division of the USPIS, but hundreds of systems have since been sold to many other organizations, including the FBI, military EOD units, the National Institute of Justice (for evaluation by state and



Simulated letter bomb and RTR-3 system X-ray image

local bomb squad units), and foreign govern  
FBI plans to procure further-upgraded portable  
tems (RTR-4 units) for every accredited bomb s  
United States. ■



Ro

## LATENT FINGERPRINT RECOVERY

Fingerprint recovery and analysis has been an important aspect of criminal investigations for many decades. A wide variety of techniques have been developed and used with varying degrees of success. Different methods are employed depending on the specific host materials, environmental conditions, elapsed time, and other factors. There is a compelling need for continuing technical advances in this area, however, particularly with respect to the detection and recovery of latent fingerprints on problematic

surfaces, including paper, faces, porous materials, firearms cartridges.

Significant developm  
tant to future forensic in  
have recently been achieve  
research and developm  
focused on latent fingerpri  
Many aspects of the work  
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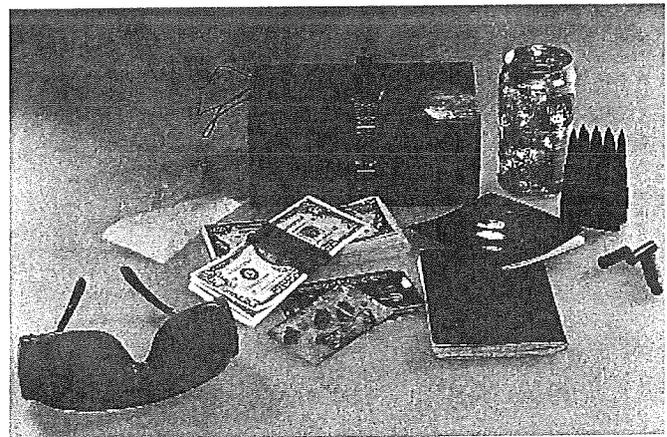


Considerable progress has been achieved in most of these areas, and key results have already been widely disseminated to law-enforcement agencies and security/intelligence organizations, particularly forensics specialists and crime laboratories that deal with terrorist-related crimes, to support ongoing or new investigations. Specific noteworthy accomplishments include the following:

- ✓ Several new chemical compounds offering significant potential for use in recovering latent fingerprints have been identified; one of these substances provides both sensitivity and cost advantages compared to DFO, an organic substance currently used to recover fingerprints from paper and other surfaces. It produces the strongest fluorescent latent fingerprints on paper to date; the reagent is being considered for adoption as a standard by forensics laboratories both in the United States and internationally.
- ✓ A model for what happens to latent fingerprints on ballistic cartridge cases after firing and improved print recovery methods have been developed.
- ✓ Studies of UV luminescence and fluorescence have led to development of a prototype, portable system for rapidly recovering latent fingerprints in the field. The system may also be useful in detecting and characterizing stains caused by other body fluids (e.g., blood, semen, and saliva) at crime scenes.
- ✓ A print-retention spray has been developed to help preserve latent fingerprints on certain types of surfaces.
- ✓ Two new types of physical developers have been identified that show considerable promise for recovery of latent fingerprints from problematic surfaces.

Techniques developed as part of latent fingerprint recovery work supported by TSWG have already contributed to the successful conclusion of an investigation involving the 1997 theft by terrorists of U.S. Dragon shoulder-launched, anti-tank missiles. The missiles were stolen for use against a commercial airliner. Recovery and analysis of latent fingerprints on wooden missile shipping crates left in the desert for several weeks enabled identification of the terrorist perpetrators and led to timely recovery of the missiles. A potential terrorist act with horrific consequences was avoided.

Important work in the area of latent fingerprint recovery is continuing. One major focus involves systematic study of the changing character of fingerprints with time, reflecting the fact that latent prints are seldom recovered from crime scenes or the sites of terrorist incidents immediately after being deposited. The work includes careful examination by scanning electron microscopy (SEM) of prints treated with the sensitive lipid-visualizing reagent Physical Developer (PD) to help establish a better understanding of how the reagent reacts/interacts with the lipid portion of the print residue. Results are expected to contribute to further optimization of other reagents used in fingerprint visualization and recovery. Additional work in progress includes efforts directed toward the development of improved methods for recovering fingerprints from water-soaked evidence, and chemical analyses of latent fingerprint residue deposited under crime scene conditions. ■



Display of IR-illuminated fingerprints on evidence related to terrorist activity



**MITIGATION OF  
CHEMICAL/  
BIOLOGICAL  
AGENT  
EFFECTS**

Improvised explosive devices (IEDs) that might be fabricated and deployed by terrorists can take many forms and produce a variety of harmful effects. Techniques for disarming, disabling, or otherwise neutralizing such devices must be capable of minimizing collateral damage associated with the effects of blast and heat, device fragmentation, and the possible dispersal of chemical and biological (C/B) agents upon detonation.

Improved capabilities for mitigating many of these effects have recently been developed as part of more comprehensive activities supported by TSWG to enhance the effectiveness and safety of local law enforcement agency bomb squads, military explosive ordnance disposal (EOD) teams, FBI and FAA bomb neutralization specialists, and U.S. Army Technical Escort Unit personnel.

advanced models for analyzing explosively released aerosols and estimating the effects of agent dispersal have been formulated.

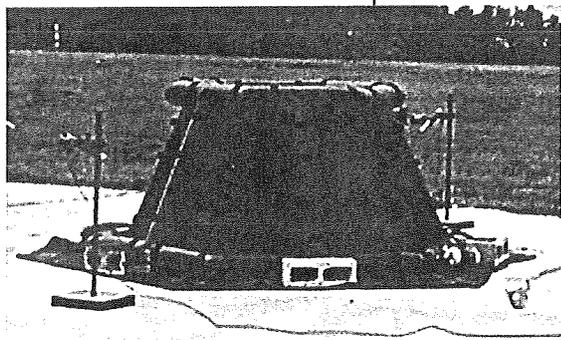
TSWG has supported research and development efforts pertinent to the mitigation of the effects of C/B agents for many years. One noteworthy approach involved the development of an "actively scavenging aerosol cloud" able to cause particles in the agent cloud to agglomerate on the scavenger and induce settling. Enhancement of this effect was achieved by increasing the electronic charge on the scavengers to exploit forces of electrostatic attraction between the agent and the scavenger material. Subsequent work investigat-

*Enhanced mitigation of C/B agent effects was achieved by merging concepts developed by U.S. researchers and an international team.*

ed the effectiveness of aqueous foams for restricting the dispersal of agent particles upon IED detonation. This approach, which involved the development of opti-

New approaches for capturing agent particles have been discovered, a more effective protective structure for containing the products associated with IED detonation has been designed and demonstrated, and more

mal means for producing foams having characteristics suitable for C/B agent mitigation using existing foam generators, also proved promising. The effectiveness of an aqueous foam in limiting the dissemination of a mustard agent simulant was demonstrated in 1995, and the foam system was subsequently made available to U.S. forces in Somalia.

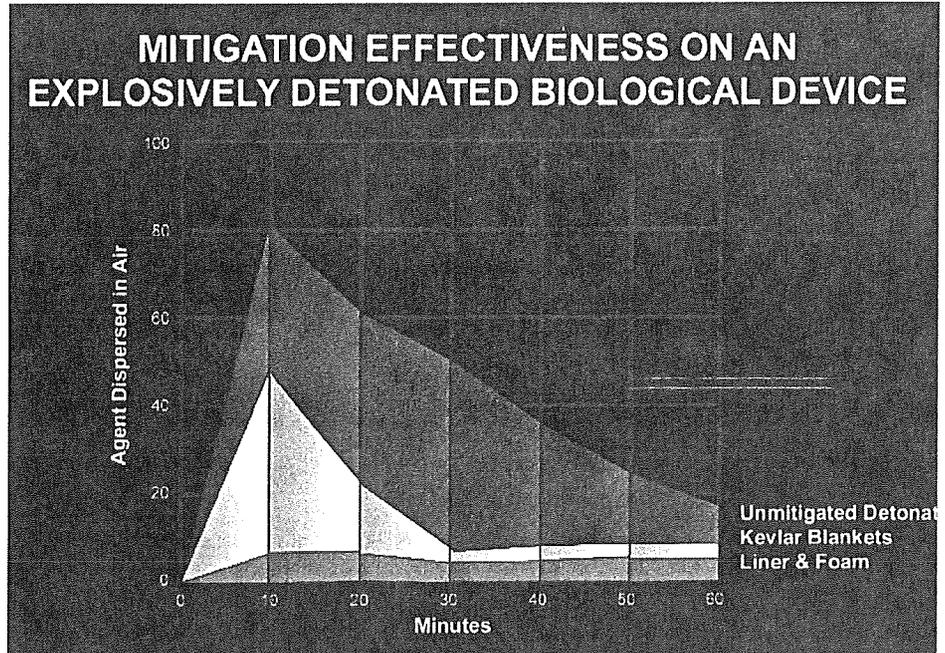


C/B agent containment tent



Further exploitation of these developments was achieved by combining the results with related efforts previously supported by the Department of Energy (DOE). The mission of the DOE Nuclear Emergency Search Team (NEST) is to respond to a wide range of nuclear emergencies. NEST units may also be called upon to deal with incidents involving sophisticated threats. In dealing with some threats, a large tent filled with foam is used to contain radioactive materials that might be dispersed during attempts to neutralize the device. Work supported by TSWG investigated whether the NEST approach, appropriately scaled down, could be effective in containing C/B agents dispersed by detonation of an IED. A merging of concepts being pursued by an international team and researchers in the United States yielded an effective solution—an aqueous foam injected into a Kevlar tent containing the subject IED. The use of Kevlar, with proven effectiveness as an armor material, enables better containment of fragments associated with device detonation.

Following successful testing as part of an international C/B mitigation testing program, as well as operational and acceptance testing by the U.S. Army, the tent/foam system has been deployed by the Army Technical Escort Unit. The system complements other capabilities developed by TSWG for dealing with IEDs that might contain C/B agents, including a protective mask for first responders and a hybrid full-body suit for use by EOD teams. Continuing TSWG activities in this area involve efforts to incorporate various decontaminants into C/B agent mitigation foams, including the use of enzymes and peptides. Promising results have been achieved in tests against G-series chemi-



Mitigation can dramatically reduce the amount of agent dispersed into the air by an IED

cal agents (e.g., sarin, the chemical agent dispersed in the 1995 subway terrorist incident in Tokyo). ■



Aqueous foam being injected into containment tent



New capabilities important to the safety and effectiveness of first responders to terrorist attacks-including medical, search and rescue, fire-fighting, hazmat emergency response, military and law-enforcement, and forensic personnel-have recently been demonstrated in TSWG efforts to develop a universal-fit mask able to provide reliable protection against a

market was found to meet many anticipated user needs. The main thrust of the bilateral project thus involved extensive testing and modification of the candidate mask to address an expanded set of requirements specified by the first-responder community.

*The mask provides excellent protection against a wide range of threat agents... in liquid, aerosol, and vapor forms.*

CHEMICAL/  
BIOLOGICAL  
MASK  
FOR FIRST  
RESPONDERS

wide range of chemical and biological threat agents. Use of the mask by first-responder teams will allow them to safely enter contaminated areas and effectively perform critical post-attack functions for periods of up to 12 hours. Many other applications are anticipated, including use by military forces conducting special operations involving potential exposure to a wide variety of toxic materials.

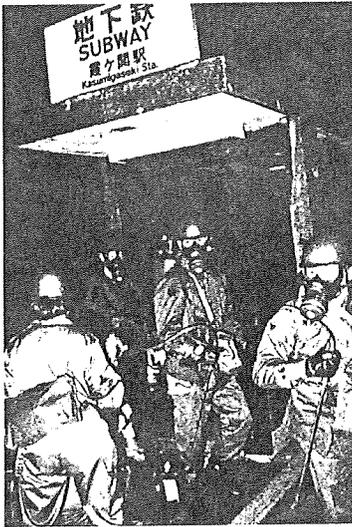
One key factor in achieving successful results on the project involved effective collaboration with an international partner having considerable prior experience and expertise in the development and use of masks for C/B protection, particularly masks having improved neck-seal designs and blown air components that provide positive inside pressures and eliminate fogging. A commercial product available on the international

The comprehensive evaluation process involved many different types of tests:

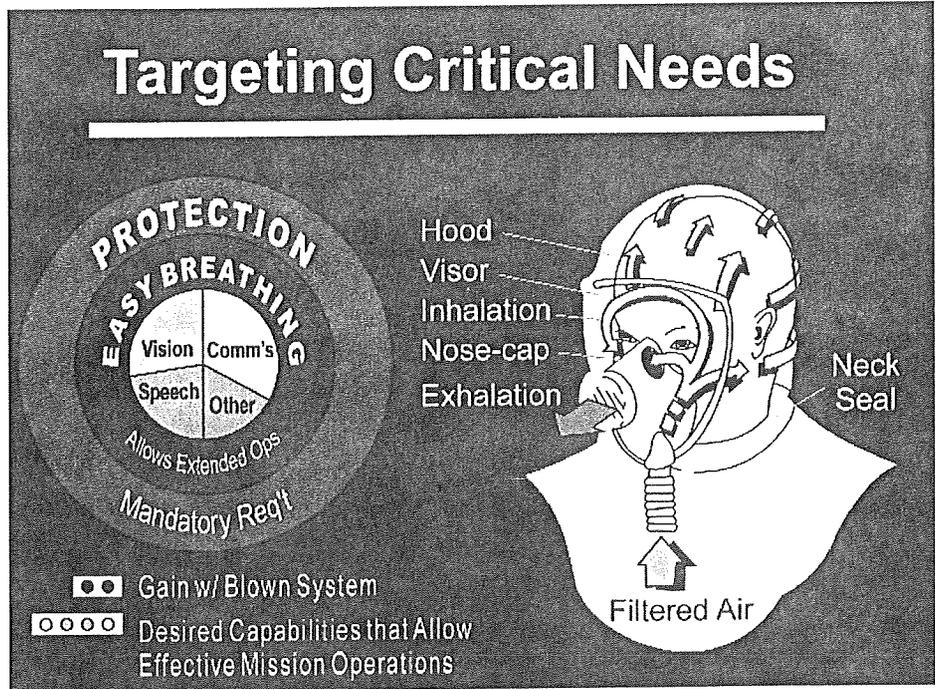
- ✓ Protection factor tests, conducted in an aerosol chamber with human volunteers, to assess the ability of the mask to provide protection against various surrogate threat agents while the wearers performed a variety of tasks;
- ✓ Liquid chemical agent penetration tests, conducted at a certified agent testing facility using U.S. military agent penetration standards;
- ✓ Respiratory system tests to determine air flow rates of the mask motor blower and inhalation and exhalation resistance at different breathing rates and volumes;



Improved mask for protection against C/B agents



Tokyo chemical agent terrorist incident



Selected C/B mask features

- ✓ Vision tests to examine all aspects of peripheral vision, static and color acuity, depth perception, light transmission, lens distortion, and other factors;
- ✓ Communications tests to determine the extent of hearing and speech losses through the hood/mask material under various conditions;
- ✓ Tests under a range of work levels (energy expenditure rates) to determine that the wearer can perform at or near full unmasked capacity without fogging the lenses in different climatic environments.

*Mask development involved extensive laboratory testing and weeks of field evaluations to optimize comfort and performance.*

The modified mask design offers many operational features. It provides excellent protection against a wide range of threat agents (liquids, aerosols, and vapors), with protection factors of up to 10,000 (at such a level, wearer exposure is only 1/10,000 of the ambient agent concentration). The design enables easy breathing, unmuffled speech, and satisfactory hearing. It incorporates drinking tubes for supplying liquid nourishment to wearers during prolonged periods of use. The mask also accommodates glasses, beards (due to its neck-seal design), and long hair, facilitating universal use.

In addition, field evaluations of prototype masks were conducted over a period of several weeks to identify any significant human factor considerations important to optimizing overall mask comfort and performance.

Certification of the mask by the National Institute of Occupational Safety and Health (NIOSH), required prior to deployment and use by a wide range of federal, state, and local first-reponder agencies, is pending. ■



**EOD SUIT FOR  
ENHANCED  
PROTECTION  
AGAINST  
CHEMICAL/  
BIOLOGICAL  
AGENTS**

The protective suits currently worn by most military explosive ordnance disposal (EOD) teams and bomb disposal units deployed by civilian law enforcement agencies are designed to provide protection against blast wave effects and moderate- to high-velocity casing fragments associated with the possible detonation of an explosive device during standard disarming and disablement operations. Recent work by TSWG has resulted in the development of superior equipment that integrates complementary protective capabilities against hazards caused by the simultaneous release of chemical and biological (C/B) agents that might be incorporated into improvised explosive or dispersal devices used by terrorists. An accelerated testing effort conducted as part of the project facilitated the first operational deployment of the suit at the 1996 Olympic Games in Atlanta.

The project involved extensive collaboration with an international partner having well-developed capabilities pertinent to the design and manufacture of protective EOD equipment. Critical issues related to providing protection for teams and individuals handling explosive devices containing C/B threat agents were already being explored. The work supported by TSWG involved modifications to an existing EOD protective suit (designated EOD-7G) devel-

oped by the partner to accommodate M40 C/B protective masks available in the U.S., followed by carefully controlled testing at several different laboratories offering unique capabilities and expertise.



EOD suit for enhanced protection against C/B agents



EOD suit test using instrumented anthropomorphic simulator and biological agent simulant

The testing program conducted to establish the levels of ballistic and C/B protection provided by the modified systems was rigorous and comprehensive. Selected oversight functions were provided by U.S. Army Technical Escort Unit personnel and technical experts from the Army Soldier, Biological and Chemical Command. Appropriate nerve agent and blister agent simulants were identified, incorporated into IEDs containing small amounts of explosives, and detonated under controlled conditions in close proximity to specially instrumented anthropomorphic simulators (mannequins) fitted with the test suits. The effects of fragment and droplet impact were evaluated, particularly with respect to penetration by agents that might be inhaled or come into



The capabilities of forensic investigators responsible for analyzing vehicle bomb incidents perpetrated by terrorists and other criminals have been significantly enhanced by recent and continuing TSWG-supported efforts to develop computer-based tools that can accurately predict various effects associated with detonation of the explosive. An advanced physically-based, statistical software suite designed to support the investigation of vehicle bomb incidents has been developed and demonstrated. Its controlled deployment and use will have a significant impact on the ability of field investigators to conduct rapid and efficient data collection and analysis activities at the scene that may be critical to solving such crimes.

Bombs concealed and transported to targeted sites in cars, vans, and trucks have become a terrorist weapon-of-choice over the last decade, and they have been used with devastating effects in attacks both within the United States and abroad. On-site investigation of such incidents presents many challenges to forensic specialists, who have traditionally relied on their prior experiences in gathering and analyzing evidence, and in reconstructing the event as a significant first step toward identifying the perpetrators. Some effective means for bringing laboratory and test explosion data to the field in a user-friendly form to support post-incident investiga-

### CONTINUED

contact with human skin. Tests to determine the compatibility and effectiveness of two types of undergarments offering enhanced protection against C/B agents were conducted. Respirator unit performance and resistance to invasion by toxic vapors were also evaluated.

Based on successful test results, the hybrid protection system developed under this TSWG project has now been accepted as the U.S. standard for EOD teams. The protective suit will permit personnel to effectively complete required device disarm/disablement tasks under a range of climactic conditions. System availability for widespread use by civilian law enforcement agencies is anticipated over the next several years. Continuing efforts to improve the system are expected to address issues related to incorporation of a self-contained breathing apparatus, the effect of optional cooling suit use on system performance, and ways to increase ballistic protection for hands. ■

## ENHANCED SOFTWARE TOOLS FOR ANALYSIS OF VEHICLE BOMB INCIDENTS

tions has long been needed. In addition, applicable research data for many types of vehicle bomb events has not been available.

The work supported by TSWG has effectively addressed these needs. Conducted in collaboration with the Bureau of Alcohol, Tobacco, and Firearms (ATF) and engineers at the

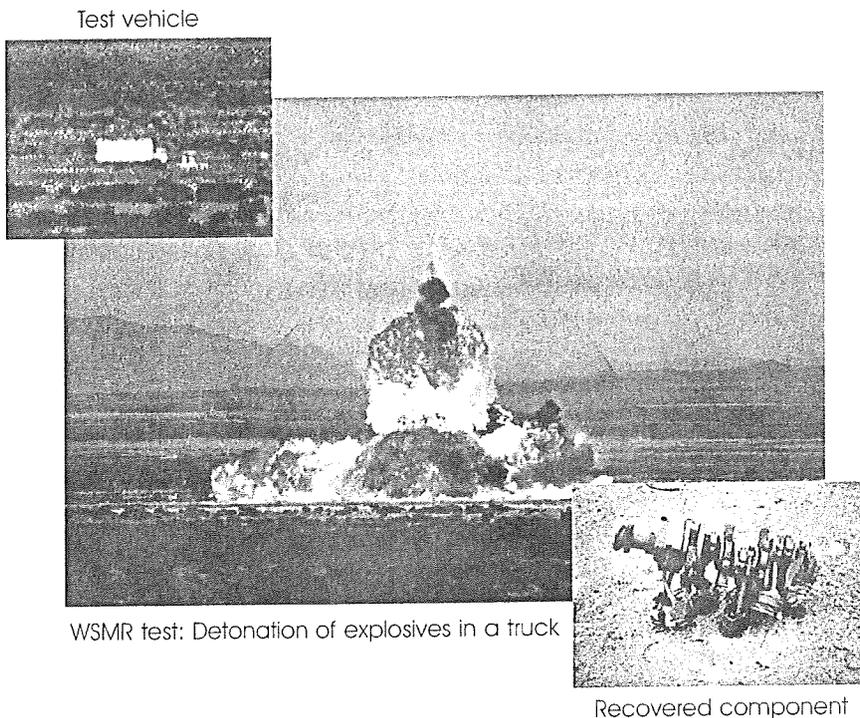


Passenger van after detonation of contained explosive



U.S. Army Waterways Experiment Station (WES), specific activities have included systematic testing and evaluation of the effects of explosives detonated in vehicles, the development of statistical computer models for analyzing and describing observed effects, and research directed toward defining the post-blast signatures of vehicle bombs. About 30 tests have been conducted to date to support the development of a growing body of explosive effects data and computerized database. Analysis of the data using statistical methods has enabled development of the noted software suite (VEXAS: Vehicle Explosive Analysis Software) for use in the field.

The vehicle bomb tests were conducted at the Permanent High Explosives Test Site at White Sands Missile Range (WSMR). They included detonations of explosives in full-size sedans, mini-vans, large passenger vans, and commercial trucks on several different types of road surfaces. Explosive charges, principally ANFO (an ammonium nitrate/fuel oil mixture) and C-4, have ranged in weight from 50 - 20,000 lbs. depending on the type of vehicle. Extensive post-blast data has been collected for each test, including measurements of blast pressure and thermal effects as a function of distance from the point of detonation, crater size and shape, vehicle component/fragment velocities and trajectories, and the mass and rest location of recovered components and fragments. Additional data recorded for each test has included details regarding the test configuration and weather conditions.



The VEXAS post-blast analysis tool developed using such data has both correlative and predictive capabilities. Information collected at the site of a vehicle bomb incident, including crater measurements, the location and mass of recovered vehicle components and fragments, type of road surface, glass breakage (associated with blast pressure), and weather conditions, is provided as input. VEXAS analyses then generate useful output regarding the likely weight and type of explosive used, the projected area to be searched for additional evidence, the projected weight and

size of the host vehicle, and likely vehicle orientation. A graphic depiction of the distribution of vehicle components and fragments is also provided for correlation with material already collected and to guide continuing evidence-gathering efforts.

An early prototype of the VEXAS suite was used by ATF investigators at the site of the Oklahoma City bombing in 1995.

Since that time, significant upgrades have been incorporated into the software to increase its reliability. Efforts to provide additional improvements continue to be supported. The significant ATF role in this overall activity has contributed to the training of more than 200 ATF agents in large vehicle bomb post-blast investigation and analysis. ■



**IMPROVED  
BOMB  
DISRUPTION  
DEVICE  
(PAN)**

The goal of bomb squads responsible for neutralizing small bombs and a variety of improvised explosive devices is to cause disruption of the firing circuitry or triggering mechanism by some suitable remote means without causing detonation of the explosive. A portable device that directs a high-velocity projectile at the explosive object, thereby rendering it inoperable, is usually used. Achieving this objective helps to ensure the safety of personnel and eliminate potential harmful consequences associated with detonation. The availability of effective and reliable equipment for this purpose is of critical importance.

tion-actuated, non-electric (PAN) disrupter, was developed to replace older such devices known as police water disrupters, which have been widely used for many years. The PAN disrupter incorporates proprietary technology developed at Sandia that, by design, utilizes a non-electric shock-

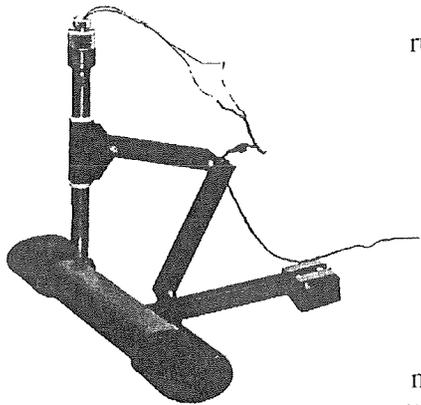
tube initiation system as a means for achieving more controlled delivery of disrupter projectiles. It is a low-cost, man-portable, simple-to-use system able to accommodate a variety of projectile types, including standard shotgun shells and a

The PAN disrupter overcomes three key problems characteristic of earlier systems by:

- ✓ Providing new means for controlling (from the perspectives of timing and impact energy) whatever disrupter matter is fired out of the device;
- ✓ Significantly reducing susceptibility to interference from RF signals;
- ✓ Enabling synchronization of multiple shots that may be required for effective disruption.

wide variety of other special projectiles. The range of available projectile types (greater than 30) enables system operators to induce a broader range of effects during disruption, which may be critical to mission success. During development of the disrupter, an aggressive approach was taken in providing prototype disrupters to bomb squads across the country for testing under actual field conditions. Certain variants of the device were used in the FBI's Unabomber investigation. PAN equipment was also made available to bomb squad units in Atlanta for possible use at the 1996 Olympic Games. In 1997, the PAN

An improved bomb-disruption device developed by engineers at Sandia National Laboratories under TSWG sponsorship has recently been provided to some 400 bomb disposal units across the United States under a special FBI equipment procurement and distribution program intended to help combat terrorism. The patented device, a percus-



PAN Disrupter positioned to disable a pipe bomb



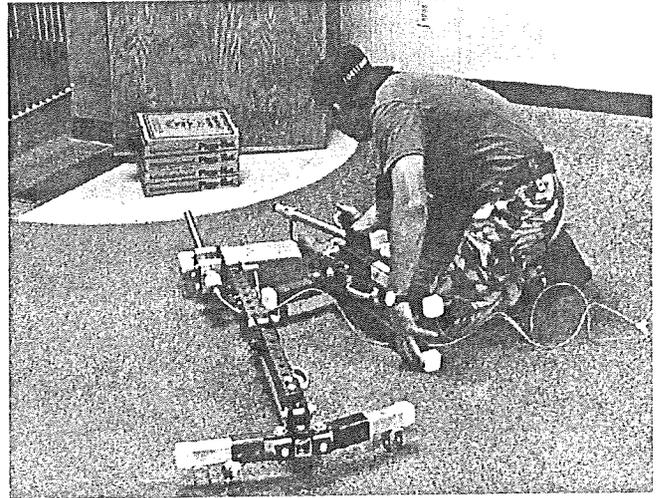
disrupter was used to safely disable a number of letter bombs in-situ at the United Nations building in New York.

Successful development of the PAN disrupter enabled subsequent commercialization. Both the standard system

and a smaller mini-unit are now being produced by Ideal Products in Lexington, Kentucky, under a production license issued by Sandia. Training of various law enforcement personnel on the use of the system is provided by the FBI at its Hazardous Devices



PAN Disrupter being used to disable a car bomb



Technician aiming two PAN Disruptors at an improvised explosive device

School at Redstone Arsenal in Alabama, the only civilian public safety bomb school in the United States. ■

**EXPLOSIVE  
PRODUCTS  
REFERENCE  
SEARCH SYSTEM  
(EXPRESS)**

The availability and accessibility of relevant, comparative historical data and detailed technical information is of critical importance in investigating and solving many types of crimes. This is particularly true for terrorist incidents and other criminal acts that involve the use of improvised explosive devices (IEDs). Work supported by TSWG, conducted in collaboration with the Explosives Unit of the FBI Laboratory, has resulted in a major contribution to the investigation of such incidents. A comprehensive database for centralizing and disseminating extensive and detailed information on both domestic and foreign bombing incidents to certified users has been developed and implemented.

The work was initiated in response to a joint request by several government agencies having responsibilities for investigating incidents involving the use of bombs and explosives. Stated objectives of the effort were to develop an information storage and retrieval system to facilitate more rapid identification and disablement of devices encountered by EOD units in the field, to expedite associated criminal/forensics investigations, and to significantly improve the efficiency and effectiveness of the counterterrorism response to bombing incidents. Within six months, a prototype system was produced and put into operation. All of the stated objectives were met, and demonstrated capabilities of the database, called the



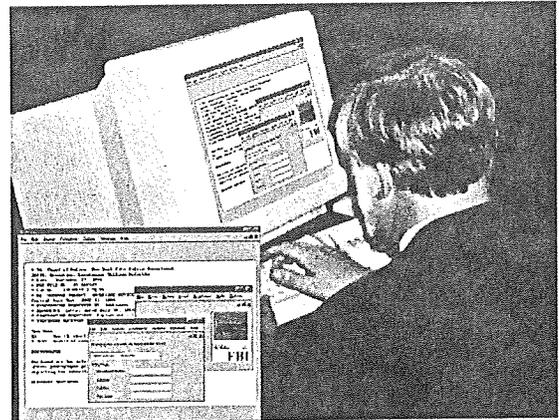
Explosive Products Reference Search System (EXPRESS), exceeded design expectations. Early versions were used in investigating Unabomber incidents and at the 1996 Olympic Games in Atlanta.

The effective integration of information compiled in EXPRESS was accomplished through a database development effort that involved the merger of two rapidly developing technologies—full-text search capabilities and true-color image retrieval and manipulation. The result was a single, state-of-the-art package capable of performing full-text search and simultaneously displaying full-color images linked to a particular file. At the time EXPRESS was being developed, no commercially produced system offering such capabilities was available.

EXPRESS search capabilities enable the rapid and accurate identification of similarities between bombing cases previously documented and those currently under investigation. Queries may address a wide range of factors important to device disablement or in gathering evidence, including bomber techniques, device construction, target types, and effects associated with detonation. After a search has been initiated and a report is brought to the screen, any related information that has previously been linked to that report is simultaneously displayed in the system image viewer. The full-text search capability of EXPRESS allows much greater search flexibility than achievable with

field-test or keyword type databases, thereby providing a more timely, accurate, and efficient comparison among various potentially related cases. Image display features enable unambiguous illustration of what is described in the cited reports, and on-screen comparisons can be made with devices encountered in the field. The time required to identify specific characteristics of a bomber's signature, sharpen the focus of investigative efforts, and distribute information gathered in early stages of the investigation to appropriate agencies can be shortened dramatically.

EXPRESS is currently used by numerous Federal, state, and local government law enforcement and other agencies responsible for dealing with bombing incidents, including EOD teams and bomb disposal units. A number of significant enhancements have been made over the last few years. Development of a visual detonator identification system, for



Split screen display: text and igniter image



Investigators at a bombing incident site

example, enables a bomb technician or investigator in the field to rapidly and accurately identify unknown detonators based on physical characteristics and/or forensic analysis of com-

*The principal elements of EXPRESS include:*

- (1) A comprehensive compilation of full-text records of hundreds of forensic reports on many types of bombing incidents—and covering a wide range of IEDs—that have been examined and characterized by FBI laboratory technicians over the last 25 years;
- (2) A reference file on military and commercial explosives, including information on composition, performance characteristics, manufacturers, and distribution; and
- (3) Collected technical data on foreign explosives, explosive products, and explosive devices, including those that might be of use to terrorists.



ponents. Use of this system in conjunction with information on detonator profiles compiled by the FAA contributes to the safe disablement of many types of IEDs. In addition, the incorporation of a bombing incidents database compiled by the USPS Forensic Laboratory and ATF into EXPRESS has greatly expanded the number of accessible cases available for review and comparison with new incidents.

Investigations of incidents involving the use of bombs and explosives have been further enhanced by TSWG development of a complementary informational database on homemade explosives and IEDs. The system, known as AIRSTED (Automated Information Retrieval System of Terrorist Explosive Devices), was developed using the enabling information retrieval technology in EXPRESS. AIRSTED contains extensive information on explosives, explosive devices, and their manufacture compiled from

existing underground publications, numerous books and other open publications dealing with explosives and bomb-making, and additional sources. The entire database, which contains tens of thousands of pages of text and numerous associated images, is available to authorized users on a CD ROM, thereby providing a cost-effective, organized, and compact method for ready retrieval of available data. In addition to providing timely support to field investigators, the ability to catalog various types of explosives and devices that might be employed by terrorists is also useful in conducting threat assessments and forensic analyses.

Current responsibility for the operation, maintenance, and continued development of EXPRESS and AIRSTED, including any required hardware upgrades, data input for both systems, and the handling of requests for data in EXPRESS, rests with the FBI. ■

The unauthorized and concealed transport of certain radioactive substances and special nuclear materials (SNM) poses a serious threat to human health and safety, and to the national security of the United States and its allies. There is an urgent and continuing need to develop ever more capable and reliable means for detecting, identifying, and restricting the movement of these materials. In the hands of extremist political organizations or small terrorist groups, such materials could be used to engineer advanced weapons with severe disruptive or destructive capabilities. The wide-area dispersal of radioactive substances by explosives, for example, could greatly aggravate the harmful consequences of terrorist bombing

incidents. Of even greater significance and concern is the potential use of SNM by terrorists or renegade states in the development of improvised nuclear devices.

As a consequence of TSWG-supported technical developments, hundreds of advanced systems able to detect radioactive materials have been deployed in the United States and internationally over the last few years to help restrict the illicit transport of nuclear materials and their possible use by terrorists. The TSWG efforts, conducted in collaboration with the Department of Energy (DOE) and the United States Customs Service (USCS), involved modifications and upgrades of existing X-ray inspection

## **NUCLEAR MATERIAL DETECTION AND IDENTIFICATION SYSTEMS**



equipment to enable the detection and interdiction of contraband nuclear material. Two types of systems for detecting gamma rays (resulting from natural radioactive decay of nuclear materials) were developed—one designed for integration into standard airport X-ray baggage/luggage scanners, the other, smaller unit intended for use with mobile X-ray inspection equipment. Used in conjunction with a handheld radiation pager, a gamma ray detection device developed concurrently by the DOE, these systems greatly enhance the overall capabilities of USCS and warehouse inspection personnel, bomb squads, and other law-enforcement organizations.



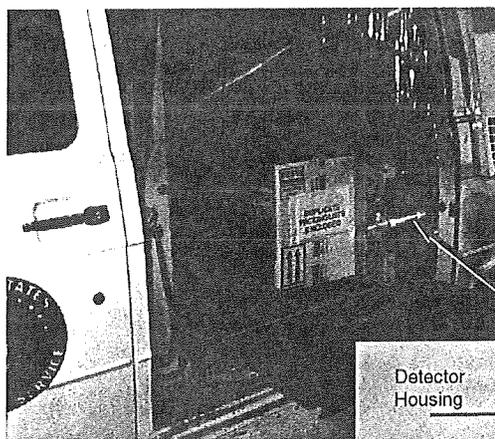
NMIS: handheld gamma ray spectrometers

One significant design consideration for the X-ray inspection systems involved the development of suitable means for overcoming potential effects of X-ray interference on the performance of the gamma ray detector. A special collimator was developed to meet this requirement. Another key aspect of the effort involved enhancing the capabilities of the systems by modifying the software to achieve low-cost, reliable, and automated detection of high-density nuclear or shielding materials. Following successful testing and evaluation, the units were deployed at selected airports in the United States and Europe, and in numerous mobile inspection vans operated by the USCS. Both types of systems have consistently demonstrated high reliability and low false alarm rates in operation.

Significant additional efforts resulting in improved capabilities for detecting nuclear materials have also been supported by TSWG. One such project involved the development of a Nuclear Material Identification System (NMIS), a stand-alone, automated, handheld gamma ray spectrometer able to provide both detection and

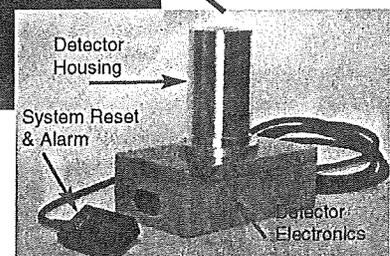
identification capabilities not previously available in a low-cost, compact inspection package. NMIS capabilities complement the capabilities of the X-ray inspection systems by providing a rapid means for identifying materials initially detected by these systems. Using a proprietary template-matching algorithm, the NMIS system is capable of detecting, identifying, and differentiating among radioisotopes commonly found in commerce and special nuclear materials. Designed for use by both civilian authorities—including USCS inspectors, law enforcement personnel, HAZMAT response teams, and bomb squads—as well as special military personnel, NMIS serves a variety of

important inspection/detection/identification functions. Specific examples include environmental monitoring, emergency response, regulatory compliance, and waste evaluation. The technology has been commercialized by Science Applications International Corporation (SAIC) in a product called RadSmart, which is now in production.



Radiation detector mounted in USCS van

Luggage radiation analyzer





Capabilities for detecting nuclear materials have been further enhanced through TSWG support for another project that involved significant modifications to a commercial radiation pager. The pager, with original design capabilities limited to the detection of gamma rays, was integrated with a helium ( $\text{He}^3$ ) neutron detector to enable the simultaneous detection of both gamma rays and neutrons. Originally developed for use by Federal government officials to enable new capabilities for detecting contraband nuclear materials that emit neutrons, the upgraded device has since transitioned to the commercial world and is now being marketed under the name Handheld Radiation Monitor (HRM) by Sensor Technology Engineering, Inc. (Santa Barbara, California). The device provides capabilities not previously available for many types of inspections, and it is expected to find extensive use by a range of security/inspection personnel.

The most recent TSWG project to enhance U.S. technological capabilities for restricting the unauthorized transport of nuclear materials involved development of a system enabling the detection and interdiction of SNM, radiation-contaminated products, and certain other substances hidden in passenger or cargo vehicles. This work effectively exploited earlier developments at Lawrence Livermore National Laboratory (LLNL), which were focused on the use of advanced technological means for detecting plant-derived drugs—especially marijuana, and development of a pilot vehicle inspection system for use at U.S. border crossings. During the course of the investigation, however, the

*Improved means for detecting nuclear materials during illicit transport will restrict their potential use by terrorists.*

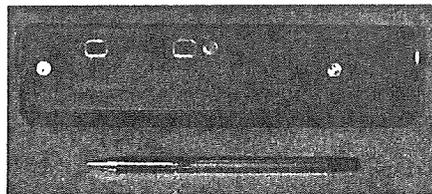
LLNL tests showed that the passive sensors used to detect naturally occurring potassium-40 gamma ray emissions from organ-



Border crossing portal inspection system

ic substances were also capable of reliably detecting similar emissions from other types of materials, including SNM.

Subsequent efforts by LLNL scientists, supported by TSWG, involved optimization of overall detector performance and extensive laboratory testing. The resultant prototype monitoring system—a portal radiation detector dubbed the Non-Invasive System for the Detection of Unauthorized Substances (NISUS)—was recently installed at a border crossing station in Texas for field evaluations. A high level of sensitivity to radioactive isotopes—including indicators of illegal drugs—has been demonstrated in early experiences with the system. The inspections are easily and routinely conducted as the subject vehicles advance slowly through the inspection portal. ■



Handheld radiation monitor (HRM)



## AUTOMATED LIGHT SURVEY SYSTEM

New capabilities for enhancing nighttime security at Federal, state, and local correctional facilities—with recognized broad applicability to many other types of fixed or temporary installations—have been achieved through TSWG-sponsored efforts to develop an advanced, computer-based method for conducting light surveys in an accurate and efficient manner.

A portable Automated Light Survey (ALS) system has been developed that greatly facilitates site analysis and objective, systematic identification of areas requiring additional illumination or heightened surveillance. Areas of excessive illumination can also be identified. The system is already being used with great success by the Federal Bureau of Prisons (FBOP) to conduct surveys and improve security at numerous sites around the country, including facilities housing convicted terrorists.



Man-portable ALS equipment

TSWG work in this area was initiated in 1994 in response to an FBOP request for assistance in conducting light surveys. Such surveys have long been performed as part of security-enhancement procedures to determine if lighting levels within selected perimeters are sufficient to enable the detection of escapees or intrud-

ers. Prior to the development of the ALS system, however, the only means for conducting these surveys has involved manual time-consuming and imprecise measurement methods. Armed with a site map and a light meter, security personnel have walked around a facility and entered light levels manually onto the map at various locations of interest. Survey results, which typically provide fewer than 100 light level measurements, have generally yielded insufficient detail to achieve desired security objectives. A faster, more accurate, approach was required, one able to exploit available technologies in an advanced automated system.

The ALS system effectively integrates proven differential GPS technology with a digital light sensor and customized software on a notebook computer. It consists of a GPS antenna/receiver and computer, a portable backpack assembly, and a handheld keypad for supplemental data entry by an operator/rover responsible for data collection. The system can be used both to create accurate facility maps, particularly important where detailed maps are not available, and to conduct light surveys of the facility at any time from dusk to dawn and under various ambient conditions (including periods of precipitation and fog). As roving security personnel chart facility grounds in areas surrounding building exteriors, along fence lines, and other regions important to maintaining security, the ALS system automatically measures light levels and records geographic coordinates. A typical sur-



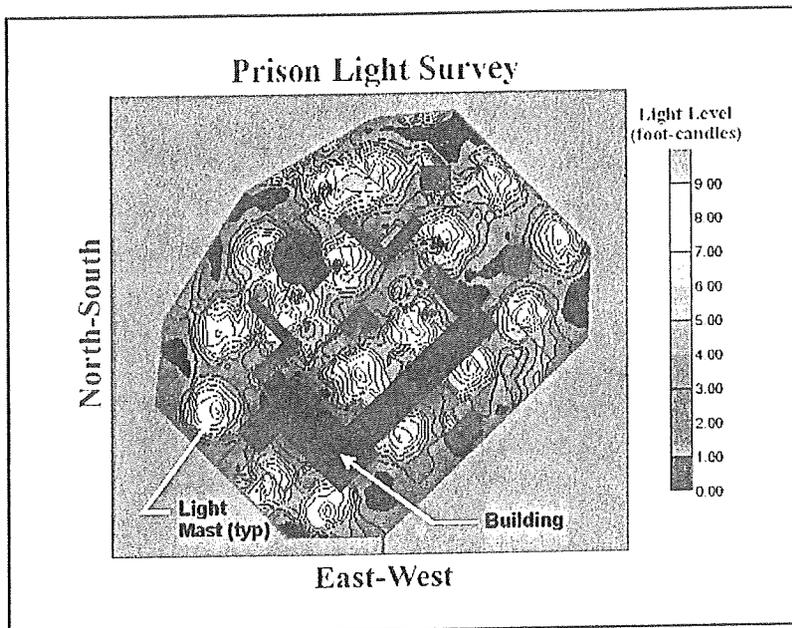
vey with this equipment can provide tens of thousands of light measurements, thereby enabling a much more complete and accurate assessment. Post-processing of the collected data allows illumination contours to be displayed on a geographically precise map of the facility previously generated by the system.

A distinguishing feature of this TSWG project was the development of customized software that simplifies system operation. Using a graphical programming language, an executive module was developed to control the functions and actions of all the underlying software in a seamless manner. The various types of software used in the system include the software required to run the GPS receivers and data acquisition process, differ-

graphical operating system software, communications software for modem operation during GPS almanac download and mission planning operations, and GPS mission planning software.

FBOP successes in using the ALS system are expected

to contribute to its use by many other law-enforcement organizations and agencies responsible for improving and maintaining security at government buildings and other installations, including embassies, both in the United States and abroad. Important military uses of the system are also anticipated. A range of applications of ALS pertinent to physical security are currently being investigated.

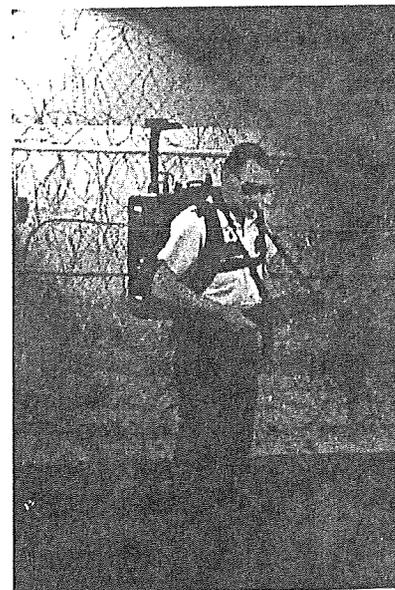


Prison light survey: results

*Effective use of the ALS system will contribute to enhanced physical security at government buildings and other installations, including embassies.*

ential correction software to correct rover data during post-processing, data management software to translate collected data into required formats, CAD software for generating base maps, contour-mapping software for generating the final light-level map combined with base map overlay.

Successful development and demonstration of the ALS system has resulted in commercialization of the technology by Engineering Technology, Inc. of Orlando, Florida. The company produces ALS units for sale and also offers site light survey services. ■



Prison light survey: data collection



**IMPROVED  
FLASH/BANG  
(MK141)  
DIVERSIONARY  
DEVICE**

*Effective diversionary devices may be critical to the successful execution of counterterrorist assault operations and hostage rescue missions.*

The success of many limited tactical operations conducted by special military forces or law enforcement agencies is often dependent on the effective execution of diversionary actions that distract and confuse targeted enemy forces, criminals, or terrorists. Such actions are particularly important in room-clearing operations, where assault teams frequently use hand-thrown diversionary devices immediately prior to advancing. The devices produce a bright flash and loud explosive noise that temporarily blind and disorient room occupants, facilitating team entry.

The capability to conduct such operations was significantly enhanced by an early TSWG program accomplishment that involved the development of an improved flash/bang diversionary device, designated the MK141. Because of its recognized importance, the project was co-supported by the FBI and various DoD organizations. The MK141 is a low-concussion, non-lethal grenade that produces a brilliant flash and

an extremely loud report upon detonation. It has been used successfully in numerous tactical operations over much of the last decade. Principal users include DoD counterterrorist teams (particularly Navy SEALs and Army Special Forces) and FBI tactical operations units (e.g., hostage rescue teams).

The MK141 was developed as a more effective—and safer—replacement for an earlier diversionary device, designated the MK118A, that suffered from a number of inherent design/performance deficiencies. The most serious problem associated with the MK118A was its potential unintended lethality. The device employed a high-



MK141 diversionary device and training simulator

velocity fuse-ejection mechanism that posed a hazard to users, hostages, and other non-combatants. It also produced too much smoke for many use scenarios, restricting the visibility of users attempting to rapidly move into enclosed areas and exploit the intended diversionary effects of the device.

Successful development of the MK141 eliminated these critical problems and also provided other improvements. A safer, lower-velocity fuse-ejection mechanism was incorporated into the device. A more optimal combination of smoke and



flash effects, and a higher acoustic output, were achieved. A design featuring non-burning case fragments, which reduces the probability of collateral damage due to fires following detonation, was also adopted; this feature eliminated another problem with the older MK118A. In addition, a significant increase in overall device reliability was achieved.

An early demonstration of the effectiveness of the MK141 occurred at the Federal correctional facility in Talladega, Alabama in August 1991. Some 15-20 of these diversionary devices were used to subdue rioting prisoners and enable the safe rescue of nine hostages. Due to the effectiveness of the MK141, the need for gunfire by law enforcement per-



Prison assault and hostage  
rescue operation

sonnel behind the prison wall was eliminated.

To date, more than 20,000 MK141 devices have been produced and delivered to user agencies to support certain tactical operations. TSWG has also supported development of a MK141 training simulator to facilitate transition and enhance user safety. Alternative technologies and concepts that might lead to even more effective diversionary devices are currently being explored. ■

## SUMMARY

The Technical Support Working Group is an established and effective forum for identifying, prioritizing, and responding to critical needs and requirements of the national community for combating terrorism. Active participation in TSWG activities by representatives from more than 50 U.S. government departments and agencies helps to ensure that results derived from the wide range of technology development projects and prototyping efforts conducted under TSWG direction-in close cooperation and coordination with the user agencies-can be rapidly transitioned to effective new capabilities in the field. TSWG program efforts involving international partners leverage the capabilities of our allies and provide important opportunities for drawing on their greater experiences in dealing with the daunting problem of global terrorism. In summary, the

guiding philosophy of smarter, faster, cheaper that drives the well-coordinated, flexible, fast-track TSWG interagency program for combating terrorism has produced a record of significant technical accomplishment that can be expected to continue well into the future. ■





# GLOSSARY

AIRSTED	Automated Information Retrieval System of Terrorist Explosive Devices
ALS	Automated Light Survey
ARDEC	U.S. Army Armaments Research, Development and Engineering Center
ATF	Bureau of Alcohol, Tobacco and Firearms
CACTIS	Community Automated Counterterrorist Information System
CAD	Computer-Aided Design
C/B	Chemical/Biological
CIA	Central Intelligence Agency
CLASS	Consular Lookout and Support System
DARPA	Defense Advanced Research Projects Agency
DEA	Drug Enforcement Agency
DIA	Defense Intelligence Agency
DLA	Defense Logistics Agency
DoC	U.S. Department of Commerce
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DoS	U.S. Department of State
DoT	U.S. Department of Transportation
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
EXPRESS	Explosive Products Reference Search System
FAA	Federal Aviation Administration
FBI	Federal Bureau of Investigation
FBOP	Federal Bureau of Prisons
FEMA	Federal Emergency Management Agency
GPS	Global Positioning System
HAZMAT	Hazardous Materials
HHS	U.S. Department of Health and Human Services
IBIS	Interagency Border Inspection System
ICAO	International Civil Aviation Organization
IED	Improvised Explosive Device
INS	U.S. Immigration and Naturalization Service
IWG/CT	Interagency Working Group on Combating Terrorism



LLNL	Lawrence Livermore National Laboratory
NCIS	Naval Criminal Investigative Service
NEODTD	Naval Explosive Ordnance Disposal Technology Division
NEST	Nuclear Emergency Search Team
NIOSH	National Institute of Occupational Safety and Health
NIST	National Institute of Standards and Technology
NSA	National Security Agency
NSC	National Security Council
NSWC	Naval Surface Warfare Center
OASD(SO/LIC)	Office of the Assistant Secretary of Defense for Special Operations and Low-Intensity Conflict
R&D	Research and Development
SBCCOM	U.S. Army Soldier and Biological Chemical Command
SEM	Scanning Electron Microscopy
SNM	Special Nuclear Materials
SOCOM	U.S. Army Special Operations Command
TEU	U.S. Army Technical Escort Unit
UK	United Kingdom
UV	Ultraviolet
USCS	United States Customs Service
USPIS	United States Postal Inspection Service
USPS	United States Postal Service
USSS	United States Secret Service
VEXAS	Vehicle Explosive Analysis Software
WES	U.S. Army Waterways Experiment Station
WSMR	White Sands Missile Range



# APPENDIX

## *TSWG Member Organizations*

TSWG membership includes extensive representation from numerous Federal, government departments and agencies, including the Department of Defense, Department of Commerce, Department of Energy, Department of Health and Human Services, Department of Justice, Department of State, Department of Transportation, and the Department of the Treasury. A detailed listing of member organizations is provided below.

### DEPARTMENT OF DEFENSE

- Office of the Assistant Secretary (Special Operations/Low-Intensity Conflict), Forces and Resources: OASD(SO/LIC) F&R
- Office of the Assistant Secretary (Special Operations/Low-Intensity Conflict), Combating Terrorism: OASD(SO/LIC) CT
- Office of the Under Secretary of Defense (Acquisition & Technology), Strategic and Tactical Systems/Land Warfare: OUSD(S&T) S&TS/LW
- Defense Intelligence Agency (DIA)
  - ◆ Central MASINT Organization, Technology Coordination Office
- Defense Logistics Agency (DLA)
- Defense Threat Reduction Agency (DTRA)
- National Security Agency (NSA)
- The Joint Staff
- Unified Commands
- US Air Force
  - ◆ Air Combat Command
  - ◆ Force Material Command
  - ◆ Air Force Research Laboratory (AFRL)
  - ◆ Force Protection Battle Laboratory
  - ◆ Force Protection System Programs Office
  - ◆ Office of Special Investigations
- US Army
  - ◆ Army Materiel Command (AMC)
  - ◆ Army Research Laboratory (ARL)
  - ◆ 52d Ordnance Group
  - ◆ Center for Health Promotion & Preventive Medicine
- ◆ Criminal Investigation Division
- ◆ Director of Military Support
- ◆ Joint Program Office for Bio Defense
- ◆ Medical Research Institute for Infectious Diseases
- ◆ National Guard Readiness Center
- ◆ Office of the Chief of Army Reserves
- ◆ Soldier and Biological Chemical Command (SBCCOM)
- ◆ Special Forces Command (SOCOM)
- ◆ Technical Escort Unit (TEU)
- ◆ Corps of Engineers
  - Waterways Experiment Station (WES)
  - Protective Design Center
- US Marine Corps
  - ◆ Chemical Biological Incident Response Force (CBIRF)
  - ◆ Marine Corps Systems Command
  - ◆ Security Battalion, Marine Corps Combat Development Center
- US Navy
  - ◆ Joint Program Office - STC
  - ◆ Military Sealift Command
  - ◆ Naval Criminal Investigative Service (NCIS)
  - ◆ Naval Special Warfare
  - ◆ Naval Facilities Engineering Service Center
  - ◆ Naval EOD Technology Division

### DEPARTMENT OF COMMERCE

- National Institute of Standards and Technology (NIST)
- Office of Security Operations

**DEPARTMENT OF ENERGY**

- Defense Programs
- National Laboratories
- Office of Safeguards and Security
- Office of Energy Intelligence

**DEPARTMENT OF HEALTH AND HUMAN SERVICES**

- Centers for Disease Control & Prevention
- Food and Drug Administration (FDA)
- US Public Health Service, Office of Emergency Preparedness

**DEPARTMENT OF JUSTICE**

- Drug Enforcement Administration (DEA)
- Federal Bureau of Investigation (FBI)
  - ◆ Hostage Rescue Team
  - ◆ Laboratory Division
    - Bomb Data Center
    - Chemistry Unit
    - Forensic Science Research & Training Center
    - Hazardous Materials Response Unit
    - Material Analysis Section
    - Materials and Devices Unit
    - Trace Analysis Unit
- National Infrastructure Protection Center
- Federal Bureau of Prisons (FBOP)
- National Institute of Justice (NIJ)
- US Marshals Service

**DEPARTMENT OF STATE**

- Office of the Coordinator for Counterterrorism
- Diplomatic Security
- Foreign Building Operations

**DEPARTMENT OF TRANSPORTATION**

- Intelligence & Security Division
- Federal Aviation Agency (FAA)
  - ◆ Civil Aviation Security

- ◆ FAA Technical Center

- Federal Transit Administration
- US Coast Guard Headquarters

**DEPARTMENT OF THE TREASURY**

- Bureau of Alcohol, Tobacco and Firearms (ATF)
  - ◆ Explosives Technology Branch
  - ◆ National Laboratory Center
- US Customs Service (USCS)
- US Secret Service (USSS)
  - ◆ Financial Crimes Division
  - ◆ Forensics Services Division
  - ◆ Special Services Division
  - ◆ Technical Security Division

**OTHER**

- Central Intelligence Agency (CIA)
  - ◆ Counterterrorist Center
  - ◆ Center for CIA Security
  - ◆ Office of Transnational Issues
- Environmental Protection Agency (EPA)
- Federal Emergency Management Agency (FEMA)
- General Services Administration (GSA)
- Supreme Court of the United States
- US Capitol Police
- US Postal Service (USPS)
  - ◆ US Postal Inspection Service (USPIS)



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