

The author(s) shown below used Federal funds provided by the U.S. Department of Justice and prepared the following final report:

**Document Title: National Law Enforcement and Corrections
Technology Center, Western Region**

**Author(s): National Law Enforcement and Correctional
Technology Center**

Document No.: 192735

Date Received: February 22, 2002

Award Number: 96-MU-MU-K006

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Final Report

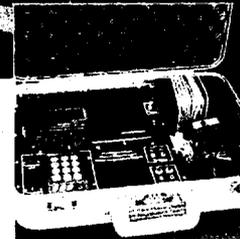
National Law Enforcement and Corrections Technology Center— Western Region

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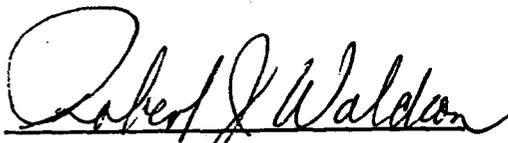
Final Report

National Law Enforcement and
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Western Region

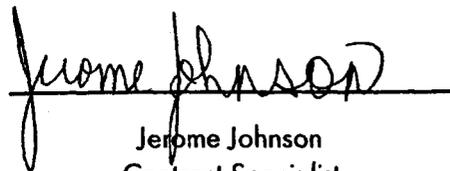
Grant Number 96-MU-MU-K006

September 2001

Submitted by
The Aerospace Corporation



Dr. Robert J. Waldron
Director
National Law Enforcement and
Corrections Technology Center—
Western Region



Jerome Johnson
Contract Specialist
Civil & Commercial Contracts

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Executive Summary

The Aerospace Corporation has operated the National Law Enforcement and Corrections Technology Center—Western Region (NLECTC-WR) for three and a half years under a grant from the National Institute of Justice (NIJ). The grant was administered by the Office of Science and Technology (OS&T) within NIJ which operates a system of similar centers around the United States.

The mission of the NIJ Center system is to be the “honest broker” to the nation’s law enforcement, corrections and criminal justice communities. The Western Center provides technology information and technology assistance in the nine western-most states—Alaska, Arizona, California, Hawaii, Idaho, Nevada, Oregon, Utah, and Washington. The assistance requires that the Center provide independent, objective and relevant information to the communities described above.

The Aerospace Corporation, a nonprofit technical organization created to provide honest-broker, technical services to the Air Force space program, operated the Western Center in accord with the objectives of the NIJ center program during the three-and-a-half year period of this grant. The Center drew upon the technical skills resident in some 2000 scientists and engineers at The Aerospace Corporation to render technical assistance to law enforcement and corrections agencies in the western United States.

One of the primary goals of the Center’s activities is to understand the needs of the state and local law enforcement and corrections agencies. An essential element in understanding those needs is the interaction the Center maintains with an Advisory Council composed of senior law enforcement and corrections members from the nine states. The Center met with the group semiannually, presenting information to them and soliciting their needs and issues in return.

The Center engaged in a concerted effort to reach out and touch as many agencies in the region as possible. One of the most effective tools, developed in the last year of the performance period, is an e-mail broadcast system that provides technical news and announcements to several hundred recipients. In addition to presenting information to the recipients, the Center used the system to solicit answers to specific questions posed by individuals to their colleagues.

The Center worked with the California Peace Officers Standards and Training (POST) organization to make presentations to criminal investigators who received “core course” training from POST. The Center made presentations to students in the course about “nonstandard” forensics in which the

Center has developed expertise. The contacts averaged 200 per year for the period of performance of the grant.

The most significant activities of the Center focused on providing Science, and Engineering Advice and Support (SEAS). This broad activity ran the gamut from answering simple questions concerning the functioning of a particular technology to complex design and integration issues. In between were activities for evaluation, acceptance testing, requirements, analysis and configuration management of technologies which were of interest to the law enforcement and corrections agencies of the western states.

Specific areas of interest to the agencies and the NIJ involved protective equipment, tracking of suspects and work detailees, forensic analysis, less-lethal weapons, communications, counterterrorism, corrections, and school safety. The level of involvement in these areas varied to the extent that the agencies requested assistance. Forensic analysis was the most significant area of support for the Center during the period of performance. The Center’s technical staff made significant progress in recovering information from poor video and audio tapes, as well as from computer hard drives. In addition, specialists in metallurgy and trace contamination detection were able to apply their skills to specialized forensic examinations.

The Center, using donated computers from The Aerospace Corporation’s recycled computer program, started a gift program to deliver basic computing capability to agencies in the western region. The first five computers were delivered to agencies in Oregon at the end of the reporting period.

In summary, the Center reached out to agencies through more than 50 conferences and symposia, assisted over 150 agencies within the region with forensics, researched and/or spoke with nearly 200 vendors, provided technical information to over 700 criminal investigators, supported over 725 felony investigations with forensic analyses (many resulting in convictions), broadcast technology information to over 1000 practitioners on a weekly basis, supported 18 agencies from outside the region with forensics, and received over 60 letters of appreciation.

The Center provided a large number of services to law enforcement and corrections agencies in the western United States during this period. The Aerospace Corporation is proud of its accomplishments in operating the NLECTC-WR and feels that the corporation’s contributions have improved the conditions of law enforcement and corrections agencies within the western US.

Introduction

The National Law Enforcement and Corrections Technology Center – Western Region (NLECTC-West) is operated by The Aerospace Corporation under a cooperative agreement with the National Institute of Justice (NIJ). This document is the final report of the cooperative agreement that funded the NLECTC-West from 1 July 1996 through 31 January 2000. Readers who are unfamiliar with NIJ can refer to Appendix 1 for a brief synopsis of NIJ's Office of Science and Technology, which manages the NLECTC-West.

Mission of NIJ Center System

The mission of the National Law Enforcement and Corrections Technology Center System is to be the "honest broker" to the nation's law enforcement, corrections, and criminal justice communities. The system provides technology information, assistance, and expertise for these communities. For the Western Region center, this mission is focused on the nine westernmost states – Alaska, Arizona, California, Hawaii, Idaho, Nevada, Oregon, Utah, and Washington.

Providing technology information, assistance, and expertise incorporates the following activities:

- Science and engineering advice and support
- Capacity building
- Technology introduction
- Technology demonstrations
- Technology testing and evaluations
- Technology and technical information dissemination
- Technology identification
- Technology commercialization through the Office of Law Enforcement Technology Commercialization (OLETC)

Goals

The role of the honest broker requires an independent, objective, nonprofit organization that is connected to law enforcement and corrections needs and requirements, and that is credible to both the technical and the law enforcement and corrections communities. The maintenance of this role requires a process of constant interaction with all entities. To that end, the NLECTC system:

- Maintains awareness of criminal justice operational needs
- Maintains awareness of the state of the art in appropriate technologies
- Ensures regular communication between the user and technical communities
- Facilitates the development, evaluation, and implementation of appropriate technologies

Objectives

As a consequence of adopting the goals mentioned above, the NIJ has embarked on a number of activities to achieve the specified goals and missions. With this in mind, the NLECTC system seeks to:

- Improve communications with:
 - Other components of the Department of Justice's Office of Justice Programs
 - Other technology programs
 - The user community, including courts and prosecutors
 - The scientific industry community
 - The Department of Defense, Department of Energy, and other federal programs
 - All components of the NLECTC System
- Improve interaction between the Law Enforcement and Corrections Technology Advisory Council, the NLECTC System's Regional Advisory Councils, and the Office of Science and Technology
- Deliver and publicize successful results
- Be source of independent, objective standards and evaluation of law enforcement and corrections equipment and technologies
- Increase outreach efforts through:
 - Creating and implementing a professional marketing plan
 - Displaying and demonstrating technology
 - Facilitating and promoting commercialization of new technologies
 - Participating in conferences, meetings, and symposia
 - Enhancing the dissemination of information through JUSTNET(a linked set of internet sites), TechBeat (a quarterly publication), reports, buying guides, and other special publications

NLECTC-West Summary

The Aerospace Corporation has, during the period of this agreement, made substantial contributions in all of the NIJ mission areas. Aerospace has worked with vendors to evaluate and improve products, with technologists to apply existing technology in new ways, with the user community through demonstrations, evaluations, and education, and with other federal entities to bring technology to state and local law enforcement and corrections organizations. In all cases the local agency either solved an immediate problem (e.g., forensics) or improved its capacity to handle similar technical issues on its own.

An important function of the NLECTC-West program is the outreach it provides to the communities NIJ serves. The outreach manifests itself through direct contact (brochures, mailings), demonstrations, funding and management assistance to emerging technologies, and through conferences and symposia.

Today, the NLECTC-West actively participates in marketing the NIJ products and information, routinely displays and demonstrates technology, assists promising new technology

developers, holds regional meetings and conferences, and uses the resources of The Aerospace Corporation to disseminate NIJ publications.

Guiding Principles

During the period of this agreement The Aerospace Corporation made a distinction between the two principal entities in this enterprise called the NLECTC. NIJ has been thought of as the "Customer," and the Law Enforcement and Corrections (LEC) communities have been viewed as the "Client." The Aerospace Corporation utilized this concept to differentiate the products and services delivered by the corporation under this cooperative agreement.

The Customer

The Aerospace Corporation has recognized the NIJ as source of policy and procedure in areas that affect the NLECTC system. As such, The Aerospace Corporation solicited guidance from the NIJ in certain policy areas, including review of news releases and publications that mention or describe the NLECTC-West.

The Aerospace Corporation has ensured that none of its staff represented the NIJ in any media event, or spoke for the NIJ and its policies.

The Aerospace Corporation recognized that within the NIJ organization there are several groups supporting the overall goals of the NIJ technology program and that the NLECTC-West had interaction with the other portions of the NIJ organization. However, the corporation also understood that the NLECTC system is under the guidance of the Technology Assistance Division (TAD) and that TAD had final authority in deciding the amount and level of interaction between the NLECTC-West and the other operating components of NIJ.

The Aerospace Corporation supported the commercialization of products for the LEC community and worked with vendors to make those products marketable. Nonetheless, The Aerospace Corporation ensured that there be no appearance of endorsement of any particular product.

The Client

The Aerospace Corporation viewed its role as one of providing science and engineering advice and support (SEAS) to the LEC community. SEAS can be broadly defined to include many types of information. However, it has been the goal of The Aerospace Corporation that SEAS be provided so as to achieve two goals: 1) provide information in a "holistic" manner, i.e., given in context and with reference to other pertinent information as needed, and 2) give information so as to expand the capacity of the agencies to conduct operations and carry out their mission. These activities will be described in section 2.

It has been the goal of the corporation to understand the LEC operating environment to the extent necessary so that technology can be integrated successfully without the corporation becoming a consultant for an individual agency.

It has also been the goal of The Aerospace Corporation to assist the NIJ in reaching out to the LEC community, explaining the program and the benefits it offers. As a consequence, all of the staff of the NLECTC-West has supported the outreach process through numerous activities that will be described in section 2.

In summary, The Aerospace Corporation has demonstrated a thorough understanding of the NIJ goals and processes instituted to improve the criminal justice system through improvements in technology.

The Aerospace Corporation

The Aerospace Corporation is an independent, nonprofit corporation chartered in 1960 to meet special technical research and development needs essential to US national security. The corporation provides state-of-the-art assessment of technology and supports the application of new technologies to ground, space, and communications systems. Over the past 40 years, the corporation has been a key technical partner to the US government on virtually every US Air Force and national security space mission.

Aerospace does not manufacture or sell hardware or software, and thus remains completely independent and objective in its evaluation of competing technologies. Therefore the government utilizes the corporation's capability as an "honest broker" to assist with the evaluation of proposals and in the source selection process. Additionally, because of its role as a trusted agent, Aerospace maintains databases of proprietary manufacturing and test information on commercial high-technology products. Access to this information often allows Aerospace to perform technical comparisons and evaluation of equipment without the necessity of formal requests to manufacturers.

Technical Capabilities of The Aerospace Corporation

The corporation employs approximately 2200 scientists and engineers, as well as 1000 members of support staff. About 70 percent of the technical staff have Master's or Ph.D. degrees. The average experience of the members of the technical staff is 21 years, with many having worked in their technical disciplines for 30-35 years. Aerospace uses its recently retired engineers and scientists to provide a surge capability, ensuring that adequate staff are available to perform unplanned special projects as well as sustain corporate memory. The corporation's budget for fiscal year 2000 was approximately \$380 million.

Many of Aerospace's most experienced technical staff are in its Engineering and Technology Group, which serves as the resource pool from which Air Force and national security projects and programs are staffed. This very broad and deep "matrix" of technical specialists is one of the strongest assets of the corporation. It ensures that very experienced talent in all technical disciplines will be applied when and where needed on all projects supported by the corporation.

The corporation has extensive and unique expertise in communications system engineering technology for Law Enforcement Center applications. This expertise allows Aerospace to provide technical support on projects involving the interoperability of multijurisdictional communications systems at the hardware implementation, design, and theoretical modeling levels. In addition, Aerospace possesses extensive computer tools for communications coverage analysis and ground system and network control analysis. This capability, coupled with the deep experience in all forms of communications electronics and hardware, allows Aerospace to respond to near-term as well as long-term communications planning issues. Furthermore, the corporation maintains a staff of specialists in



The Aerospace Corporation

frequency management and licensing procedures, both at the national and international level. This staff has access to the International Frequency Listing, a catalogue of space and terrestrial radio transmitters in 166 countries, covering the US and worldwide radio spectrum.

In its role as space technology provider to the US government, the corporation has developed the Laboratory Operations centers. The facilities and equipment of the labs is valued at over \$100 million and contains state-of-the-art equipment for design, prototyping, and testing of high-technology products. These laboratories and capabilities are maintained with Air Force funds to ensure rapid response to realtime issues such as spacecraft anomalies and parts failures. Using scanning electron microscopes, X-ray microscopes, thermal and infrared scanners, and advanced molecular spectrometers, the labs can conduct testing of the most minute sample of material in the Materials Analysis Facility and in the Nondestructive Evaluation Facility. These capabilities and facilities are available to the law enforcement community for use in forensic investigations that can benefit from ultrahigh-magnification devices.

The corporation also maintains over \$250,000 worth of communications simulation tools and facilities. This includes simulations of the Global Positioning System (GPS), which can be applied to Automatic Vehicle Location (AVL) studies as well as many geolocation problems, both domestic and international. Since Aerospace performed the original research that led to the GPS, the

resident expertise has developed many nontraditional applications for national security and law enforcement.

Aerospace developed and operates a Trusted Computer Systems Department for the US government. The department has staff and facilities in El Segundo, CA and in Columbia, MD. The department specializes in the security of, and prevention of nonauthorized access to, government wide-area networks. These skills, knowledge and capabilities are relevant to the law enforcement community and are available from Aerospace on a sole-source basis. This permits training in state-of-the-art network security, and demonstration of future capabilities and research into "cyber-crime." Corporate experts provide support for research, design, and application of encryption and signal analysis as well as evaluation of network security for NASA, the National Weather Service, and other federal agencies. The NLECTC-West can train a cadre of law enforcement experts using the skills and capabilities of Aerospace.

The El Segundo facility maintains a computer forensics facility, which has been utilized for extraction of criminal evidence from computers. This capability has become more and more valuable as crime has moved from the physical to the electronic, or virtual, domain.

The corporation designs, develops, and maintains some of the nation's most sophisticated equipment for image analysis, including digital-image processing and extensive image enhancement.

The corporation maintains signal processing and analysis facilities, which permit electronic signal analysis and enhancement of audio signals. These capabilities allow Aerospace experts to remove background noise and compensate for poor sound quality. Expertise in the fields of electro-optics and sensors provides the capability to both design equipment and analyze signal information, which in turn supplies prosecutors with trial evidence crucial to effective law enforcement.

The Aerospace Corporation employs a number of law enforcement experts within the Aerospace Security Department, most of whom are formerly sworn officers. This allows the NLECTC-West to draw not only on technical talent,



Computer Laboratory

but also on law enforcement talent within the corporation.

The Aerospace Library contains over 95,000 book titles, as well as 700 technical periodicals and more than 145,000 technical reports. The library has access to hundreds of online electronic databases, including those of the University of California and the Library of Congress, and to depositories of defense and security information. In addition, the Aerospace staff has access to classified documentation and resources for storing such information.

Aerospace facilities available to the NLECTC-West

The NLECTC-West maintains dedicated facilities at the Aerospace General Offices in El Segundo, CA, which include offices, electronic network access, and support staff. These offices are adjacent to the Laboratory Operations centers, thus facilitating the transfer of evidence under secure conditions when necessary. The corporation maintains extensive meeting facilities both in El Segundo and the Washington D.C. area (Rosslyn, VA), and makes them available to groups and organizations related to the law enforcement community. El Segundo is located two miles from Los Angeles International Airport, and the Rosslyn office is easily accessible by the Washington Metro. Corporate facilities in El Segundo can accommodate groups of up to 200. The facilities can also host meetings requiring video teleconferencing, or of a classified nature, when required. These facilities have been used on several occasions by the law enforcement community for meetings and conferences.

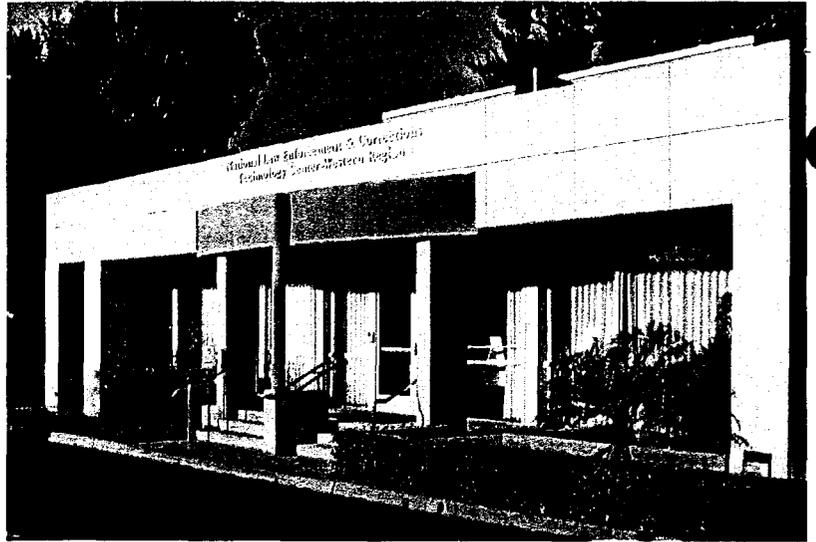
The Aerospace Institute, the educational organization of The Aerospace Corporation, provides assets for training, including classroom activities and experienced trainers. The Institute develops and teaches specialized courses upon request by clients. The Institute is available to assist in training of law enforcement and corrections staff.

In addition to meeting facilities, Aerospace makes its publications, graphics, and distribution facilities available to the NLECTC-West. These facilities and services are available for mass distribution of outreach material via electronic means, hardcopy mail services, and through the packaging and shipping department (distribution of computer equipment). The Aerospace Corporation distributes surplus computer equipment at no cost to law enforcement organizations upon request and when available.

Other government agencies supported by The Aerospace Corporation

The Corporation provides technical services to the following federal government agencies and organizations:

- Space and Missile Systems Center (US Air Force)
- National Reconnaissance Office
- Department of Justice
- US Army
- US Navy
- NASA
- NOAA



NLECTC-West Facility

- National Security Agency
- Federal Emergency Management Agency
- DARPA
- Department of Energy
- Jet Propulsion Laboratory
- United States Geological Survey
- Department of Transportation
- US Coast Guard
- FAA

Aerospace also provides technical assistance and services to the following California state agencies and those of other states:

- California Department of Transportation (CalTrans)
- Occupational Safety and Health Administration
- California State University – Dominguez Hills

Summary Benefits

The NLECTC-West has had access to technologies and methods across the entire security spectrum, from electronics, materials, and signals analysis to image enhancement and computer forensics. The NLECTC-West has had the good fortune to bring these technologies and methods to bear on LEC needs without having to invest in technical education or training.

This access has resulted in a very cost-effective sharing of technical lessons learned as well as access to extensive technology and laboratory facilities already developed from federal funds.

Finally, the corporation feels that it benefits from the association with NIJ in supporting the LEC community. The NLECTC-West's role as an "honest broker" is in keeping with the corporation's other responsibilities to government agencies, and the LEC agencies provide basic security to the communities in which the corporation's employees live and work. Being recognized by the LEC agencies helps cement the corporation's commitment to the community. Some of the formal acknowledgments of the corporation's support to LEC agencies are reprinted in Appendix 2. In addition, the Center was mentioned several times in a technology article about law enforcement that appeared in the 7 July 1997 issue of Forbes magazine. That article is reproduced in Appendix 3.

Summary of Activities

In this section we will use the essential elements of the NIJ monthly activity reporting process for presenting the past activities of the NLECTC-West. We have modified that format to highlight the technical activities initially, and then follow with administrative areas at the end of this section.

Some examples of each activity area will be presented in the main body of the report. Other details will be provided in appendices as appropriate. This approach should make the report more readable the first time through, yet will contain substantive information for readers with more time to read the appendices.

Regional Advisory Council

An important element in the successful operation of the NLECTC-West is the Regional Advisory Council (RAC), which operates with the Center's director to provide guidance and advice on the important issues facing the LEC communities. The NLECTC-West RAC has been functioning since the early days of the Center's existence.

The RAC membership is delineated in the table below. This group represents a broad spectrum of agencies and capabilities, and it provides the NLECTC-West with critical commentary on the technologies that can most benefit the LEC agencies of the western US.

The RAC meets semiannually, with both corrections and law enforcement members attending. The meetings generally consist of sessions devoted to the general reporting of NLECTC-West activity, technologies of potential interest to each community (law enforcement and corrections), and a discussion of technology requirements that the RAC feels warrant attention by NIJ research teams.

The meetings are held throughout the region so that local issues can be seen first hand. To date the RAC has met in Anchorage, Seattle, Salt Lake, Phoenix, and El Segundo. There have also been meetings at two California prisons (Calipatria and Pleasant Valley), which are in remote areas of central and southern California.

NLECTC-West Regional Advisory Council

NAME	AGENCY	NAME	AGENCY
Mr. Frank Ahmad Chief, Technology Transfer Office	Space and Missile Systems Center U.S. Air Force	Mr. Ron Ingles Chief	La Verne, CA Police Department
Mr. Lee Baca Sheriff	Los Angeles County Sheriff's Department	Mr. Martin Mayer, Esq. Lt. Col. Earl R. Morris	Law Offices of Mayer and Coble Utah Department of Public Safety
Mr. Robert Bayer Director	Nevada Department of Prisons	Director, Law Enforcement and Technical Services Division	
Mr. Cois Byrd	California Department of Corrections Narcotics Authority	Mr. Mel Nichols Chief	Redondo, Beach, CA Police Department
Mr. Allen Cooper Director, Division of Institutions	Alaska Department of Corrections	Mr. Kenneth J. O'Brien Executive Director	California Commission on Peace Officers Standards and Training
Ms. Carol Daly Undersheriff	Sacramento, CA Sheriff's Department	Mr. Bernard Parks Chief	Los Angeles, CA Police Department
Mr. Ben de Haan Deputy Director	Oregon Department of Corrections	Major Dave Rich	Idaho State Police
Mr. Larry Erickson Executive Director	Washington Association of Sheriffs and Police Chiefs	Mr. Dominick Rivetti Chief	San Fernando, CA Police Department
Major Lee Erickson	Oregon State Police	Mr. Ted Sakai Director	Hawaii Department of Public Safety
Mr. Charlie Fannon Chief	Wasilla, Alaska Police Department	Mr. Joseph Santoro Chief	Monrovia, CA Police Department
Lt. Col. David A. Felix Safety Assistant Director Criminal Justice Support Division	Arizona Department Of Public Safety	Mr. Timothy. B. Slocum Correctional Administrator	Utah Department of Corrections
Ms. Doreen Geiger Ass't to the Secretary for Facility Planning	Washington Department of Corrections	Mr. James Spaalding Director	Idaho Department of Corrections
Mr. Tim Grimmond * Chief	El Segundo, CA Police Department	Mr. Terry Stewart Director	Arizona Department of Corrections
Mr. Brad Hoover Chief	Whittier, CA Police Department	Mr. C.A. Terhune Director	California Department of Corrections
		Mr. Fred Witte	Honolulu, HI Police Department

* Chair

The RAC chairman is an automatic member of the national advisory council for NIJ, known as the Law Enforcement and Corrections Technology Advisory Committee (LECTAC). The regional council contributes to the LECTAC's priority development process, which ensures that local requirements are voiced at a national level.

In addition to the guidance provided by the RAC, the NLECTC-West benefits from its association with senior members of LEC organizations, which offer venues for demonstrations of technology and for evaluation of technology in real-world environments. These demonstrations and evaluations prove beneficial to both the developers as well as to the center. Examples of these demonstrations include inmate tracking systems, vehicle-stopping technology for pursuit management, night-vision surveillance equipment, and non-lethal weapons.

Outreach

Outreach refers to diverse approaches the Centers use to increase awareness of who they are and what they do. In one form or another, all Centers engage in outreach activities, establishing and cultivating ties to the law enforcement and corrections communities; maintaining this contact with the system's client base is at the hub of NLECTC's mission. Centers have a liaison role between these communities and the NIJ.

The Center provided technology information to law enforcement and corrections organizations in the Western Region. Center personnel accomplished this task by directing outreach information as a two-tiered process:

First, Center staff provided a first level of outreach services by continuous mailing of NIJ products, detailing the NLECTC system services to all state and local law enforcement and corrections agencies within the Western Region. This effort required the compilation and maintenance of information about all agencies within the region. The targeted person within each agency was typically a Chief of Police, Sheriff, or Director of Public Safety. Products delivered under this level of contact were NIJ brochures describing the NLECTC system, JUSTNET information, and the TechBeat newsletter.

Second, the Center staff directed an effort towards agencies and organizations that provided maximum leverage of the information provided. These efforts are described below.

NLECTC-West E-mail Broadcast System

An important part of the NLECTC-West's outreach program has been the use of e-mail to communicate with agencies. In 1999 the NLECTC-West inaugurated the NLECTC-West Broadcast E-mail System (NEBS). The NEBS development was the outgrowth of an increasing reliance upon Internet e-mail as a means for requesting and disseminating information.

At the end of the reporting period, NEBS contained approximately 1000 names and addresses of law enforcement and corrections personnel who were interested in receiving information via e-mail.

The system was designed so that the subscriber could categorize his or her interests into 100 specialty areas. The subscription form, with the categories, is shown in Appendix 4.

Utilizing these categories, NEBS has been used to solicit information from the subscribers about issues and interests and to request information from practitioners to help other practitioners. As an example, a small sheriff's department in Oregon requested assistance in identifying software that would run on a PC and be appropriate to manage a 20-bed jail facility. Within a few hours, the requester had received several calls from outside his state offering information about such systems.

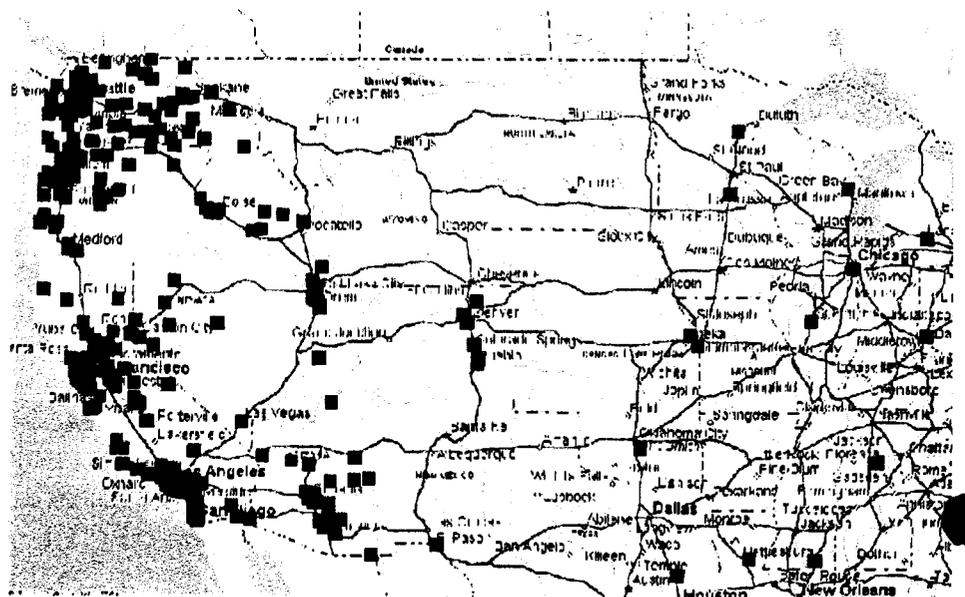
NEBS has been used to broadcast NIJ-developed products such as the weekly News Summary, prepared by a professional service and broadcast by the NIJ center in Rockville, MD. NEBS has been used to alert agencies to the publication of grant solicitations and new publications prepared by various departments within the US Department of Justice.

The current distribution of NEBS subscribers amongst the various states is:

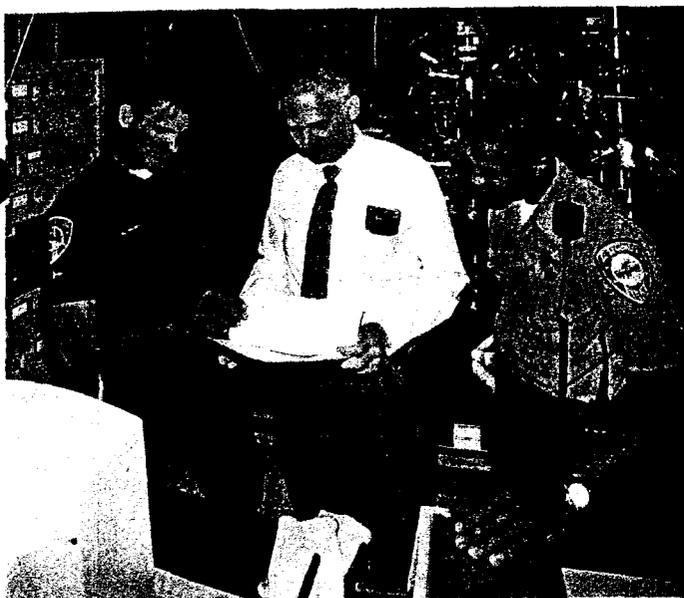
Alaska	86
Arizona	118
California	751
Hawaii	11
Idaho	54
Nevada	29
Oregon	161
Utah	76
Washington	203
Other states	85
Unknown	279
Total	1853

California Peace Officers Standards and Training (POST)

Another important component of the NLECTC-West outreach program is the education module the Center developed with California POST. The module forms a portion of a POST course taught to criminal investigators. This course is a "core" curricu-



E-mail Distribution



POST Instruction

lum offering that is required for state certification as a criminal investigator. The course is offered monthly and in it students are introduced to all the elements of conducting a criminal investigation. The students are given a crime scene to process and from this initial information, they work for two weeks to investigate the crime. Early in the course the students are introduced to techniques for collecting and preserving evidence.

At two of the venues (five total) the NLECTC-West presents a two-hour segment devoted to describing the NLECTC system and the services available from the NLECTC-West. In addition, the presenters offer ideas about evidence that the traditional coursework ignores (e.g., videotapes, audiotapes). The presentation points out best practices for handling the evidence (gained from the center's forensic experiences) and utilizes examples of poor video camera placement to demonstrate that law enforcement agencies can optimize their own video surveillance if they are careful in the setup phase.



Outreach Display

The presentation also discusses use of the NLECTC-West's trace element analysis capabilities, its work in computer data recovery, and its audio enhancement techniques. The NLECTC-West staff also shows the NIJ outreach video to acquaint the students with the entire NIJ center system.

The POST instructors have indicated that the standard cases that the students work on each session will be updated in the fall of 2000 to reflect the increasing presence of digital evidence at crime scenes.

During the period of this grant the NLECTC-West has made presentations to approximately 700 investigators from California through the association with California POST. The POST presentations have given the NLECTC-West high visibility with the criminal investigators in California.

Conferences/Symposia/Speaking Engagements

In addition to information shared by e-mail messages sent to individuals, and the POST presentations, the NLECTC-West has made numerous presentations at meetings and conferences.

The Center, through the assistance of the RAC, compiled a list of regional conferences, seminars, and meetings planned in each state for each year. The Center worked with the RAC to select a list of events in which to participate. Participation included establishment of a booth with NIJ/NLECTC products for distribution, a conference presentation detailing the services provided by the NLECTC system, and examples of technology services provided under the SEAS and outreach processes.

The NLECTC-West used these opportunities to present information about the NIJ center system as well as about the capabilities of the NLECTC-West specifically. In some engagements the topics were specific to the interests of the organization (e.g., forensics). In other cases, the topics covered the entire spectrum of the NIJ Center system. In all cases, the staff discussed the center system and its potential benefits to LEC agencies.

In some of the cases, the presentations were made to local community groups, like the Rotary or Lions club, which have an interest in community safety issues. In other cases, the presentations were made to professional organizations representing law enforcement and corrections agencies. The table in Appendix 5 provides a listing of the significant conference and symposia speaking engagements during the period of this agreement.

Science Engineering Advice and Support (SEAS)

SEAS forms an essential element of the NIJ mission. It is this activity that imparts and shares technical information with LEC agencies. The NIJ has, in the last year, adopted the breakdown of SEAS activities presented below that we will use for the purposes of this report. This report will document significant activities within each of the categories. (NOTE: An important ingredient in the NLECTC-West process is working with technology vendors, developers and researchers. To avoid focusing on a few at the exclusion of others, the report will list those vendors with which the center has worked or whose products the center has reviewed in Appendix 6.)

The variety of activities that fall into the SEAS category is extensive. The SEAS activity runs the gamut from responses to

fundamental technical questions to larger, complex systems analysis and systems engineering activities.

In the following paragraphs we describe some of the basic activities involved in the SEAS effort and then apply them to projects and requests we have received during the reporting period. The following is a taxonomy of responses to SEAS questions.

- Technology Question
- Sanity Check
- Short Study
- Requirements Analysis
- Design or Specification Assistance
- RFP Assistance
- Evaluation Assistance
- Verification
- Acceptance Testing
- Initial Training and Familiarization

In the following paragraphs we amplify the meaning of the taxonomy listed above.

- Technology Questions—Typically a request for SEAS starts as a simple question to have some technology explained or clarified, or some product that uses a technology identified. The Center's response will either satisfy the request, which occurs in most instances, or lead to further dialog and more detailed responses by the Center.
- Sanity Check—On occasion, an agency might ask to have the Center validate a technology solution to a problem. An example might be the selection of some products and/or technical support to solve an agency need. The Center's response might be as simple as a validation of the approach, a recommendation to consider some additional products or approaches, or a suggestion to simplify the proposed solution. At times the Center might recommend the use of a technological solution that has been implemented by another agency. The Center's response usually ends any future dialog with the requesting agency.
- Short Study—SEAS work for requesting agencies on straightforward technology issues or projects sometimes lead to a short study. In these instances the Center will meet with the requestor to clarify the need, gather information or data, analyze the results, and produce a short report addressing the requestor's needs and recommended solutions.

SEAS work for a requesting agency can also be as detailed as supplying assistance with the procurement of a product or system. The following describes the assistance steps taken. Typically a request for procurement assistance involves proceeding through all of the following steps. During this process, the Center guiding principle is to provide assistance in a manner that will leave the agency with the capacity to repeat this process on other systems, without future assistance.

- Requirements Analysis—A first step in this procedure is to define the requirements for the particular system. The Center will teach the requesting agencies how to

determine their requirements in a manner that will lead towards the development of a procurement document. The Center will help the agency to follow a planned and assigned effort to identify who knows what is needed, what it is that is required, and how to refine and document the needs. This process is often more disciplined than the agency is used to.

- Design or Specification Assistance—When the needs are well stated, the Center will help to develop a system design, system specification, and system cost estimate. This is typically an iterative process, which involves refining the design to meet the available budget. The design process requires the agency to quantify the technical requirements of the system, e.g., size, speed, capacity. These quantities must be self-consistent and they must integrate with one another to form an integrated system rather than a collection of isolated components.
- RFP Assistance—The Center's assistance in the development of a procurement package involves helping the agency put together a document in a format that is consistent with the procurement policies of the agency's government, and that leads to the acquisition of a system in a timely manner without protest from unsuccessful bidders. It includes the statement of work, the terms and conditions of the contract which the agency intends to use.
- Evaluation Assistance—The Center's assistance in the evaluation of bidder responses involves helping the agency in the successful implementation of the evaluation criteria defined in the RFP package, ensuring that the agency has a documented audit trail of the process to defend any possible vendor protests.
- Verification—The Center's assistance in the verification of a procured system involves helping the agency to accept a system that is consistent with the system specification and to identify any differences between what was promised and what was delivered.
- Acceptance Testing—The Center's assistance in the acceptance testing of a system involves helping the agency to ensure that the system procured meets the performance specifications requested by the agency and supplied by the vendor.
- Initial Training and Familiarization—The Center's assistance in the training and familiarization of a system involves helping the agency to establish a training regimen to ensure that the system is used effectively and that the agency's staff understands all of the features of the new system.

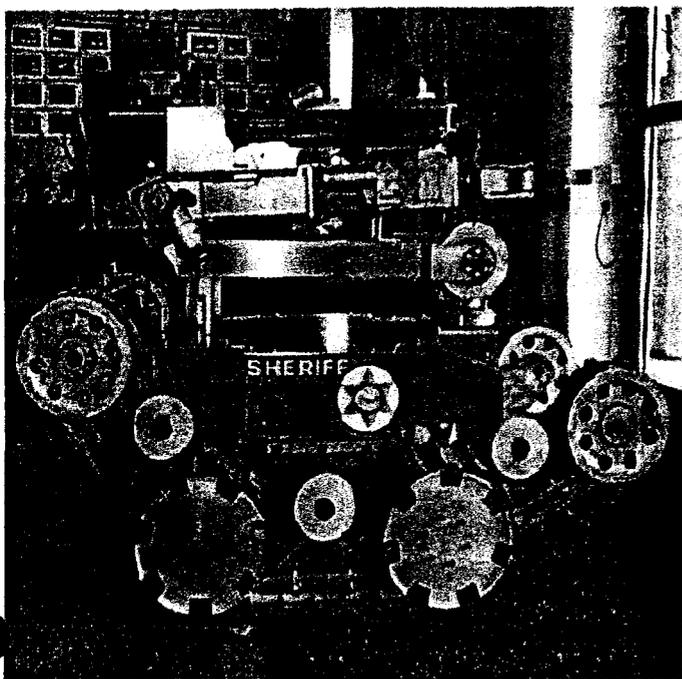
In the table that follows we summarize some of the significant SEAS activities in a matrix format to demonstrate the application of the above taxonomy to support we have provided to law enforcement and corrections agencies.

In some cases, the requests for assistance do not fall into neat, predetermined categories. An important example of this occurred when the Los Angeles Sheriff's Department (LASD) came to the Center and requested assistance for their bomb squad. The department uses remote-controlled robots to approach and examine suspicious objects that might be

Significant SEAS Activities

Significant SEAS Activities

	Outreach	Short Study	Requirements Analysis	Design/Spec Development	RFP Development	Evaluation/Selection	Installation/Verification	Acceptance Testing	Training/Operations
Border Tactical (BORTAC) Communications	✓		✓	✓			✓	✓	✓
Channel Capacity Analysis of Trunked Radio System	✓	✓							
Cellular Digital Packet Data (CDPD) Coverage Study	✓	✓							
Radio Interference Analysis Study	✓	✓							
Los Angeles Radio Interoperability (LA RIO)	✓		✓	✓			✓	✓	✓
Manhattan Beach, CA Repeater Study		✓							
Mill Creek, WA Communication Study	✓	✓							
Portable Hostage Negotiating System	✓		✓	✓			✓	✓	✓
Public Safety Radio Basics	✓	✓							
Radio Study for Mat-Su Borough	✓	✓							
Modesto, CA Tower Interference Study	✓	✓							
Ventura, CA Mobil Data Computer Study	✓		✓	✓	✓	✓	✓	✓	✓



Bomb Squad Robot

explosive devices. The department also uses the robot in hostage situations to approach the barricaded suspect with audio and video capabilities. Using these elements of the robot the officers are able to assess the situation, communicate with the suspect, and in some cases initiate action using the mobility and equipment of the robot.

The robot, through age and constant use, often ceased responding to the control signals generated by an operator at a safe distance from the suspicious object or barricaded suspect. Video signals from the robot continued to work, but the robot would not maneuver as instructed. Consequently, one of the officers would have to carry a wire "umbilical" to the robot and plug it into a receptacle. This procedure often placed the officer at risk and it reduced the mobility of the robot.

The Center took possession of the robot for several weeks to investigate the problems experienced by the LASD deputies. Experienced electronic circuit analysts and antenna design staff looked at all elements of the robot's command and control circuitry and decided on two courses of action: 1) redesign the antennas to provide more "gain" and therefore a stronger received signal from the operator, and 2) redesign the power supply on the robot so that the video circuits could not "rob" the control circuits of power and thus limit the robot's responses to commands.

The redesigned robot and antennas were returned to the LASD and the bomb squad has learned to bounce signals off of buildings and control the robot out of direct line-of-sight of the operator. In addition, they have found that they can operate the robot at a longer stand-off distance, thereby improving officer safety. Subsequent to this activity the department has returned and requested new transmit antennas for an additional truck which has just been equipped with a newer robot.

In another case, a small police department requested assistance in assembling a portable kit that could be used by the department's hostage negotiators. The kit had to contain the portable phones, tape recorders, and other equipment that a negotiator could pick up quickly when responding to a hostage situation. The department had some of the equipment, but they needed assistance in developing a robust package and prewiring all of the components so that the equipment could be assembled reliably and quickly.

The center contacted support staff who had experience with electronics and the packaging of equipment into test kits and portable packages for deployment to operations sites. They took the existing phones and recorders and built them into a rugged case that could be quickly picked up and taken to the site of a hostage or barricaded-suspect situation.

Officer Protection and Crime Prevention

The NLECTC-West has not been involved in any significant crime prevention project during this period of performance. The Center's efforts in this portion of the NIJ reporting scheme have been focused on officer-protection issues.

Examination of body armor, personal protective equipment (PPE), and surplus federal property available through the Federal Excess Surplus Property 1033 program constitute the majority of activity in the category of officer protection. The



Hostage Negotiation Kit

Center has also worked with technologists to understand the utility of technology in the detection of individuals in obscured environments that might improve officer safety.

Through the mechanisms available to law enforcement and corrections agencies, there is and will remain the opportunity to work through the system of state surplus-property coordinators to acquire officer protection equipment such as helmets, shields, shin guards, and other protection equipment for special teams and riot control. One strategic goal of the NLECTC-West is to enhance and expand the program to offer more to both law enforcement and corrections agencies. The State of California, which began the 1033 pilot program in 1994, has efficiently refined this program and intends to coordinate assistance to other states in the Western Region.

There is a growing requirement to improve and equip peace officers with certain levels of PPE normally allocated and fitted at various levels for fire, hazmat and other specialty personnel. An identified trend, in light of the national concern about various weapons of mass destruction (WMD) terrorist threats, is to evaluate and appropriately equip and train law enforcement officers with suitable PPE for unusual occurrences.

The NLECTC-West has, during the last year of this award, placed itself in a position to understand the issues surrounding first-responder protection to WMD events. The Center has assigned one individual to become familiar with the issues and the equipment. This same person has been working with vendors to understand the products that are available and has also been working with first responders to understand the limitations of these products when used.

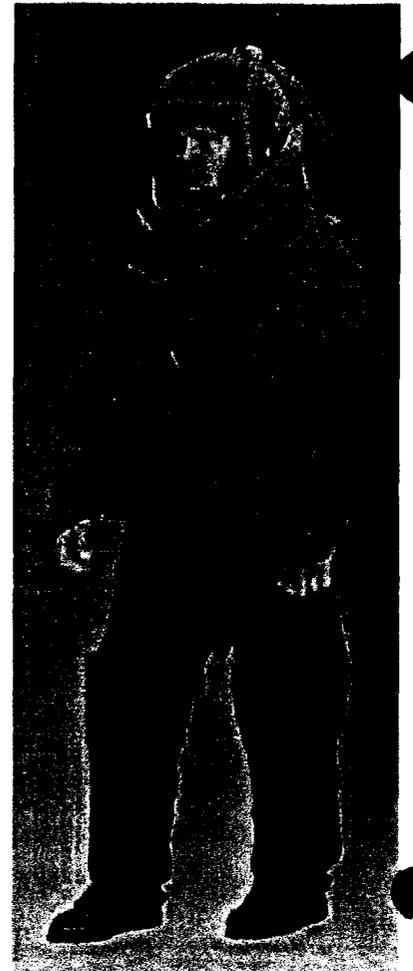
If the trend towards training, equipping, and using peace officers with the ability to take immediate action when responding to an incident such as a chemical terrorist event continues, the ability to evaluate PPE for law enforcement use will become a necessity.

Body armor continues to be of prime concern and a major consideration for officer protection. Wearability, durability, and increased protection are all technical challenges for the near term. Requirements and interest for advanced body armor continues. The L.A. Sheriff's Department Special Enforcement Bureau is currently searching for advanced, effective body armor and continues to coordinate with the NLECTC-West for technical assistance and information.

In addition to numerous meetings concerning the 1033 program, both with state representatives and with federal officials, the NLECTC-West was actively involved in specific technologies aimed at improving officer safety. They are described below.

Ceramic Body Armor. The NLECTC-West worked with law enforcement personnel and a vendor to examine the utility of a new style of body armor that utilized ceramic inserts with a standard kevlar-based vest. The vendor, utilizing technology developed for the Blackhawk helicopter and later the Navy's SEAL teams, fabricated a vest utilizing a specialized ceramic plate. The ceramic plates were capable of withstanding armor-piercing AK-47 rounds and law enforcement personnel were interested in the technology. The law enforcement agencies expressed interest and the Center contacted the Office of Law Enforcement Technology Commercialization (OLETC) and manufacturers to assist the vendor in obtaining financing.

Work Detail Tracking. The NLECTC-West initiated a requirements-collection activity to determine the need for and the operating requirements of a system to monitor the location of inmates assigned to work details that were away from the inmates' normal custody site. Center staff visited with Arizona Department of Corrections personnel as well as with staff from the California Department of Corrections, the Washington State Department of Corrections, the Washington Association of Sheriff's and Police Chiefs, and the Los Angeles Sheriff's Department. In addition, the staff met with providers of inmate tracking within facilities to determine the applicability of their systems away from permanent tracking sites. The Center staff has documented these



Protective Equipment

requirements for NIJ, which is looking for a funding opportunity to develop a prototype.

Emergency Response Gas Masks. The NLECTC-West worked with several manufacturers to bring information to emergency responders regarding emergency response gas masks. In particular, law enforcement and corrections officers do not always see the technology that is available to fire and hazardous materials units. These presentations and information exchanges occurred during the regular meetings with the RAC.

Through the Wall Radar. Time Domain, Inc., a developer of high-frequency communications equipment, built a prototype device that would radiate low-power radar through walls and record the return signal on a display that approximated the range and motion of subjects hidden by the wall. The vendor demonstrated the device to the staff at the NLECTC-West, which has agreed to find test sites for evaluation of the technology. Time Domain, Inc. has agreed to provide a model of their next-version device, which will be smaller than the current system.

Hughes Land Warrior Technology. The NLECTC-West organized a meeting between Hughes Electronics and representatives of five local police agencies for a demonstration of the US Army's Land Warrior 2000 system. The system is a specially designed set of equipment to provide the soldiers of the (near) future with command and control capabilities to include realtime video, satellite communications, and advanced sensors such as infrared, all contained in lightweight, bullet-resistant equipment designed for the infantry. The applications to SWAT, surveillance, and riot-control make the system of interest to law enforcement agencies. Follow-on meetings were held by the five law enforcement agencies with the vendor.

In summary, the NLECTC-West has determined that there is a validated need for advanced, more protective body armor; that there is value to supporting the 1033 Federal Surplus Program; that there is an emerging requirement for PPE for law enforcement personnel that can be quickly donned, is readily accessed, and is affordable; and that night vision, communication

improvement, and advanced sensors all have a role to play in the improvement of officer safety.

Investigative and Forensic Sciences

The NLECTC-West has made a significant commitment to the understanding and expansion of technology's role in forensics, especially in forensics that is not normally covered by the traditional crime laboratory charter. The focus of these forensic activities can be divided into four areas: video, audio, computer, and trace-element analyses. The Center's goal has been to understand the current needs of criminal investigators with regard to these nontraditional areas of forensics.

As a consequence, the Center accepted and helped to process evidence that could not be analyzed by existing crime labs. During the course of these analyses, the NLECTC-West developed procedures and processes that were formulated into a set of best practices for handling video evidence (see Appendix 7). In addition, the Center was able to identify equipment and software that law enforcement agencies could purchase when the agency had the funding and staff to work on the cases themselves (see Appendix 8).

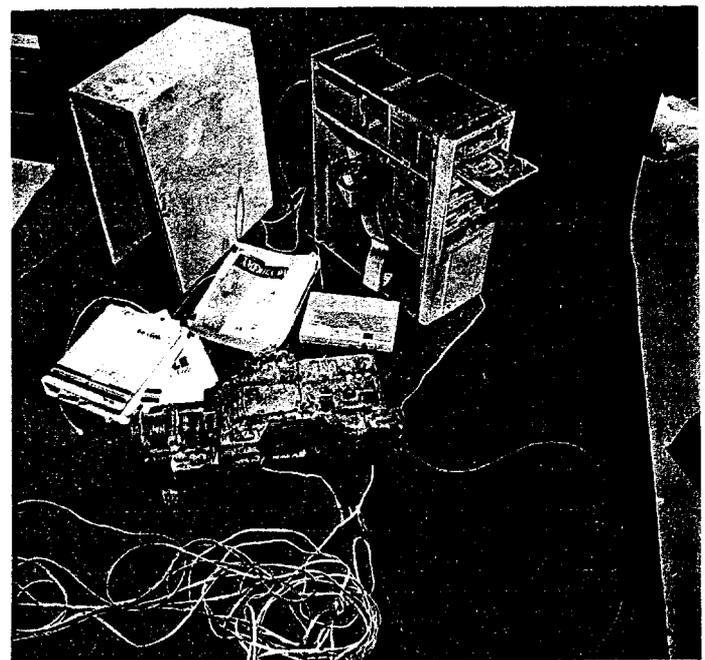
In order to work with the agencies in this sensitive area, the Center established a set of internal policies and practices for the proper control of evidence delivered to the Center. These procedures and policies were established under a prior grant and were maintained during the period of performance of grant no. 96-MU-MU-K006 (see Appendix 9 for the procedures).

Building upon a prototype evidence tracking system developed by the Center under a previous grant, the NLECTC-West maintained a database of evidence received for analysis and processing, and treated all evidence as though it were Confidential Information under The Aerospace Corporation's standard Department of Defense classification policies.

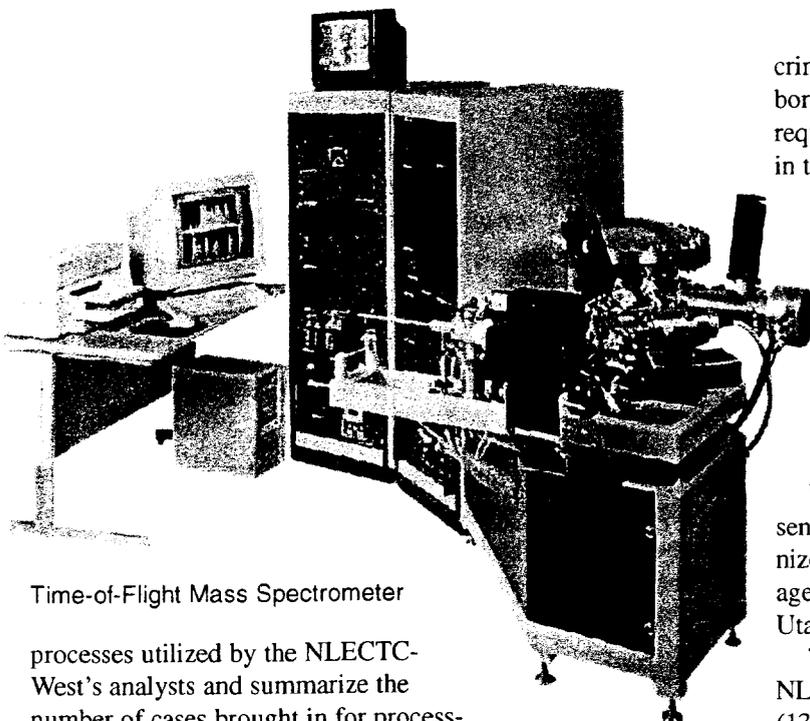
The NLECTC-West accepted 727 cases for the period covered by grant no. 96-MU-MU-K006. In the following paragraphs the report will describe some of the techniques and



Video Enhancement Laboratory



Computer Forensic Case



Time-of-Flight Mass Spectrometer

processes utilized by the NLECTC-West's analysts and summarize the number of cases brought in for processing. In Appendix 10 there are more detailed descriptions of the work NLECTC-West performed for select cases. These descriptions are meant to provide an indication of the support the NLECTC-West provided to local agencies that was unavailable from the agencies' own crime laboratories.

Video Forensics. The NLECTC-West accepted 511 cases for video processing during the period of performance of this grant. The casework provided support to prosecutors, investigators, corrections agencies, and to public defenders in a few cases. The NLECTC-West accepted casework from all over the United States, although the majority of cases originated in the western states.

Audio Forensics. The NLECTC-West accepted 188 cases for audio processing during the period of performance of this grant. These services have provided law enforcement, corrections, and prosecutorial agencies with products that they valued highly. These services provided information that led to arrests, validated Miranda notifications, corroborated witness testimony, and developed new leads for investigators.

Computer Forensics. During this grant period NLECTC-West began providing continuing, on-call support to law enforcement or prosecutorial agencies that required the recovery of information that has been intentionally or inadvertently removed from a PC computer system. The center accepted 10 cases during the reporting period. The techniques developed recovered information from an indicted murderer's, "erased" computer system, to determine if the suspect had recorded information that would link this person to a sought-after serial killer. The NLECTC-West is using this experience to recommend enhancement equipment and software to law enforcement and corrections agencies, and to develop standards and guidelines for the recovery of computer-based information.

Trace Element Forensics. The NLECTC-West has been able to utilize the technical skills and equipment of The Aerospace Corporation to provide LEC agencies support in investigations that required equipment not normally found in a typical

crime lab. The analyses performed by the NLECTC-West border on the exotic, but were nonetheless valuable to the requesting agencies. The Center received a total of 18 cases in this category during the reporting period.

The following table and chart summarize the forensic casework during the period of this grant award. In the chart, 1996 represents only 6 months of activity, and in 1999 we have included January 2000.

The NLECTC-West provided investigative support to 169 different agencies in the United States. Of these 169 agencies, 18 are located outside of the NLECTC-West service area. These agencies and their states are itemized in Appendix 11.

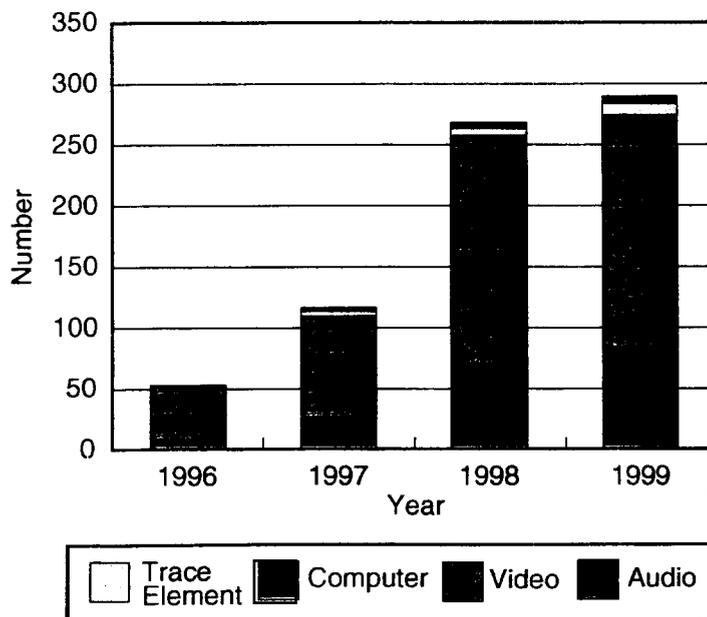
Within the western region, only Utah and Nevada did not send the Center casework. In the case of Nevada, we recognize that we have to increase our outreach activities. Utah agencies appear to have more resources at their disposal, but Utah also represents an opportunity for increased outreach.

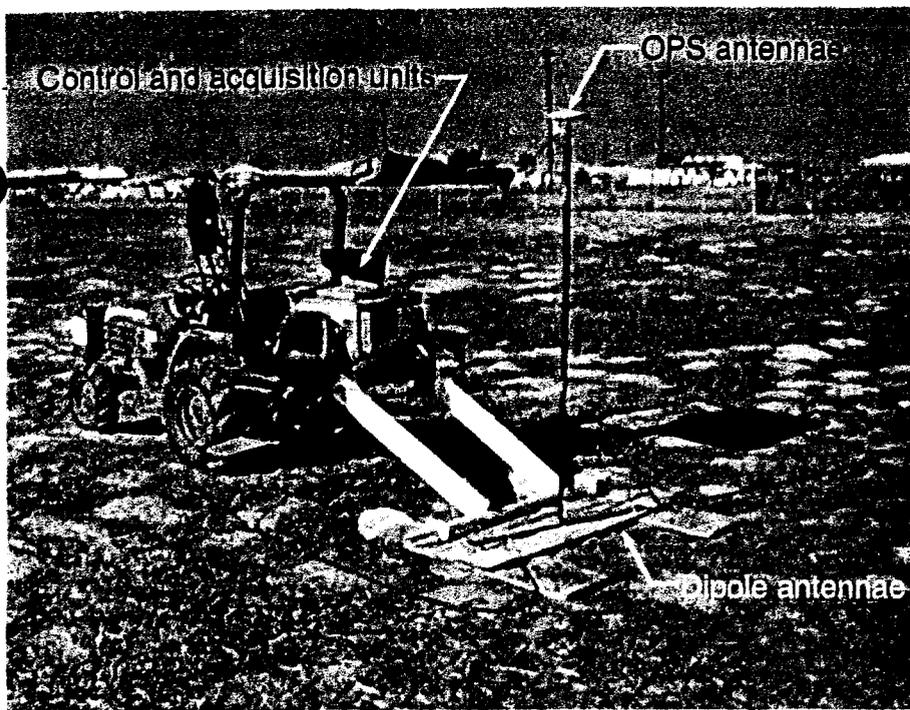
The predominate number of agencies served by the NLECTC-West's forensic analyses came from California (137). The remaining 14 agencies were distributed amongst 6 states. These statistics show the benefit of the NLECTC-West's support to the California POST course for criminal investigators and to its work with the California Peace Officers Association (CPOA) (identified in the Symposia Conference Table).

The success of the POST and CPOA outreach activities points to opportunities in other states to accomplish similar levels of contact.

Forensic Casework During Grant Period

Forensic Casework 1996-1999	1996	1997	1998	1999
Audio	8	26	70	84
Video	45	85	189	192
Computer		1	3	6
Trace Element		4	6	8
Total	53	116	268	290





Ground Penetration Radar

Ground-Penetrating Radar. A recurring SEAS request for the capability to search and discover things that have had been buried in the ground led to a search for a technology that would assist in these law enforcement support operations. At its very basic, the functional requirement was the ability to discover either property or dead bodies buried in soil, discarded in water such as lakes, ponds, streams, or harbors, or both.

This capability is, potentially, a powerful tool for investigation, prosecution and, perhaps, rescues. The initial search for a supporting technology took about 2 years, including formal testing, evaluation, and some technical exploration into existing but generally inadequate technologies used in other industries for other purposes.

The general requirement for such a supporting technology can be described as the capability to search an area and discover or rule out the existence of a buried object. This requirement has the following constraints (things it must do): it must be portable and it should be highly portable; operation should be simple, i.e., capable of being used effectively with minimal training; and a search must be faster and more accurate than the alternative, which is generally a search party.

Restraints (things that it must not do) are the following: it must not cause damage to objects on the surface of the search area; it must not be hazardous to operate; and the cost to rent, purchase, or operate must not be unreasonable in comparison to its utility.

This capability is considered a developing operational requirement and as such is incomplete for constraints and restraints.

Technology scouting discovered four technologies of potential utility. Two exist as tools for other industries and uses, and two are experimental prototypes adaptable to the operational requirement.

The existing technologies are metal detectors and portable ground-penetrating radar units. The two prototype devices use nuclear magnetic resonance for the first, and synthetic-aperture

ground-penetrating radar and GPS coupled with advanced tomography for postprocessing imaging for the second. Of the four, the latter has the most promise, and is a significant advancement in comparison to all the others.

There have been at least four requests through outreach for operational assistance. Two have been requests for searches for missing persons believed buried and two have been for contraband detection. Two searches using existing ground-penetrating radar were unsuccessful. One search for a buried body was unsupported with existing funding. One search for a discarded weapon demonstrated good potential capability but the target weapon was not found in the search area. However, the technology demonstrated an effective field capability. A synopsis of the event is described below.

The Los Angeles Sheriff's Department requested assistance in the search for a discarded weapon used in a murder. The weapon was discarded in Railroad Canyon Lake in Riverside County, California in 1992. This

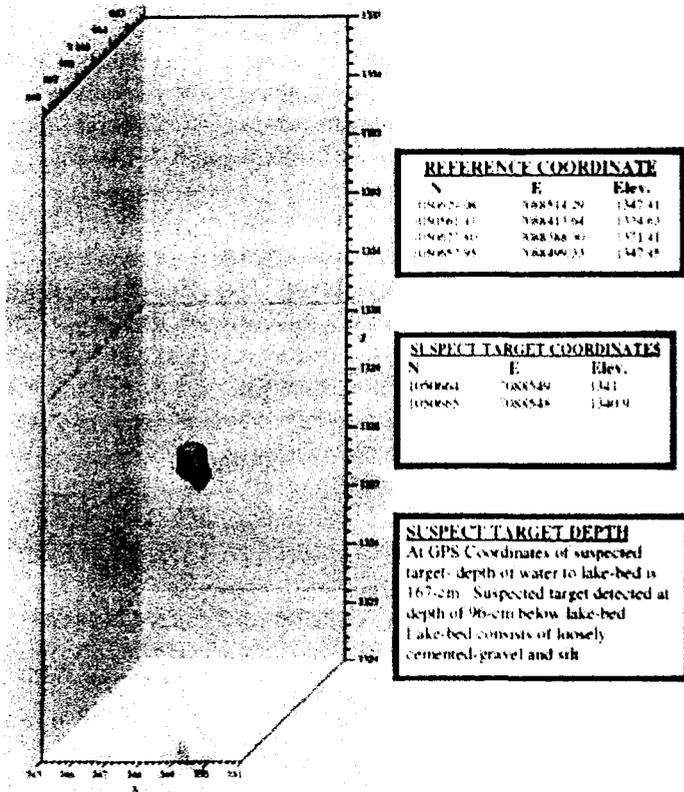
support operation was planned and executed in September 1999; Dr. Khosrow Bakhtar of Bakhtar Associates agreed to use his prototype Earthradar for the search. The target search area was approximately 100 square meters. A sedimentologist from the University of California, Los Angeles estimated that the target would be under approximately 4 feet of silt, given the time, climatic conditions, and soil composition in the search area.

Dr. Bakhtar calibrated his Earthradar for the subject area search. He used differential GPS for precision location of targets and mounted his antennae to a rigid inflatable rubber boat. He tested the calibration on a similar pistol supplied by the LASD and positioned in the water as a test. He found that pistol in three of three attempts.

His search revealed 4 possible targets. All targets were within 3-4 feet below the floor of the lake, in approximately 4 feet of water. Each possible target was located and marked.

Logistic support for this operation was extensive. The rigid inflatable rubber boat and crew was borrowed from the Second Battalion, First Marine Regiment at Camp Pendleton. The picket boat used to maintain the search pattern and its crew came from the US Coast Guard Station, Long Beach. Coordination for support was handled by the NLECTC-West.

Dr. Bakhtar performed postprocessing on his collected data and eliminated three of the four targets. The image of the most promising target is in the figure at the right. The LASD dive team returned to the site, used a backhoe to dig in the area and found the target after extensive sifting of the extracted mud. This search was hampered by limited ability to perform underwater excavation. The final discovery of the target was by using a magnetometer commonly used to find underground cables and pipes. The target was an L-shaped hinge similar in size and weight to a small pistol. A follow-on interrogation of the suspect revealed that the pistol had actually been thrown in the lake in a different place.



Front view of suspected buried target

GPR Image of Buried Object

This technology is worthy of continued development for policing and public safety use. This prototype was developed under funding from the US Air Force for the purpose of clearing bombing ranges of unexpended ordnance. Leveraging that research to produce a useful tool for this documented requirement is worthwhile.

Less-lethal Weapons

During this reporting period the NLECTC-WR initiated and expanded a program planned to investigate, identify, and evaluate promising technologies applicable to the law enforcement and corrections industry's needs for less-lethal weapons and devices. The goal of this initiative was based on three broad categories of effort:

- Identify the requirement and the need
- Identify and evaluate the state of the art
- Investigate and encourage the entrepreneurial development of promising candidate technologies

Once this capability had been developed, the next stage was to create a network of researchers, operators, developers, and law enforcement and corrections agencies progressive in their approach to the application of less-lethal technology.

The NLECTC-WR was, and continues to be, ideally suited for the study, research, and development of less-lethal technology. Arguably, most, if not all, of the ideas for less-lethal weaponry and the majority of ideas and pursuant development have originated in this region. Federal labs in the Pacific Northwest, California, and New Mexico have, and continue, to do research probes on less-lethal technologies. Many of the advanced ideas for the next generation of less-lethal technology have originated from small research firms

in the West, often spin-off companies from the aerospace industry in Southern California.

Recognition of the need to develop effective and safe less-lethal weapons for use by law enforcement and the military has surged periodically in the recent past. Events encouraging the development and employment of these types of weapons include the 1970 Kent State University protests and a 1986 report by the US Attorney General that specifically identified the need for the immediate development of effective less-lethal options for law enforcement operations.

Current interest in the use and development of less-lethal weapons regained momentum in 1994 and can be marked subsequent to the 1993 deployment of the US Marines to Somalia. The Marines were trained on and equipped with nonlethal weapons by the Los Angeles Sheriff's Department. This renewed interest and the recognition by both the Department of Justice and the Department of Defense of the dual-utility of less-lethal technology created several initiatives to advance the state of the art.

Following the national trend, less-lethal weapons are gaining acceptance for law enforcement and corrections applications. Such weapons, as evaluated by the industry in general, offer the ability to compel compliance, offer additional operational options to peace officers, and reduce violence. Experts agree that the state of the art at present is refined kinetic energy weapons, examples of which include bean-bag rounds, sponge grenades, stingball grenades, and a variety of options on this theme. Other traditional less-lethal options include CS (or "tear") gas and OC (or pepper) spray.

The NLECTC-WR personnel monitored, attended, or participated in a continuing series of symposia, conferences, trade shows, and demonstration events, and observed a variety of less-lethal weapon initiatives between 1994 and 2000. Of particular significance was the Memorandum of Understanding (MOU) between the Department of Defense and the Department of Justice. This MOU enabled the NLECTC-WR to establish information networks among the various research labs, program offices, and executive agents of the Department of Defense and the Department of Energy.

Further, the NLECTC-WR established and has maintained, through its Advisory Council, active networking with the technology exploration section of the L.A. County Sheriff's Department and with law enforcement instructors of less-lethal weapons courses, various research and development companies and inventors, researchers, and advisors.

Building the capacity to explore, evaluate, and assess the characteristics of various less-lethal technologies, the NLECTC-WR staff has briefed or presented information on the topic of less-lethal technologies to a variety of law enforcement organizations. Examples of agencies include the California Peace Officers' Association, the California Corrections Technology Committee, the L.A. Sheriff's Department, the California Peace Officers' Association technology committee, the Canadian Police Research Center, an Emergency Response Team of the Royal Canadian Mounted Police, the IACP and representatives from the British Home Office.

By 1999, the NLECTC-WR had established and maintained an active liaison with the Department of Defense Joint

Non-Lethal Weapons Directorate and the Marine Corps Systems Command Non-Lethal Weapons Program Office. There is a direct correlation between the research and development for less-lethal weapons used in Military Operations in Urban Terrain (MOUT). This activity has commonality with modern policing.

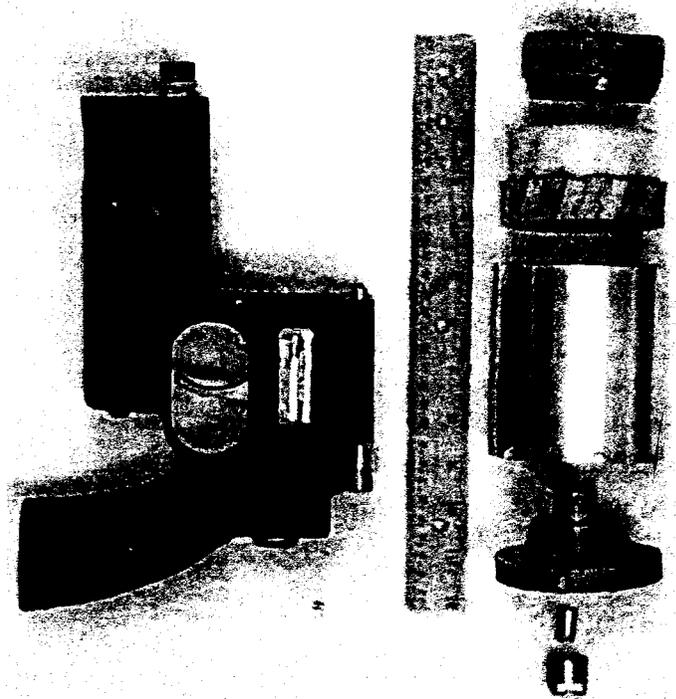
Having established a general background in the assessed needs of law enforcement and corrections, the NLECTC-WR has supported, encouraged, or assisted in the sponsorship of several less-lethal projects.

Ring Airfoil Projectile. The ring airfoil projectile (RAP) is a product of the US Army Research Lab developed in the 1970s as a first attempt to make a nonlethal round combining kinetic energy and incapacitating agent. The original system was demonstrated to the NLECTC-West Advisory Council in January 1997. The system satisfied the requirements of range, accuracy, and non-lethality for policing and corrections. There were two significant advantages to this technology in addition to its functional attributes: the successful adaptation of this system for domestic policing could provide a model for dual-use technology (DOD/DOJ), and the extensive research and development for technical, human factors engineering and testing had already been done. It was designated as an appropriate system for follow-on evaluation and testing.

The US Army's final type-classified (production model) projectile was composed of a soft rubber structure of 32-durameter hardness, contained CS powder (tear gas) as the incapacitating agent, and was launched from a muzzle-mounted adapter for the standard service rifle (the M-16A1) of that time. Energy to propel the projectile by way of a sabot on the launcher adapter came from a low-grain blank cartridge.

The projectile's advantage in range and accuracy is due to its trajectory and flight characteristics. In contrast to most current less-lethal (and lethal) projectiles, which are ballistic, the RAP is aeroballistic. That is, it flies. The cross-section of the RAP is that of a conventional wing, with a leading edge, a trailing edge, and a chord. This wing shape is formed into a circle and spin-stabilized. The resulting characteristics include accuracy, stability due to spin (5000 rpm), and conservation of launch energy. Unlike a bullet, beanbag, or other conventional projectile, which loses energy quickly once leaving the muzzle, the RAP retains most of its energy through its maximum effective range. A beanbag cannot be used at point blank range because of the high muzzle velocity needed to propel that beanbag a relatively short distance. The beanbag must be launched at a more lethal velocity and used at a determined distance where the projectile's velocity is likely to be non-lethal. In contrast, the RAP can be launched at a non-lethal velocity and maintain that velocity, less minimal velocity decay, for its entire effective range.

The RAP was presented to the National Institute of Justice as a potential research and development project in early 1997. It was approved, funded and initiated. The original RAP system consisted of the M-16 rifle as a launcher, a launcher-adaptor fitted to the rifle muzzle, the RAP projectile, and a low-grain blank round for propulsion. This system was evaluated by a panel of law enforcement advisors and changed as the conceptual design and function, based on examination of the prototype, required that the RAP projectile retain the same



Ring Airfoil Projectile

flight, kinetic energy, and accuracy characteristics. The launcher would be shaped and fired like a pistol, and the projectile and blank would be combined to make a self-contained round that could be quickly loaded, fired, and discarded. This system would be very light weight and relatively inexpensive. The projectile would be designed to carry OC powder instead of CS gas crystals, and the impact would have an effective dispersal pattern on impact. Guilford Engineering Associates, in conjunction with the original principle investigator of the Army system, Abe Flatau, produced a prototype launcher within 6 months.

The project was funded and work has continued uninterrupted from 1997 until the end date of this report. Guilford Engineering has teamed with CDS, Inc., a company specializing in chemical agents, for the development of the complete projectile. There has been no consulting collaboration with the originator, Abe Flatau, since 1998.

As of the end date of this contract period, the state of the project is as follows: one launcher has been built, the full-up round has been designed, and the dispersal pattern for the round after impact has been periodically tested and documented. Technical problems of initial muzzle velocity, chemical agent dispersal, automated manufacturing of the projectile, and material selection for manufacture of the self-contained round remain unsolved.

Multiple policing and correctional agencies in the Western Region are enthusiastic about evaluating the end product. **Incapacitating Gas EA 4923.** Information and research on the chemical incapacitating agent EA4923 was discovered after several outreach requests for technology exploration to improve on the two principal chemical agents currently used in policing: tear gas (CS) and oleoresin capsicum. NLECTC-West forwarded the initial information to the Research and Development

Division of the Office of Science and Technology, National Institute of Justice for information and investigation in 1998.

Delivery, dispersal, effectiveness, and environmental cleanup are four considerations in the operational employment of riot-control agents. The investigation of the compound EA4923 was to explore the possibility of improving on the problem of environmental cleanup and decontamination.

The investigation of compound EA4923 occurred in 1998 and 1999, and consisted of an examination of compiled research and several personal interviews with four researchers.

The researchers were:

James W. King, Ph.D., Foundation for Chemistry,
PO Box 116 Balsam, NC 28707-0116

George A. Grant, GA Grant Scientific Consultants, Ltd.,
General Delivery Box 25, Calabogie, Ontario, KOJ1HO

Timothy B. Weyandt, M.D., Weyant Associates,
Rt. 1, Box 387D, Huntingdon, PA 16652-9301

Walter E. Sultan, 1203 Springwood Terrace,
Fallston, MD 21047

Their combined research is found in a US Army report from the Aberdeen Proving Ground through Battelle Columbus, 505 King Ave, Columbus, OH 43201-2693. The subcontract number is 104077-TG117669.

From the report, and from interviews with Dr. King and Dr. Weyandt, the NLECTC-West reported the following applicable information to the research and development division of the Office of Science and Technology:

EA4923 required no environmental cleanup for decontamination. Dr. King, a chemist, explained that the outgassing of EA4923 was complete within 24 hours of dispersal and often in less time. In other words, the compound and the associated smell evaporates and dissipates without cleanup. This is in contrast to CS, which requires 15 minutes of decontamination and OC, which requires 45 minutes of decontamination for the same effect as OC.

The other issue regarding OC is unintentional death after exposure. Dr. Weyandt, a physician and career Army doctor, had several comments on the advantages of EA4923 over OC concerning unintended reactions to chemical agent, summarized as follows:

OC is currently considered less of a threat because it is a naturally occurring substance and is therefore labeled "natural." The use of this word can be potentially misleading. It is generally known that the British Police use CS and avoid the use of OC. Dr. Weyandt's opinion is that in the long term, OC may produce more unintended consequences than either CS or, if ever used, EA4923. Population statistics indicate a 1 in 100,000 chance of allergic reaction to either CS or EA4923, but a 1 in 10,000 chance of an allergic reaction (food reaction) for a naturally occurring substance like OC.

CS, CN (commonly called Mace), and EA4923 were evaluated by the Army in the 1980s for effectiveness and other attributes, summarized by the aforementioned report by the listed points of contact. The Department of Defense rejected CN because of the higher potential for skin blistering. The Army chose CS as the favored riot-control agent. The Marine Corps chose EA4923 as the agent of choice for training, but the final

outcome was universal use of CS for training and riot control.

It is the opinion of all of the points of contact, and the general opinion of their listed report, that EA4923 should be selected, or at least evaluated and tested, for use as a riot control agent.

NLECTC-West forwarded this technology exploration discovery to NIJ/OS&T Research and Development in early 1999 as additional data to assist in the continuing and difficult search for progress in less-lethal technology.

Acoustic Incapacitation Devices. The NLECTC-WR has been working with SARA Corporation to evaluate devices developed by SARA for non-lethal incapacitation. SARA, operating under a contract to the Defense Threat Reduction Agency, has developed several devices that may have application for law enforcement and corrections agencies. The devices generate low-frequency waves that induce nausea in the targeted individual, reducing their effectiveness in threatening officers.

In summary, the NLECTC-WR had, by 2000, established the capacity to evaluate, inform, track, and present information on the general initiative for the use and advanced development of less-lethal technology in law enforcement and corrections. The intermediate goals of understanding current use of less-lethal technology employment; creating the ability to effectively brief current use and policy; and evaluating and monitoring near-term and advanced research and development had been achieved by 2000. The NLECTC-WR maintains and updates a current file and briefing on less-lethal technology. (Appendix 12 lists additional meetings and conferences that the Center supported in this area.)

Information and Sharing Analysis

The NLECTC-WR has recognized from the outset of its formation that sharing information amongst LEC agencies presents one of the greatest opportunities for the NLECTC-WR to improve the safety and efficiency of the agencies' officers and staff. The NLECTC-WR has worked with agencies in Alaska, Hawaii, Washington, Oregon, California, and Arizona on various elements of information sharing. The NLECTC-WR has assisted these agencies with voice communications, data delivery systems to patrol vehicles, database organization, dispatch center design studies, and radio system coverage analysis. The project summaries for several of these projects are contained in Appendix 13.

Training and Simulation

Exploration into the utility of modeling and simulation for use in policing, law enforcement, and public safety is generally undertaken in three areas: initial training, proficiency training, and rehearsal for complex operations. The impetus for using modeling and simulation for initial training and proficiency training is cost and resource conservation. This is similar to advances in simulation for flight training. It enables the teaching of familiarity and procedure for initial training, and it hones learned behavior and clarifies procedure in proficiency training. Rehearsal modeling and simulation similarly conserves resources, and offers the potential to examine different courses of action in complex and multidisciplinary public safety operations.

This can range from planning for large events such as parades, conventions, and riots to tactical planning for high-risk events.



Ventura, CA Mobile Data Computer

Initial cost and data collection are the two main detractors for modeling and simulation development in policing, law enforcement, and public safety. Accurate modeling is complex, and modeling of the real world is based on accurate collection of real-world data that will lead to accurate prediction models. Leveraging previous and current Department of Defense research and taking advantage of the quality of computer games are two means of infusing modeling and simulation into public safety that may be cost effective.

There have been several examinations of the potential utility of modeling and simulation pursued through outreach activities of the NLECTC-West.

Through coordination with the NLECTC-West, the San Bernardino Sheriff's Department investigated modeling and simulation for initial training for driving, and for creating a common operating picture at an emergency operations center for training in preparation for complex operations.

This investigation included a trip to White Sands Missile Range, New Mexico, to the US Army Training and Doctrine Analysis Center (TRADOC). There, briefings were given on modeling and simulation for training and proficiency on vehicles and on individual tactical skills. This application was titled "soldier station" and has direct crossover utility for individual peace officer training and proficiency. Obstacles to its employment are general acceptance, initial cost, and the time and cost required to tailor it to peace officer standards and training instead of soldier skill proficiency. Some, but not all, of these skills from the differing professions are similar.

The ability to create a common operating picture using a large emergency operations center and its infrastructure to simulate events and response also holds great promise. The demonstration to the San Bernardino Sheriff's Department included

the ability of the system to create, maintain, and direct a scenario of increasing complexity. Designed to create the ability to wargame at battalion and higher level, this modeling and simulation capability has direct crosslink application in medium to large urban policing agencies, as well as any size agency with large geographical responsibility. Again, initial cost and maintenance, and cost to tailor this system to specific local conditions, are the two main obstacles to large-scale acceptance.

Based on several investigations of requirements for agencies, and interviews with the California POST, it seems that most emphasis for modeling and simulation will begin with initial training, and specifically for training to a standard. Development will accelerate when modeling and simulation is useful to exchange some of the initial training for procedure and knowledge now done by direct delivery, called "seat time," for self-paced and appropriately demonstrated and documented "simulation."

Finally, a limited technical field experiment using Department of Defense modeling and simulation showed promise for utility in Los Angeles, in rehearsing and preparing for the Democratic National Convention (DNC).

In 1999, the Los Angeles Police Department requested simulation for helicopter crews for simulated familiarization flights in and around downtown L.A., near the Staples Center, the site of the DNC

The Institute for Defense Analysis, directed by the US Army Reserve and in collaboration with the University of California, Los Angeles, constructed a simulated flight program that was a geographical replica of the area of downtown L.A. around and including Staples Center. The simulation was complete, with trees, street signs, billboards, and other visual clues commonly used by pilots operating by visual flight rules (VFR) and using ground reference. The purpose was to be able to do an area familiarization for the crews.

Additionally, the Los Angeles Sheriff's Department used the system to enhance the common operating picture, brief complex operations and events, and evaluate courses of action during the DNC.

As a result of these operational experiments, the agencies made suggestions for "operational enhancements" to the current prototype. These operational enhancements were minimally intrusive to the ongoing operations and have the distinct benefit of revealing both shortfalls and strength of design and implementation of any technology. This type of data-gathering is unique to outreach activities, and is not otherwise available. This validates outreach activity that includes technology experiments to improve equipment, gear, or devices that have been built but not tested in an operational event.

Counterterrorism Technologies

Presidential Decision Directives (PPD) 39 and 61 directly address the threat of terrorist events using weapons of mass destruction (WMD) and disruption of the national network of critical infrastructure. The significance of these indicators of national policy is that such terrorist events are both a national security concern and a local law enforcement and emergency management situation. They are neither traditional missions for first responders nor common or expected missions for military operations. Although it is likely that crimes will occur during these events, a terrorist act is not of itself a crime. Terrorist



Counterterrorism Threat

events fall between our definition of crime and our traditional understanding of war.

This emerging mission for public safety requires new concepts, operations, and technology. The NLECTC-West defined the strategy from which it would then develop specific technology missions and expertise: investigate and define the law enforcement and public safety responsibility to address the unusual occurrences of WMD terrorism; mitigate disruption/destruction of critical infrastructure and then identify specific technology requirements for first response at the local level.

Tools for prediction, mitigation of events, and consequence management were identified as priority law enforcement and policing requirements for this multifunctional and complex operation. Concepts of intelligence gathering and synthesis, methods of tracking and pattern recognition were also considered useful tools for this effort. Further, personal protective equipment (PPE) beyond the present definition of officer safety would eventually be required.

Research for the identification, utility assessment, and creation of technology useful for counterterrorism preparation initiated and accomplished to date is as follows: the congressional report on the threat of domestic terrorism and the vulnerability of national critical infrastructure, often referred to as the Gilmore Commission, cited two specific local examples of models of planning and preparation for these two new threats. Los Angeles County was cited by the commission as a leader in *organization and preparation for countering terrorist threats*. The Los Angeles County Sheriff's Department, operating from their Emergency Operations Bureau, has organized a multifunctional public safety network. The L.A. Sheriff's Department functions as the secretariat of the group and has a small core staff detailed to the task of orienting, organizing, and training this multifunctional group as a counterterrorism cell, using

forensic intelligence and crosstraining to develop group competence. The state of New Mexico was also cited by the commission as an example of public-private sector cooperation in the identification of critical infrastructure vulnerabilities. The state's emergency operations management has successfully created a synergistic cooperative network among its public safety organizations and its private sector infrastructure concerns. The commission cited both these activities as models for other states and regions to use as examples. NLECTC-West has representation on both the Los Angeles Terrorism Early Warning Group and the New Mexico Critical Infrastructure Assurance Committee. Over time and with continued association, the goal is to understand the operations, explore the technology that will have utility within these operations, and offer a valuable perspective to the continued development of capacity for local response. The follow-on goal is to formalize the best practices and encapsulate this operational knowledge into an effective course of instruction that will be offered periodically throughout the Center system by the NLECTC-West staff.

The basic operational model for command, control, and operation of a Terrorism Early Warning (TEW) Group has been developed over a four-year period in Los Angeles County, with the Los Angeles Sheriff's Department acting as the facilitator and secretariat for the organization. Unlike more traditional models of public safety operation, it stresses the integration of operations as fundamentally different as law enforcement and public health. Over time, the TEW has recognized that this form of joint operation has a synergistic strength in operation. It is this concept of operation that the NLECTC-West intends to capture, describe, and disseminate as it builds a course for local and state law enforcement.

In summary, the counterterrorism effort and the concept of a domestic response network is an advanced concept designed to augment the initial training mandated to 120 cities by PDD 39. It will require specific technology for all aspects of operations, situational awareness, and command and control. The essential building block of integrated efforts of an operational law enforcement agency with other public safety departments has been the key to current success and future entrepreneurial advancement in effectiveness. Continued valuable contributions from the NLECTC-West and the Center system will hasten effective technology solutions. (See Appendix 14 for other significant activities in counter-terrorism.)

Corrections

Corrections efforts were distributed across all the Center's normal operations and capabilities. Work tasks included:

- outreach to various state departments of corrections
- system engineering advice and support (SEAS) to requesting organizations, including
- forensic support
- evaluation and demonstration of emerging technologies
- support to the Center system's technology subcommittee on corrections
- interaction with the Center's Regional Advisory Council (RAC) Subcommittee on Corrections
- requests as well as proactive actions in support of regional corrections conferences.

Outreach. The Center utilized various approaches to increase the awareness of corrections agencies as to services and products available to them. The primary form of providing information was through the RAC corrections members. These members carefully and correctly informed their state counterparts as to the Center's services and availability. As a result of this approach, the Center was able to provide information to requesting agencies and respond to requests for SEAS work.

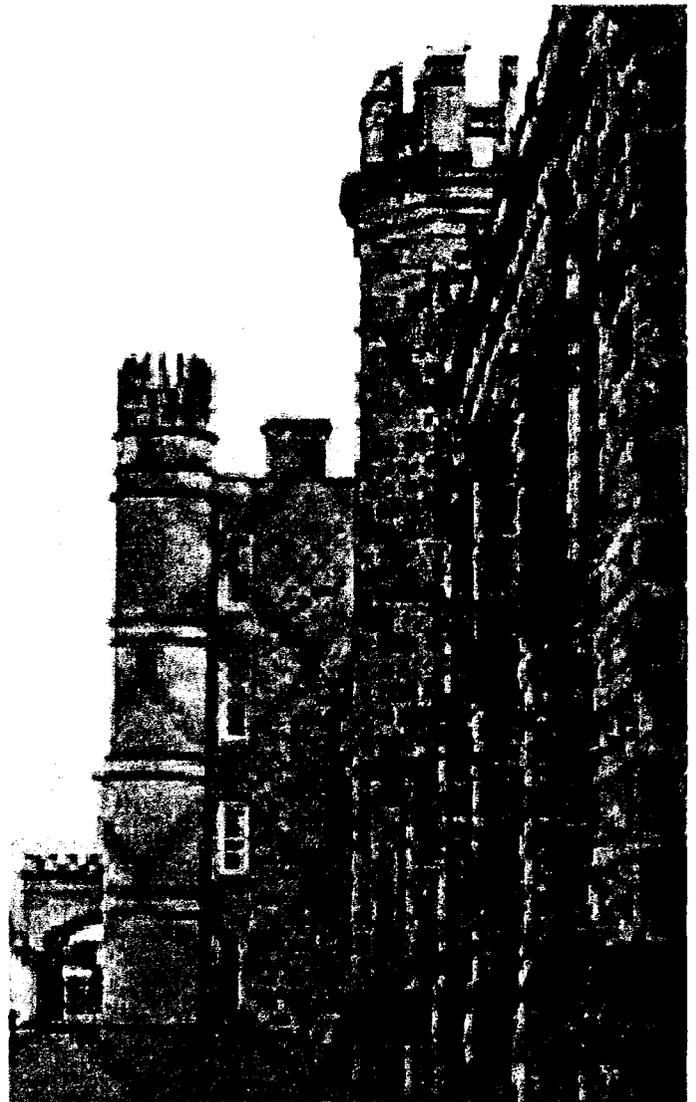
SEAS. The Center, through the auspices of the RAC, was able to provide support to corrections agencies and worked to provide assistance to corrections agencies with emerging technologies:

- **Audio and video tape enhancement**—The Center service of providing enhancement of audio and video surveillance tapes for law enforcement agencies was used by corrections agencies for their specific needs. The Center enhanced audiotapes, providing investigators with information about narcotics trafficking, third-party calling, and gang intelligence information. Videotapes were enhanced to provide investigating officers with information about riot participants and exercise yard assaults.
- **Work detail tracking project**—According to the American Correctional Association Directory for the year ending June 30, 1997, there were 9,482 escapes, with only 6,507 recoveries. The vast majority of these escapes represent walk-aways from minimum encampments or outside work release assignments. The Center worked on this shortfall to help develop the requirements for a system to assist correctional managers in maintaining an increased level of control and identification of inmates in a work-release or work-crew environment, and to provide an immediate notification of an attempted walk-away.

NLECTC Corrections Subcommittee Support. In order for the NLECTC Centers to consistently deliver SEAS to the corrections community in an effective manner, a technology subcommittee for corrections was established. A member of the Center staff represented the Western Region Center at committee meetings. Meetings were held at various venues, typically during national corrections conferences. During these meetings, the Center representative presented information detailing efforts of interest underway in the Western Region.

RAC Corrections Subcommittee Support. The Center established a Corrections Subcommittee of their Regional Advisory Council (RAC) so as to provide technical interchanges of specific interest to corrections and custody RAC members. During these meetings, current and evolving technology-intensive products were presented to the group. This approach usually led to discussions about the needs and requirements of the various agencies in the Western Region.

Regional Conference(s) Actions. The Center, with the assistance of RAC corrections members, was able to compile a list of candidate regional conferences to attend and present briefings. The Center selected high-impact statewide conferences and meetings across the Western Region and provided technology presentations and, when available, set up a booth that depicted the Center's services.



Moundville Prison

School Safety

Although the specific focus area and earmarked funding for the general category of school safety did not exist within the mandate of the Office of Science and Technology during this reporting period, NLECTC-West has explored and evaluated various applicable concepts and technologies.

Interviews and inquiries of individual peace officers and agencies in various parts of the west similarly evaluate the challenge of school safety. The problems of illegal drugs and weapons are the most dramatic part of the challenge, and, in general, a school population is a reflection of the local population and its inherent security challenges.

The US Department of Education briefs that schools are, by and large, safe havens for children. It cites statistics that show that 43 percent of American schools have no crime. Our inquiry into various schools in different locations and cultures do not reach the same conclusion. Further, local peace officers dispute the statistic and generally opine that crime in school is similar to crime in the surrounding community, but that it goes largely unreported.

Deterrence of drug use, possession, and sale and deterrence of violence are the two operational issues of interest. Again,

inquiry reveals that the same skills a peace officer requires in the general area are valuable and useful in a school environment. Therefore, technology assistance useful in maintaining social order in the town or city can directly cross over to utility within a school.

At present, most requests for assistance involve technologies to compel deterrence from violence, or to detect weapons. Therefore, surveillance and weapon-detection technologies coupled with operational expertise and a cooperative atmosphere among school resource officers, administrators, and teachers is a first requirement.

Pierce County in Washington State has created a network among its schools to collect and make available to first responders information about school facilities that might be useful in a crisis response. Technologies that support communication between police agencies and other multifunction groups are requirements.

Several western states seem to be identifying contingency planning for school events with other complex incident planning. Computer-aided tools that manage data for course-of-action development may be useful. Also of possible utility are tools for simulating tactical operations by rehearsal. The utility of these assisting technologies is speed of response and simplified coordination.

As with all technology assistance, concept development should lead technology assistance development. The strategic plan of action for the NLECTC-West is the following: create a network of school resource officers and their associated multifunctional teams (administrators and teachers); and inquire about and assess their plans for the improvement of the school safety environment; work to identify and develop assisting technologies with continual assessment and feedback from that local level, then refine, experiment and improve over time; keep this network informed on improvements, emphasize development at the operational level, and use that operational knowledge to drive technology requirements.

Surplus Property

In January 2000, the NLECTC-West observed that small agencies were in need of computing equipment and that The Aerospace Corporation was embarking upon a computer modernization program. The Center took advantage of this opportunity by initiating and developing a program of distributing reconditioned high-end personal computers to small agencies and facilities in the western United States.

Surplus computers were selected from storage at the Aerospace facility and transferred to the NLECTC-West, where the process began. The procedure started with a "governmental wipe" of the hard drives, which rewrites the "0's and 1's" of the binary code on the disk. After the wipe, the systems were sent through a check and testing process to make sure that the computers and monitors were running at optimum performance. After the performance levels of each system were established, they were loaded with an operating system (Windows 95-b) and word-processing software (Microsoft Works). The next step involved the installation of a 56.6k-voice/fax modem, as well as its software components. The modem was then thoroughly tested to establish proper working order.

The resulting configuration allowed law enforcement agencies, which did not have the technology available to them before, to be able to perform light word processing and have access to the Internet, as well as establishing e-mail accounts. The systems were then packaged in foamed containers and shipped via FedEx directly to the agency designated to receive the computer.

A representative from each state who sits on the NLECTC-West's Regional Advisory Council identified agencies that were in need of such technology. During this reporting period the surplus computer program has delivered the first five computers to agencies in Oregon. The waiting list includes agencies from other states in the western region and those agencies will receive equipment as it becomes available.

Administrative Activities

Organization

The NLECTC-West carried out its activities during this reporting period utilizing the staff activities described below.

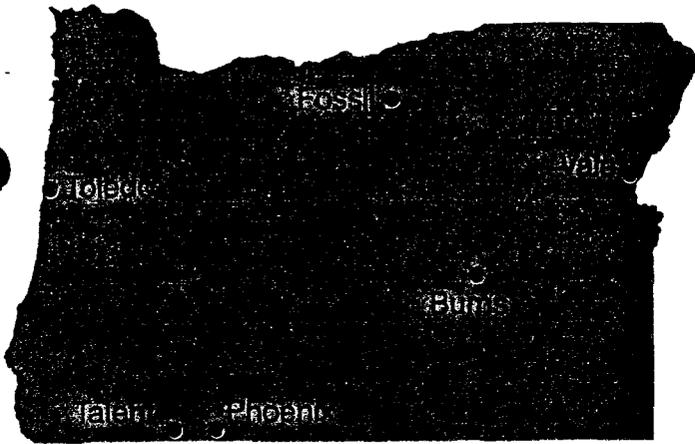
The director of the NLECTC-West provided the primary interface between The Aerospace Corporation and the NIJ program manager during the grant period. The director was responsible for project oversight and direction. The director ensured that the NLECTC-West:

- was the honest broker between the communities it services and the technology communities it utilizes
- maintained awareness of criminal justice operational needs
- maintained awareness of the state of the art in appropriate technologies
- facilitated regular communication between the user and technical communities
- encouraged the development, evaluation, and implementation of appropriate technologies
- was a trusted agent of both NIJ and the LEC community

The director provided a combination of support in administration of the Center, outreach to the LEC community, and some direct technical support. The primary duties of the director were to:



Refurbishing Surplus Computers



Oregon Communities Receiving Computers

- interact with and satisfy the NIJ customer
- facilitate science and engineering advice and support to meet the needs of requesting law enforcement and corrections organizations
- organize and work with the Regional Advisory Council
- organize and manage a staff to satisfy the above
- ensure the quality of the above work products
- work with The Aerospace Corporation to provide the infrastructure for the Center
- appoint staff to the NIJ Subcommittees
- maintain the budget and schedule of the Center

The primary technical support of the Center came from two in-house staff members who interacted with the technical matrix from The Aerospace Corporation. These staff members had the primary responsibility to work with the NIJ customer and the LEC clients in those technology areas involving system design, system integration, or technology insertion into existing systems. These individuals also had the responsibility to stay abreast of the emerging technologies that will benefit the LEC clients.

In addition to working with the technical matrix staff at The Aerospace Corporation, the staff contacted other Centers, national labs, and the military in order to uncover and understand the technologies that might prove valuable to the LEC community. They also maintained working relationships with the other Centers in the NIJ system, with the Research and Technology Development Division of NIJ, and with the Joint Program Steering Group at NIJ.

During this reporting period, the outreach activities of the Center were distributed amongst the various in-house and technical support staff. Toward the end of the period it became apparent that the outreach activity was significant enough, in both importance and effort, to require its own dedicated position. The director created a position of Outreach Manager, whose primary responsibility was the outreach portion of the NLECTC-West's activities. By the end of the reporting period the Outreach Manager became the primary responder to LEC requests for forensics assistance and for general information regarding the Center system. This position ultimately managed the mailing programs, the forensic database system, the client quality-assessment program, and conference and symposia

support program. Focusing these diverse efforts in one position has greatly enhanced the capability of the Center to conduct its outreach activities.

Toward the end of the reporting period, the director found it expedient to focus many of the Center's infrastructure issues in one individual. Tapping the experience of a secretary with extensive experience in the corporation, the director assigned this individual the responsibility to ensure that the daily operation of the physical plant and the interactions with The Aerospace Corporation were consistently maintained. In addition, this person became the Center's focal point for interaction with the Regional Advisory Council. This focus has proven valuable and has provided a consistent and effective relationship with the diverse group found in the Regional Advisory Council. In effect the director created the position of an executive assistant.

In addition, the executive assistant became responsible for maintaining the joint calendar for the Center staff, for organizing the travel plans for the NLECTC-West staff, and for ensuring that these travel plans adhered to the NIJ guidelines for cost and reimbursement. The director has found that the executive assistant is often the first contact that the LEC communities have with the NLECTC-West and a well-trained and experienced individual provided a positive and responsive first impression to LEC agencies contacting the Center for the first time.

The operation of the NLECTC-West relies heavily on the "matrix" engineering staff of The Aerospace Corporation. These individuals have primary responsibility for providing objective technical assistance to the NLECTC-West and the Center's clients and customer. They are expected to bring the expertise they have acquired in support of the Air Force mission to LEC agencies, to the extent allowed by classification and security.

These individuals were selected from a cadre of over 2200 scientists and engineers. During the period of this report, the NLECTC-West has utilized a core set of the technical matrix to assist in forensic investigations, provide systems analysis, conduct technology evaluations, and support education and outreach activities. As a consequence, this core group is not only technically well-versed, it is also familiar with the issues and needs of the LEC community. In some instances, this group has been called upon to assist in outreach activities as well, e.g., conducting technical presentations to the POST courses.

During the course of operation the Center staff discovered that there was also valuable talent and information to be found in the infrastructure support staff that maintains the corporation's operations and physical plant. The NLECTC-West has found that there is a pool of expertise at The Aerospace Corporation that provides not only critical skills used in operating the NLECTC-West, but also hands-on experience in operating complex systems (e.g., nationwide computer networks). This staff provided insight and guidance on daily operating needs of agencies establishing similar systems and networks.

Of particular value to the NLECTC-West has been the presence of full-time, experienced law enforcement personnel on the staff of the Corporation. These individuals are recent retirees from major law enforcement agencies in the Los Angeles County area. They include two medal of valor recipients who have strong and valuable ties to law enforcement

agencies in the region. Their operations expertise was utilized on several occasions to review and comment upon the work products of the NLECTC-West.

Staff and Consultant Qualifications

The table below lists staff members who provided the bulk of technical support during the period of this grant.

Technical Staff

Name	Title	Exp
Robert Pentz	Center Director (retired July 1999)	40 years
Dr. Robert J. Waldron	Center Director (August 1999 to present)	32 years
Michael Epstein	Systems Engineering Manager	35 years
Matt Begert	Technology Applications Manager	25 years
Dr. Fletcher D. Wicker	Senior Communications Analyst	24 years
Dr. Raymond J. Talbot, Jr.	Senior Forensic Analyst/System Engineer	29 years
Dr. Donald J. Rudy	Imagery Forensic Analyst	23 years
Dr. Jorge V. Geaga	Imagery Forensic Analyst	15 years
Dr. Harry C. Koons	Senior Audio Forensic Analyst	30 years
Dr. James L. Roeder	Audio Forensic Analyst	29 years
Donald J. Buchwald	Computer Forensic Analyst	30 years
Dr. Steven H. Margolis	Computer Forensic Analyst	20 years
Larry R. Jansen	Computer Forensic Analyst	24 years
Dr. Gary Stupian	Senior Forensic Analyst	25 years
Brent A. Morgan	Forensic Analyst	18 years
Neil A. Ives	Forensic Analyst	10 years
Ranwa Haddad	Director, Trusted Systems Division	20 years
Charles Lavine	Senior Engineering Specialist	17 years
Robert Cummings	Law Enforcement Advisor	15 years

Supervision, Coordination, Control of Workflow

This section describes the approach used to manage the workflow at the NLECTC-West during the reporting period. It also discusses the monitoring, controlling, and reporting procedures the Corporation implemented.

Supervisory Objectives

The broad objectives of The Aerospace Corporation's management plan was to deliver trusted technical support and information to the NIJ customer and LEC clients that was useful and timely. The corporation understood that the LEC communities have little in the way of research and development funding, and therefore needed technology that was available now or in the very near future. As a result, the corporation focused its efforts on the near-term technologies, leaving the development of advanced technology to others. In particular, the corporation met the following objectives:

Satisfaction of NIJ Goals/Objectives

The NIJ goals and objectives have been supported and satisfied by The Aerospace Corporation during the reporting period. Technology demonstrations, technical assistance, and "honest broker" services were provided throughout the entire period of performance. The list of accomplishments in other sections of this report attest to satisfaction of NIJ's goals.

Adherence to Budgets

The Aerospace Corporation maintains a suite of budget products that are used to manage its activities for the Air Force. The corporation uses SAP accounting software to generate tracking and budget expenditure information in compliance with Department of Defense directives. This accounting system has been approved by the Defense Contract Audit Agency. The NLECTC-West utilized this same software to manage the financial portion of the NIJ deliverables.

The corporation provided the NLECTC-West with the ability to track labor expenditures to the hour, per week, per employee level. These expenditures were organized into functional units called job orders, with each job order capable of being further refined into suborders.

The Aerospace Corporation established one job order for the NIJ grant. The NLECTC-West then established sufficient numbers of suborders so as to track the expenditure of NIJ funds to the level desired by NIJ. All budgets were met and costs were kept within the assigned funding levels during the entire period of the grant.

Maintenance of Adequate and Flexible Staffing

The Aerospace Corporation organized its staffing for the NLECTC-West to provide skilled technical support to the core activities of interest to NIJ. These activities took advantage of NLECTC-West staff who work closely with the LEC agencies to define projects that fit into the NIJ support and research programs. The staff also worked on the NLECTC key issues subcommittees, and maintained contact with the NIJ program manager to ensure current and timely support to NIJ and the LEC client.

The NLECTC-West staff had at its disposal a virtually unlimited resource pool in nearly every technical area of interest to NIJ. This pool was called upon to support new activities and new technologies with only a modest start-up time. Forensics, communications, materials science, and other disciplines were called upon by the NLECTC-West staff to meet urgent requests from the LEC community.

Another feature of the corporation's approach to managing the NLECTC-West was its ability to maintain technical currency in areas of interest to NIJ. Technical currency is the "coin of the realm" for The Aerospace Corporation. Without technical currency, the corporation ceases being of value to the Air Force. The NIJ naturally participates in and takes advantage of this currency by virtue of the fact that the NLECTC-West draws upon the same technical talent pool as does the Air Force. The technology overlap between the two programs was and continues to be extensive.

The Aerospace Corporation used the "customer" and "client" designations to differentiate amongst the work products it delivered.

Customer (NIJ)

The NIJ work products were generated in five basic modes:

Ongoing: the ongoing work product was that produced by utilizing the NIJ contact management system.

Periodic: these work products were those generated as part of the monthly administrative and financial reporting process and the quarterly director's meetings.

Ad hoc: these work products resulted from NIJ queries concerning NLECTC-West activities, technology questions, and NIJ's forwarding of requests from NIJ itself, other Centers, or from legislators.

Planned: these work products resulted from known activities that take place during the fiscal year at uneven intervals, such as conferences that NIJ has designated for NLECTC-West support.

Special projects: these products arose when NIJ assigned the NLECTC-West a new task with additional funding and guidance, e.g., Facial Recognition

Client (LEC)

The client work products were broken into three basic categories:

- **Periodic work products**—composed of information products of various types. They were the result of proactive efforts by the Center to reach agencies and provide them information. These work products included:
 - Mailings of NIJ brochures, pamphlets, and reports
 - E-mail messages, with information of interest to the agencies (sent on a regular basis)
 - Ad Hoc presentations at local meetings and professional or regional associations
 - Presentations at education or training sessions
 - Planned briefings and/or booth operation at conferences and symposia
- **Ad Hoc work products**—the result of agency requests for information and technical assistance. These work

products come in many forms and sizes, including:

- Forensic casework
- Specific technology questions
- General questions regarding potential technologies to meet specified needs
- Questions regarding the design and implementation of systems
- Questions regarding the interconnection of multiple systems
- Requests procurement support (defining a process, collecting requirements, etc.)
- **Planned work products**—those resulting from agreements with agencies to support their conferences, to attend and assist technology committees, and to work on projects of interest to the agency. In some cases, these planned activities result in improved capacity for the agency or agencies to operate on their own in the future (e.g., a network architecture design or a radio interconnect project).

The Center has gained an understanding of the types of products it needs to produce in order to maintain its value to both NIJ and the LEC communities. As a result of the experience of the past reporting period, the Center has made adjustments to its procedures and staffing, as well as to its products, and is now in a better position to provide the services expected by both the customer and the client.

Special Projects

In addition to the normal activities that the NLECTC-West undertook during the reporting period, there were two particular projects that received special attention by the NLECTC-West. In each case, the NIJ recognized the special capabilities of the NLECTC-West to work on these projects and therefore funded additional activities. The first activity involved a substantial effort on the part of the NLECTC-West over the entire period of the grant. The second activity was shorter and more focused in nature, and involved the evaluation of vendor activities in the area of facial recognition. These projects are discussed in the following sections.

Border Research and Technology Center (BRTC)

In 1995 the NLECTC-West agreed to assist NIJ in the creation of the BRTC in San Diego. The NLECTC-West assigned one person to be a temporary on-site presence until NIJ could place a permanent director in San Diego, the home of the BRTC. Since that initial connection with the BRTC, the NLECTC-West has continued to provide technical support to the BRTC, primarily in technical areas that have continued to be of interest to the BRTC. The funding for the BRTC activities has been provided to The Aerospace Corporation through the main grant that funds the NLECTC-West. As a consequence, the BRTC activities are reported here as a special project for the NLECTC-West.

The NLECTC-West has maintained a support function for two principal BRTC activities: 1) The BORTAC radio interconnect project, and 2) SENTRI, the dedicated commuter lane project. In addition, there have been other activities for which the BRTC has requested support from the NLECTC-West.

BORder TACTical (BORTAC)

In 1995 the US Attorney for the Southern District of California requested that the BRTC work with local public safety agencies (BORTAC team) in the San Diego area to address the problem of incompatibility amongst the radio systems of public safety agencies in the area. The NLECTC-West representative and a representative from the Navy's Federal Fire Department became the project managers for the BORTAC project. At the beginning of this reporting period the BORTAC team had identified a technical approach for improving the radio system interoperability of the area's public safety agencies. The approach utilized common phone circuits to pass voice transmissions amongst radio systems for rebroadcast.

In September 1996 the agencies had received funds and installed hardware for the system. The US Attorney hosted a new conference announcing the availability of the system for use by law enforcement agencies at the local, state, and federal levels.

In the subsequent months, the BORTAC management team met with the participating agencies on a monthly basis, through the summer of 1997. The management team worked with the agencies to identify opportunities to utilize the BORTAC system in support of law enforcement operations. The team encouraged the agencies to practice utilizing the system so that it would be readily available to them in an emergency. The management team organized a dry-run exercise, involving multiple agencies dealing with an accidental spill of hazardous materials resulting from the overturn of a vehicle smuggling methamphetamine ingredients on the interstate highway. As a result of the exercise, the agencies modified their procedures for such an operation and began training their dispatchers on the proper use of the system.

Subsequently, the NLECTC-West representative on the BORTAC management team worked with the local agencies to identify further training activities that were, in turn, used to develop procedures and eliminate operational problems that naturally result from combining law enforcement agencies for joint operations.

During 1997 the agencies began to use the BORTAC system on a regular basis, and the agencies developed new uses for the system that had not been anticipated by the team at the outset. The agencies conducted truancy sweeps, stolen vehicle roundups, joint operations during US/Mexico border demonstrations, and Fourth of July operations, as well as pursuits and rescue operations.

The Counterdrug Technology Assessment Center (CTAC) of the Office of National Drug Control Policy (ONDCP) provided the funding for the BORTAC equipment and decided that the project was worth advertising and disseminating to other agencies in the US. Consequently, the NLECTC-West, along with the Navy Federal Fire Department, made presentations to various technology forums sponsored by CTAC. As a result of these forums, two more systems were installed along the southwest border during the period of this grant. In both



Baseband audio is shared between agencies on different frequencies.

systems, one in El Centro California and the other in Brownsville Texas, the NLECTC-West provided project management and technical support to the design and buildout of the respective systems.

During the process of explaining the BORTAC concepts and how they might be implemented, the NLECTC-West developed a set of frequently asked questions (FAQs) which have been distributed to agencies seeking further information on the concept. The FAQs are included in Appendix 15.

Secure Electronic Network for Travelers' Rapid Inspection (SENTRI)

Concurrent with the BORTAC project, the NLECTC-West representative to the BRTC became involved with a new project that was also of interest to the US Attorney for the Southern District of California. That project was the rapid and secure transport of travelers across the US/Mexico border.

Studies, conducted by various public interest groups and universities, indicated that there was a large number of regular travelers who crossed the border on a daily basis. The study considered these people to be regular contributors to trans-border commerce and important components in a thriving commercial trade zone.

The studies indicated that the waiting time required during peak transit times across the border significantly reduced the productivity of the region. The US Attorney urged the federal agencies operating along the border to consider alternative review and inspection procedures that would allow the most frequent, and trusted, border crossers swifter passage through the border checkpoints. Under the leadership of the Immigration and Naturalization Service (INS), the federal agencies established a committee that began to look into the problem. The committee became known as the SENTRI team.

The NLECTC-West representative to the BRTC joined the SENTRI team as a technical liaison between the SENTRI team and the US Attorney's office. The legal staff of the SENTRI team carefully reviewed the NLECTC-West member's affiliation and motives, since the NLECTC-West member was the only individual working for a corporation. Once the review was complete, the NLECTC-West member became a participant in the SENTRI procedures.

The SENTRI team considered a myriad of issues in approaching the problem of passing some travelers quickly across the border, while maintaining the integrity of the border at the same time. The NLECTC-West member contributed technical information regarding possible approaches for verifying travelers who were enrolled in the system. In addition, the NLECTC-West member provided the team with access to local information sources that were used to conduct background checks on the enrollees in the SENTRI program.

During the course of three years, the SENTRI team designed, installed, and tested dedicated lanes for commuters in California and Texas. The team worked with vendors to evaluate technologies for tagging vehicles, imaging the passengers and drivers, checking for contraband, and building databases for enrollees, as well as orderly processes for enrolling travelers, advertising the program, and ensuring that the integrity of the border was not violated by the SENTRI system.

The SENTRI team, including the NLECTC-West member,

was given Vice President Gore's Hammer Award for reinventing the way government works. The award was presented by Attorney General Janet Reno, who had oversight of the INS.

The NLECTC-West member who worked on the SENTRI team is still consulted regarding the activities of the team, which has continued to develop dedicated commuter lanes at US/Mexico Ports of Entry (POE). The team is still active and the NLECTC-West member is still copied on minutes and invited to meetings.

Other BRTC Activities

The NLECTC-West support to the BRTC covered many activities in addition to BORTAC and SENTRI.

The NLECTC-West was involved in the early identification of advisory council members for the BRTC. The NLECTC-West representative identified individuals from the following agencies to become members of the advisory council for the BRTC: INS, US Border Patrol, US Customs Service, US Coast Guard, FBI, EPA, ONDCP, Defense Advanced Research Projects Agency, San Diego Police Department, San Diego Sheriff's Department, California Highway Patrol, Imperial County Sheriff's Department (CA), Pima County Sheriff's Department (AZ), Sandia National Laboratories, San Diego Regional Technology Alliance, and San Diego Dialog (a social science research group).

The NLECTC-West worked with the US Border Patrol to research geographic information systems that could help the agency with manpower assignments, research into surveillance systems, wire-tapping facilities, improved seismic sensors, and lighting systems.

The NLECTC-West worked with the BRTC's government liaison manager (US Navy detailee) to identify and transfer surplus property to the US Border Patrol, INS, the L.A. County Sheriff's Department, and the San Diego County juvenile detention camp located in Campo, CA.

The NLECTC-West worked with US Navy research organizations in San Diego to develop working relationships for technology transfer from Navy activities to border law enforcement activities. The NLECTC-West arranged for Navy presentations to federal and local law enforcement agencies regarding Navy communications and surveillance technologies that could be beneficial to the law enforcement agencies. The NLECTC-West worked with the US Border Patrol and the Navy to obtain infrared surveillance equipment for evaluation by the Patrol utilizing Navy equipment.

The NLECTC-West continues its support of the BRTC today, primarily in SENTRI and BORTAC. The other NLECTC-West activities were taken over by a permanent director of the BRTC in 1997.

Facial Recognition

The National Institute of Justice (NIJ) assigned the Center imagery enhancement as one of its focus areas. Since its inception, the Center has continued to develop and improve a capability to meet the video forensic needs of law enforcement and corrections agencies in the nine western states. These efforts have given the Center an understanding of its requirements to operationally support law enforcement and corrections agencies as well as the Office of Science and Technology (OST).

Facial Recognition Constructs



Based on this expertise, NIJ requested that the Center work with OST, the National Institute of Standards (NIST), and NIJ grantees to develop a methodology and process for introducing and demonstrating video face recognition technology to law enforcement operations.

As part of this effort, the Center worked in an advisory role to recommend practices and technical solutions to develop a standard mechanism to introduce video and face recognition technology into law enforcement agencies. Further, the Center was asked to recommend minimum technical specifications, applicable technical standards, and target configurations of systems, hardware, and software that would support end user needs. The Center also provided support in the area of interoperability testing concepts, providing expertise and lessons learned from experience with various integration tasks.

During the course of this project Center staff members visited three vendors involved in an NIJ Facial Recognition project. During these visits, the Center's representatives were briefed on the technologies in use and the proposed program plan for this project. Center personnel visited Viisage Technologies and Sonotech, Inc., for in-depth demonstrations and technical dis-

cussions about their facial recognition capabilities and products. Following these meetings a Center project manager traveled to the Northeast Center to attend a program management meeting. This meeting focused on the NIJ's grant award and subsequent management of a Facial Recognition project with Anser Corporation. Center staff developed a briefing explaining the basics of facial recognition and the issues that must be addressed when selecting and installing such systems.

Generally, facial recognition systems use some other biometric technology, such as fingerprint identification or voice recognition, to validate results. Currently these systems are in use for suspect identification, gang tracking, illegal alien trafficking, crowd surveillance, and facilities-access control. Typical systems compare captured and digitized images against some sort of archived imagery data. One of the principal techniques in use is the process of developing "eigenfaces" for captured images. This process, developed by Sirovich and Kirby, transforms the image into a set of linear deviations from a mean or average face. This approach requires accurate positioning of the image and is sensitive to lighting. In fact, some people consider facial-recognition systems to in fact be illumination-recognition systems. This two-dimensional approach works well as long as the face is not twisted, dipped, or raised by any large amount. The two leading implementers of this technological approach are Visonics Corporation and Viisage Technologies, Incorporated.

In an effort to reduce the errors associated with head positions outside of expected limits, the Office of Law Enforcement Technology Commercialization (OLETC) is finalizing a three-dimensional approach to facial recognition. This approach involves dividing the head into 64 categories, to create 256 possibilities for each feature (256 noses, 256 chins, etc.). By reducing these features to linear vectors, the software can search 1 million images in less than one second.

Currently the field of facial recognition is moving quickly as compute power increases and more and more organizations see the possibilities for application of this biometric.

Appendix 1

Synopsis of NIJ and the Office of Science and Technology Mission

National Institute of Justice (NIJ)

Created in 1968, the NIJ is the research and development arm of the US Department of Justice (DOJ). The NIJ was created to reduce and prevent crime, and to improve the criminal justice system. One element of the NIJ's mission has been to identify, develop, and introduce new technologies to fight crime and improve criminal justice. NIJ accomplishes a significant portion of this mission through a grant-dissemination process. The NIJ grants focus on specific technical problem areas and seek qualified respondents to research and understand the application of technology to the improvement of the criminal justice system. To further explore the use of technology, NIJ formed the Office of Science and Technology (OS&T) in 1992.

Office of Science and Technology (OS&T)

The Office of Science and Technology provides federal, state, and local law enforcement and corrections agencies access to the best technologies available, and helps them develop capabilities essential to improving efficiency and effectiveness. The goal of OS&T is to support the development of new technologies to serve the needs of law enforcement and corrections agencies, while avoiding overlap and duplication.

The core activity in the OS&T mission is the issuance of grants to accelerate the introduction of new and effective technology to the law enforcement and corrections communities. Grants are awarded in specific technical areas (e.g., DNA forensics) as part of an overall technical program focused on areas of interest. The Research and Technology Development Division (RTDD) and the Joint Program Steering Group (JPSG), which is a joint effort of the DOJ and the Department of Defense, administer these grants.

The areas of interest are gathered from the law enforcement and corrections communities through the Law Enforcement and Corrections Technology Advisory Council

(LECTAC). Priorities garnered from LECTAC provide guidance to OS&T regarding research focus areas, which are in turn supported through grant solicitation and peer review selection.

Description of the NIJ Center System

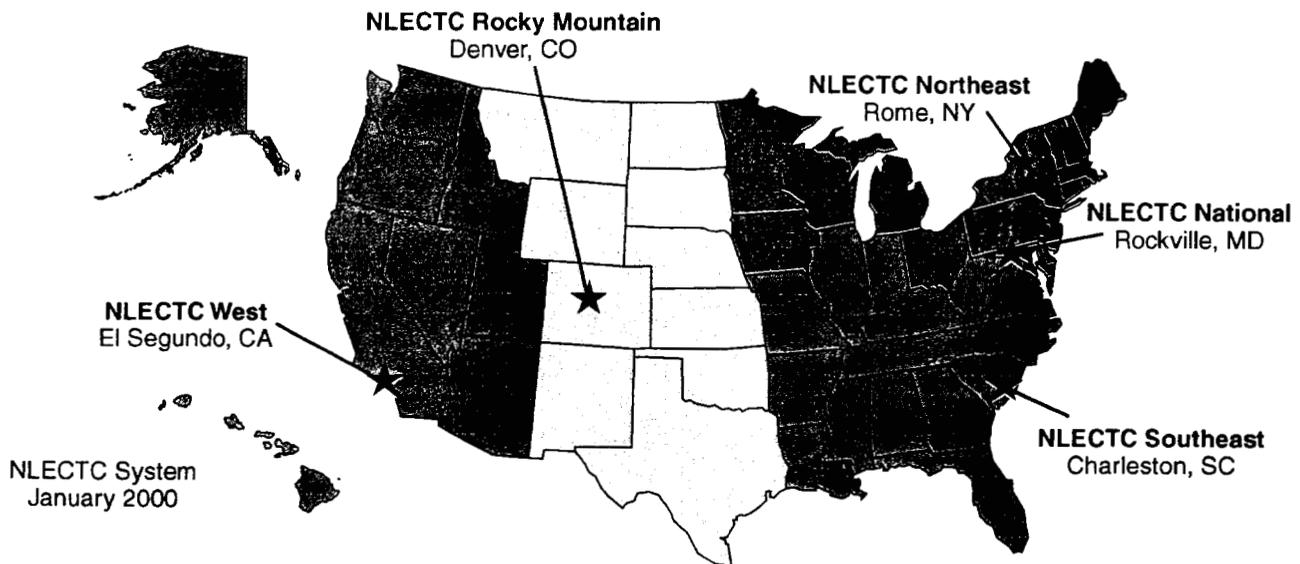
One of the primary mechanisms through which OS&T accomplishes its mission is its network of regional technical assistance centers—the National Law Enforcement and Corrections Technology Centers, which are also funded through the grant process. The Technical Assistance Division (TAD) of OS&T administers these Centers. TAD and RTDD staff work together to ensure that the Centers understand the needs and goals of the RTDD technology programs.

The NIJ Center system is designed to work with and complement the other OS&T grant programs. The Centers work to gather requirements that assist the LECTAC in setting priorities, and that assist technologists in understanding the needs of law enforcement and corrections agencies.

Current System of Centers

The NIJ currently operates a “confederation” of technology centers, located in various regions of the United States. There are four centers like the NLECTC-West, i.e., general-purpose facilities that perform all of the functions described above. These centers are coupled with specialty organizations that focus on forensics, the border, commercialization, standards, and system-wide information support. Though the Centers share responsibility for delivering the functions outlined earlier, they are each encouraged to draw upon their own particular expertise to make unique and singular contributions to the overall mission. It is this diversity within the overall framework that gives the NIJ Center system much of its vitality.

Below is a map of the NLECTC sites as they were constituted in January 2000.



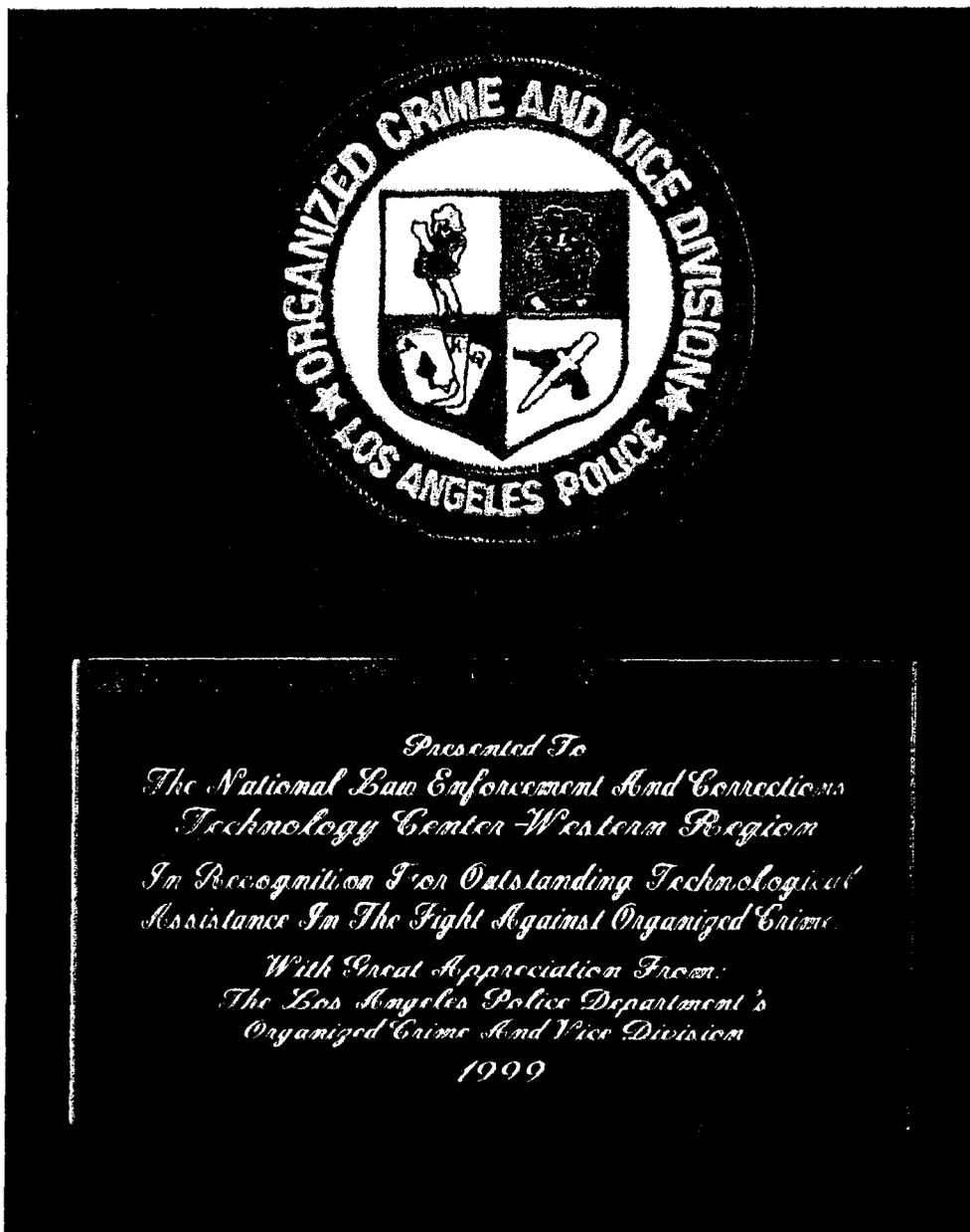
Appendix 2

Letters of Appreciation and Recognition

The work of the NLECTC-West is often solicited at the early stages of a law enforcement or corrections agency's need. The assistance may take the form of a request for information concerning a particular technology, the application of a technology, or direct assistance on a technical matter, e.g., forensic assistance, hardware repairs, or fabrication of a unique, one-of-a-kind product.

In most instances, the Center is unaware of the final disposition of the information. In some cases, forensics for example, the assistance provided by the Center is given early in an investigation or prior to utilization by the agency. As a consequence, the agency may not always be in a position to formally acknowledge the assistance at the time it is given.

However, when the Center's assistance is acknowledged, it becomes a gratifying element to the staff of the Center. This appendix shares some of those acknowledgements with the reader. These letters often indicate the role of the Center in a much larger activity and they provide the context for the Center's efforts.





SHERIFF-CORONER DEPARTMENT
COUNTY OF ORANGE
CALIFORNIA

MICHAEL S. CARONA
SHERIFF-CORONER

SERVING THE UNINCORPORATED AREAS OF
ORANGE COUNTY AND THE FOLLOWING CITIES
AND AGENCIES:

DANA POINT
LAGUNA HILLS
LAGUNA NIGUEL
LAKE FOREST
MISSION VIEJO
SAN CLEMENTE

SAN JUAN CAPISTRANO
STANTON
VILLA PARK
HARBORS, BEACHES & PARKS
JOHN WAYNE AIRPORT
OCTA

OFFICE OF SHERIFF-CORONER

January 26, 2000

ASSISTANT SHERIFFS
DON HADL
JOHN HEWITT
GEORGE H. JARAMILLO
TIM SIMON
DOUG STORM

National Law Enforcement Technology Center
C/O The Aerospace Corporation
Attn: Dr. Robert J. Waldron, Director
2350 E. El Segundo Blvd.
El Segundo, CA 90245-4691

Dear Dr. Waldron:

I would like to take this opportunity to thank you and one of your staff, Engineering Specialist Albert Young, for lending his expertise to solving an involved technical problem for us.

Investigator Bill Davis, from my Special Operations Bureau, met with Mr. Young of the Aerospace Corporation regarding some malfunctioning electronic countermeasure equipment. This equipment is crucial to our Special Operations Bureau when they are tasked with locating covert electronic surveillance transmitters, phone line taps, etc. Repair and service was no longer available from the original manufacturer or other sources due to the intricate nature of the circuitry. Mr. Young was not only able to restore the equipment to working order, but also added some modifications that improved the original design.

Please express my sincere appreciation to Mr. Young, and if my staff can assist you or your organization in any way, please don't hesitate to call.

Sincerely,



Michael S. Carona
Sheriff-Coroner

MSC:il



SHERIFF-CORONER DEPARTMENT
COUNTY OF ORANGE
CALIFORNIA

MICHAEL S. CARONA
SHERIFF-CORONER

SERVING THE UNINCORPORATED AREAS OF
ORANGE COUNTY AND THE FOLLOWING CITIES
AND AGENCIES:

DANA POINT
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LAGUNA NIGUEL
LAKE FOREST
MISSION VIEJO
SAN CLEMENTE

SAN JUAN CAPISTRANO
STANTON
VILLA PARK
HARBORS, BEACHES & PARKS
JOHN WAYNE AIRPORT
OCTA

OFFICE OF SHERIFF-CORONER

January 7, 2000

ASSISTANT SHERIFFS
DON HAIDL
JOHN HEWITT
GEORGE H. JARAMILLO
TIM SIMON
DOUG STORM

National Law Enforcement Technology Center
C/O The Aerospace Corporation
Attn: Dr. Robert J. Waldron, Director
2350 E. El Segundo Blvd.
El Segundo, CA 90245-4691

Dear Dr. Waldron:

Just a quick note to thank you and one of your staff, Dr. Harry C. Koons, for his most expeditious technical assistance.

Investigator Bill Davis, from my Special Operations Bureau, approached Dr. Koons with a Nagra, reel-to-reel miniature audio tape that contained a covert conversation with a murder suspect in a high profile Orange County homicide case. A significant part of this covert recording was done in a crowded restaurant/bar and parts of the conversation were inaudible. Dr. Koons accepted the challenge, and through his technical expertise was successful in filtering out 50% of the background noise on the recording tape. This gave the investigators the additional needed evidence to present to the prosecutor. Please express my appreciation to Dr. Koons, and if my staff can assist you or your organization in any way, please don't hesitate to call.

Sincerely,

Michael S. Carona
Sheriff-Coroner

MSC:iii



County of Los Angeles
Sheriff's Department Headquarters
 4700 Ramona Boulevard
 Monterey Park, California 91754-2169



LERROY D. BACA, SHERIFF

PLEASE REFER

TO FILE NO. _____

August 6, 1999

The Aerospace Corporation
 2350 East El Segundo Boulevard M1/300
 El Segundo, California 0-245-4691

Re: NLECTC-WR-V99-039-GK

Dear Sir,

On January 31, 1999, a "take-over" robbery occurred at the Garfield Bar & Grill, located at 14123 1/2 Garfield Avenue in the City of Paramount. Fortunately the responding deputy noted that there was a surveillance camera located within the establishment and seized the videotape. Unfortunately the videotape was of poor quality due to having been recorded over and over.

Detectives from the Lakewood Station's Paramount Field Office brought the tape to your business where Executive Secretary Gail Klass assisted the detectives. Analyst Jorge V. Geaga reviewed the videotape and produced several still photographs from the enhanced videotape. As a result two (2) suspects were identified and information was attained that placed the two (2) suspects at a homicide scene the week previously. A "live line-up" was scheduled for the eight victims of the Paramount robbery to see the suspects. Unfortunately when it came for the line-up, the victims were either unavailable or had second thoughts in regards to the prosecution of the suspects. As a result the Paramount robbery case could not be filed. However, the suspects are currently being prosecuted in regards to the homicide.

I would like to personally thank your for your assistance in enhancing the videotape which aided in the prosecution of the suspects.

Sincerely,

LERROY D. BACA, SHERIFF


 Marvin O. Cavanaugh, Captain
 Commander, Lakewood Station

A Tradition of Service



CITY OF LONG BEACH

POLICE DEPARTMENT

400 WEST BROADWAY • LONG BEACH, CALIFORNIA 90802

Robert M. Luman
Chief of Police

Anthony W. Batts, Deputy Chief
Dale L. Brown, Deputy Chief
Ed Hatzenbuehler, Bureau Manager
Jerome E. Lance, Deputy Chief

Ref. 5.6

July 16, 1999

Robert M. Pentz
Director
National Law Enforcement and Corrections Technology Center - West
c/o The Aerospace Corporation
2350 East El Segundo Blvd.
El Segundo, CA 90245-4691

Dear Mr. Pentz:

I am writing to thank you and your staff for hosting our group June 30, 1999. We all found the visit extremely interesting. The resources at your center are truly remarkable.

I filed a report to my deputy chief to share with the other Department chiefs. After describing the tour and Center, I recommended our Chief of Police consider of your offer to become a member of the Advisory Council.

I also discussed your offers to present a four-hour investigations class at our Academy, participate in a round table or panel discussion with our Department managers and provide another tour of your facility to other Long Beach Police Department personnel. I recommended we take advantage of all of these proposals and volunteered to coordinate our efforts. As soon as I get Department approval, I will contact you and start making arrangements.

In closing, thank you again for a thoroughly interesting and enlightening visit. I look forward to working with you.

Sincerely,

Donald M. First
Commander, Long Beach Police Department

DMF:plj
Cmdr. First/mr. pentz letter

Mr. Matt Begert
2350 E. El Segundo Blvd, M1/300
El Segundo, CA 90245

Dear Mr. Begert:

On behalf of the California Peace Officers' Association, we wish to extend our thanks for your participation at COPSWest! We have received a tremendous response to our show, particularly the seminar offerings – **for this we thank you.**

We were thrilled to learn over 1,100 attendees visited our show which had over 230 exhibiting companies. Hopefully, you had an opportunity to visit some of these vendors and enjoy the number of unique “tools of the trade” that were on display.

COPSWest will return to the Ontario Convention Center September 27-28, 2000. We invite you to attend this event which promises even more exhibiting companies, attendees and exciting events!

Once again, thanks for your support and dedication to helping make the “first” annual tradeshow such a tremendous success!

Sincerely,



Carol Hutchings
Tradeshow Manager

1455 Response Road, Suite 190, Sacramento, CA 95815

Phone—(916) 263-5525

Fax—(916) 263-6090

E-mail—copswest@cpoa.org

Website—www.copswest.com

**DEPARTMENT OF INSURANCE
FRAUD DIVISION**

1999 E. SLAUSON AVENUE
CITY OF COMMERCE, CA 90040
Phone: (323) 278-5000
Fax: (213) 838-0028

N. K. NEWMAN, *Deputy Commissioner*

October 14, 1999

Dr. Robert Waldron, Director
National Law Enforcement & Corrections
Technology Center - Western Region
Aerospace Corporation
2350 El Segundo Blvd.
El Segundo, CA 90245

Dear Dr. Robert Waldron:

On behalf of the California Department of Insurance Fraud Division I would like to thank you for the assistance from the Western Region of the National Law Enforcement & Corrections Technology Center.

I supervise a team of criminal investigators who have been conducting a three-year investigation of a Russian Organized Crime Ring involved in a multi-million dollar conspiracy to defraud insurance companies. This criminal enterprise involves doctors, attorneys and co-conspirators who stage automobile collisions that target innocent victims on public highways.

During the course of our investigation we conducted 203 undercover surreptitious recordings involving over 125 suspects. After extensive analysis of the surreptitious recordings several of the tapes were identified as crucial for a criminal prosecution, however, five of these tapes were difficult to hear due to background noise and low volume of the suspects' voices. On July 8, 1999, we delivered the five tapes for enhancement. By July 28, 1999, we were able to pick up the original audiotapes after they were duplicated on to computer CD's for analysis. On September 9, 1999 the final analysis was completed and picked up by us for review.

The completed tapes were successful and the enhanced audiotapes will be utilized in the prosecution of several suspects.

I would especially like to acknowledge the assistance we received from a member of your staff, Gail Klass. Gail was exceptionally helpful in explaining your facility to us, allowing a smooth transition to drop off and pick up evidence and providing additional resource information.

Thank you very much for the assistance,
Sincerely,

A handwritten signature in cursive script that reads "Randall Richardson".

Randall Richardson
Supervising Investigator
Fraud Division

Protecting California's Consumers



1000 Wilson Boulevard
Arlington, Virginia 22209-2211
(703) 351-8300
Fax (703) 351-8383

Philip S. Schaenman
President

March 30, 1999

Mr. Robert M. Pentz
Director
NLECTC-West
C/o The Aerospace Corporation
2350 East El Segundo Boulevard
El Segundo, CA 90245-4691

Dear Mr. Pentz:

We would like to extend a word of thanks for the interest and involvement of your Center in the recent NIJ Electronic Crime Project field work. We enjoyed an excellent series of workshops and the three days at each site were well organized. Support from your staff was instrumental to the success of the workshops. Our jobs were made easier knowing that most of the details and logistics were capably handled by personnel from your office. We would especially like to thank Don Buchwald for his efforts.

We sincerely hope that by working with us on this project, your Center benefited from the collaboration with key individuals in your region, and that this effort helped to expand the base of state and local law enforcement officials with whom to work in the future.

Again, thank you for the first-rate support throughout the sessions. We will keep you apprised of progress on the draft report. We look forward to working with each of you in the future.

Sincerely,

A handwritten signature in black ink, appearing to read 'Hollis Stambaugh', written over a horizontal line.

Hollis Stambaugh
Project Manager

Cc: Saralyn Borrowman
Trent DePersia



City of Compton

POLICE DEPARTMENT

April 19, 1999

Mr. Robert M. Pentz, Director
National Law Enforcement
and Corrections Technology Center West
C/O The Aerospace Corporation
2350 East El Segundo Boulevard
El Segundo, CA 90245-4691

HOURIE L. TAYLOR
Chief of Police

STEVEN M. ROLLER
Captain
Administrative Service Bureau

PERCY J. FERRODIN
Captain
Investigative Service Bureau

RAMON E. ALLEN
Captain
Uniform Service Bureau

Ref. 2.0

Dear Mr. Pentz:

Within the last several weeks, the Compton Police Department has called on your agency for assistance in attempting to identify the perpetrators of three violent crimes including a homicide which occurred in this city.

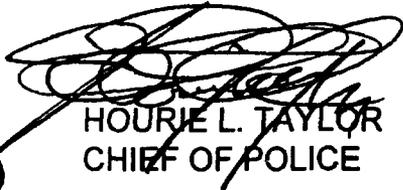
Your staff immediately offered their assistance and was successful in obtaining information which directly led to the identity of the suspects who have been arrested and charged with various felony offenses.

Without the invaluable assistance of your staff, these violent individuals could have remained unknown, free to prey on our citizens again.

On behalf of the Compton Police Department and the citizens of Compton, I would like to personally thank members of your staff for their help and offer special recognition for the efforts of Michael Epstein and Jorge V. Geaga.

In the future, if my staff or I can be of any assistance to you, please do not hesitate to call upon us.

Sincerely,


HOURIE L. TAYLOR
CHIEF OF POLICE

DEPARTMENT OF CALIFORNIA HIGHWAY PATROL

2555 First Avenue
Sacramento, CA 95818-2696
(916) 657-7171
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March 12, 1999

File No.: 040.13999.CPOAPEN

Robert M. Pentz, Director
National Law Enforcement & Corrections Technology Center
2350 E. El Segundo Bl. - M1/300
El Segundo, CA 90245-4691

RBG
Dear Mr. Pentz:

I wish to express my sincere appreciation for hosting the California Peace Officers' Law Enforcement Technology Committee. Your staff of presenters provided invaluable information which generated some active conversation and comments. I believe they sparked concern in some who, perhaps, had not given this matter much attention in the past.

I very much appreciated the hospitality you extended to us, including a great lunch. I look forward to your continued association with the CPOA Law Enforcement Technology Committee.

Sincerely,

A handwritten signature in cursive script that reads "Michael Vega".

Michael Vega, Assistant Chief
Chairperson
CPOA Law Enforcement Technology Committee



U. S. Department of Justice

*United States Attorney
Central District of California*

*Jeffrey C. Eglash
Assistant United States Attorney
(213) 894-2414*

*United States Courthouse
312 North Spring Street, 13th Floor
Los Angeles, California 90012*

March 29, 1999

Robert J. Waldron, Ph.D.
Program Manager
National Law Enforcement and Corrections
Technology Center
c/o The Aerospace Corporation
2350 East El Segundo Blvd.
El Segundo CA 90245-4691

Dear Dr. Waldron:

I just wanted to thank you once again for allowing a group of Assistant United States Attorneys and federal agents from various law enforcement agencies to attend the tour of your facility on March 19th. I was very sorry that I wasn't able to attend, and after hearing the reports from those who did, I am even more sorry, since everyone found the visit to be extremely informative. It was kind of you and your staff to take the time to show our group around, and I appreciate your courtesy and consideration in arranging for the visit.

Thank you once again, and please don't hesitate to let me know if there is anything I can do for you.

Very truly yours,

ALEJANDRO N. MAYORKAS
United States Attorney

JEFFREY C. EGLASH
Assistant United States Attorney
Chief, Public Corruption & Government Fraud Section

"Founded in 1927"



"Cooperatio

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 Dr. A.L. Henry

Tim Grimmond
 Chief of Police
 El Segundo Police Department
 348 Main Street
 El Segundo, CA 90245

March 12, 1999

Dear Tim:

Thank you for providing an excellent presentation yesterday to our organization on the National Law Enforcement & Corrections Technology Center in El Segundo. Their outstanding level of professionalism and technical expertise can certainly enhance law enforcement investigations. I recently started to receive the free weekly news summary from the NLECTC which is very much appreciated.

We appreciated your willingness to share your comments with us and look forward to our continued association with you and members of your department.

With appreciation,

James M. Botting

*Many
 sent to
 Botting
 W. Henry*

LOS ANGELES POLICE DEPARTMENT



BERNARD C. PARKS
Chief of Police

RICHARD J. RIORDAN
Mayor

P.O. Box 30158
Los Angeles, Calif. 90030
Telephone:
(213) 485-5201
Re8#5.1

March 15, 1999

Mr. Robert Pentz, Director
The National Law Enforcement
and Corrections Technology Center
Western Region
c/o The Aerospace Corp
2350 East El Segundo Blvd M1-300
El Segundo, California 90245-4691

Dear Mr. Pentz:

The Los Angeles Police Department's Organized Crime and Vice Division is tasked with investigating a wide variety of complex and often technologically advanced criminal cases. The success of many of these criminal investigations hinges on the cooperation and assistance from technical experts. The National Law Enforcement and Corrections Technology Center and the Aerospace Corporation have been particularly helpful to detectives from my command, and I want to express my sincere appreciation for their effort.

For the past two years employees from the National Law Enforcement and Corrections Technology Center have provided invaluable assistance to detectives. Many tedious hours were expended in the examination and analysis of computer information in two major unrelated investigations. The huge task was accepted on very short notice and completed prior to the court deadlines. Most recently, photographic technicians from the Aerospace Corporation were requested to enhance and enlarge an important photograph on very short notice. Without hesitation, the request was accepted and accomplished. The results were impeccable. Without their assistance, these investigations could not have been brought to a successful conclusion.

AN EQUAL EMPLOYMENT OPPORTUNITY - AFFIRMATIVE ACTION EMPLOYER

Recycle and made from recycled waste A small recycling symbol consisting of three chasing arrows forming a triangle.

My profound gratitude is extended to the employees and staff for their exemplary professionalism and untiring work ethic in assisting the Los Angeles Police Department in its fight against organized crime.

Very truly yours,

BERNARD C. PARKS
Chief of Police


MARLIN D. WARKENTIN, Captain
Commanding Officer
Organized Crime and Vice Division



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February 22, 1999

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Downey

Robert Pentz, Director Of The National Law Enforcement & Corrections Technology Center
The Aerospace Corporation
Post Office Box 92957
M1/300
Los Angeles, California 90009-2957

Dear Mr. Pentz:

Thank you for sharing your time and expertise with the members of the Independent Cities Association (ICA). Your presentation was extremely interesting. I am still amazed at the practical technology that the federal government, through The Aerospace Corporation, is making available to cities. This was a well kept secret until last week.

Thank you for the work you do to assist our cities in dealing with the "bad guys." It is genuinely appreciated.

Very truly yours,

Mary Cammarano
Mary Cammarano
Seminar Chair

ds
Enclosure (Seminar Chair)

P.S. I hope you and Susan enjoyed your stay in Santa Barbara.

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- General Legal Counsel
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CITY OF LONG BEACH

POLICE DEPARTMENT

400 WEST BROADWAY • LONG BEACH, CALIFORNIA 90802

Deputy Chiefs
Dale L. Brown
Jerome E. Lance
Tony VanCoutren

2.2PRD

January 29, 1999

Mr. Michael Epstein
Program Manager
Nat'l Law Enforcement &
Corrections Technology Center
Western Region
2350 E. El Segundo Boulevard
El Segundo, CA 90245-4691

Dear Mr. Epstein:

On behalf of the Long Beach Police Department, I am pleased to present you with the enclosed Chief's Citation award for your presentation to our management staff.

I would like to take this opportunity to thank you for the time you spent speaking to our group last November. Your presentation was very interesting and relevant to the direction and goals our department is heading.

Sincerely,

Marlene Parker, Administrator
Planning & Research Division

MP:std
Epstn.Ltr



LAURA CHICK
CITY OF LOS ANGELES
COUNCILMEMBER, THIRD DISTRICT

CITY HALL
200 N. Main Street, Room 415
Los Angeles, CA 90012
(213) 485-3436
(213) 485-8988 Fax
TDD (213) 473-5971

DISTRICT OFFICE
19040 Vanowen Street
Reseda, CA 91335
(818) 756-8848
(818) 756-9179 Fax
TDD (818) 345-6624

Email address:
lchick@c03.ci.la.ca.us

January 21, 1999

Dr. Robert Waldron
Program Manager
National Law Enforcement and Corrections Technology Center
2350 E. El Segundo Blvd.
El Segundo, CA 90245-4691

Dear Dr. Waldron:

Recently members from our Los Angeles Fire Department had the opportunity to visit your center in El Segundo. They reported to me that they found their visit to be very informative. I have attached their letter for your information.

I am very pleased to have been able to play a role in drawing the attention of our Fire and Police Departments to the resources available at your center. I am looking forward to seeing this collaboration between the City and your center grow and result in further partnerships.

Sincerely,

LAURA CHICK
Councilmember
Third District

LC:KC:jh

cc: William Bamattre, Chief Engineer and General Manager
Los Angeles Fire Department



* CHAIR: PUBLIC SAFETY COMMITTEE
* VICE-CHAIR: PUBLIC WORKS * MEMBER: GOVERNMENTAL EFFICIENCY





Long Beach Police Department

Chief's Citation

December 22, 1998

Michael Epstein

"In Appreciation"

On November 12, 1998, you provided an informative presentation to the managers of the Long Beach Police Department about the research and investigative capabilities of the National Law Enforcement and Corrections Technology Center. The presentation covered many fascinating topics including elements of video tape evidence, drug detection systems, and computer architecture. The information was interesting as well as, relevant to the present and future technological goals of the Department.

We realize the growing role technology plays in law enforcement. Your organization has done a remarkable job in this area. We look forward to working with you in the future.

Thank you for spending time with us. We very much appreciate the material you provided and the ideas you shared.

Sincerely,

A handwritten signature in cursive script that reads "Robert M. Luman".

Robert M. Luman
Chief of Police

NATIONAL RESEARCH COUNCIL

2101 Constitution Avenue Washington, D.C. 20418

OFFICE OF THE CHAIRMAN

Mr. Robert Pentz
Aerospace Corporation
National Law Enforcement and Corrections Technology Center - Western Region
2350 East El Segundo Blvd., M1/300
El Segundo, CA 90245-4691

Dear Mr. Pentz:

On behalf of the National Research Council, I would like to express my appreciation of your service as a member of the Committee on Marking, Rendering Inert, and Licensing of Explosive Materials. The successful completion of this complex project within very challenging time constraints is clear evidence of the dedication and hard work of the committee. Your report has provided an important contribution to the NRC and our nation.

We are grateful to you.

Sincerely,


Bruce Alberts
Chairman

The National Research Council is the principal operating agency of the National Academy of Sciences and the National Academy of Engineering to serve government and other organizations

CITY OF LOS ANGELES
CALIFORNIA

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December 10, 1998

Mr. Robert Pentz
The Aerospace Corporation
2350 East El Segundo Boulevard
El Segundo, CA 90245-4691

Dear Mr. Pentz:

National Law Enforcement and Correction Technology Center

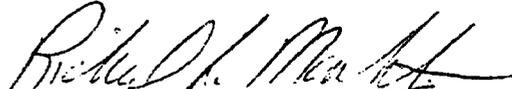
On Tuesday, December 8, 1998, I had the privilege of touring your facility with two other members from our Department. Dr. Robert Waldron, who briefed us on your organization and personally escorted us on our visit, met us. His infectious enthusiasm and sincerity made us feel welcomed the moment we walked into your facility. The welcome mat was placed at every door we entered. Each member of your staff whom we met took the time from their busy schedule to extend a professional courtesy and spoke with us regarding their area of expertise.

Our Department's Arson Section has benefited from your services in the past. However, we were unaware of the many other areas where we may be able to access assistance from your organization. For those difficult technical problems we sometimes face we know that we can turn to you and request your help.

Once again, we enjoyed our visit and thank you. Please convey our appreciation to your staff.

Very truly yours,

WILLIAM R. BAMATTRE
Chief Engineer and General Manager


RICHARD F. MARKOTA, Commander
FCCS II/RCN Section





LOS ANGELES COUNTY DISTRICT ATTORNEY'S OFFICE
BUREAU OF CENTRAL OPERATIONS

GIL GARCETTI • District Attorney
ROBERT P. HEFLIN • Chief Deputy District Attorney
RICHARD L. JENKINS • Assistant District Attorney

RONALD H. "MIKE" CARROLL • Director

November 23, 1998

Mr. Robert Pentz
Director
National Law Enforcement & Corrections Technology Center
2350 East El Segundo Blvd.
El Segundo, CA 90245

RE: People v. Leknes & Darrow
BA170807

Dear Mr. Pentz:

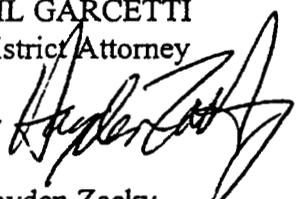
I am writing this letter to inform you of the invaluable service that your organization provided to the People of the State of California regarding the above case. Thomas Tomka, a District Attorney investigator brought a security tape to Dr. Rudy for purposes of enhancement. Initially, the tape was very grainy and its images were difficult to identify. Thanks to the work of Dr. Rudy, the tape was "slowed down" and enhanced, and we were able to identify the perpetrators. As a result, both defendants were convicted of very serious crimes, including residential burglary and home invasion robbery.

Without your organization's services, the likelihood of a successful prosecution would have certainly been reduced.

Very truly yours,

GIL GARCETTI
District Attorney

by


Hayden Zacky
Deputy District Attorney

18000 Criminal Courts Building
210 West Temple Street
Los Angeles, CA 90012
(213) 974-3701



**LAW OFFICES
LOS ANGELES COUNTY PUBLIC DEFENDER**

VAN NUYS BRANCH OFFICE

**14400 ERWIN STREET MALL
10TH FLOOR
VAN NUYS, CALIFORNIA 91401**

(818) 374-2350

TDD (800) 801-5551

**MICHAEL P. JUDGE
PUBLIC DEFENDER**

November 19, 1998

Dr. Robert J. Waldron, Program Manager
National Law Enforcement and Corrections
Technology Center-Western Region
c/o The Aerospace Corporation
2350 East El Segundo Blvd.
El Segundo, CA 90245-4691

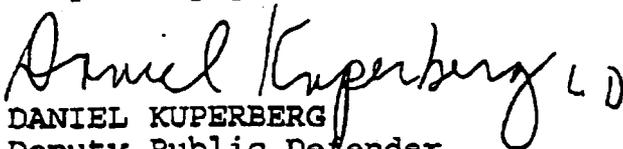
Re: People v. Domingo Ramos
Our case no: LA030463
Your case no: V98-154-BW

This letter is to thank you and your office for your assistance in the above-entitled case. Yesterday, the District Attorney's Office officially dismissed all charges against my client, Domingo Ramos. As you will recall, your office helped enhance a videotape that was instrumental in showing that while a carjacking/kidnapping was being committed in Van Nuys, Mr. Ramos was visiting a relative in a hospital in Santa Monica. Jorge Geaga of your Technical Staff was particularly helpful and cooperative.

Since first being assigned to this case, I felt that Domingo Ramos was innocent; your office's efforts helped insure that an innocent man was not wrongly convicted.

Thank you again for your contribution to our system of criminal justice.

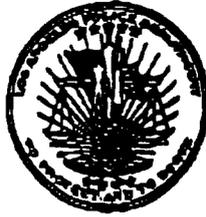
Very truly yours,


DANIEL KUPERBERG
Deputy Public Defender

bcc: Jorge Geaza
cc: Michael Judge, Public Defender
Robert Pentz
Richard F. Walmark, Deputy District Attorney

DK:ld

LOS ANGELES POLICE DEPARTMENT



BERNARD C. PARKS
Chief of Police

P.O. Box 30158
Los Angeles, Calif. 90030
Telephone:
(213) 485-4131
Ref #: 8.2.3

RICHARD J. RIORDAN
Mayor

Ms. Marlene Beckman
Special Counsel to the Assistant Attorney General
Department of Justice
810 7th Street, NW
Washington, D.C. 20531

It is with great satisfaction that I write this letter regarding the excellent work done by your organization at National Law Enforcement & Corrections Technology Center.

Detective William Henebry of the Los Angeles Police Department, Financial Crimes Division, began an eleven-month investigation into a mail theft and counterfeit check ring which was operating in Northern and Southern California, as well as Nevada. Two hundred and fifty members of this ring have been identified and/or arrested. Several of these suspects were involved in other serious crimes, such as: rape, arson, explosives, drug sales, mail theft and burglary. Over 8,000 items of property have been booked thus far and over 25 search warrants have been served. The loss to the banking industry alone is in the millions of dollars.

National Law Enforcement & Corrections Technology Center has worked very closely with Detective Henebry by providing necessary information, documents and computer technology, which has identified hundreds of victims located within computer programs seized during the arrest of these suspects.

The National Law Enforcement & Corrections Technology Center, headed by Robert Pentz, and his staff, Don Buchwald, Steve Margolis and Larry Jansen, always showed a willingness to share their time and expertise with Detective Henebry and they continue to be an asset to the on going investigation. If it wasn't for the center's help we may not have had the positive outcome in this case.

Ms. Beckman

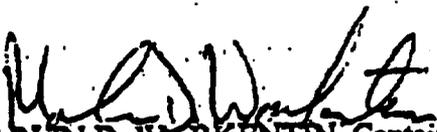
Page 2

8.23

Please extend my gratitude to the members of the National Law Enforcement & Corrections Technology Center in El Segundo for their tireless cooperation, dedication and professionalism in assisting the Los Angeles Police Department, Financial Crimes Division, to better serve our community.

Very truly yours,

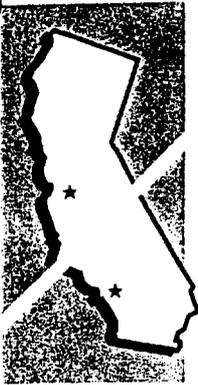
BERNARD C. PARKS
Chief of Police



MARLIN D. WARKENTIN, Captain
Commanding Officer
Financial Crimes Division

RSA

RESEARCH SECURITY ADMINISTRATORS



November 9, 1998

Robert Waldron
The Aerospace Corporation
P.O. Box 92957
Mail Stop: M1-300
Los Angeles, CA 90009

Dear Bob:

Thank you so much for your presentation at RSA on October 30th. You were fabulous.

The evaluation results from the attendees ranged from "good to excellent" and several comments were written regarding how much they enjoyed your particular presentation. Your rapid response to agree to be a fill in speaker at the last minute for the seminar was greatly appreciated. I can not thank you enough!

Sincerely,

Donna Kahl
Program Chair

cc: R.M. Pentz
R.K. Sable
L. Chandler
C. Howard



EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D. C. 20503
(202) 395-2740

September 18, 1998

To: Robert Pentz

Just a short note to say thank you for your hospitality during my recent visit to Los Angeles. The presentations of the various technologies being developed was quite impressive. I look forward to seeing you again at the *NIJ Technology Fair for Law Enforcement and Corrections* in Washington.

Sincerely,

A handwritten signature in cursive script, appearing to read "Jim Boden".

Jim Boden



HAL BARKER

SHERIFF - CORONER - PUBLIC ADMINISTRATOR
COUNTY OF EL DORADO
STATE OF CALIFORNIA

REPLY TO:

HEADQUARTERS
300 FAIR LANE
PLACERVILLE
CA 95667
530 621-5655
FAX 626-8163

JAIL DIVISION
900 FORNI ROAD
PLACERVILLE
CA 95667
530 621-6000
FAX 626-9472

TAHOE DIVISION
1360 JOHNSON BLVD., SUITE 100
SOUTH LAKE TAHOE
CA 96150
530 573-3000
FAX 544-6809

August 11, 1998

Dr. Robert Waldron
NLECTC
2350 East El Segundo Blvd.
El Segundo, CA 90245-4691

Dear Dr. Waldron:

On behalf of the El Dorado County Sheriff's Department, District Attorney's Office and the family of victim Dawn Peitz, I extend our gratitude and thanks for the assistance you and your staff provided us.

I send a special thank you to Neil Ives and Brent Morgan for their time, energy and effort in the analysis of the passbook, sand and tape lifts. We were able to show the jury our attempts to locate the missing body and the extraordinary measures your team took to try to pinpoint where the suspect had dumped the body.

With the assistance of you and your team, we were able to convict the suspect, Michael Barnes, of Second Degree Murder for which he will be serving a sentence of 15 years to life.

On a personal note, Detectives Fitzgerald and Campagna wish to send their thanks for welcoming them and making their visit to your facility an interesting and educational one.

Thank you again. We sincerely appreciate this cooperation between our respective agencies.

Very truly yours,


HAL BARKER
Sheriff - Coroner
Public Administrator

HB/cs

"Serving El Dorado County Since 1850"



WASILLA POLICE DEPARTMENT

250 N. KNIK STREET
WASILLA, ALASKA 99654-7014
(907) 373-9077
Fax: 373-9051



Honorable Ted Stevens
United States Senate
522 Hart Building
Washington, D.C. 20510-0201

Dear Senator Stevens;

In the past I have mentioned to you the excellent work being done by the National Law Enforcement and Corrections Technology Center - Western Region. They are a branch of the National Institute of Justice set up to help the individual states upgrade their law enforcement capabilities through improved technology and information.

I would also remind you that the NLECTC-WR has greatly helped the State of Alaska by assisting individual departments. They have helped some of us acquire vehicles, weapons, communications studies, upgraded computer programs and facilities information. Even as I write this letter to you they are completing a study for the Nome Police Department. They also just recently completed a "Vehicle Pursuit Management Study" which will help all departments nationwide. Congress will be getting more information on this study in the near future.

I would like to invite you and/or your staff to attend a Technology Fair in Washington, D.C. on March 30-31, 1998, at the Rayburn Building on South Capitol Street. I am faxing your office all available information regarding this event.

Please try to attend or see if it is possible for a staff member to represent you at the Technology Fair. I would also like to encourage you to support the Technology Center concept because it is helping more than any other program in my experience in law enforcement.

Sincerely,

Charlie Fannon
Chief of Police



SHERIFF-CORONER DEPARTMENT
COUNTY OF ORANGE
CALIFORNIA

BRAD GATES
SHERIFF-CORONER

SERVING THE UNINCORPORATED AREAS
OF ORANGE COUNTY AND THE CITIES OF:

DANA POINT
LAGUNA HILLS
LAGUNA NIGUEL
LAKE FOREST
MISSION VIEJO

SAN CLEMENTE
SAN JUAN CAPISTRANO
STANTON
VILLA PARK

July 2, 1998

RAUL RAMOS
UNDERSHERIFF

ASSISTANT SHERIFFS
JOHN HEWITT
JERRY KRANS
TIM SIMON
DOUG STORM

Mr. Robert M. Pentz, Director
National Law Enforcement and Corrections Technology Center
2350 E. El Segundo Bl. M1/300
El Segundo, Ca 90245-4691

I am writing to you to express my appreciation for the outstanding work performed by your staff on behalf of the Orange County Sheriff's Department Homicide Detail. During the investigation of the kidnapping, rape and strangulation murder of a young woman, investigators identified two suspects believed to be responsible for the crimes. These two suspects were placed together in an interview room and their conversation was recorded.

Because of their whispering and the background noise present, investigators could not hear a large portion of the conversation. The only portions of the recording that were understandable were self serving statements made by the suspects, probably intended to be overheard by investigators. The recording was delivered to your facility and investigators requested your assistance in enhancing the recordings.

Research Scientist James Roeder processed the tapes to lower the background noise and enhance the whispering to understandable levels. After reviewing the enhanced recordings provided by your staff, investigators were able to understand enough of the suspect's conversation to determine they were discussing several different versions of their alibi in order to fine tune their story. With the addition of this new information investigators were able to obtain criminal complaints charging the suspects with the murder and special circumstances enhancements making the subjects eligible for the death penalty.

Without the assistance of your staff, using technology not otherwise available to investigators, the admissions made by these two suspects would not have been recovered. Without these statements made by the suspects themselves, investigators likely would have had to settle for a criminal complaint charging only one of the suspects and then probably without the special circumstances enhancement.

Please accept and pass on to your staff our sincere gratitude and thanks for the invaluable assistance provided to investigators during the course of this investigation.

Sincerely,

BRAD GATES
Sheriff-Coroner

Robert D. Kemmis, Captain
Investigation Division

JM:sv

550 N. FLOWER STREET • P.O. BOX 449 • SANTA ANA, CALIFORNIA 92702-0449 • (714) 647-7000



LOS ALAMITOS POLICE DEPARTMENT



Michael J. Skogh
Chief of Police

Arl L. Farris
Captain

Cassandra Frye
Support Services
Manager

June 4, 1998

Dr. Robert J. Waldron
NLECTC-WR
c/o the Aerospace Corporation
2350 East El Segundo Boulevard, M1-300
El Segundo, California 90245-4691

Dear Dr. Waldron:

I want to thank you for speaking at the Orange County Chiefs' and Sheriff's Executive Seminar in Palm Springs on Wednesday, April 29, 1998. The presentation that you and your counterparts presented on White Collar Crime and Less than Lethal Weaponry was very well received, in addition to being very informative. I appreciate the time each one of you took out of your busy schedules to speak at our seminar. If I can ever be of any assistance to you, please don't hesitate to contact me.

Sincerely,

MICHAEL J. SKOGH
CHIEF OF POLICE

MJS:ap

3201 Katella Avenue
Los Alamitos, CA
90720-5601

Telephone:
(562) 431-2255

FAX:
(562) 431-6499



THE CITY OF SANTA CLARA CALIFORNIA

CHARLES R. AROLLA
CHIEF OF POLICE

June 3, 1998

1541 CIVIC CENTER DRIVE
SANTA CLARA, CA 95050
FAX (408) 248-0276

Dr. Robert Pentz
NLECTC-WR/ Aerospace Corporation
Mail Stop M1-300
2350 E. El Segundo Blvd.
El Segundo, CA 90245

Dear Dr. Pentz:

I am writing to express our appreciation for your agency's work and for the much needed resources you have provided.

I have been briefed by Robbery/Homicide Detective Sgt. George Teal. He explained how your group has been helpful, responsive and instrumental in the on-going investigation of various cases.

The most recent case involved a sawed-off rifle robbery of a convenience store where detectives had only marginal, poor tracking videotape showing the crime.

Mr. Bob Waldron very professionally coordinated a rapid return of high quality still photographs from that videotape. A Santa Clara Police Analyst's subsequent flyer enabled a patrol officer to locate the vehicle and driver within 24 hours after we received the videotape photographs.

Because video and other electronic media are so pervasive in our society, police agencies have a real need for assistance in image capture and analysis. The private sector sources are, oftentimes, expensive as well as not readily available. We appreciate your publicly funded agency which does such excellent work.

I see only more and more demand for your expertise and services.

If there is any way our agency may assist you in the future, do not hesitate to contact us.

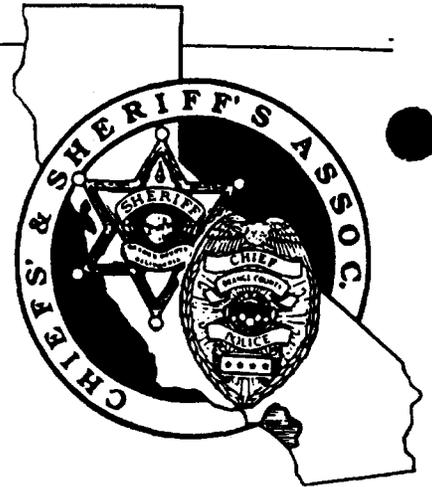
Sincerely,

SANTA CLARA POLICE DEPARTMENT



CHARLES R. AROLLA
Chief of Police

CRA:GT:rj



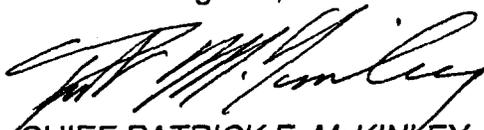
May 6, 1998

Dr. Robert J. Waldron
Program Manager
National Law Enforcement
& Corrections Technology Center
2350 E. El Segundo Blvd. - M1/300
El Segundo, CA 90245-4691

Dear Dr. Waldron:

Thank you for joining us and sharing the information regarding technical support for law enforcement. The Aerospace Corporation is very fortunate to have a Program Manager who understands both the DOD and DOJ sides of the equation. Your presence in the desert at our workshop and the information you shared is greatly appreciated.

With best regards,


CHIEF PATRICK E. MCKINLEY
Secretary/Treasurer

PEM/rk

CITY OF LOS ANGELES
CALIFORNIA

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MAYOR

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LOS ANGELES, CA 90012

WILLIAM R. BAMATTRE
CHIEF ENGINEER
AND
GENERAL MANAGER
(213) 485-6003
<http://www.ci.la.ca.us/dept/LAFD>

April 21, 1998

Mr. James L. Roeder
The Aerospace Corporation
2350 East El Segundo Blvd.
El Segundo, CA 90245-4691

Dear Jim:

On March 17th, 20th and 27th, members of the Los Angeles City Fire Department, Significant Incident Investigation Team met with you to enhance audio tape recordings of the incident tactical channels.

In addition to our meetings at your facility, you graciously traveled to our communications center to obtain a digital recording from the master tapes.

The Los Angeles City Fire Department would like to thank you for your time, expertise and courtesy you provided. The enhancement of the tactical channels coupled with the CD-ROM and shareware version of the Cool Edit 96 program will greatly assist our investigation.

If I can be of any assistance in the future, please do not hesitate to contact me.

Sincerely yours,

MICHAEL J. CASTILLO, Captain II
Los Angeles City Fire Department
Significant Incident Investigation Team





SHERMAN BLOCK, SHERIFF

County of Los Angeles
Sheriff's Department Headquarters
4700 Ramona Boulevard
Monterey Park, California 91754 - 2169



(213) 974-9420

April 2, 1998

Dr. Robert M. Pentz
NLECTC - WR
c/o The Aerospace Corporation
2350 E. El Segundo Boulevard - M1/300
El Segundo, California 90245-4691

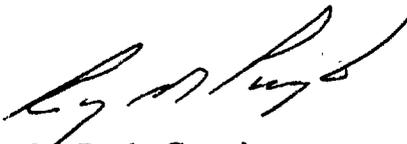
Dear Mr. Pentz:

I would like to take this opportunity to thank you for allowing Dr. Robert Waldron and Dr. Gary Stupian to take time from their daily duties in order to speak at the Spring 1998 meeting of the California Association of Crime Laboratory Directors seminar which was held in Burbank on March 26 and 27, 1998.

They are both enthusiastic and knowledgeable speakers and represented the National Law Enforcement and Corrections Technology Center well. Judging from the comments that were made, their presentation was very well received. Their highly professional and well prepared presentation helped the group to gain an understanding of the capabilities of the National Law Enforcement and Corrections Technology Center and the possible applications of your technologies to the field of forensic science.

On behalf of the Scientific Services Bureau, please accept my sincere thanks and appreciation for an excellent presentation.

SHERMAN BLOCK, SHERIFF



Roy M. Pugh, Captain
Scientific Services Bureau

A Tradition of Service



P.O. BOX 163029
SACRAMENTO, CA 95816-3029
Public: (916) 227-4045
Facsimile: (916) 227-4010
(916) 227-4184

April 2, 1998

Mr. Ron Sable, Senior Vice President
Corporate Division
The Aerospace Corporation
1000 Wilson Boulevard, Suite 2600
Arlington, VA 22209-3988

RE: Letter of Appreciation - Military Contraband and Law Enforcement Workshop

Dear Mr. Sable:

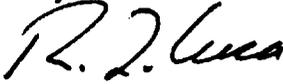
I would like to commend Dr. Robert Waldron from your western region for assisting the California Department of Justice in presenting two workshops titled Military Contraband and Law Enforcement. The workshops were a great success.

Dr. Waldron presented a block of instruction dealing with the types of technology that your center makes available to law enforcement. His knowledge, speaking skills, sense of humor, and the computer graphics he brought with him proved an excellent combination and appreciated by the 200-plus attendees of the workshops. He provided a great deal of information in an easily understood, interesting, and professional manner and is a credit to your organization.

I want to thank you and your organization – especially Dr. Waldron – for making this a successful event. We look forward to working with him as additional workshops are presented to other law enforcement and military personnel in the future.

Sincerely,

DANIEL E. LUNGREN
Attorney General


R. J. LUCA, Chief
Bureau of Investigation

mem

cc: Robert Pentz, Director
Dr. Robert Waldron

GREGORY THOMPSON
ASSISTANT DISTRICT ATTORNEY

OFFICE OF
THE DISTRICT ATTORNEY
COUNTY OF SAN DIEGO

PAUL J. PFINGST
DISTRICT ATTORNEY

NORTH COUNTY Branch Office
325 South Melrose Drive
Vista, CA 92083-6691
(619) 940-4301

March 27, 1998

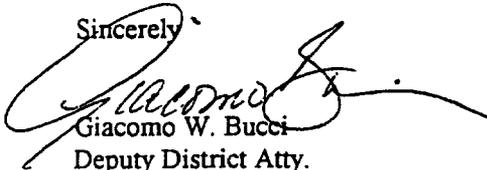
Mr. Mike Epstein
The Aerospace Corporation
2350 East El Segundo Blvd.
El Segundo, CA 90245-4691

Subject: Examination of audio tape of People v. Eric Smith #SCN 05492

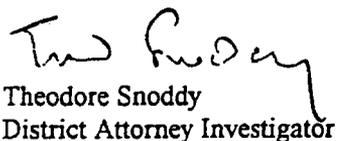
Dear Sir:

Thank you for your invaluable expertise in the analysis of the audio tape our office sent for your examination. Your efforts allowed us to revoke the probation status of an individual who terrorized a victim of Domestic Violence. We both appreciate your cooperation and efforts to complete the task without expense to our office and in the timely manner in which it was completed.

Sincerely,



Giacomo W. Bucci
Deputy District Atty.
San Diego County



Theodore Snoddy
District Attorney Investigator



Police Department

Mr. Robert M. Pentz, Director
National Law Enforcement & Corrections
Technology Center - Western Region
2350 E. El Segundo Boulevard - M1/300
El Segundo, CA 90245-4691

Dear Mr. Pentz:

Detective John Hullar of my department recently distributed a "wanted flyer" of a suspect in a liquor store robbery, which depicted a "still" photograph of the suspect. I remarked to Hullar that the flyer was professional, and I was impressed with the quality of the suspect's picture.

Detective Hullar explained how your Center developed the photo from a video tape taken from the scene of the robbery. The technology you have provided, not only to Baldwin Park but law enforcement in general, will help all of us make our communities safer. Thank you.

If I can ever be of assistance, please call me at (818) 813-5225.

Sincerely,

Dennis Kies
Acting Chief of Police

DK/ast



WASILLA POLICE DEPARTMENT

250 N. KNIK STREET
WASILLA, ALASKA 99654-7014
(907) 373-9077
Fax: 373-9051



Honorable Ted Stevens
United States Senate
522 Hart Building
Washington, D.C. 20510-0201

Dear Senator Stevens;

In the past I have mentioned to you the excellent work being done by the National Law Enforcement and Corrections Technology Center - Western Region. They are a branch of the National Institute of Justice set up to help the individual states upgrade their law enforcement capabilities through improved technology and information.

I would also remind you that the NLECTC-WR has greatly helped the State of Alaska by assisting individual departments. They have helped some of us acquire vehicles, weapons, communications studies, upgraded computer programs and facilities information. Even as I write this letter to you they are completing a study for the Nome Police Department. They also just recently completed a "Vehicle Pursuit Management Study" which will help all departments nationwide. Congress will be getting more information on this study in the near future.

I would like to invite you and/or your staff to attend a Technology Fair in Washington, D.C. on March 30-31, 1998, at the Rayburn Building on South Capitol Street. I am faxing your office all available information regarding this event.

Please try to attend or see if it is possible for a staff member to represent you at the Technology Fair. I would also like to encourage you to support the Technology Center concept because it is helping more than any other program in my experience in law enforcement.

Sincerely,

Charlie Fannon
Chief of Police



City of San Gabriel

• City With A Mission • Founded 1771 ♦

March 19, 1998

Mr. Don Rudy
National Law Enforcement
& Corrections Technology Center
2350 E. El Segundo Blvd., M1/300
El Segundo, CA. 90245-4691

Dear Mr. Rudy,

I would like to thank you and Mr. Ray Talbot for your help in assisting me with the video tape that I brought into your office on March 12, 1998. The time I spent there was very interesting and informative. I've begun to implement some of the information/suggestions that you gave me, and I've also been given the "go ahead" to re-create the crime scene as was suggested by you and Mr. Talbot.

Per your inquiry, I've called my friend in Sacramento (the one who sent me the DMV printout for 88-89 Crown Victoria's) to see if he could find out if DMV has this on an electronic format or on a computer base disk. Unfortunately at this time, he is away doing some training and won't return until March 23rd. I've left a message for him, and as I soon as I learn anything I will get back with you.

Once again, I thank you for all your help.

Sincerely

David A. Lawton
Chief of Police

Det. P. Barwick
Traffic Bureau

Police Department: 625 South Del Mar Avenue, San Gabriel, California ♦ Mail: P.O. Box 130, San Gabriel, California 91778-0130
♦ 818-308-2828 ♦ FAX 818-576-2354 ♦

LOS ANGELES POLICE DEPARTMENT

BERNARD C. PARKS
Chief of Police



P.O. Box 30158
Los Angeles, Calif 90030
Telephone: (818) 623-4006
Ref #: 7.4

RICHARD J. RIORDAN

Mayor

March 17, 1998

National Law Enforcement & Corrections Technology Center
2350 E. El Segundo Boulevard
El Segundo, California 90245-4691

ATTN: Mr. Robert Pentz
Mr. Michael Epstein

Dear Sirs:

On January 15, 1998, Detective Jim Gerardi, who is assigned to the Los Angeles Police Department, North Hollywood Division Robbery Unit, brought to your office a video tape of a robbery at a 7-11 Market. The suspect in the video also committed a kidnap/robbery in the parking lot at the same location. In hopes of getting the video enhanced, Detective Gerardi met with one of your employees, Mr. Jorge Geaga. Mr. Geaga was able to enhance the video and obtain very good identifiable photos of the suspect.

As a result of the service provided by your technology center, the suspect in this case was identified and arrested. When the suspect was shown the photo of himself committing the robbery, he confessed to three robberies and the kidnapping. This suspect is currently awaiting trial for these crimes. The Los Angeles Police Department, and in particular North Hollywood Detective Section, greatly appreciates your outstanding service and is looking forward to working with your agency in the future.

Very truly yours,

BERNARD C. PARKS
Chief of Police


DONALD C. FLOYD, Captain
Commanding Officer
Operations Support Division
North Hollywood Community Police Station

AN EQUAL EMPLOYMENT OPPORTUNITY - AFFIRMATIVE ACTION EMPLOYER

LOS ANGELES POLICE DEPARTMENT



BERNARD C. PARKS
Chief of Police

P.O. Box 30158
Los Angeles, Calif. 90030
Telephone: (213) 207-2100

RICHARD J. RIORDAN
Mayor

Ref #: 4.5.2

March 4, 1998

Mr. Robert Pentz
N.L.E.C.T.C. - WR
2350 East El Segundo Boulevard
El Segundo, CA 90245-4691

Dear Mr. Pentz:

Between October 6, 1996 and October 15, 1997, three murders occurred in Rampart Division which were partially filmed by nearby security cameras. Rampart Homicide Detectives, Jim Freund, Jeff Anderson, Adrian Soler, and Bob Brophy were assigned to investigate the murders. It was imperative for the detectives to have the video images enhanced in order to clearly observe the individuals and vehicles present at the crime scenes. The National Law Enforcement and Corrections Technology Center, Western Region, was contacted and enthusiastically agreed to isolate and enhance the necessary portions of the three videos. Mr. Ray Talbot and Mr. Don Rudy offered their assistance to the detectives in completing this task. Consequently, the detectives were able to obtain valuable information about what really happened at the scene of these three different murders.

Detectives Jeff Anderson and Jim Freund are currently engaged in the successful prosecution of a suspect responsible for one of the murders. The enhanced images provided by the National Law Enforcement and Corrections Technology Center are an essential piece of evidence corroborating statements made by the witnesses. Rampart Operations Support Division wishes to thank the National Law Enforcement and Corrections Technology Center, Western Region, for their generous and greatly appreciated assistance in these cases.

Very truly yours,

BERNARD C. PARKS
Chief of Police


RICHARD A. MERAZ, Captain
Commanding Officer
Rampart Operations Support Division

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=====

DEPARTMENT OF FORESTRY AND FIRE PROTECTION

1234 E. Shaw Avenue
Fresno, California 93710-7899
Telephone: (209) 222-3714, Ext. 128
FAX: (209) 222-0583
Ref: 9000 P1

December 19, 1997

Dr. Raymond J. Talbot, Program Manager
National Law Enforcement and
Corrections Technology Center
2350 E. El Segundo Boulevard
El Segundo, California 90245-4691

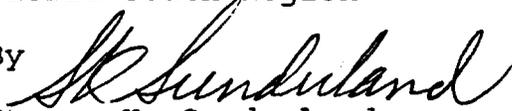
Dear Dr. Talbot:

Thank you for taking the time to participate in our investigation workshop. Your presentation on photographic imaging and interpretation was quite informative for us all. Everyone I spoke with afterward had positive things to say about the way they would change their technique when photographing evidence.

Sincerely,

Tim Turner
Acting Region Chief
Sierra-South Region

By


Steven K. Sunderland
DEPUTY CHIEF
Fire Prevention

hk



STATE OF IDAHO
Department of Correction
Planning and Building Operations

PHILIP E. BATT
GOVERNOR
JAMES C. SPALDING
DIRECTOR

ED KING
OPERATIONS MANAGER

January 22, 1998

Mr. Robert Pentz
NLECTC - Western Region
C/O Aero Space Corporation
P O Box 92957 M1300
Los Angeles, CA 90009-2957

RE: Sandia Technologies

Mr. Pentz;

I represented the State of Idaho Department of Correction at the Physical Protection System Design and Evaluation course at Sandia National Laboratories in Albuquerque, New Mexico the week of December 14 to 19, 1997. I would like to take a moment to commend the National Law Enforcement & Corrections Technology Center for making the presentation possible. I found the program to be extremely informative and valuable to all correction facilities. This program affords the blend of a valuable marriage of security and technology with minimization of error. This particular advancement of technology is exactly what today's correctional facilities will be finding a necessity as opposed to a possibility.

This course captured and held my attention throughout. I felt that an additional day would have been extremely beneficial, in order to afford an opportunity to ask more questions and possibly work through more depth.

3268 ELDER STREET, BOISE, IDAHO 83705 (208) 334-2013 (208) 334-4108 Fax

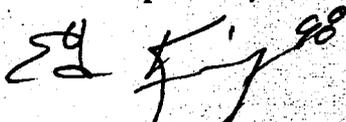
AN EQUAL OPPORTUNITY EMPLOYER

I appreciate your efforts in establishing the western region. I am copying this letter to our legislators to also thank them for their support of Mr. Jeremy Travis's agenda moving

In just the short time afforded in defining and organizing the great amount of technology that has been transferred (particularly through training) the design operation of the Department of Correction has been effectively moved in to the 20th Century. This has enabled the DOC to shorten their learning current curve match the rapid growth of this industry. This program will benefit the taxpayers with substantial savings.

I have enjoyed the opportunity working with you and your staff, and look forward to future endeavors.

Respectfully,



Ed King

Cc: Senator Dirk Kempthorne
Senator Larry Craig
Representative Helen Chenoweth
Representative Mike Crapo

3268 ELDER STREET,

BOISE, IDAHO 83705

(208) 334-2013

(208) 334-4108 Fax

AN EQUAL OPPORTUNITY EMPLOYER



California Peace Officers' Association

1455 Response Road, Suite 190, Sacramento, CA 95815
(916) 923-1825 FAX (916) 263-6090

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Asst. Chief, BNSF Railway Police

December 8, 1997

Mr. Robert Pentz, Director
National Law Enforcement and Corrections
Technology Center - Western Region
2350 East El Segundo Blvd., M1/300
El Segundo, CA 90245-4691

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Sheriff, Merced County

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Chief, Shafter

BERT WALSH
Chief, FBI, San Francisco

Dear Mr. Pentz:

On December 4, 1997, Dr. Robert Waldron, assisted by Mr. Don Buchwald, made a "Hi-Tech Crime" presentation to the CPOA Board of Directors in San Diego. In behalf of the CPOA Board, I thank you, Dr. Waldron, and Mr. Buchwald not only for the outstanding presentation but for the outstanding report on this subject.

I am hopeful that the Law Enforcement and Corrections Technology Center will remain as partners with CPOA as we move forward with our proposal to develop regional hi-tech computer crime task forces.

Your assistance is sincerely appreciated.

Thank you.

Very truly yours,

GREG COWART, President
California Peace Officers' Association

cc: Chief Grimmond
Ross Hutchings, CPOA

Executive Director
ROSS D. HUTCHINGS, CAE

"Dedicated to Professional Law Enforcement" . . . Established in 1921



DEPARTMENT OF THE AIR FORCE
AIR INTELLIGENCE AGENCY

21 NOV 1997

Mr. Dennis B. Richburg
Technical Director
2 Hall Blvd Ste 201
San Antonio TX 78243-7009

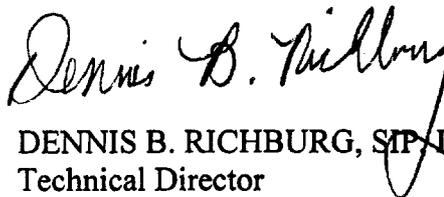
Mr. Robert Pentz
Director
National Law Enforcement & Corrections Technology Center—Western Region
2350 E. El Segundo Blvd M1/300
El Segundo CA 90245-4691

Dear Mr. Pentz

Thank you for initiating dialogue with Air Intelligence Agency (AIA). AIA is leading the Air Force in maintaining a preeminent role of collecting and exploiting information. Your interest and expertise are focused on the right place to explore areas of AIA expertise that could be leveraged by the law enforcement community.

Since your visit, my staff and I have been studying potential opportunities for expansion of our relationship with civilian law enforcement agencies. Additionally, we are studying the best path to take in offering assistance. We expect to provide a more substantive response by the end of February 1998. Please refer your questions or comments to me or Mr. Mike Tinney, HQ AIA/XRRT, (210) 977-4588, email: mptinne@aia.af.mil.

Sincerely


DENNIS B. RICHBURG, SIP, DAF
Technical Director

cc:
HQ SMC/XRR (Dr. Richard Arvizu)

"Freedom Through Vigilance"



N I C I

A CIVIL - MILITARY INSTITUTE



Post Office Box 4209
San Luis Obispo, California 93403-4209

November 12, 1997

Mr. Robert Pentz
Director
National Law Enforcement & Corrections
Technology Center
2350 East El Segundo Boulevard
El Segundo, California 90245

Dear Mr. Pentz:

We greatly appreciate the briefing and demonstration Bob Waldron gave during the recent Congressional staff visit on the technology developed by the National Law Enforcement and Correction Centers. This group is particularly interested in military technology that can be adapted to support law enforcement operations. The demonstration on how current technology is being used to support meth lab detection was very impressive. The additional applications in the areas of Weapons of Mass Destruction and toxic spillage was of special interest to the staff group.

We appreciate your support of this Congressional staff visit, and look forward to bringing future groups to your location. We strongly feel these visits, which provide Congressional members and their staffs with invaluable insight into the activities of agencies involved with counterdrug operations, are vital to maintaining their support.

Sincerely,

Louis J. Antonetti
Colonel, California Army National Guard
Director

COMMERCIAL (805) 782-6700 • DSN 630-6700 • FAX (805) 782-6745



STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC SAFETY
STATE POLICE FORENSIC SCIENCE LABORATORY
278 Colony Street
Meriden, CT 06451

June 30, 1997

Mr. Mike Epstein
Aerospace Corporation
2350 El Segundo Blvd.
Station M1 - 902
El Segundo, CA 90245

Dear Mike,

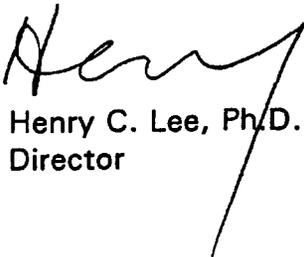
I have recently received the enhanced tape and photograph from the homicide case in Taiwan. I want to thank you for all your efforts to help me out. I hope the information from the enhancement will provide some leads for the investigative team.

I am enclosing herein autographed copies of my physical evidence book for you and Bob. Please give the book to him for me. I am also enclosing a "stress test" ruler for each of you.

Although no license plate or model information could be ascertained from the tape in this case, I was very impressed with the quality of the image you were able to produce. I am sure that we will be able to use your expertise in future cases, and I feel your work will be an asset to the entire law enforcement community.

Thank you again for your assistance in this matter.

Sincerely yours,



Henry C. Lee, Ph.D.
Director

Phone (203) 639-6400 Fax (203) 639-6485

An Equal Opportunity Employer

LOS ANGELES POLICE DEPARTMENT



BAYAN LEWIS
Chief of Police

P.O.Box 30158
Los Angeles, Calif. 90030
Telephone: (213) 485-3202

Ref#: 8.2.2

RICHARD J. RIORDAN
Mayor

June 16, 1997

Robert M. Pentz, Principal Director
Law Enforcement and Public Safety Directorate
The Aerospace Corporation
2350 E. El Segundo Boulevard
El Segundo, California 90245-4691

Dear Mr. Pentz:

In December, 1995, two robbery suspects using a facsimile bomb extorted employees at a San Fernando Valley Miller's Outpost store. Los Angeles Police Department, Criminal Conspiracy Section detectives were assigned the case. The detectives learned that these suspects had committed at least 50 similar extortions throughout five Southern California counties.

During the Miller's Outpost robbery, a surveillance camera captured a picture of one suspect. Unfortunately the image was extremely poor and could not be reproduced for identification. Detectives requested image enhancing assistance from Aerospace Corporation, a federal grant funded program, located in the City of El Segundo. You, William Repetto and Ray Talbot successfully enhanced the photos, which ultimately were presented in court as evidence. This defendant was given a sentence of 170 years. The second suspect, not identified on video, resulted in a hung jury. Obviously, your assistance in this investigation played an important role in the apprehension, prosecution and conviction of the suspect.

This is but one example of many investigations where Aerospace Corporation personnel have supported the Los Angeles Police Department. I am grateful for the assistance provided by you and your personnel and hope that this relationship will continue to prosper.

Very truly yours,

BAYAN LEWIS
Chief of Police


DANIEL R. KOEMIG, Captain
Commanding Officer
Detective Support Division

AN EQUAL EMPLOYMENT OPPORTUNITY — AFFIRMATIVE ACTION EMPLOYER



WASHINGTON COUNTY, OREGON
Sheriff's Office

May 15, 1997

Mr. Robert M. Pentz
Principal Director
Law Enforcement and Public Safety Directorate
National Law Enforcement and Corrections Technology Center
2350 E. El Segundo Blvd.
El Segundo, CA 90245-4691

Sir;

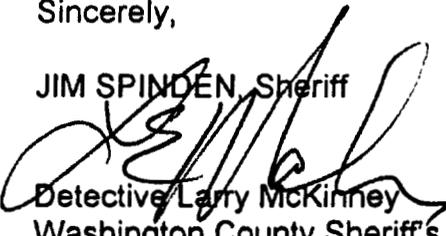
On 02-04-96, Derrick P. Duehren killed his wife and burnt their house to the ground. An investigation was initiated by this agency which resulted in Mr. Duehren's arrest for the murder of his wife and arson of their home. During this investigation an incredible amount of direct physical evidence was examined and I personally found that both the State of Oregon Crime Lab and the FBI Lab lacking in many respects regarding technical experts in the fields of metallurgy and fire cause. As this case went forward, the Defense Team that was hired by Mr. Duehren was able to put forward several theories regarding the fire cause. These were stumbling blocks to the prosecution due to the lack of expertise available to us.

I contacted you well into our investigation and you were kind enough to send me several experts. Dr. Gary Stupian and Dr. Wei Kao were among them and were the primary experts working on our case. These two gentlemen were able to give us technical and scientific information and examinations of evidence that enabled us to conclusively eliminate several of the Defense's theories. I credit these gentlemen with a significant contribution toward the successful prosecution of Mr. Duehren and bringing justice for the victim, Roxanne Duehren, and her family.

I would like to thank you for your overwhelming support and thank Gary and Wei and all the people from your organization that were involved in this case.

Sincerely,

JIM SPINDEN, Sheriff


Detective Larry McKinney
Washington County Sheriff's Office

Jim Spinden, Sheriff

150 North First Avenue, MS 32, Hillsboro, OR 97124-3072
phone: (503) 648-8700 • fax: (503) 648-8610



Matanuska-Susitna Borough

DEPARTMENT OF PUBLIC SAFETY

680 NORTH SEWARD MERIDIAN PARKWAY, WASILLA, ALASKA 99654

EMERGENCY SERVICES: (EMS, FIRE AND RESCUE) (907) 373-8800 / FAX (907) 376-0799
ANIMAL CONTROL: (907) 746-5500 / FAX (907) 746-6683

May 12, 1997

Robert Pentz, Director
NLECTC
2350 East El Segundo Boulevard
El Segundo, California 90245

Dear Mr. Pentz:

This letter is to follow up on a discussion I had with Mike Epstein of your office. Mr. Epstein was very helpful in explaining the assistance to our community that could be available and the services your organization provides. Our Borough encompasses over 23,000 square miles with a population of approximately 51,000. During the summer this number can easily double on busy weekends as we are on of the primary tourist and recreation areas in Alaska.

Our present communications systems for law enforcement, Fire, EMS and disasters is aging and in need of replacement. Although we realize the need for change, we do not have the technical and design expertise to develop a needs based replacement system. From the discussion with Mr. Epstein your organization can and appears willing to provide us with that expertise and assistance.

On behalf of the Matanuska-Susitna Borough and the cities of Wasilla and Palmer we would like to formally request NLECTC assistance with a review and assessment of our current communications and information systems and assistance in the development of a new system. Mr. Epstein stated he would be available the week of June 2, 1997 to meet with us and collect the necessary data.

I will be available as the initial point of contact for the project, however, all of the system users will be fully involved in the review process and any decisions on system changes. On behalf of our community and the emergency service users, I appreciate your help and assistance to us.

Robert Pentz
Page 2
May 12, 1997

Please feel free to contact me regarding the site visit or any other details that may be required prior to the visit.

Sincerely,



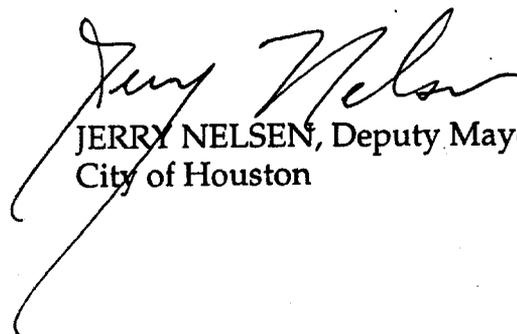
KEVIN KOECHLEIN, Director
Public Safety Department



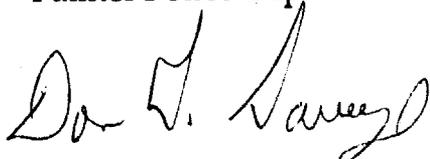
CHARLES FANNON, Chief
Wasilla Police Department



MIKE LAMB, Chief
Palmer Police Department



JERRY NELSEN, Deputy Mayor
City of Houston



DON SAVAGE, Captain
Alaska State Troopers



POLICE DEPARTMENT

237 W. COMMONWEALTH AVE. • FULLERTON, CA 92832-1881 • (714) 738-6800 • FAX (714) 738-0961

PATRICK E. MC KINLEY CHIEF OF POLICE

April 22, 1997

Michael Epstein, Program Manager
National Law Enforcement & Corrections
Technology Center – Western Region
2350 E. El Segundo Blvd., M1/300
El Segundo, CA 90245-4691

Dear Mr. Epstein:

On March 23, 1997, an attempted homicide occurred in the city of Fullerton. The victim was followed home from his place of employment in the city of La Habra and was shot four times at his front door. The suspects were filmed on videotape in the victim's place of employment (Hometown Buffet Restaurant).

Detective Bova took the video to the National Law Enforcement Technology Center in El Segundo to have the video enhanced. Photographs were produced to show the victim, and/or witnesses. You quickly assisted our Department and then turned us over to the Project Engineer, William Repetto. The photographs produced from the video were instrumental in this investigation. That photograph, coupled with additional information and photographs, led to the arrest of the "shooter" in this incident. The video and photographs are still being shown to various law enforcement agencies in an effort to identify the second suspect in this case.

We appreciate the great work your staff performed in this case. Because of the technical expertise of your Center, a very dangerous shooter is in custody. Your efforts are recognized and greatly appreciated.

With best regards,

PATRICK E. McKINLEY
Chief of Police

PEM/SMM:rk



MAYOR
Miguel A. Pulido
MAYOR PRO TEM
Robert L. Richardson
COUNCILMEMBERS
Tony Espinoza
Brett Franklin
Thomas E. Lutz
Patricia A. McGuigan
Ted R. Moreno



CITY OF SANTA ANA
POLICE DEPARTMENT
60 CIVIC CENTER PLAZA • P.O. BOX 1981
SANTA ANA, CALIFORNIA 92702

CITY MANAGER
David N. Ream
CITY ATTORNEY
Joseph W. Fletcher
CLERK OF THE COUNTY
Janice C. Guy

April 9, 1997

Director Robert M. Pentz
National Law Enforcement & Corrections
Technology Center - Western Region
2350 E. El Segundo Blvd.
El Segundo, Ca. 90245-4691

The Santa Ana Police Department would like to take a moment to thank the members of the National Law Enforcement & Corrections Technology Center - Western Region, for your interest in assisting the Santa Ana Police Department, C.O.P. Task Force with technical advice which might provide better service to the citizens of Santa Ana.

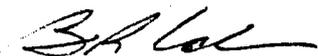
Your support and technical expertise are greatly appreciated, therefore, the Santa Ana Police Department request your continued support and assistance with the assessment of electronic surveillance equipment (recording devices, surveillance vehicles and night vision technologies).

Due to recent events, we are also requesting the logistical support in locating and obtaining an armored personnel carrier along with transitional assistance for operational deployment.

Once again if there is any way the Santa Ana Police Department can be of any service to you, please feel free to contact us.

Sincerely,

Paul M. Walters
Chief of Police


Bruce R. Carlson
Captain of Police
Field Operations Division

LOS ANGELES POLICE DEPARTMENT

WILLIE L. WILLIAMS
Chief of Police



RICHARD J. RIORDAN
Mayor

P.O. Box 30158
Los Angeles, Calif. 90030
Telephone:
(213) 237-1310
Ref #: 5.6

February 18, 1997

Michael Epstein
Program Manager
The Aerospace Corporation
2350 East El Segundo Boulevard
Suite M1/300
El Segundo, California 90245-4691

Dear Mr. Epstein:

On January 11, 1997, Igor Razilov was tragically murdered during the robbery of the Union Pawn Shop in Los Angeles, California. The event was captured on video tape, however, the quality of the video tape was poor. Detectives having attended a seminar presentation in the past demonstrating the capabilities of The Aerospace Corporation, requested technical assistance in reviewing the video tape for enhancement purposes. William Repetto, was able to produce clear color images of the suspects and events, formally not recognizable. His assistance in reviewing and lending his expertise in this investigation has proven useful and beneficial in evaluating leads of possible suspects.

The service provided by The Aerospace Corporation is an essential tool in modern police work. With the prolific use of video tape by numerous businesses and private citizens, the quality of the images are not always optimum. It is refreshing to have the technology and necessary expertise available to develop fruitful investigative leads.

Very truly yours,

WILLIE L. WILLIAMS
Chief of Police

A handwritten signature in cursive script, appearing to read "Julie Nelson".

JULIE NELSON, Lieutenant
Acting Commanding Officer
South Bureau Homicide





**HAINES POLICE DEPARTMENT
CITY OF HAINES, ALASKA**

P.O. BOX 1049
HAINES, ALASKA 99827
(907) 766-2121

December 16, 1996

Robert Pentz, Director
National Law Enforcement & Corrections Technology Center
The Aerospace Corporation
2350 E. El Segundo Blvd.
El Segundo, CA 90245-4691

Dear Bob:

About eight months ago at one of the NLECTC-WR meetings I heard discussion about the high cost of individual departments purchasing vehicles, supplies, etc.

During this time you mentioned the possibility of departments possibly working together to combine quantities they need to hopefully get a better unit price.

I returned to Alaska and contacted the Alaska State Troopers and the State of Alaska Department of Transportation. They allowed me to piggy back my patrol unit needs onto their State of Alaska vehicle bid. They also allowed me to purchase vehicle tires thru their State Bid.

I realized about a \$2,500. savings on my patrol unit and our city saved about twenty dollars per tire based on the old way of doing things.

During tough financial times like we are all going thru, it will be tactics like this which helps us survive. This opportunity probably exists in other states and could represent a real saving for small departments. I credit the Technology Center with my being able to stretch my budget and still end up in the black.

Thank you for the idea and for caring enough to make a difference.

Sincerely:

Charlie Fannon (lme)

Charlie Fannon
Chief of Police

DCF:lmr

LOS ANGELES COUNTY DISTRICT ATTORNEY'S OFFICE
BUREAU OF BRANCH & AREA OPERATIONS

GIL GARCETTI • District Attorney
SANDRA L. BUTTITTA • Chief Deputy District Attorney
FRANK E. SUNDSTEDT • Assistant District Attorney

ROGER J. GUNSON • Director
Region I

November 22, 1996

Janet Reno,
Attorney General
Washington, D.C.

Re: People v. Charles Edgar Rathbun, #YA026602
National Law Enforcement and Corrections Technology Center -
Western Region

Dear Ms. Reno,

I have been assigned for the past eleven months to prosecute the above-mentioned case, and during that time, have worked closely with technical personnel at the National Law Enforcement and Corrections Technology Center - Western Region.

This was a very high profile case in which a photographer was charged with the murder and sexual brutalizing of a model he was photographing. This particular case seemed to be, at the initial stages of investigation, only the tip of the iceberg of potential cases involving the suspect, and it was very important that our case be strong and thorough. The Law Enforcement and Corrections Technology Center - Western Region provided expertise that helped to prove to the jury that the defendant lied during his defense, and the defendant was convicted.

I was previously unaware of the services and technological advancements that the Center offered, and I have been very pleased with their response and work product. I am also very glad that this resource is becoming available to the local criminal justice system through sponsorship and grants from the Department of Justice. As the technical world becomes more available to the criminal, it is necessary that law enforcement and the justice system have the tools and resources to effectively combat this trend, and these Centers are a timely addition to our arsenal. Based on my experience in this case, the formation of the NIJ - funded Western Regional Center is a step in the right direction.

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825 Maple Avenue
Room 190
Torrance, CA 90503-5098
(310) 222-3552

Janet Reno
11/22/96
Page two

The individuals I worked with -- Donald Buchwald, Larry Jansen, Ray Talbot and Bill Repetto very graciously contributed their time and effort to assisting the prosecution in the Rathbun case, and each has been an enormous help.

Thank you very much for all of the support and assistance you have provided me via this valuable organization. I can only say that I have been fortunate to work with such talented and dedicated people, and I look forward to having the opportunity to interact with the National Law Enforcement and Corrections Technology Center Western Region the future.

Very truly yours,

GIL GARCETTI,
District Attorney of
Los Angeles County, by


Mary-Jean Bowman,
Deputy District Attorney

c: Robert Pentz, National Law Enforcement and Corrections
Technology Center - Western Region



SHERMAN BLOCK, SHERIFF

County of Los Angeles
Sheriff's Department Headquarters
4700 Ramona Boulevard
Monterey Park, California 91754-2169



October 23, 1996

Mr. Robert Pentz, Director
National Law Enforcement and Corrections Technology Center--
Western Region
c/o The Aerospace Corporation
2350 El Segundo Boulevard
El Segundo, California 90245-4691

Dear Mr. Pentz:

I would like to personally thank you for recently providing assistance to investigators from the Homicide Bureau of the Los Angeles County Sheriff's Department on a particularly brutal murder involving four family members in the City of Baldwin Park. On very short notice, you arranged a meeting with technicians from the National Law Enforcement and Corrections Technology Center--Western Region/Aerospace Corporation, which had positive results in solving this crime.

A video image from a local bank, where the possible suspect used an ATM card stolen from the scene of the crime, was available, but our "Tech Crew" was unable to sufficiently produce a clear enough image to aid the investigators' efforts to identify the suspect. Mr. Bill Repetto and Dr. Ray Talbot were instrumental in the successful outcome of this investigation. Working all afternoon and into the early evening, they were able to produce both enhanced and enlarged frame-by-frame images of the original video depicting the actions of the female suspect. Based on their effort and the exceptional results, Deputy Elizabeth Smith reported that they were able to obtain a positive identification of the suspect. Unfortunately, the suspect has since fled the country to Mexico. The FBI has been notified, and they believe an arrest in the case is forthcoming.

This spirit of cooperation and exceptional effort is truly appreciated. On behalf of the involved members of the Los Angeles County Sheriff's Department, we thank you and look forward to our continued beneficial association.

Sincerely,

SHERMAN BLOCK
SHERIFF

A Tradition of Service



CITY OF INGLEWOOD CALIFORNIA
ONE MANCHESTER BOULEVARD / INGLEWOOD, CALIFORNIA 90301-1750

TELEPHONE (310) 412-5200 • FAX (310) 412-8798

POLICE DEPARTMENT

OLIVER M. THOMPSON
CHIEF OF POLICE

JAMES E. SEYMOUR
CAPTAIN

JON A. OLIVER
CAPTAIN

September 23, 1996

JOHN R. FRAZIER
CAPTAIN

MARK F. WEINBERG
ADMINISTRATIVE SERVICES COMMANDER



Director Robert Pentz
National Law Enforcement and Corrections Technology Center
2350 E. El Segundo Blvd. - M1/300
El Segundo Ca. 90245

Dear Mr. Pentz

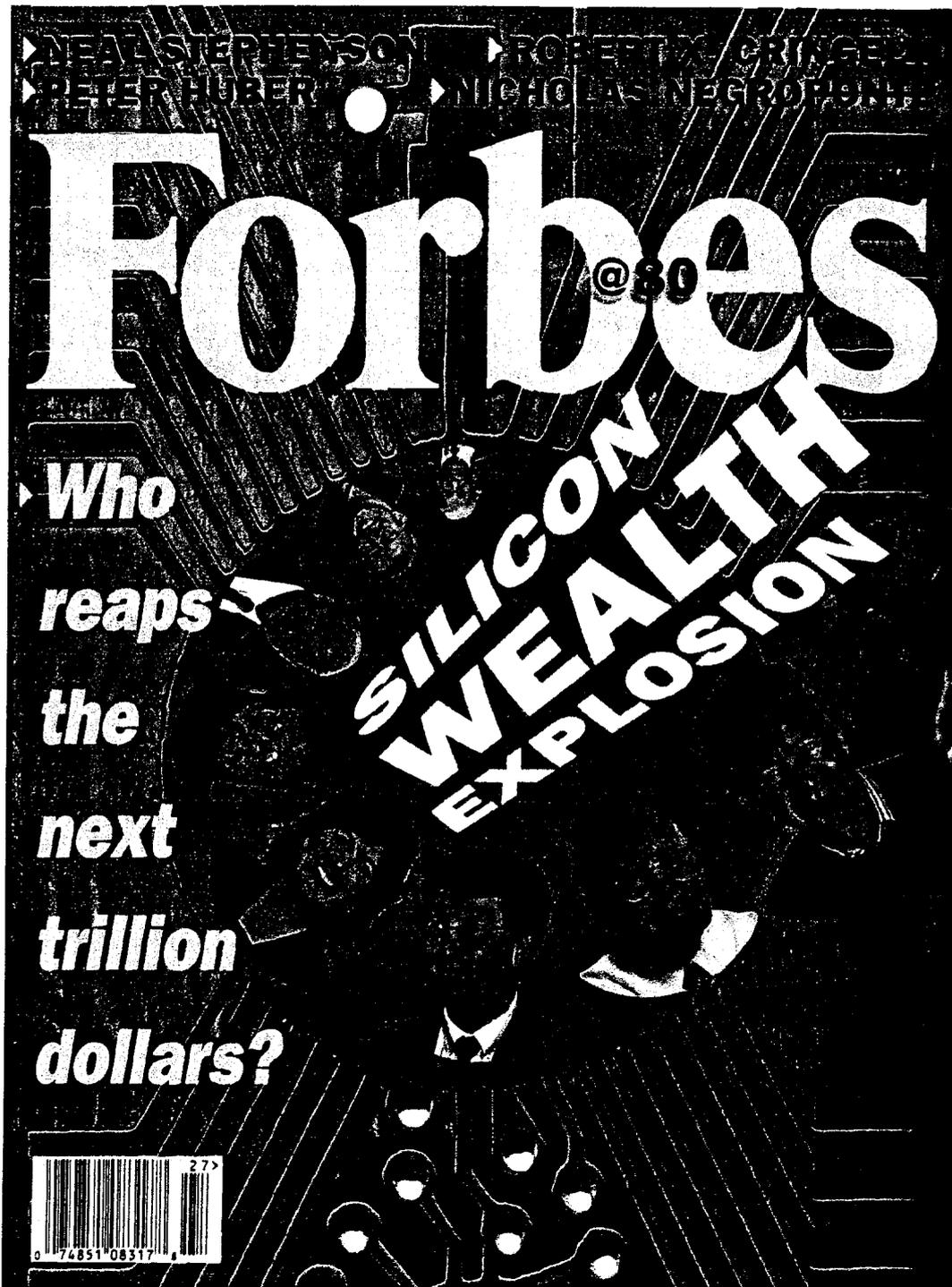
I would like to thank you and **Mr. Robert G. Repetto** for assisting the Inglewood Police Department in solving a homicide case. Inglewood Police Investigators obtained a very poor quality video tape which showed the suspects inside the business where the murder took place. With the technology of your organization and Mr. Repetto's resourcefulness and skill, the video tape was sufficiently enhanced so that Investigators were able to identify one suspect and the murder weapon. The enhanced video tape is a key element of the case and will provide the District Attorney's Office with powerful evidence.

Mr. Repetto is to be commended for his professionalism and enthusiasm. The successful clearance of this case would have been in jeopardy without his expertise. Please extend my gratitude to Mr. Repetto.


OLIVER M. THOMPSON
CHIEF OF POLICE

Appendix 3
Forbes Article

In July 1997, one year into the period of performance for this cooperative agreement, Forbes magazine published an article about the use of technology in law enforcement. That article made reference to the NIJ Center system and to the Western Center in particular. The article is interesting in its capturing of thoughts that were prevalent at that time, relative to the use of technology by law enforcement agencies. It is presented here with permission of Forbes.



Reprinted by permission of Forbes Magazine © 2001 Forbes Inc.

Robocop

You're on camera! Knowing that, how many killers, thieves and kidnapers would carry on? Technology may do more than tough judges or cops to cut crime.

By Srikumar S. Rao

1:03 p.m.: SERGEANT Gregory Lewis of the College Station, Tex. police department receives the call in his car while cruising on Highway 6. Carjacking and kidnaping at the Post Oak Mall.

1:08 p.m.: Screeching to a halt in front of a department store, Sergeant Lewis separates a distraught woman from the gathering crowd. She had strapped her 5-year-old into the back seat and was entering the driver's seat of her Camry when two men came alongside. One yanked her out and hurled her to the ground. Both got into the car and sped away with her child screaming in the rear.

There are eyewitnesses, and Sergeant Lewis takes quick descriptions of the carjackers. The mother has a wallet-size photo of her daughter, and he scans it into his handheld PC. The image is instantly digitized and enlarged. Software enables him to come up with composite drawings of the criminals based on the eyewitness descriptions. The pictures are transmitted to dozens of patrol cars.

1:29 p.m.: State Trooper Clay Taylor pulls into a truck stop in Hearne, 20 miles away. He ambles through the restaurant, mentally comparing faces with the pictures spewed out by his onboard printer. A burly, overwrought man who is sweating profusely looks like a close match. Taylor shoots the man with an inconspicuous video camera. Wireless

links transmit the images to the computer in his patrol car and then to headquarters.

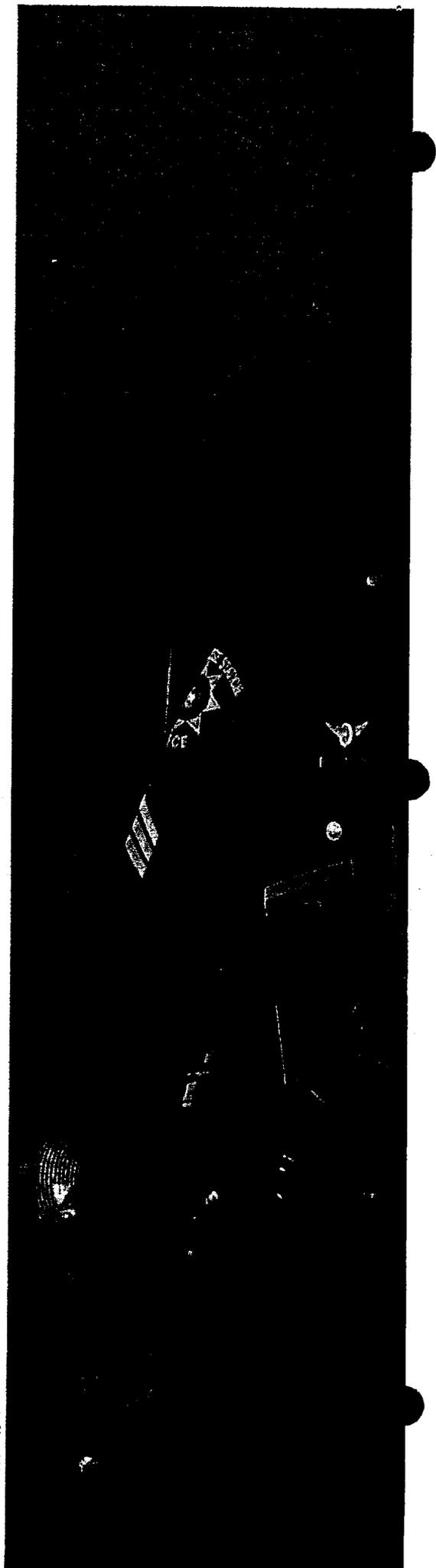
1:31 p.m.: "That's him!" screams the woman, looking at the likeness of the burly man on a television screen at the police station. A computer takes dozens of facial measurements—such as the distance between his eyes—and compares them with a federal database of known felons. Three minutes later it has a match. The burly man is wanted in Montana for armed robbery and manslaughter.

1:37 p.m.: The burly man emerges from the restaurant and gets behind the wheel of a Mercury Sable. Beside him is an accomplice. There is a figure in the rear. The face of a small girl appears above the back seat, and the accomplice forces her down. Taylor rushes to his car and punches in the license number of the Sable. A database reveals that it was reported stolen ten minutes ago.

As the Sable pulls out of the truck stop, Taylor pursues it at a distance. He's not going to pounce until he has some backup. He uses radar to track the car and a satellite positioning system to transmit his location to a police dispatch system. The dispatch officer plots an interception.

1:46 p.m.: The Sable runs over a thin hose rolled across the highway, triggering a powerful electromagnetic pulse that disables its ignition and engine-control electronics. It coasts to a halt 200 feet away. From behind a clump of trees close to where they knew the car would stop, police officers bombard the Sable with a pul-

Srikumar S. Rao is chairman of the marketing department at the C.W. Post campus of New York's Long Island University.



JAMES MCGOWN

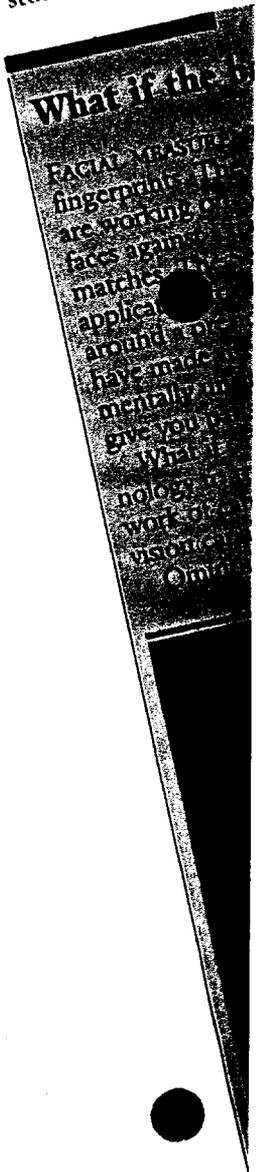




sating green laser that naus
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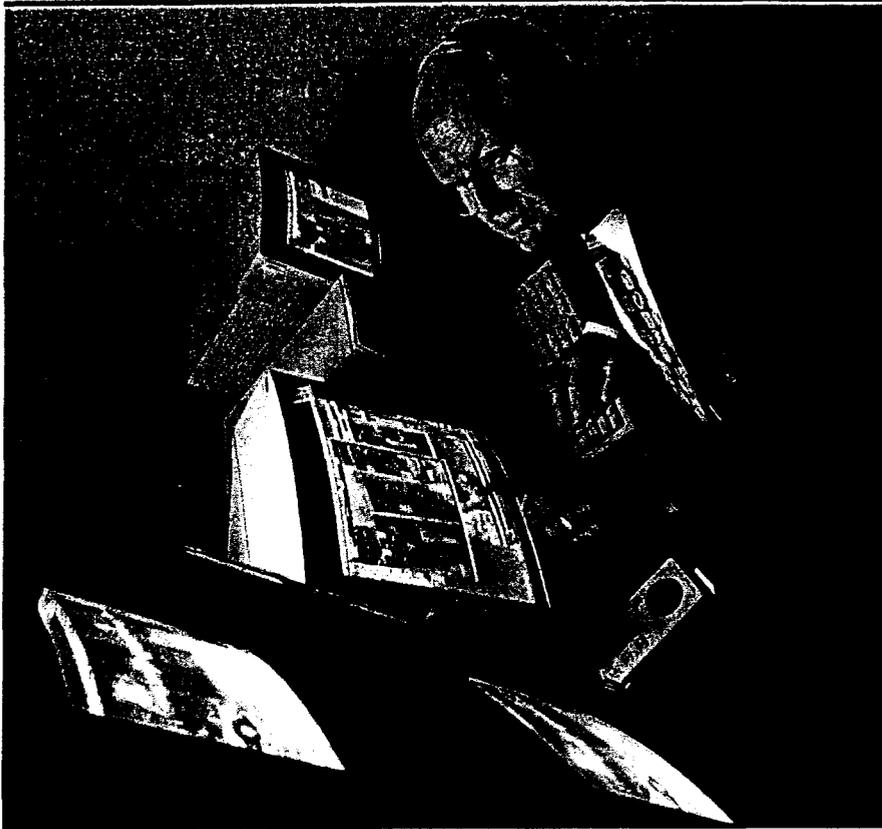
Elapsed time between
 and capture: 48 minutes

Postscript: The burly
 panion is wearing a gol
 photograph of the br
 puter-matched with
 stolen objects. It was



What if the

RACIAL MEASUREMENTS
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VIEN EWANS

equipment that Wyatt Earp did," says David Boyd, director of the Office of Science and Technology for the National Institute of Justice. "Television series that show police using exotic gadgets do not reflect reality."

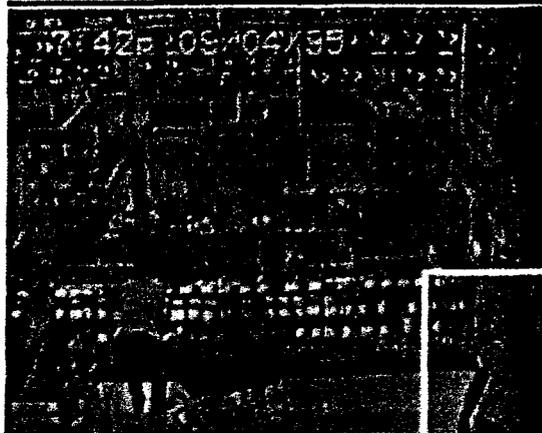
David Boyd's office, formed in 1992, is trying to bring law enforcement into the next century. It is piggybacking on research done by the Department of Defense and other federal agencies. It has also set up a network of law enforcement research centers tucked within federally funded research institutions like the Aerospace Corp. in El Segundo, Calif. and Rome Laboratory, in Rome, N.Y.

While the episode described above was imaginary, there have been less dramatic real-life successes with computer-aided crime detection. Two years ago an 8-year-old we'll call Yolanda was playing in an alley outside her home in Whittier, Calif. when a man grabbed her, covered her mouth, put her in his car and sped away.

Twelve hours later a sexually molested Yolanda was released within a block of where she was picked up.

"She is an amazing kid," says Sergeant Edward Childs of the Whittier police department. "She remembered street signs, highways and other details of where she had been taken." Yolanda helped Childs locate a Target store where the molester had bought her a stuffed bear to quiet her. The security cameras in the store had picked up the man and the girl as they visited several departments. Alas. "They were grainy, poor-quality images," recalls Childs. "We just couldn't get a recognizable mug shot that we could distribute."

The police went to researchers at Aerospace Corp. for help. "We digitized the images, analyzed them on a computer, manipulated the contrast and brightness," says Robert Pentz, director of the Law Enforcement



THE WHITTIER CALIFORNIA POLICE DEPT.

Lawman Robert Pentz; images enhanced from grainy surveillance photos

The little girl remembered enough to nail the kidnapper.

efficient to strike out at bad guys while the trail is still warm.

Unfortunately we are not there yet. Says William Baker, a manager at the Federal Highway Administration who is helping to design this law enforcement system of the future: "We don't have the networks or the databases or the search software in place. But the technology is available, and we are working to bring it all together."

Time to get moving on it. There are waits while suspects are identified, offenders tracked, results of forensic

tests obtained and warrants issued. Coordination between different agencies, each of which has some knowledge about a crime or criminal, takes too long. Some of this is caused by bureaucracy. More is caused by a lack of technology that most businesses take for granted.

"He might come to you in a car and use a radio, but the typical law officer today basically carries the same





Center at Aerospace. "We came up with a usable photograph within 48 hours." It was released to the media. Allen Eugene Nedrow, on parole for child molestation, was recognized by his parole officer and picked up the same day. He was sent back to prison on a 42-year sentence.

Something as mundane as a relational database can pay dividends for police. The Oxnard, Calif. police department created a database of gang members, with names, addresses, phone numbers, photos of tattoos, nicknames, names of associates, cars, criminal records of family members, distinguishing scars, drug habits and, in some cases, details of every encounter with the law and school records.

"In one instance one of our gang members was involved in a homicide in Santa Barbara," explains Cheryl Garcia, gang offender case manager. "[This system] helped us identify and locate him in a hurry. In another, a gang member denied in court that he was one. We were able to fish out photographs of him in gang regalia to refute this."

There was, until recently, an excuse for crummy electronics in law enforcement: lack of money. That's no excuse anymore. Moore's law has made everything with a transistor in it

Sensor mounted on a plane; narcotics agents manufacturing methamphetamine in a test

Big Brother is sniffing.



Crime control: vendors to watch

Company	Headquarters	Products	Web (www.)
Nanogen	San Diego, Calif.	Genetic sample processing; DNA microchip	nanogen.com
Foster-Miller	Waltham, Mass.	Less than lethal net projectile	foster-miller.com
Miros	Wellesley, Mass.	Facial recognition systems	miros.com
Jaycor*	San Diego, Calif.	Automobile arrestor; acoustic weapon detector	jaycor.com

ever cheaper.

Imagine how just two electronic technologies—wireless communications and video cameras—could make a serious dent in street crime in a big city. Suppose, for example, that every

subway car were outfitted with 10 video cameras and 20 panic buttons. When a button is pressed, the cameras transmit pictures to a police dispatching station. If something doesn't look right, police meet the train at the next station.

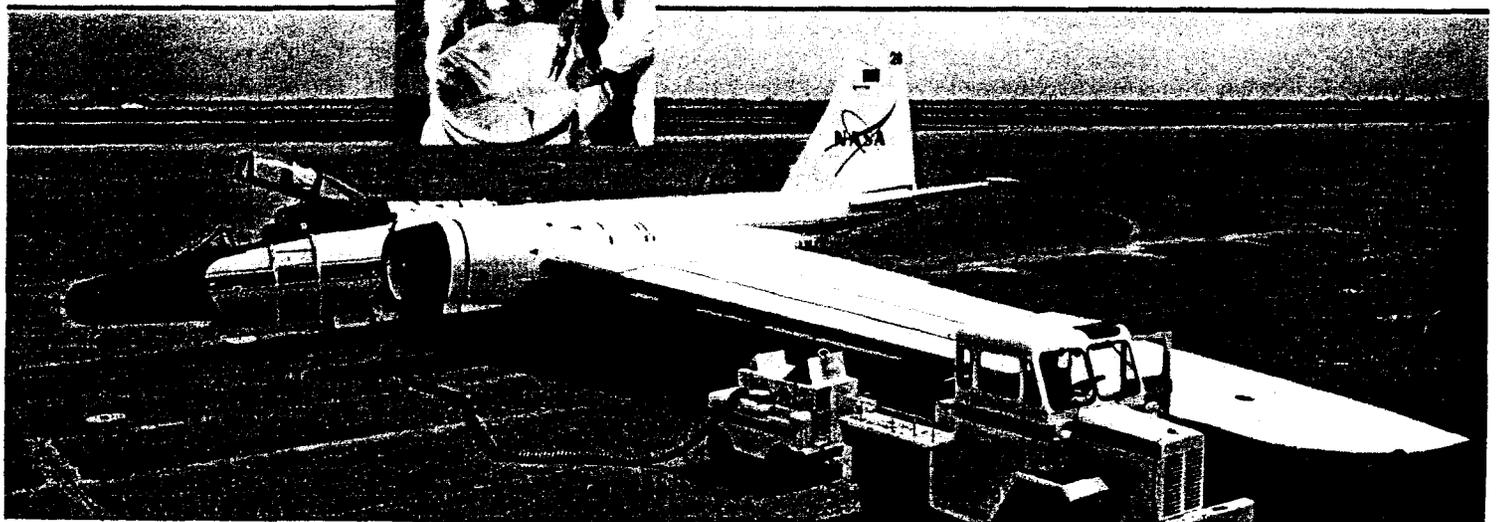
Or imagine this. Cab drivers buy cameras and display screens for the backs of their cabs. A neural network detects threatening moves—such as pulling out a knife or a gun—and switches on the camera, which beams images to a police station. Instantly the passenger is in a videoconference with

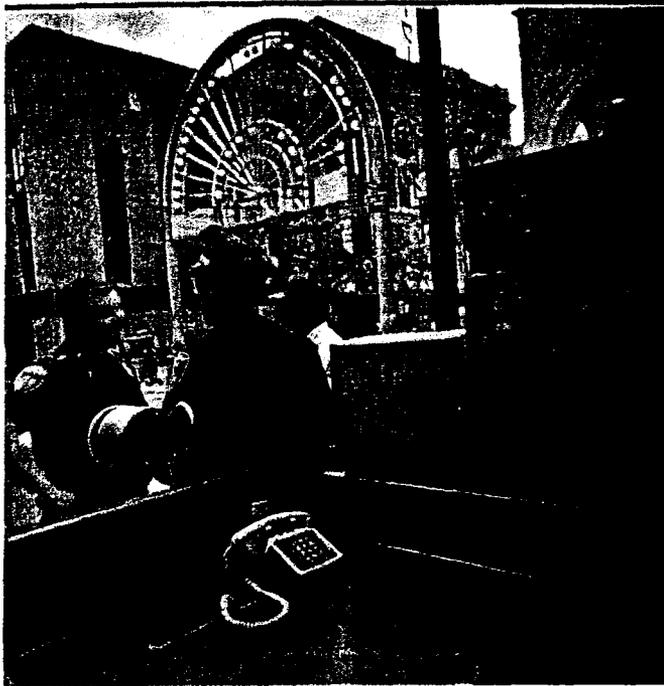
the police sergeant. With the camera on him and the cop watching, does the crook still want to do a holdup? Possibly, but less likely.

Here's another idea. In a section of town where felony rates are high, you equip every resident with a cellular wrist alarm. These cheap transmitters would work off existing cellular phone networks. If any mugging victim or bystander presses the two buttons on his alarm within a two-second interval, his position and identity are transmitted to a police computer, which dispatches the nearest patrol car. If a lot of people had these things, there would be fewer happy muggers on the streets.

Exotic electronic devices like these are suddenly affordable. You can get a decent video camera for \$400. A cellular alarm would be like a beeper working in reverse and no more expensive. U.S. taxpayers, who already spend \$28 billion a year on police salaries, might be willing to spend a few billion more on electronics. Perhaps, if they were sufficiently fed up with street crime, they could even find a way to overcome the

PHOTOGRAPHS BY GARY HARTER / AEROSPACE CORP





Electronic surveillance in downtown Baltimore

The eyes may be as good as street lamps.

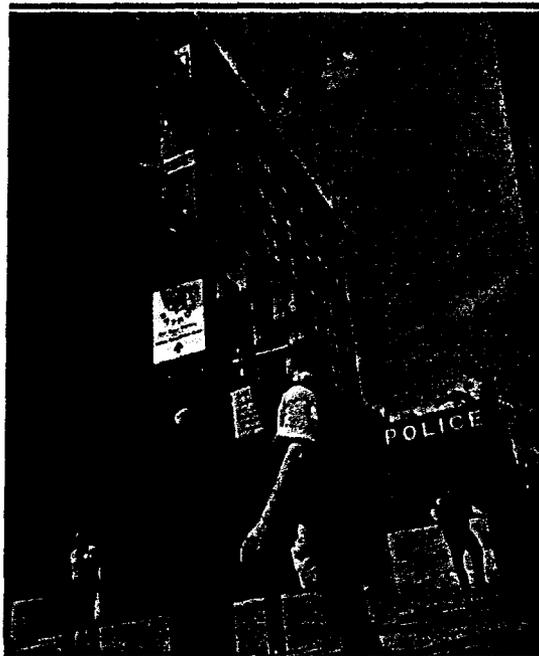
inevitable court challenges to anything that helps the police.

Shimmering on the horizon are entirely new methods of detecting crimes, identifying criminals, protecting police officers and incapacitating violent offenders.

■ Aerospace Corp. has developed methods of identifying molecular effluents, using remote infrared spectral monitoring and related technologies. A modification of the means used by the military to detect chemical warfare deployment and the like, these methods let police officers detect chemical plumes released during cocaine processing or methamphetamine production.

■ Downtown Partnership, a public/private not-for-profit group, together with the Baltimore police department and the Mass Transit Administration, launched a video patrol operation covering 16 blocks in a heavily trafficked area in downtown Baltimore. Sixteen conspicuously mounted cameras survey public areas, with images beamed to a police monitoring site. Property crime has recently declined by 50% in the area.

■ Military technology developed to detect snipers has been modified for civilian law-enforcement use. Sensitive microphones are mounted on utility poles and in public locations of



PHOTOGRAPHS BY MANUELO PAGANELLI

a city where shots in the night—or even in the daytime—are commonplace. The sound of a shot reaches different microphones at different times, and the system can pinpoint its location by complex calculations.

A two-month test of such a system, which placed approximately 80 microphones in a square mile in Dallas, found that, in at least one instance, faster police response enabled law enforcement officials to

identify witnesses who might otherwise have disappeared.

■ Scientists have produced a prototype computer chip that can greatly accelerate DNA testing. Goal: Match DNA from a crime scene with DNA from a suspect within minutes—instead of days.

■ The National Institute of Justice is working with the Department of Defense and private firms to develop technology—to be used in hostage situations and drug raids—that will permit police officers to see through walls. Penetrating radar, ultrasonic acoustic imaging and infrared thermal imaging are some methods being investigated. Some prototype devices can provide pictures of what is on the other side of several feet of concrete.

Variations of these technologies, and others such as X rays and electromagnetic wave detection, have led

to sophisticated methods of detecting concealed guns and knives from as far away as 30 feet. Assuming the courts go along with such scanners, it would be hard for a hoodlum to walk undetected down the street carrying a weapon.

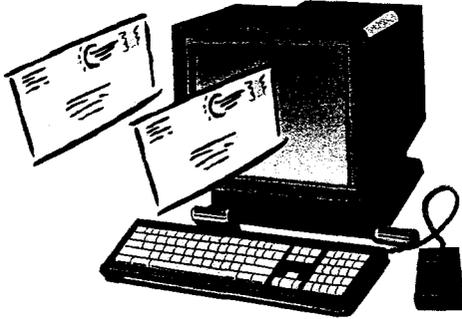
Can financially strapped police departments afford all these gadgets? Where they can't, what's to stop public-spirited citizens and businesses from putting up private funds? What hurts crime helps business.

Will criminals make use of technology as quickly as the good guys do? Good question. The best answer is that the really smart rotten people after big stakes will use the gadgets.

But most criminals are neither smart nor affluent. When it comes to firearms, a low-IQ criminal is about as well-equipped as police departments and many store owners. But the technology arms race begins to be very lopsided beyond that point. Street hoodlums do not tap into databases or use electronic countermeasures.

Computer technology, in short, should be able to more than tip the balance toward the law-abiding. ■

Appendix 4 E-Mail Broadcast System



The NLECTC-West has developed an e-mail broadcast system as part of its Center outreach service. This system has been established so that the Center can broadcast timely information to subscribers and use the subscribers to assist with questions about technologies in use at various agencies within the Western Region. The NLECTC E-mail Broadcast System (NEBS) uses Center-developed software to

- Categorize subscribers
- Manage the category list
- Manage subscribers' information
- Transmit information via e-mail according to the category list
- Manage transmitted data
- Keep statistics on the message volume.

NEBS has a current subscriber list of about 1,853 names. On a weekly basis, these subscribers receive the NLECTC Weekly Newsletter as a rebroadcast from the National Center. Further, news items of interest and publication announcements are broadcast as they become known. NEBS is extremely valuable for asking subscribers for information. As an example, if some law enforcement practitioner wants to know who has any knowledge about a particular item or process, NEBS will e-mail subscribers for their answers. Usually, responses are received within hours. In one case, an Oregon agency requested information regarding PC software that could be used to manage a 20-bed jail. Within a day, the requesting agency received information from five agencies in three other states. Since subscribers are categorized according to their interests, no subscriber receives information or requests for information unless their profile indicates an interest in that area.



NLECTC - West

National Law Enforcement and Corrections Technology Center
A Program of the National Institute of Justice

Emails will be provided for information purposes only. These messages are not intended to bias your views and do not necessarily represent the views of any or all of the members of the NLECTC-West staff.

First name	
Last name	
Title	
Agency / Company	
Street address	
City	
State/Province	
Zip/Postal Code	
Country	
Phone	
Fax	
E-mail address (preferred)	

Subscription Categories

- | | | |
|---|--|--|
| <input checked="" type="checkbox"/> NLECTC Newsletter | <input type="checkbox"/> Education / Training | <input type="checkbox"/> Crime Mapping |
| <input type="checkbox"/> Police Chief | <input type="checkbox"/> Intelligence | <input type="checkbox"/> Information Technology |
| <input type="checkbox"/> Sheriff | <input type="checkbox"/> Fire / Arson | <input type="checkbox"/> Prosecutorial |
| <input type="checkbox"/> Warden | <input type="checkbox"/> State Police / Patrol | <input type="checkbox"/> White Collar Crime |
| <input type="checkbox"/> Law Enforcement | <input type="checkbox"/> Counter Terrorism | <input type="checkbox"/> Community Policing |
| <input type="checkbox"/> Corrections / Custody | <input type="checkbox"/> Gangs | <input type="checkbox"/> Asset Foreiture |
| <input type="checkbox"/> Forensics | <input type="checkbox"/> Hazmat | <input type="checkbox"/> Crime Prevention |
| <input type="checkbox"/> Communications | <input type="checkbox"/> Drugs / Crime | <input type="checkbox"/> Probation / Parole |
| <input type="checkbox"/> Industrial Security | <input type="checkbox"/> SWAT / Weapons / LTL | <input type="checkbox"/> Juvenile Justice |
| <input type="checkbox"/> Electronic Crime | <input type="checkbox"/> Bomb Squad | <input type="checkbox"/> Family Violence |
| <input type="checkbox"/> Tribal Policing | <input type="checkbox"/> School Safety | <input type="checkbox"/> Transportation Security |
| <input type="checkbox"/> Organized Crime | <input type="checkbox"/> Air Support | <input type="checkbox"/> Excess Property |
| <input type="checkbox"/> Location & Tracking | <input checked="" type="checkbox"/> Emergency Management | <input type="checkbox"/> Grants Information |

NEBS has been very well received by subscribers and has proven to be a useful tool in the accomplishment of the Center's outreach service mission.

Since its inception, NEBS has

- Acquired 1,853 names
- Developed 69 categories
- Transmitted 440 messages, producing about 20,000 e-mails per month.

A sample of the online subscription form is shown below. It indicates the variety of subscriber categories that can be checked by the subscriber to focus his or her interest areas.

Appendix 5

Conference and Symposia Presentations

The NLECTC-West has made presentations at numerous conferences and symposia during its operation. The table below contains a partial list of these conferences and symposia.

Agency	Year	Agency	Year
Agora Security Administrators	1998,1999	L.A. South Bay Industrial Security	1997
Air Force Intelligence Agency	1997	Long Beach, CA Police Department	1998, 1999
Alaska Police Chiefs Annual Meeting	1996	Los Angeles County Criminal Justice Coordinating Committee	1998
Association of Professional Law Enforcement		Los Angeles County Security Administrators	1999
Emergency Response Trainers (ALERT) Annual Meeting	1998	Los Angeles Police Department Command Staff	1997
Burkhalter Panel (Wireless Interoperability Presentation)	1997	Los Angeles Police Department Crime Lab Director	1998
California Association of Crime Lab Directors	1998	National Association for Justice Information Systems	1996
California Association of Criminalists	1997	National Sheriff's Association Conference	1999
California League of Cities	1999	NIJ Concealed Weapons Detection Meetings	1998, 1999
California National Guard (National Interagency Counterdrug Institute)	1997	Office of National Drug Control Policy Technology Fair	1998
California Peace Officers Association Technology Meetings	1997,1998, 1999	Orange County, CA Police & Sheriff's Association	1998
City of Los Angeles Information Technology Agency	1998	Oregon State Police	1998
Concealed Weapons Detection Committee Meetings	1998,1999	Research Security Administrators Association	1998
Congressional Staff Members on National Guard Visit	1997	Salt Lake City, UT Police Chiefs	1999
Delinquency Control Institute	1998	San Francisco Police Department	1998
DOE Technology Support Manager	1999	Santa Clara County HTCIA Meeting	2000
FPED	1999	Santa Clara County, CA Police Chiefs' Association	1999
Forbes Magazine* (see appendix 3)	1997	Southern California Chapter of National Technical Investigators Assn.	1998
Independent Cities Association	1999	Southern California Civilian/Military Investigators	1998
International Association of Chiefs of Police Annual Meeting	1997	State of Alaska Communications Annual Meeting	1999
Janes Conference on Transnational Crime	2000	Sultan, WA Police Department	1997
L.A. City Council Public Safety Chair	1998	UCLA Course Presentation—Forensic Science	1998
L.A. County County Criminal Justice Coordinating Committee	1998	US Air Force Open House—50th Anniversary	1997
L.A. County Foothill Burglary Investigators Association	1999	US Attorney (Los Angeles) Staff	1999
L.A. County Police Chiefs' Technology Committee	1998	US Attorney Law Enforcement Summit	2000
L.A. South Bay Police Training Committee	1998	Washington State Department of Corrections Technology Conference	2000

Appendix 6 Vendor List

An important element of the center's role in disseminating the best technical information available to law enforcement and corrections agencies is its understanding of and contact with various commercial vendors. The information gleaned from these contacts allows the staff to maintain currency on the state of technology, both in and out of the law enforcement and corrections communities. The Center must maintain a delicate balancing act because it cannot endorse or appear to endorse a particular product or manufacturer. The staff, nonetheless, continues to read and understand the product information provided by vendors and attempts to maintain a database of products and some of the information relating to those products.

On the following pages we present a list of vendors and their general category of technology products. When questions arise as to the availability of products to satisfy a particular need, the center is able to assemble a list of those vendors in the database that may satisfy the need requested. In all cases, we ensure that we do not appear to recommend one over another, but merely provide the references to assist the requester in solving a particular problem.

Vendor Database

Number	Vendor	Category	Number	Vendor	Category
1	1st Net Technologies	Other	28	Alert Devices International	Vehicles/Accessories
2	3-D Investment	Corrections—Weapons	29	Alert Systems Corp.	Misc. Hardware
3	A.O.I. Electrical Inc.	Vehicles/Accessories	30	Alexander Batteries	Communications
4	A.R.F. Products	Corrections—Communication Systems	31	Allied	Corrections—Perimeter Security
5	A/Safty Enterprises	Emergency Operations	32	Alpha Group, The	Other
6	Abraxas Technologies	Other	33	Alpha Systems Lab	Corrections—Communication Systems
7	Access Catalog Company	Other	34	Alphametrics Controls	Corrections—Computer Software/Hardware
8	Access Controls	AVI Equipment; Physical Security	35	ALTA Analysis	Misc. Software
9	Accura Technology	Corrections—Weapons	36	Altaris	CAD
10	Accuracy Systems Ordance Corp.	Weaponry	37	Alvarado Manufacturing	Corrections—Perimeter Security
11	Ackerman's Uniforms	Clothing & Armor	38	Amber IR Products	AVI Equipment
12	Acorn	Corrections—Environmental Systems	39	American Electron Products	Corrections—Surveillance
13	AcSys Biometrics Inc.	Facial Recognition	40	American Mobile Satellite Corp.	Communications
14	Action Ammo	Corrections - Weapons	41	American Science and Engineering	Misc. Hardware
15	Adams Electronics USA	Misc. Hardware	42	American Security Fence	Corrections—Perimeter Security
16	Adamson Industries	Vehicles/Accessories	43	Ani Safety Inc.	Corrections—Tactical Equipment
17	Adaptive Digitle Systems	Corrections—Surveillance	44	Ann Arbor Computer	Corrections—Perimeter Security
18	Adroit Systems Inc.	Other	45	AOR USA, Inc.	Communications
19	ADS Instrumentation Abstract Service	AVI Equipment	46	Apogee	Corrections—Surveillance
20	Adtec Incorporated	Corrections—Perimeter Security	47	APUNIX Photo Identification Systems	AVI Equipment
21	Advanced Institutional Management Software	Corrections—Computer Software/ Hardware	48	ARA Communications	Other
22	Advanced Interactive Systems	Training Technology	49	Arbor Software	Misc. Software
23	Advanced Membrane Transducers	Other	50	Ares	Corrections—Environmental Systems
24	Advanced Training Systems	Training Technology	51	ARGO	Other; Weaponry
25	AeroVironment Inc.	Vehicles/Accessories	52	ARINC	Misc. Hardware
26	Aiphone	Corrections - Communication Systems	53	Armament Systems and Procedures Inc.	Weaponry
27	Air Lock	Corrections—Perimeter Security			

Number	Vendor	Category	Number	Vendor	Category
54	Armor Holdings Inc.	Corrections	100	Centech Group Inc., The	Emergency Operations
55	Armour of America	Clothing & Armor	101	Citicorp	Other
56	Armstrong Monitoring Corp.	Misc. Hardware	102	Click 2 Enter	Misc. Hardware
57	ASIS International	Training Technology	103	CML Technologies	911 Systems
58	Association of Public-Safety Communication Officia	Communications	104	Cobra Gun	Corrections—Weapons
59	AT&T	Corrections—Communication Systems	105	Cody Computer Services	RMS
60	AT&T Network Systems	Communications	106	Cognitec	Facial Recognition
61	Atlas/Soundolier	Corrections—Communication Systems	107	Colebrand Limited	AVI Equipment
62	Atmel Grenoble	Biometrics	108	Colt Manufacturing Company Inc.	Weaponry
63	Audio-Technica U.S. Inc.	AVI Equipment	109	Combined Tactical Systems Inc.	Weaponry
64	Aura Systems	Misc. Hardware	110	Communication MFG	Corrections—Computer Software/Hardware
65	AuthenTec, Inc.	Biometrics	111	Communications- Applied Technology	Communications
66	Autocon	Corrections—Environmental Systems	112	Com-Net Ericsson	Communications
67	Automated Access	Corrections—Perimeter Security	113	Compression Labs Inc.	Corrections—Communication Systems
68	Avitar	Misc. Hardware	114	ComPro Systems Inc.	Computer Hardware
69	Backup, The	Training Technology	115	Compu-Capture	AVI Equipment
70	Baldur Systems Corp.	Misc. Hardware	116	Computer Cop	Software
71	BALL-Space Systems Division	Communications	117	Computer Solutions LTD	RMS
72	Baltimore Aircoil	Corrections—Environmental Systems	118	Concord	Corrections—Environmental Systems
73	Barringer Instruments, Inc.	Misc. Hardware	119	Consultants LKG-CMC Inc.	Other
74	Bearcom Wireless Worldwide	Communications	120	Contel Executone	Corrections—Communication Systems
75	Benchmark Enterprises	Corrections—Tactical Equipment	121	Contrac	Corrections—Surveillance
76	Best Lock Corporation	Corrections—Perimeter Security	122	Control Data	Corrections—Surveillance
77	BI	Corrections	123	Control Screening	Misc. Hardware
78	BI Inc.	Corrections—Surveillance	124	Copware Software for Peace Officers	Software
79	Biodynamics Engineering Inc.	Other	125	Corporate Interior Services Inc.	Office Equipment
80	Biometrica Systems	Facial Recognition	126	Correa Enterprises Inc.	RMS
81	Bio-Safe Skin Products	Emergency Operations	127	Court Vision SystemsCommunications	Corrections - Communication
82	Biosite Diagnostics	Corrections—Contraband Detection	128	Crimestar Corp.	RMS
83	Bird Eye Security	Corrections—Communication Systems	129	Cross Match Technologies Inc.	Biometrics
84	BIS Computer Solutions	CAD	130	Crownbridge Industries	Corrections—Surveillance
85	Blauer Manufacturing Co. Inc.	Clothing & Armor	131	Cruisers	Vehicles/Accessories
86	Blueforum	Communications	132	Cuffclip Inc.	Clothing & Armor
87	Bodyguard Restraining System, The	Misc. Hardware	133	C-VIS	Facial Recognition
88	Bolle	Corrections—Tactical Equipment	134	Cyrun	CAD
89	Borsuk, Robert K.	Other	135	D.M. Data	Software
90	Brady Industrial Products	Corrections—Environmental Systems	136	Data911	911 Systems
91	Broadcast and Surveillance Systems	AVI Equipment	137	Datalux Corporation	MDT/MDC
92	Brookdale	Corrections—Tactical Equipment	138	Dataradio	MDT/MDC
93	Butler National	Corrections—Computer Software/Hardware	139	DataVision Head-Up Displays	MDT/MDC
94	CALEA	Other	140	Decision Quest	Software
95	Canon Inc.	AVI Equipment	141	Defense Technical Information Center	Other
96	Capitol Furniture Distributing Co.	Office Equipment	142	Del Norte	Corrections—Perimeter Security
97	Caswell International Corp.	Training Technology	143	DELSY Electronic Components AG	Biometrics
98	CAVPRO	Clothing & Armor			
99	CECO	Corrections - Perimeter Security			

Number	Vendor	Category	Number	Vendor	Category
144	Delta Thermographics	Corrections—Weapons	189	Federal Pacific Reliance Electric	Corrections—Environmental Systems
145	Design Space	Corrections—Environmental Systems	190	Federal Signal Corp.	Misc. Hardware
146	Digatron Inc.	AVI Equipment	191	FINGERPRINT CARDS AB	Biometrics
147	Digital	Computer Hardware	192	First Choice Armor	Clothing & Armor
148	Digital Biometrics Inc.	AVI Equipment	193	FlashPoint Technology, Inc.	AVI Equipment
149	Digital Computer Integration	Computer Hardware	194	FLIR Systems	Night Vision
150	Digital Office Systems	Corrections—Surveillance	195	FN Herstal	Weaponry
151	Digital Solutions Inc.	Corrections	196	FN Manufacturing, Inc.	Training Technology; Weaponry
152	Digital Technologies 2000	Misc. Hardware	197	Folger Adam	Corrections—Perimeter Security
153	Disaster Preparedness Products, Inc.	Corrections—Tactical Equipment	198	Forensic Solutions Inc.	Misc. Hardware
154	Disposable Waste Systems	Corrections—Environmental Systems	199	Forensic Technology Inc.	Forensics
155	Diversified Photo/ Graphics Supply	AVI Equipment	200	Formtek	Crime Mapping
156	DLR Group	Corrections	201	Forrest Tool Company	Corrections—Tactical Equipment
157	Dodgen Mobile Technologies	Emergency Operations	202	G.B. Manchester	Corrections—Computer Software/Hardware
158	Dominion Wireless Inc.	Communications	203	Gamber-Johnson Mounts	MDT/MDC
159	Draik Company	Corrections—Environmental Systems	204	Geac Computer Corporation Limited	CAD
160	DRS Hadland Inc.	AVI Equipment	205	Gelco Space	Corrections—Environmental Systems
161	E Team	RMS	206	General Electric	Corrections—Surveillance
162	e2e, Inc	CAD; RMS	207	Geomet Technologies Inc.	Misc. Hardware
163	Earth Terminals	Other	208	GEZ Microsystems Inc.	Biometrics
164	Earthwatch Inc.	AVI Equipment	209	Global Systems International	Corrections—Integrated Management Systems
165	EC & M	Corrections—Environmental Systems	210	Glock	Weaponry
166	Ecco	Corrections—Biometric Systems	211	Glove Specialties	Corrections—Tactical Equipment
167	Echostar	Communications	212	Gould Electronics	Corrections—Environmental Systems
168	EIA USA	Misc. Hardware	213	Gozon	Corrections—Weapons
169	ElectroCom Automation	Corrections—Communication Systems	214	Grabber International	Corrections—Tactical Equipment
170	ElectroCom Communication Systems	Communications	215	Graphico Technologies	Communications
171	Electrolux Wascator	Corrections—Environmental Systems	216	Greyfell Software Inc.	RMS
172	Emerson Knives Inc.	Weaponry	217	Groen Brothers Aviation, Inc.	Misc. Hardware
173	EMS Inc.	Corrections	218	GTE Government Systems Corp.	Communications
174	EMX Inc.	Night Vision	219	GTE Mobilnet	Corrections—Communication Systems
175	Enforcement Technology Group Inc.	Weaponry	220	GTE Sylvania	Corrections—Perimeter Security
176	Environmental Diagnostics Inc.	Corrections—Contraband Detection	221	HDS Video/Audio Equipment	AVI Equipment
177	EO Tech	Clothing & Armor; Weaponry	222	Heimann Systems	Misc. Hardware
178	EPIC Solutions	AVI Equipment	223	Hewlett Packard	Computer Hardware
179	Esi Companies Inc.	Misc. Hardware	224	High Impact Training Solutions	Training Technology
180	ESRI Environmental Systems Research Institute Inc.	Crime Mapping	225	Hi-Shear	Other
181	EVAC+CHAIR Corp.	Office Equipment	226	Hitachi	AVI Equipment
182	Evercom	Corrections	227	Hitech Systems, Inc.	CAD
183	Executive Communication Systems	AVI Equipment	228	Hoffman Engineering Company	Corrections—Environmental Systems
184	Eyedentify Inc.	Corrections—Biometric Systems	229	Honeywell	Corrections—Perimeter Security
185	F. Morton Pitt Co.	Other	230	Hornady	Corrections—Weapons
186	Fail Safe Lighting	Corrections—Environmental Systems	231	Horton Automatics	Corrections—Perimeter Security
187	Falcon Lock	Corrections—Perimeter Security	232	HSV Technologies Inc.	Weaponry
188	Federal Cartridge Corporation	Corrections—Weapons	233	HTE, Inc.	CAD

Number	Vendor	Category	Number	Vendor	Category
234	Huber & Associates, Inc.	RMS	282	Knight Communications	Communications
235	Hughes	Forensics	283	Kodak	AVI Equipment
236	Hughes Network Systems	Computer Hardware	284	Kroll Associates	Training Technology
237	Hunno Technologies Inc.	Biometrics	285	Kwan Software Engineering, Inc.	Software
238	Hurst Entry Systems	Misc. Hardware	286	L3 Communications	Communications
239	Hydro-Force Inc.	Weaponry	287	Laiser Aim	Corrections—Weapons
240	Hy-Security	Corrections - Perimeter Security	288	Land Air Sea Systems Inc.	Misc. Hardware
241	I2	Software	289	Laser Products	Misc. Hardware
242	Identix	Biometrics	290	LawTech Publishing Co., Ltd.	Other
243	IES	Training Technology	291	LEADS Software Group	Software
244	II-Tracker Inc.	Misc. Hardware	292	Lexis-Nexis	Software
245	Illusion Inc.	Software	293	Life Point Inc.	Misc. Hardware
246	Illustra Information Technologies	Other	294	LIFE Safety Systems	Emergency Operations; Night Vision
247	Image Metrics PLC	Software	295	Lifeline Shelters	Corrections—Environmental Systems
248	Image Ware	AVI Equipment	296	Light Signatures	Corrections—Computer Software/Hardware
249	Imagis Cascade	Biometrics	297	Lighting & Electronic Design, Inc.	Misc. Hardware
250	Imagis Technologies	Facial Recognition	298	Littelfuse	Corrections—Environmental Systems
251	Inficon	Misc. Hardware	299	Litton Data Systems	MDT/MDC
252	Information Discovery Inc.	Other	300	Lockheed Martin	Forensics
253	Information Technologies, Inc.	CAD	301	Logicube	Computer Hardware
254	Information Technology Group	CAD	302	Logistic Systems Inc.	CAD
255	Inframetrics	AVI Equipment	303	Lynch Diversified Vehicles	Emergency Operations
256	Innovation Distributing	Misc. Hardware	304	M3i Technologies Inc.	MDT/MDC
257	Insulgard Corporation	Clothing & Armor	305	Magnasync	Corrections—Surveillance
258	Intelli Wonxx	MDT/MDC	306	Malin	Facial Recognition
259	Interactive Tactical Group	Software	307	Man Barrier	Corrections—Perimeter Security
260	Intergraph Public Safety	CAD	308	Mark Correctional Systems	Corrections—Environmental Systems
261	Intermar	Corrections—Environmental Systems	309	Mark I Systems Inc.	AVI Equipment
262	Interspec Inc.	Corrections—Communication Systems	310	Mat Factory	Corrections—Tactical Equipment
263	Intouch Communications	Communications	311	McGard	Corrections—Perimeter Security
264	Ion Track Instruments	Misc. Hardware	312	McGraw Edison	Corrections—Environmental Systems
265	Irvine Sensors Corp.	Misc. Hardware	313	Medical Devices International	Corrections—Tactical Equipment
266	ISPRA	Corrections—Communication Systems	314	Medtronic Physio Control	Misc. Hardware
267	ITI Security	Corrections—Biometric Systems	315	Melles Griot	Misc. Hardware
268	Itronix	MDT/MDC	316	Metorex Security Products	Misc. Hardware
269	ITT Industries	Night Vision	317	Microsystems	Computer Hardware
270	ITT Weaver	Corrections—Environmental Systems	318	Mikon Computer Systems	Computer Hardware
271	Jalan	Other	319	Milstor Corp.	Weaponry
272	Javelin Electronics	Corrections—Computer Software/Hardware	320	Mini-Graphic Systems Inc.	Corrections—Computer Software/Hardware
273	Jaycor	Communications; Weaponry	321	Minolta	Corrections—Computer Software/Hardware
274	John E. Chance & Associates	Communications	322	Mission Communications	Communications
275	Judicial Video Systems	Corrections—Communication Systems	323	Mistral Security	Corrections—Environmental Systems
276	Kaiser Electronics	Misc. Hardware	324	Mitel	Corrections—Surveillance
277	Keefe Supply Company	Corrections	325	Mitsubishi	Corrections—Communication Systems
278	Keithley/Metrabyte	Software	326	MK Ballistic Systems	Corrections—Weapons
279	Keystone Information Systems, Inc.	CAD	327	Mobile Product News	Communications
280	Kinetic Sciences Inc.	Biometrics	328	Mobile Vision, Inc.	AVI Equipment
281	KMB	Corrections	329	Modem	Emergency Operations

Number	Vendor	Category	Number	Vendor	Category
330	Monitor Dynamics Inc.	AVI Equipment	377	P-CEL Research	Misc. Hardware
331	Mosler	Corrections—Perimeter Security	378	Pelican Products	Misc. Hardware; Night Vision; Weaponry
332	Motion Phone Technology	Corrections—Communication Systems	379	Pelican Products, Inc.	Corrections—Weapons
333	Motorola	Corrections—Communication Systems	380	Perimeter Products	Corrections—Perimeter Security
334	MRM Security	Corrections—Perimeter Security	381	Perimeter Security Systems	Misc. Hardware
335	National Business Systems	Corrections—Computer Software/Hardware	382	Personal Security & Safety Systems Inc.	Misc. Hardware
336	National Defense Industrial Association	Other	383	Perspective Measurements	AVI Equipment
337	National Interlock Systems Inc.	Misc. Hardware	384	Phillips Laboratory	AVI Equipment
338	NEC Technologies Inc.	Biometrics	385	Phillips Lighting	Corrections—Environmental Systems
339	Network General Corp.	Software	386	Phoenix Worldwide Industries	Forensics
340	New Centurion Associates	CAD; RMS	387	Picturetel	Corrections—Communication Systems
341	New Eagle Communications	Corrections—Communication Systems	388	Pinkerton Security	Other
342	New Heights Inc.	Misc. Hardware	389	PK Industries	AVI Equipment
343	New World Systems Corporation	CAD	390	Plant Equipment, Inc.	911 Systems
344	NeXT Software Inc.	Computer Hardware	391	Plymold Booths	Corrections—Environmental Systems
345	Nextel	Communications	392	PMG MFG Group—Roadspike	Misc. Hardware
346	Nicolet Imaging Systems	Misc. Hardware	393	PMW Associates	Other
347	Nighthawk Systems Inc.	Night Vision	394	Polaroid	AVI Equipment
348	Nightvision Equipment Co. Inc.	Night Vision	395	Police Scientific Development Branch	AVI Equipment
349	Nik Public Safety Inc.	Other	396	Positron Public Safety Systems Inc.	CAD
350	Noble Security System Inc.	Weaponry	397	PRC Public Sector Inc.	CAD
351	Norix Group Inc.	Corrections	398	Prescolite	Corrections—Environmental Systems
352	Northern Telecom	Corrections—Communication Systems	399	Professional Safety, Inc.	Misc. Hardware
353	NOVA Engineering Inc.	Communications	400	Prom-com	Corrections—Communication Systems
354	Omega	Corrections—Perimeter Security	401	Pro-Tech	Weaponry
355	Omega Group, The	Crime Mapping	402	Protective Medical Products	Misc. Hardware
356	On Star	Vehicles/Accessories	403	Protogroup Development Inc.	Other
357	Optical Electronics Inc.	AVI Equipment	404	PSI International Inc.	Other
358	OptiScan Ltd.	AVI Equipment	405	Psychemedics Corporation	Misc. Hardware
359	Oracle	Software	406	Public Eye	Misc. Hardware
360	Orbacom Systems Inc.	Communications	407	Public Safety CD	Software
361	Orion Scientific Systems	Software	408	Public Safety Systems Incorporated	CAD
362	Outdoor Security Systems	Corrections—Perimeter Security	409	PULNiX	AVI Equipment
363	Ozalid Corporation	Corrections—Computer Software/Hardware	410	Pursuit Safety Concepts	Misc. Hardware
364	P.A.C.A. Body Armor	Clothing & Armor	411	QSI	Corrections—Tactical Equipment
365	Pacific Access Computers	RMS	412	Quadro Corp.	Misc. Hardware
366	Pacific Arepco Inc.	Communications	413	Quantum Magnetics	Misc. Hardware
367	Pacific Bell	Corrections—Communication Systems	414	Radian International	Misc. Hardware
368	Pacific Compactor	Corrections—Environmental Systems	415	RAFAEL USA Inc.	Clothing & Armor
369	Pacific Concepts	Corrections—Miscellaneous	416	Rapiscan Security Products	Misc. Hardware
370	Pacific Northwest Laboratory	Other	417	Raytheon	Night Vision
371	Pacific Security Systems	Corrections—Perimeter Security	418	RBR International Ltd.	Weaponry
372	Palomar Display Products Inc.	MDT/MDC	419	RDT Integrated Systems	Software
373	Panasonic	Computer Hardware	420	Recognition Systems Inc.	Biometrics
374	Paradigm4	Communications	421	Recognitions Systems	Corrections—Biometric Systems
375	Paragon Imaging	AVI Equipment	422	Reid Systems	Other
376	Par-Kut International Inc.	Corrections—Perimeter Security	423	Remington Law Enforcement	Weaponry

Number	Vendor	Category	Number	Vendor	Category
424	RFI Electronics	Corrections—Computer Software/Hardware	469	Spacesaver Corp.	Office Equipment
425	RIB	Corrections—Environmental Systems	470	Special Technologies Laboratory	AVI Equipment
426	RIPP Restraints Inc.	Misc. Hardware	471	Spectrum Industries Inc.	Office Equipment
427	Roche Diagnostic Systems	Corrections—Contraband Detection	472	Sperry West Inc.	AVI Equipment
428	Ross Associates	Misc. Hardware	473	Spillman Data Systems Inc.	CAD
429	RR Brink Locking Systems	Corrections—Perimeter Security	474	Spying Eye Surveillance	AVI Equipment
430	Ruud Lighting Inc.	Corrections—Environmental Systems	475	Square D. Company	Corrections—Environmental Systems
431	S.W.A.T.E.C. Inc.	Training Technology	476	StarSignal, Inc.	Corrections—Computer Software/Hardware
432	Saco Defense Inc.	Other	477	STC Diagnostics	Misc. Hardware
433	Safariland Ltd Inc.	Clothing & Armor	478	Stellar Systems	Corrections—Biometric Systems
434	Safeguards	Corrections—Perimeter Security	479	Stinger Spike System	Misc. Hardware
435	Safety Systems Corporation	Corrections—Tactical Equipment	480	STMicroelectronics	Biometrics
436	Sage International	Corrections—Weapons	481	STOVACT Inc.	Misc. Hardware
437	Sagem Morpho Inc.	Biometrics	482	Stun Tech	Corrections—Surveillance
438	SAS R&D Services Inc.	Misc. Hardware	483	SUNPRO	Other
439	Scanna MSC Inc.	Corrections	484	Syscon Justice Systems LTD.	Software
440	SCC	RMS	485	Systems Engineering and Management	Misc. Hardware
441	Sci. Applications & Research	Weaponry	486	T. L. Creates Inc.	RMS
442	Science Applications Internation Corporation	Communications	487	Tac/Corn	Communications
443	Scientific Atlanta	Communications	488	Tactical & Survival Specialties Inc.	Clothing & Armor; Weaponry
444	Scientific Dimensions Inc.	MDT/MDC	489	Tactical Telepresent Technologies Inc.	Weaponry
445	SDC	Corrections—Perimeter Security	490	Talon Executive Services Inc.	Training Technology
446	Seaberg Company	Corrections—Tactical Equipment	491	Tapeswitch	Corrections—Environmental Systems
447	Seaboard Electronic Systems	Corrections—Communication Systems	492	Taser International	Weaponry
448	SEARCH	Training Technology	493	TCI Tel. Control Inc.	Emergency Operations
449	Security Escort Detection Systems	Misc. Hardware	494	Technologia Systems, LTD.	Corrections—Biometric Systems
450	Security Link from Ameritech	Corrections	495	Teleminder	Misc. Hardware
451	Security Personal Care	Clothing & Armor	496	Television Equipment Associates	Corrections—Communication Systems
452	Self-Defense Firearms Training	Training Technology	497	Tellus	Corrections—Environmental Systems
453	SEMCO-Systems Engineering & Management Co.	AVI Equipment	498	Tensar Structures	Corrections—Environmental Systems
454	Senstar Inc.	Misc. Hardware	499	Texas Instruments Inc.	Night Vision
455	Setcom	Communications	500	Tex-Shield, Inc.	Clothing & Armor
456	Sharp	AVI Equipment	501	TFP Image Capture	AVI Equipment
457	Sherwood International	Corrections—Contraband Detectors	502	Thomas Conrad Corporation	Computer Hardware
458	Shorrock	Corrections—Perimeter Security	503	Thomas Industries	Corrections—Environmental Systems
459	SIERRA Systems Consultants Inc.	Other	504	Thom Automated Systems	Corrections—Computer Software/Hardware
460	Signalscape Inc.	Software	505	Thorntech Co.	Other
461	Signify	Corrections—Biometric Systems	506	Time Domain—Wireless Medium	Communications
462	Simplex	Corrections—Computer Software/Hardware	507	T-NETIX Inc.	Misc. Hardware
463	Sirchie Finger Print Laboratory	Biometrics	508	TOKO America Inc.	Misc. Hardware
464	Skaggs Telecommunications Service	Communications	509	Tomas & Betts	Corrections—Environmental Systems
465	Skedco Inc.	Emergency Operations	510	Tomsed	Corrections—Perimeter Security
466	Smithcot	Corrections—Tactical Equipment	511	Touchless Sensor Technology AG	AVI Equipment
467	Solaronics Inc.	Corrections - Environmental Systems	512	Tracer Systems Inc.	AVI Equipment
468	Sony	AVI Equipment	513	Trac-Tel	Corrections—Surveillance

Number	Vendor	Category	Number	Vendor	Category
514	TRAK COM	Misc. Hardware	535	Vicon Industries, Inc.	AVI Equipment
515	Trak-Tech	Corrections—Surveillance	536	Viisage Technology	Facial Recognition
516	Trax Monitoring Inc.	Corrections—Surveillance	537	Vindicator	Corrections—Perimeter Security
517	Trilling Medical Technologies	Corrections—Tactical Equipment	538	Vision Tek Inc.	Misc. Hardware
518	Trilon Technology	Misc. Hardware	539	VisionAIR, Inc.	911 Systems; CAD; RMS
519	TriTech Software Systems	CAD	540	Visionics Corporation	Biometrics
520	Troy Products	Other	541	Visionsphere Technologies Inc.	Facial Recognition
521	TRW	Communications	542	Visonic Ltd.	Communications; Computer Hardware
522	TSI Prism	Corrections	543	Vivitar Security Systems	Corrections—Perimeter Security
523	Turning Point Group	Emergency Operations	544	Voice Control Systems	Corrections—Biometric Systems
524	TV-2	Misc. Hardware	545	Voice Print International, Inc.	Misc. Hardware
525	Unisys	Misc. Hardware	546	Vorec	Corrections—Biometric Systems
526	United Service Associates, Inc.	Training Technology	547	VS Visual Statement	Misc. Hardware
527	United States Ammunition Company	Corrections—Weapons	548	Vulcan	Corrections—Environmental Systems
528	USA Software, Inc.	CAD	549	WASPC Correctional Options Services	Corrections
529	USTI	Other	550	Whelen Engineering Co. Inc.	Misc. Hardware
530	UTD Inc.	Weaponry	551	Whitehall	Corrections—Environmental Systems
531	UVC Corporation	Corrections—Communication Systems	552	Winchester	Corrections—Weapons
532	Valor Systems, Inc.	CAD	553	XL Computing	MDT/MDC
533	Veni Graphics	AVI Equipment	554	ZN Vision Technologies AG	Facial Recognition
534	Ventura Identification Systems Inc.	Biometrics			

Appendix 7

Best Practices for Handling Video Evidence

The Center has assisted in a large number of forensic examinations. One of the results of these examinations is the recognition that the practices and procedures of the first responder to a crime scene can be improved relative to the handling of video evidence. The information presented in this appendix is a good faith effort to provide information to first responders and investigators regarding the handling of their evidence.

Collecting and Protecting Videotape as Evidence

The purpose of this guide is to describe a method and checklist for the identification, collection, handling, and safeguarding of videotape for use as evidence. It is not intended to replace standard evidence-gathering procedures, but rather addresses only the special considerations involved with the collection and protection of videotape. These are recommendations based on experiences and occurrences in actual cases where the National Law Enforcement and Corrections Technology Center-Western Region has been involved in the enhancement of videotape evidence.

This reference defines five general steps for dealing with potential videotape evidence:

1. Determine the existence of videotape evidence
2. Find and stop the video recorder
3. Secure and protect the videotape
4. Document the field of view and position of the video system
5. Seek assistance for any technical problems

Finding and Collecting Videotape Evidence

In general, the procedure, done in the following sequence, can help in identifying and collecting videotape as potential evidence:

- Conduct a search for cameras with a field of view of the crime scene and paths of approach and departure to that scene
- Locate and stop the recording of the videotapes, but do not eject the tapes until documenting this information:
 - The time the tape was stopped
 - The time displayed on the recorder when it was stopped, which may be different and perhaps very different from the actual time.
 - The number on the tape counter when it was stopped
- Rewind the tape completely and document the number on the tape counter
- Document the settings, mode, model, and manufacture of the recorder
- Eject the tape

Often, the time on the video recorder does not match the actual time of day. It is important for further analysis of events to know the actual time of day the tape was stopped.

Recording the number on the tape counter may be important for time correlation and it assists in quickly finding the part of the tape needed for analysis.

Map the Relative Position of the Camera

- Record the relative position of the camera to a known or designated stationary reference point
- Note or sketch objects in the field of view of the camera
- Record the distance to any significant stationary object in the camera's field of view

The relative position of the camera to the crime scene or area of interest is potentially important for further investigation and analysis. Measuring distance to a fixed object can help determine relevant sizes and positions. The reference point or known point in the field of view must be stationary.

Safeguarding and Protecting the Videotape Evidence

These are additional safeguards for videotape that should be considered when collecting the tapes as evidence.

- Remove the "write protect" tab from the videotape. Break off this small tab of plastic on the long side of the tape cassette. It is possible to record over the tape if the tab is not removed.
- Do not play the tape to review it. Copy the tape and review the copy. Often, tapes from surveillance cameras are old, fragile, and easily damaged.
- Protect the videotape from magnetic fields around such things as electric motors, solenoids, and electric metal detectors
- Protect the videotape from exposure to direct sunlight, excessive heat, and excessive humidity. Best storage is in a cool, dry area.

Technical Analysis

Analysis of video recordings may show a synopsis of the activity or crime, provide a more complete picture of the area where the events occurred, and give a visual picture more complete than a verbal description of the area of interest. Videotapes show action, speed, and sequence, as well as a picture of physical evidence or identity of people in the field of view.

Technical Assistance

Any of the National Law Enforcement and Corrections Technology Centers (NLECTC) can provide technical information, advice, and assistance. Other sources of advice and assistance include the FBI and many of the large crime laboratories in the nation.

Appendix 8

Equipment and Software for Low-Cost Video/Audio Forensics

Forensic Video Workstation Recommendations

One of the most common tasks performed for law enforcement agencies by the video enhancement section of the NLECTC-West is to create a montage of still images from a surveillance tape. The images are typically brightness and contrast adjusted, and then some are edged enhanced (sharpened) to bring out detail. The images are then arranged in some order to tell a story about the actions shown on the videotape. Once completed, the digital images are then printed out on a high quality color printer. Occasionally a videotape requires more in-depth analysis. However, most cases only require this "Photomat" type of service. Many of the officers who bring in such cases are computer literate and would, with some minor training, be capable of performing this simple type of enhancement themselves.

Because of the many agencies supported by the NLECTC-West, the types of cases that get high priority are those involving homicides and other high-profile crimes. Due to limited resources, lesser cases, such as aggravated assault, robbery, etc. do not have the priority that is given to the higher profile cases. Currently, even high-profile cases are starting to multiply, and the delays are becoming longer. The availability of an inexpensive computer/video workstation that would enable officers to quickly create stills would be of benefit to both the agencies and the NLECTC-West. This paper is an attempt to formulate the requirements for such a workstation and to make some recommendations about how to go about acquiring one. It does not address the issue of training the officers in the use of the workstation.

Any type of computer/video workstation will consist of three major components. The first element is a device to play back the videotape evidence. Ideally, it would be desirable to have a player that could handle many types of videotapes. Unfortunately, these devices don't exist and typically several video decks need to be purchased to handle most of the common types of video evidence. These include VHS, S-VHS, Beta, 8mm, and Hi-8. VHS has some subcategories that depend on the tape speed, such as time-lapse decks. Some decks cannot play tapes recorded at different speeds. In addition, there are many types of multiplexers that can store information on the videotape in many formats. The combination of all of these factors leads to the conclusion that it would be very expensive to try and purchase video equipment to cover all possible types of video evidence that may be obtained. Therefore, the equipment should be purchased in such a manner as to cover the most likely cases first. The most common recording format the NLECTC-West receives is the EP (sometimes called SLP) version of VHS tapes. These easily constitute more than 75 percent of all video evidence received. Included in this count are the various types of multiplexed tapes that can still be played, but not demultiplexed, by an ordinary VHS tape player. In an interesting side note, some of

the more high-end VCRs will not play the tapes recorded in the EP mode, apparently because they assume that at this speed, the quality of the video would be too low for professionals.

The second most important feature of a video deck, after the format of the tape, is the ability to easily search the tape. In order of preference, this ability can exhibit itself in the form of a jog/shuttle, frame-advance controls, or the simple slow/pause controls. The latter is too crude for searching the typical surveillance video and frame advance controls are good for certain scenarios, but the best is a jog/shuttle combination. Fortunately, these controls can be found on many decks starting at the midrange price level. Some sort of tracking control is also necessary, as videotapes recorded on one machine are often off-track with respect to other videotape decks. Some of the newer decks have auto and digital tracking circuitry to eliminate the need for user controls, although sometimes these automatic controls can be confused by very poor video recordings.

Once the desired images are located on the videotape, it is often necessary to improve the way they look via brightness and contrast enhancement. Although there are devices on the market that will perform local equalization of brightness and contrast in realtime, often it is better to capture these images to a computer and then modify the images there. Again, there are several ways to do this. Most of the devices can be divided into two main categories, frame grabbers and video-capture devices. Video-capture devices would be the more useful device; however, the current technology that allows the capture of fullframe, realtime, uncompressed video to disk is very expensive. The lower-end video capture devices all compress the video to one degree or another. Compression adds artifacts to the video that can be mistaken for features; therefore, these devices are of limited utility and are not recommended. Devices that can capture uncompressed full-frame video can typically capture only one or two seconds of video to memory before losing frames. The two seconds represents 60 frames of imagery (at 30 frames per second); these 60 frames can be used together to "pull-out," or enhance, features in the frame. As the amount of video to be captured increases, the cost to do so increases greatly. However, even a few quality seconds are preferred to more frames that have introduced artifacts.

Since typically fewer than a dozen video frames need to be captured, a frame grabber, which just captures one video frame, is often a cost-effective device. Combined with a video deck with a good jog/shuttle, it can be nearly as effective as a video-capture device, and is much less expensive.

Once the image is in the computer, there are several good programs that can be used to enhance the captured images. Mostly what is required is the ability to change an image's contrast and brightness. Some sort of sharpening filter is also

useful, as is a blurring filter. The ability to cut and paste from one window to another is essential to putting together a composite image, like those typically produced at the NLECTC-West. More advanced features, like the ability to register and co-add many video frames to reduce noise or to improve resolution via filtering, are good, but are used in only rare circumstances. A description of several current software products is presented below.

After the image has been produced, the final step is to print it. Once again, there are many types of printers and each has its own strengths and weaknesses. The most inexpensive color printers are the inkjet printers. These printers spray liquid ink onto the paper to create the image. Although the low-end devices create prints that are of low to medium quality, the high-end devices, used with the correct paper, can produce nearly photographic-level prints. The major drawback to an inkjet printer is that the output can be smeared relatively easily. This sort of print would not stand up to the rigor that most prints in the law enforcement field go through. The next step up from inkjet printers is thermal wax. However, because of the constant downward march of the price of dye sublimation printers (the third category of printers), thermal wax printers are fading from the scene. Current low-end dye sublimation printers still produce prints that are of a higher quality than the high-end inkjet printers, and their prices are only slightly higher. The drawback is that the cost of materials, paper, and ink, are more expensive for dye sublimation printers than for inkjet printers.

To summarize, the devices that would go into a minimal video/computer workstation include a playback device, an enhancing device, and a hardcopy device. The enhancing device would typically consist of a computer with a video digitizing card and image-processing software; there are some task-specific devices that are currently being sold that can do simple enhancing, but are extremely limited in the functions they provide. Because of the different needs of different agencies, the recommendations will be broken down into three systems: a low-end system, a mid-range system, and a high-end

Component	Example Suppliers
VHS VCR with jog/shuttle: typical cost \$300	Hitachi VTUX627A (\$330) Phillips Magnavox VRX562AT (\$300) Mitsubishi HSU580 (\$370)
Frame Grabber: typical cost \$75	Play Inc. Snappy (\$100) AITech AIGotcha (\$50) AIMS Lab GrabIt (\$180)
Computer System: typical cost \$1500	333 Mhz Pentium II with 8-Gb disk and 64-Mb memory, 15-inch monitor, CD-ROM, and Windows 95 or Windows NT
Enhancement Program: typical cost \$400	Adobe Photoshop (\$380) Microsoft Photo Editor (comes with Office 97 Pro) Media Cybernetics Image Pro Plus (\$450)
Hardcopy Device: typical cost \$600	Alps MD-1300 (4 x 6") (\$500) Fargo PrimeraPro (\$1600)

system. The brand names given and the prices listed were current at the time of this writing, but are subject to change as prices for electronic devices fluctuate rapidly. The following is not to be construed as an endorsement of any particular brand but rather as being illustrative of the category.

Hardware

The inexpensive system consists of a VHS VCR with jog/shuttle, a frame-grabber, a mid-range computer, inexpensive software, and a low-end dye-sublimation printer.

Software

Adobe Photoshop is a powerful program in the graphic arts for manipulating images. The Center uses Photoshop for about 80 percent of its work. This is because the quality of the videotapes brought in does not warrant extensive processing. For the rest of the imagery brought in, a combination of two other programs is used. One is called NIH Image (rsb.info.nih.gov/nih-image). This program was written for the biological sciences, but is also used for general-image processing. It works best with black and white images, but it can do limited work with color. It is useful mostly for aligning a series of images where an object (person, auto, etc.) is moving in the frame and it is necessary to change the perspective so that the object remains stationary, and the background moves. These images are then added so as to remove background video noise (snow), or to improve contrast in dark images. NIH Image was written for the Macintosh computer, and is given away, free of charge, by the National Institutes of Health. There is a beta version for the PC, written by Scion Corporation, called Scion Image. It can be obtained for minimal cost from SCION (www.scioncorp.com). The other program in use at the Center is called IDL, from RSJ. This is a program-development package and it is used to develop customized image processing programs.

Another program commonly used by image analysts is Image Pro from Media Cybernetics (www.mediacy.com). Like NIH Image, it appears to be written mostly for the biological sciences, but has many nice features. None of these programs was written specifically for forensic image enhancement, but all are high-end image processing programs. There are currently two programs known that were specifically written for forensic image processing. The first is from a Canadian company called CrystalWorks (crystal1.works@telusplanet.net). This is relatively new software but it is specifically written for forensic image processing. Additionally, a company called Cognitech (www.cognitech.com) has just released its forensic video enhancement software. Cognitech has done extensive work in the field of forensic video enhancement and their software will likely reflect this experience.

There are several good Web sites for image processing in general. One is sponsored by the Mid-Atlantic Association of Forensic Scientists (www.gwu.edu/~fors/maafs/imaglink.htm). Another is the Carnegie Mellon computer vision lab site at www.cs.cmu.edu/~cil/vision.html. Both of these sites offer information on products that are available for information processing.

Of course, it should be kept in mind that no image-processing software can bring out information from an image if that information is not present to begin with.

Appendix 9

NLECTC-West Evidence Handling Policies and Practices

General

These evidence-handling procedures are established to provide uniform guidelines to maintain accountability of evidence received by the National Law Enforcement and Corrections Technology Center—Western Region (NLECTC-West):

- Items of evidence received for processing from public safety agencies must be safeguarded to maintain the chain of evidence required in criminal cases.
- Initial receipt of property will generally take place at the NLECTC-West (Building A7); property received elsewhere will, as soon as practical, be transported to Building A7 for processing.
- Evidence that is not logged through the NLECTC-West shall not be the responsibility of the NLECTC-West and NLECTC-West assigned charge numbers shall not be used for this work.
- Evidence will not be processed for private citizens or companies unless NLECTC-West is requested to do so by a public safety agency. This evidence will be processed only if delivered to the NLECTC-West by a requesting public agency.
- Any office within The Aerospace Corporation that receives and processes evidence for the NLECTC-West shall be subject to audit on a regular basis for accountability. These audits will be conducted by the evidence supervisor of the NLECTC-West. These periodic office reviews shall compare evidence on hand against the evidence control database (ECDB) for accuracy.

Definitions

- Evidence Supervisor—The evidence supervisor is the person within the NLECTC-West who is responsible for the proper handling of evidence received for processing. The supervisor shall be able to answer any questions about the status of evidence processed by the NLECTC-West. This person shall be responsible for any improvements and maintenance of the ECDB. This person shall be responsible for the procedures to be followed in the handling of evidence.
- Evidence Control Database (ECDB)—The Evidence Control Database is the data store that is used to maintain information about evidence processing requests received by the NLECTC-West. The ECDB is used to generate the acknowledgment letter, Evidence Instructions and Cover Sheet, and various status reports. The ECDB is accessible from every computer terminal within the NLECTC-West complex, and can be updated and queried by any person with current

access privileges. Access privileges are assigned and maintained by the evidence supervisor.

- Evidence Instructions and Cover Sheet—The Evidence Instructions and Cover Sheet is the internal receipt that details the movement of evidence within The Aerospace Corporation. This sheet contains the information necessary to process the evidence and information about the requesting agency. This sheet is generated by the ECDB.
- Evidence History Table—The evidence history table is that portion of the Evidence Instructions and Cover Sheet that details information about the releasing and receiving parties of an evidence transfer event.
- Evidence Case Log Binder—The evidence case log binder is the active binder that holds a copy of all Evidence Instructions and Cover Sheets and any documents associated with a case, such as mailing receipts and supplemental evidence processing instructions.
- Archival Evidence Case Log Binders—The archival evidence case log binders are the binders that hold case logs (Evidence Instructions and Cover Sheets, and any associated documents). Evidence case logs are moved to the archival binders three months after the evidence is returned to the requesting agency.
- NLECTC-West Cognizant Case Worker—The NLECTC-West cognizant case worker is the NLECTC-West representative who receives evidence and makes the ECDB entry for that evidence. The NLECTC-West cognizant case worker's responsibility can be re-assigned to meet case load requirements.
- Assigned Case Worker—The assigned case worker is the person assigned by the NLECTC-West to be responsible for the processing of evidence received from a requesting agency.

Procedures

- Receipt of Evidence—Evidence shall be sent or delivered by hand to the NLECTC-West in a manner that maintains the chain of evidence requirements for criminal cases. In the event that a requesting agency wants to send their evidence to the NLECTC-West, the requesting agency shall be sent written instructions as to how the evidence shall be sent. The evidence supervisor shall maintain the latest copy of these instructions. In the event that the requesting agency sends evidence to the NLECTC-West in a manner that breaks the evidence chain, the evidence supervisor shall notify the requesting agency by telephone and in writing, and await instructions from the requesting agency before

the evidence is processed. If the requesting agency asks that the evidence be processed, the evidence shall be handled as if the evidence chain had not been broken. In the event evidence is received by mail, the mailing receipt shall be added to the evidence store as described in the logging instructions that follow.

- **Evidence Logging**—Immediately upon receipt of evidence in Building A7, the evidence shall be logged into the ECDB and an acknowledgment letter and three copies of the Evidence Instructions and Cover Sheet shall be printed. One copy of the Evidence Instructions and Cover Sheet shall be printed on the reverse side of Aerospace Form 3966 Rev 4-92 (“Controlled Access” form), known as the “green copy,” and two copies on plain paper. One plain copy shall be combined with any supplemental evidence processing instructions and mailing receipts and placed in the evidence case log binder. One plain copy shall be mailed back to the requesting agency, along with an acknowledgment letter that shall detail the names and telephone numbers of the evidence supervisor, NLECTC-West cognizant case worker, and the assigned case worker.
- **Evidence Packaging, Sealing, and Marking**—The evidence, along with supplemental processing instructions and any other received information, shall be placed in a suitably sized envelope with the green copy of the Evidence Instructions and Cover Sheet affixed to the outside of the envelope. The envelope shall be sealed with tape and the person who seals the envelope shall write their initials across the tape joint.
- **Evidence Transmission and Transfer**—Evidence will be transmitted from the NLECTC-West cognizant case worker to the assigned case worker in a manner that maintains the physical control of the evidence. When evidence is transferred, the releasing and receiving parties shall sign the Evidence Instructions and Cover Sheet on the next available line in the evidence history table of that sheet. All information for a given line in the table shall be completed.
- **Evidence Storage and Processing**—Security during processing will be accomplished by physical control of the item of evidence or by placing it in a locked container/facility to which access is limited and controlled by the person to whom it was entrusted. Evidence shall be handled within The Aerospace Corporation in accordance with the company’s Controlled Access Practice, stated within the “Sensitive Unclassified Material - Control” Practices (see Practice Number SE-4-1, dated 7-2-96).
- **Oversized Evidence**—Oversized evidence shall be stored in a lockable storage closet. If none is available, the lockable cabinet in Room 102, Building A7 shall be used. The green copy of the Evidence Instructions and Cover Sheet shall be placed in a protective plastic sheet holder and affixed to the evidence in a manner that

ensures that it will not accidentally separate from the evidence.

- **Disclosure of Information**—Information relating to evidence or the associated case shall not be disclosed to persons inside or outside the company unless permitted by the evidence supervisor. In those cases where approvals are received, a copy of the approving letter shall be placed in the evidence case log and the ECDB shall be updated to reflect this situation.
- **Return of Evidence**—As soon as practical after processing, the evidence will be returned to the requesting agency representative. The assigned case worker shall deliver the evidence package to the NLECTC-West cognizant case worker for final processing. In the event that the NLECTC-West cognizant case worker is not available, the evidence shall be given to the Evidence Supervisor. A final entry shall be made in the ECDB indicating to whom and when the property was released. If the evidence is picked up or delivered to the originating agency, an agency representative will sign the release line on the Evidence Instructions and Cover Sheet. In the event that the evidence is mailed to the originating agency, a copy of the evidence control sheet shall be included with the evidence with instructions to date, sign, and return the Evidence Instructions and Cover Sheet.
- **Archival of Case Information**—Three months after a case is completed, or upon return of the signed Evidence Instructions and Cover Sheet by the requesting agency, the evidence package shall be moved to an archival binder.
- **Destruction of Evidence**—Evidence may be destroyed at the NLECTC-West upon a written request of the requesting agency. Paper and flat material shall be deposited in the security waste container located in Room 106, Building A7. Magnetic media shall be delivered to the magnetic media destruction supervisor (contact Aerospace security). The authorizing destruction letter shall be added to the evidence case log file.
- **Lost Evidence Procedures**—Evidence shall be considered lost when it cannot be produced for return to the requesting agency or cannot be presented for an evidence audit. As soon as evidence is defined as lost, the evidence supervisor shall be notified. It shall be the responsibility of the evidence supervisor to notify the requesting agency of lost evidence.
- **Evidence Audits**—The evidence supervisor shall perform periodic audits of active evidence case logs. During any audit period, each evidence case worker with at least one active case shall be asked to locate and display the evidence as detailed in the ECDB.
- **ECDB Reporting**—A report detailing all active cases shall be printed from the ECDB on a biweekly basis and maintained by the evidence supervisor.

Appendix 10

Selected Case Histories

In order to amplify the type of effort that the Center expends in forensic examinations, the following selected forensic examinations are presented in detail.

Audio Analysis Case

A small shop owner was robbed and murdered in his store. The suspects knew the victim and were familiar with his modest security system – an 8-mm video camera. The suspects, while browsing in the store, placed a lens cover on the camera and then proceeded with the robbery. The suspects took the camera as they left the premises and pawned it, with the tape cassette still in the camera. Investigators were able to tie the camera to the suspects, but not the victim.

Investigators asked the Center to remove background fan noise from the tape cassette so that acquaintances of the victim could identify his voice on the tape. The Center's analysts made a digital model of the hum from the fan and subtracted it from the digital copy of the original soundtrack. The resulting audio allowed investigators to confirm the victim's voice on the tape, which had already been linked to the suspects. The tape provided one additional piece of evidence in the case, which ultimately led to a conviction.

Computer Crime Case

A forgery and fraud investigator brought in a laptop computer that had been seized from a suspect involved in a routine criminal investigation. The laptop was seized under a search warrant, but was password protected and could not be examined to see if information on the computer would contribute to the investigation.

Center staff determined that the files were protected with a modest encryption program and that there was a possibility that the program could be defeated with a brute force attack on the password-protection scheme. The staff wrote a program to attack the password protection scheme and within a day determined the password necessary to open the files on the computer.

Subsequent searches of the files in the computer revealed some images that contained false driver's license data and an alias that belonged to an individual being investigated for a completely different crime. The information gleaned from the protected laptop allowed the investigators to link two different criminal investigations and ultimately convict a repeat embezzler. The conviction would not have been possible at that time without the assistance of the Western Center.

Trace Element Analysis Cases

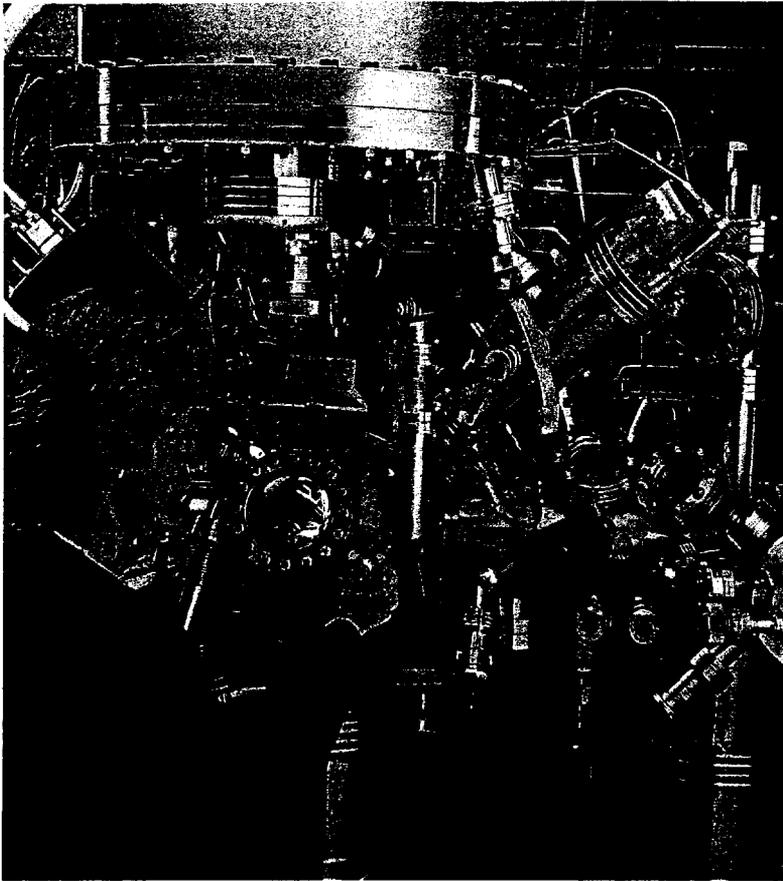
The NLECTC-West analyzed the content of recovered bullet lead for two different investigations. In both cases, the



Computer Forensics Laboratory

analyses eliminated hypotheses that, in turn, focused the investigations into other areas. The question raised in both examinations were similar: "Did samples of bullet lead taken from victims or crime scenes match bullet lead seized during searches of suspects' premises?" The NLECTC-West was able to call upon experts in the subject area who could determine the relative proportion of the predominate isotopes of lead. Using samples from various locations on the bullets, the examiners were able to produce consistent results showing the ratio of the minor lead isotopes to the predominate isotope. Further, they were able to determine the relative proportion of trace materials found in the lead and compare the isotope ratios and the trace element proportions with the same computations performed on the suspect's ammunition. One case involved an 18-year-old murder investigation and the other involved the shooting of a police officer.

In another case, investigators requested that the NLECTC-West assist them in a million-dollar fraud investigation. The investigators asked the Center to determine whether certain expensive additives had been incorporated by a vendor who was providing an advanced paint to a large school district. The vendor was supposed to have added an elastic polymer to the primary paint product so that the paint would resist cracking and peeling. The Center collected samples of the paint as



Trace Element Forensic Equipment

applied and compared the chemical composition to the specifications for the paint. The additives were not found in the applied paint and the results were provided to the grand jury that was conducting the examination.

Video Analysis Example

The Center was requested by a local law enforcement agency to review and analyze a videotape that captured a fatal collision between two passenger vans at a stoplight. The videotape was recorded from a police car that was pointed toward the intersection during a routine traffic stop unrelated to the accident. The videotape captured the collision in graphic detail, but the angle of the shot could not indicate which vehicle had the right of way.

An analyst from the Center reviewed the tape repeatedly and discovered that a secondary reflection in the image was present only at certain times of the traffic-signal cycle. The analyst was able to correlate the presence of the reflection with traffic flow in one direction only and was able to conclude that one vehicle ran through a red light and caused the collision and the resulting fatality. The Center's analysis provided the prosecutor with the evidence necessary to convict the driver of the second van of vehicular manslaughter.

Appendix 11

Agencies Supported by Forensic Analyses

The Center has provided forensic support to a large number of agencies in the Western region and to a limited number of agencies outside the region. This table presents the list of agencies that have contacted the Center and requested assistance during the period of this agreement. The reader will note that there are a large number of California agencies represented.

The size of the state and the large number of agencies in the state overwhelm the number of agencies in other states. Further, the outreach activities the Center conducts on a routine basis with California Peace Officers Standards and Training provides a ready-made return path to the Center. In addition, federal agencies, on rare occasion, ask the Center for assistance.

Agencies From Outside Western Region

State	Agency	State	Agency	State	Agency
CO	Evans, Colorado Police	FL	Tampa Police Dept	NY	Amsterdam Police Department
CO	Greeley Police Department	MT	Chouteau County Sheriff's Office	NY	Fulton County Sheriff's Department
CT	State Police Forensic Lab	MT	Garfield County Attorney's Office	NY	Potsdam Police Department
DC	Metropolitan Police Department	MT	US Forest Service	SC	Mount Pleasant Police Department
DE	Delaware State Police	ND	Bismark Police Department	TN	Hendersonville Police Department
DE	New Castle Police	NE	La Vista Police Department	TX	Harris County Sheriff's Department

Western Region

State	Agency	State	Agency	State	Agency
AK	Anchorage Police Department	CA	Bell Gardens Police Department	CA	Chula Vista Police Department
AK	Wasilla Police Department	CA	Berkeley Police Department	CA	Compton Police Department
AZ	Phoenix Police Department	CA	Beverly Hills Police Department	CA	Corona Police Department
AZ	Tucson Police Department	CA	Blythe Police Department	CA	Coronado Police Department
AZ	Yuma Police Department	CA	Brawley Police Department	CA	Costa Mesa Police Department
CA	ABC	CA	Buena Park Police Department	CA	Covina Police Department
CA	Air Force Security	CA	Burbank Police Department	CA	Culver City Police Department
CA	Alhambra Police Department	CA	CA Department of Insurance	CA	Daly City Police Department
CA	Anaheim Police Department	CA	CA Department of Corrections	CA	Drug Enforcement Agency
CA	Arroyo Grande Police Department	CA	CA Department of Justice	CA	Delano Police Department
CA	Azusa Police Department	CA	Cathedral City Police Department	CA	Department of Alcoholic Beverage Control
CA	Bakersfield Police Department	CA	Ceres Department of Public Safety	CA	Department of Insurance
CA	Baldwin Park Police Department	CA	Chino Police Department	CA	Department of the Air Force
CA	Banning Police Department	CA	California Highway Patrol	CA	El Dorado County Sheriff's Department

Western Region

State	Agency	State	Agency	State	Agency
CA	El Segundo Police Department	CA	OCPD	CA	Santa Rosa Police Department
CA	Federal Bureau of Investigation	CA	Ontario Police Department	CA	Signal Hill Police Department
CA	Fullerton Police Department	CA	Orange County District Attorney	CA	Simi Valley Police Department
CA	Garden Grove Police Department	CA	Orange County Auto Theft Task Force	CA	Siskiyou County Sheriff
CA	Gardena Police Department	CA	Pacifica Police Department	CA	Sonoma District Attorneys Office
CA	Greeley Police Department	CA	Pasadena Police Department	CA	South Gate Police Department
CA	Hanford Police Department	CA	Placentia Police Department	CA	Stanislaus County District Attorney's Office
CA	Hawthorne Police Department	CA	Placer County District Attorney's Office	CA	Stockton Police Department
CA	Hermosa Beach Police Department	CA	Placer County Sheriff's Department	CA	Target Task Force
CA	Huntington Beach Police Department	CA	Pomona Police Department	CA	Task Force for Regional Autotheft
CA	Huntington Park Police Department	CA	Redlands Police Department	CA	Torrance Police Department
CA	Inglewood Police Department	CA	Redondo Beach Police Department	CA	Tracy Police Department
CA	Kern County Sheriff's Department	CA	Rialto Police Department	CA	Turlock Police Department
CA	L.A. City Attorney's Office	CA	Riverside County District Attorney's Office	CA	Tustin Police Department
CA	L.A. Airport Police Bureau	CA	Riverside County Sheriff's Department	CA	US Border Patrol
CA	L.A. County District Attorney	CA	Riverside Police Department	CA	US Department of Justice
CA	La Mesa Police Department	CA	Roseville Police Department	CA	UCLA Police Department
CA	L.A. Public Defender	CA	Sacramento County Sheriff's Department	CA	Union Pacific Railroad Police
CA	La Verne Police Department	CA	Sacramento Police Department	CA	US Post Office
CA	Los Angeles City Fire Department	CA	San Bernadino County DA's Office	CA	US Secret Service
CA	Los Angeles Police Department	CA	San Bernadino Police Department	CA	Vallejo Police Department
CA	Los Angeles Sheriff's Department	CA	San Bernadino Sheriff's Department	CA	Ventura County Fire Department
CA	Lompoc Police Department	CA	San Diego County Sheriff's Department	CA	Ventura County District Attorney
CA	Long Beach Police Department	CA	San Diego District Attorney's Office	CA	Ventura County Sheriff's Department
CA	Los Alamitos Police Department	CA	San Diego Police Department	CA	Ventura Police Department
CA	Los Altos Police Department	CA	San Fernando Police Department	CA	Walnut Creek Police Department
CA	Los Angeles County Fire Department	CA	San Francisco District Attorney	CA	Westminster Police Department
CA	Madera Police Department	CA	San Francisco Police Department	CA	Whittier Police Department
CA	Madera Sheriff's Department	CA	San Gabriel Police Department	HI	Honolulu Police Department
CA	Mariposa County Sheriff's Office	CA	Santa Ana Police Department	HI	US Naval Criminal Investigative Service
CA	Modesto Police Department	CA	Santa Ana Unified School District Police Department	ID	Jerome Police Department
CA	Monrovia Police Department	CA	Santa Barbara Police Department	ID	Twin Falls Police Department
CA	Moreno Valley Police—Riverside Co. Sheriff's Office	CA	Santa Clara Police Department	OR	Medford Police Department
CA	Mountain View Police Department	CA	Santa Maria Police Department	WA	Auburn Police Department
CA	National City Police Department	CA	Santa Monica Police Department	WA	Grandview Police Department
CA	Oceanside Police Department	CA	Santa Paula Police Department	WA	Mukiteo Police Department
				WA	Pend Oreille County Sherriff's Department

Appendix 12

Significant Less-lethal Related Activities

The less-lethal area of law enforcement is an ad hoc area for inventors and developers. There are few major initiatives to develop new less-lethal weapons, in contrast with the number of initiatives there are to develop lethal weapon programs. As a consequence, the Center devotes a portion of its time to attending small conferences and meetings to stay abreast of the latest developments, most of which originate with small developers and inventors.

March 1996: Attendance at the Non-Lethal Defense II Conference of the National Defense Industrial Association, Norfolk, VA.

June 1996: Presentation to the Test and Technology Symposium 96: "Less-Than-Lethal Technology Requirements."

January 1997: Demonstration to the Western Regional Advisory Council; The Ring Airfoil Grenade Riot Control System.

March 1997: Technical Presentation to the NIJ Liability Panel; Ring Airfoil Grenade.

May 1997: Technical Presentation to the LECTAC of Ring Airfoil Projectile, Orlando, FL.

June 1997: Reallocation of 20,000 Ring Airfoil Grenades for evaluation as a less-lethal technology for local law enforcement by NLECTC-West.

August 1997: Assistance with preparation of project proposal to reconfigure the Ring Airfoil Grenade Riot Control System; rename the projectile Ring Airfoil Projectile (RAP) and rework the launcher to the specifications and requirements for law enforcement.

August 1997-February 2000: Continued monitoring of the NIJ developmental program of the Ring Airfoil Projectile.

February 1998: Participated in down-selection of a less-lethal technology for research and developmental funding by the Air Force Research Lab under the Small Business Innovative Research Program. The project resulted in a prototype "air cannon" with less-lethal capability. Total funding by the Air Force Lab was \$850,000, with agreement that the technology could be

further refined for use in domestic law enforcement. This serves as an example of effective dual-use research for less-lethal technology.

March 1998: Presentation by NLECTC-West staff at the Non-Lethal Defense III Symposium, "Dual Use Applications for Less-Than-Lethal Weapons, Johns-Hopkins University, MD.

May 1998: Representation at a briefing of nonlethal weapons programs and capabilities and research presented by the US Army, Edgewood Arsenal, MD.

June 1998: Publication of the article "Effective Crowd Control Measures," written and delivered to Police Chief Magazine, with an emphasis on less-lethal technology as applied to the specific application of riot control.

March 1999: Presentation by the NLECTC-West, "The Ring Airfoil Projectile—A Chemical Delivery System," Tyson's Corner, VA.

September 1999: Coordinated and participated in a briefing to the California Peace Officers Association's COP-SWEST conference and trade show on the past, present, and future of less-lethal weapons in law enforcement from scientific, conceptual, operational, and programmatic points of view.

October 1999: Deployed a prototype ground-penetrating radar to attempt to locate a discarded murder weapon (at the request of the L.A. Sheriff's Department Homicide investigation unit).

December 1999: Hosted and presented a briefing on less-lethal technology (at the request of the California Peace Officers' Association) for members of the California Assembly, specifically focusing on dual-use (law enforcement/military) technology.

January 2000: Provided information and initial evaluation to the inventors of "Tigerlight," a product combining a powerful flashlight with a pepper spray dispenser. Subsequent to contacting the NLECTC-West, the Tigerlight team attended the OLECTC Commercialization workshop.

Appendix 13

Communication Project Abstracts

This appendix contains concise summaries of a number of information and communication projects that the Center undertook during the reporting period. The projects are separate and self-contained, but they demonstrate an overall awareness and familiarity with communication issues facing law enforcement and corrections agencies in the Western Region.

BORDER TACTical (BORTAC) Communications

Project Name

BORTAC Communications

Period of Performance

August 1995—Present

Description

BORTAC provides unencrypted voice communications interoperability through connection of law enforcement dispatch centers via a central hub radio center. The system connects radio systems in the 40-Mhz, 170-Mhz, 400-Mhz and 800-Mhz bands without changing-out radios in each agency's patrol units.

Center Role

The Center, in support of the Border Research and Technology Center, provided technical project management of the project.

Participants

Office of National Drug Control Policy (hardware), 14 Public Safety Agencies in San Diego. SDPD, SDSO, CHP, FBI, DEA, BP, US Customs, Federal Fire Department, Naval Station Security were the key participants.

Center Accomplishments

The BORTAC system has been used for dozens of pursuits, task force sweeps, and other multiagency operations. The need for such a system was identified as a high-priority item in 1995 by the US Attorney for the Southern District of California. By early 1996 several designs and approaches had been considered and eventually a low-cost design was funded. The approach uses COTS technology to bring standard phone lines to a central hub, which is the electronics bank of a Navy radio system. From this hub up to 16 agencies' phone lines can be connected so that radio conversations from one agency can be heard by the others. Each participating agency assigns a frequency to the phone circuit, and conversations on that frequency are shared by all other participants.

Center POC

Bob Waldron (310) 336-2124

Products

A prototype radio interoperability system, operations guide, and document of Frequently Asked Questions (FAQs)

Channel Capacity Analysis of Trunked Radio System

Project Name

Capacity of a Five-Channel Trunked Radio System for Voice Messaging

Period of Performance

July 1996—November 1996

Description

Determine if a five-channel trunked radio system can meet the current and future needs of the the South Bay Regional Communication Authority (SBRCA).

Center Role

Problem definition, information gathering, simulation analysis, evaluation of results, reporting results.

Participants

Dr. Fletcher Wicker, Mike Epstein, SBRCA personnel.

Center Accomplishments

The Center modeled the SBRCA current architecture and simulated worst-case scenarios using radio-traffic loadings from a recent earthquake event. The Center determined that a five UHF-channel trunking system would have a utilization of less than 10 percent, even when adding 1200 additional radios to the trunking system. It was concluded that the proposed system would meet the current and future needs of the SBRCA under any foreseeable circumstances.

Center POC

Mike Epstein (310) 336-2122

Products

Final Report—"Capacity of a Five-Channel Trunked Radio System for Voice Messaging," November 1996

Cellular Digital Packet Data (CDPD) Coverage Study

Project Name

CDPD Coverage Evaluation for San Buenaventura, CA

Period of Performance

February 1998—April 1998

Description

The City of San Buenaventura, California plans to use cellular digital packet data (CDPD) as the wireless transport for a new mobile data system. This study evaluated the CDPD radio coverage in and around the city.

Center Role

Took field measurements of the signal strength throughout the city; evaluated and documented the results.

Participants

Dr. Fletcher Wicker, Mike Epstein

Center Accomplishments

Verified the quality of CDPD coverage over the city and determined the responsiveness of the mobile data equipment being installed.

Products

Final Report—"CDPD Coverage Evaluation for San Buenaventura, CA," April 1998

Radio Interference Analysis

Project Name

Interference Analysis for El Segundo, California

Period of Performance

June 1998–August 1998

Description

The Center staff provided an overview of an interference analysis between the city of El Segundo and the Cities of Burbank, Glendale, and Whittier. El Segundo wished to use one of several "off-set" frequency pairs for voice messaging. The primary channel pairs adjacent to these "off-set" pairs are being used by the other cities. The analysis described the meaning of "off-set" pairs, covered the standard FCC approach to interference, and provided a detailed engineering analysis of the true interference potential.

Center Role

The Center staff conducted the analysis and developed a briefing for the El Segundo Police Department. This effort included:

- compilation and analysis of primary license holders
- problem definition of each proposed off set channel pair
- coverage analysis
- definition of interference problems
- development of interference mitigation approaches

Participants

El Segundo Police Department

Center Accomplishments

Recommended solution to the off-set allocation problem.

Center Point of Contact

Mike Epstein (310) 336-2122

Dr. Fletcher Wicker (310) 336-7024

Products

Briefing

Los Angeles Radio Interoperability (LA ROI)

Project Name

LA RIO

Period of Performance

August 1999–Present

Description

LA RIO is a radio interoperability project similar to the BORTAC project described elsewhere. The project is designed to promote public safety radio interoperability by interconnecting the dispatch centers of the participating agencies with voice connections. The voice connections

utilize an existing data network to move both baseband voice and push-to-talk signals across the data network via voice over internet protocols (VOIP). These protocols are commercially available and allow the agencies to transfer the audio signal from one agency to another for rebroadcast. Officers from one agency are able to communicate with officers from another agency, even if in a different frequency band or under a different modulation, without the need to exchange radios. Each officer is required to communicate with his or her own radio system in order to accomplish the connection. The process eliminates the need for multiple radios in each car and the need for dispatchers to utilize commercial phone systems to relay information.

Center Role

Project planning, system design, and testing.

Participants

Police agencies in the San Gabriel Valley of Los Angeles County, Office of National Drug Control Policy (hardware)

Center Accomplishments

Concept development, prototype development, testing, and technical project management.

Center POC

Robert Waldron (310) 336-2124

Products

Initial test deployment, briefings to participants, coordination of equipment purchases and installation, support to operator familiarization.

Manhattan Beach, CA Repeater Study

Project Name

Evaluation of Alternative Locations for the Backup Public Safety Radio Repeaters for Manhattan Beach, California

Period of Performance

April 1998–May 1998

Description

This study investigated various locations for an alternative public safety repeater for Manhattan Beach, California. The method for doing the evaluation used computer simulation of the propagation effects from the various sites.

Center Role

Gather radio-system information and terrain data, perform coverage studies for candidate locations, summarize alternative locations.

Participants

Dr. Fletcher Wicker, Mike Epstein, South Bay Regional Communications Center

Center Accomplishments

The Center modeled and evaluated six possible locations. The results of the simulations were used to define a rank ordering of the best possible alternative locations.

Center Point of Contact

Mike Epstein (310) 336-2122

Products

Final Report—"Evaluation of Alternative Locations for the Backup Public Safety Radio Repeaters for Manhattan Beach, California," May 1998

Mill Creek, WA Communication Study

Project Name

An Evaluation of Alternative Dispatching and Radio Services for Public Safety in the City of Mill Creek, Washington

Period of Performance

February 1998–April 1998

Description

This study provided an evaluation of alternative public safety dispatching and radio service for Mill Creek, Washington.

Center Role

The Center provided technical assistance to the Chief of Police, Mill Creek, Washington

Participants

Dr. Fletcher Wicker, Mike Epstein, Chief of Police—City of Mill Creek.

Center Accomplishments

The Center staff provided a fresh perspective as an unbiased party with a broader view of communications technology and its application to law enforcement. The Center addressed various issues for Mill Creek, providing an answers to the questions:

- Which of the available alternatives would provide the best service for the Mill Creek Police Department and the citizens of Mill Creek?
- How should the Emergency 911 calls be routed?
- Which alternative would provide adequate radio coverage for Mill Creek?

Center POC

Mike Epstein (310) 336-2122

Products

Final Report—"An Evaluation of Alternative Dispatching and Radio Services for Public Safety in the City of Mill Creek, Washington," April 1998

Portable Hostage Negotiation System

Project Name

Portable Hostage Negotiation System

Period of Performance

March 1998–December 1998

Description

Law enforcement agencies often need systems put together from off-the-shelf items to form an operational system. In response to the needs of several SWAT and hostage-negotiating units, the Center staff was asked to produce a Portable Hostage Voice Recording System from off-the-shelf components, integrated into a rugged aluminum case for field operations.

Center Role

The Center staff developed a prototype system:

- to record telephone conversations in either switched or continuous mode
- that used either a regular telephone handset or a headset for hands-free operations
- with four additional headphone jacks to monitor the recorded call (two sets of jacks are ¼ inch, the other two are ⅜ inch, so that no adapters are needed)
- with a 20-foot cable and speaker for group monitoring in a location away from the immediate vicinity of the negotiator
- powered by either 120-volt AC or 12-volt DC
- with FCC-certified standard telephone devices, with either audible or flasher ring indicators
- that is expandable to interface with throw phones, wireless listening devices and video surveillance equipment?

Participants

Los Angeles Sheriff's Department, Huntington Beach Police Department

Center Accomplishments

The Center staff developed an integrated set of off-the-shelf components to meet the recording needs of hostage-negotiating units. This portable, rugged system includes a secured recording device, a built-in phone set, remote speaker jacks, optional circuitry for a throw-phone interface, and wireless listening devices and video surveillance equipment, all molded into a aluminum carry case.

Center Point of

Contact Mike Epstein (310) 336-2122

Products

A prototype aluminum-cased, portable hostage voice-recording system.

Public Safety Radio Basics

Project Name

Public Safety Radio Basics

Period of Performance

June 1997–July 1997

Description

Developed a tutorial briefing presenting basic radio concepts including modern technologies, basic physics, physical effects, and regulations.

Center Role

Provided an introduction to wireless radio communication for public safety personnel. Addressed the major aspects of communications as well as propagation effects.

Participants

Dr. Fletcher Wicker, Mike Epstein

Center Accomplishments

Enabled the audience to be a more knowledgeable consumer of public safety radio services.

Center POC

Mike Epstein (310) 336-2122

Products

Briefing—"Public Safety Radio Basics," July 1997

Radio Study for Mat-Su Borough**Project Name**

Radio Study for the Matanuska-Susitna Borough, Alaska

Period of Performance

July 1997–September 1997

Description

Studied and documented the public safety communication system problems in the Matanuska-Susitna (Mat-Su) Borough in Alaska.

Center Role

Documented radio-system problems for dispatchers and radio users. Evaluated the entire emergency communications network within the borough. Identified potential and existing problems and offered upgrade suggestions and methods to fix the network. Prepared a course of action to improve the system.

Participants

Dr. Fletcher Wicker, Mike Epstein, Mat-Su Borough Director of Public Safety.

Accomplishments

The final report identifies potential and existing problems. It goes on to offer general methods to fix the communication network by upgrading to modern hardware. Finally, tasks are identified to solve specific problems.

Center POC

Mike Epstein (310) 336-2122

Products

Final Report—"Radio Study for the Matanuska-Susitna Borough, Alaska," September 1997

Modesto, CA Tower Interference Study**Project Name**

Radio Tower Interference Evaluation for the City of Modesto, California

Period of Performance

Nov 1999–Dec 1999

Description

Evaluated the proposed location of a radio tower at the new Emergency Dispatch Center in Modesto. The tower was to be within a half-kilometer of two existing AM radio station transmit sites.

Center Role

The Center studied the new tower's potential disruptive effect on existing AM transmitter towers, and examined the FCC applicable regulations to determine which agency

is responsible for the remediation of any detrimental effects on the existing AM stations.

Participants

Dr. Fletcher Wicker, David Ping, Mike Epstein

Center Accomplishments

The Center evaluated the proposed system installation against the FCC regulations and reported to the customer that they would be responsible to maintain the capabilities of the existing systems.

Center POC

Mike Epstein (310) 336-2122

Products

Final Report—"Radio Tower Interference Evaluation for the City of Modesto, California, and Stanislaus County, California," December 1999

Ventura, CA Mobile Data Computer Study**Project Name**

Mobile Data Options for Ventura, California Police Department

Period of Performance

March 1997–June 1997

Description

This tutorial briefing defined the components of a mobile data system as applied to public safety. All alternative methods of providing such a system were explored. Examples included commercial mobile data services, both land-based and satellite-based, as well as private systems. This briefing was developed at the request for the City of Oxnard, California chief of police.

Center Role

Provided a tutorial of all mobile data services available to the Ventura Police Department. Explained each data service's pros and cons. Detailed what future technologies to expect within this field of study.

Participants

Dr. Fletcher Wicker, Mike Epstein

Center Accomplishments

- Provided the Ventura PD with unbiased information about mobile data systems available within their area of responsibility.
- Provided a list of mobile data alternatives, stressing that one alternative cannot be the solution to all mobile data systems.

Center POC

Mike Epstein (310) 336-2122

Products

Briefing—"Mobile Data Options for Public Safety," June 1997

Appendix 14

Significant Counterterrorism Activities

The NLECTC-West has been involved with counterterrorism activities for several years. The following activities represent some of the conferences and publications in which the NLECTC-West staff participated.

November 1998: NLECTC-West published the article "Spotlight on Domestic Terrorism" in "Police Chief," describing the national concern of the threat of domestic terrorism, the National Guard initiative, provisions of PDD 39 and PDD 61, and the general strategy for domestic response capability to terrorist threats.

December 1998: NLECTC-West presented a concept-based strategy for counter-drug operations in a document titled "Mini-manual for Counter-Drug Operations." The concept is based on lessons learned and taught by classic and successful guerrilla tacticians, applied to the domestic security problem of the cross-border flow of illegal drugs. It was an initial attempt to identify a conceptual strategy and thereby technologies useful for the interdiction of the logistics train of illegal drugs.

January 1999: Laserwatch Program initiated. Shortly after the pursuit and arrest of a man who had attempted to disrupt law enforcement helicopter operations at the Ontario International Airport, the Terrorism Early Warning Group initiated a data collection review of the intentional use of lasers directed against aircraft. The data collection revealed a trend in the southwestern United States and California. NLECTC-West created a team and briefed law enforcement aircrew on the threat, technology, and countermeasures for intentional lasing. Six briefings have been given and more are scheduled. This initiative has led to the creation of a committee of the TEW analyzing emerging threats from other forms of directed energy, such as high-powered microwaves. The committee draws heavily on the technical expertise available through the NLECTC-West.

October 1999: Initiative to create a model for a local domestic-response network. This initiative plans to create a course of instruction with examples of a domestic-response organization and plan, leveraging the experience and preparation done by the L.A. TEW. This would include decision tools, protocols, and technology to assist local agencies in creating a similar response capability. Its purpose is to standardize certain procedures and protocols to facilitate regional cooperation and support in crisis situations, but still allow flexibility of local tailoring. An overarching theme of the course is to emphasize the importance of intelligence collection, intelligence synthesis, threat scenario preparation, event prediction, and cooperative operations among agencies with different responsibilities.

December 1999: Sponsored the development of a combination database and intelligence-analysis tool to assist in planning for threats to domestic security. The tool will be designed to collect, organize, and store threat information, suggest countermeasures, and collate data on similar threat events. In final development, this information will be shared, through secure networks, among law enforcement and public safety entities.

December 1999: Briefed and offered assistance to the State of Utah Office of Comprehensive Emergency Management in the planning and preparation for security for the 2002 Winter Olympics using concepts, tools, and methods developed for the L.A. County Terrorism Early Warning Group.

June 1997-January 2000: Participated as a regular member of the L.A. County Terrorism Early Warning Group

January 2000: Initial discussions with the Center for Civil Force Protection (CCFP) on cooperative initiatives for the regional preparation, response, and standardization of certain countermeasures for infrastructure protection and the mitigation and consequence management of terrorist events.

Appendix 15

BORTAC (BORder TACTical) Frequently Asked Questions

What is the San Diego BORTAC System?

The San Diego BORTAC (BORder TACTical) is a multiagency radio interconnect system that improves interagency communications for public safety agencies in San Diego. The system improves officer-to-officer communications between agencies by removing the need for a dispatcher from each agency to relay information between the two officers involved in the joint agency incident. Once the patch is activated the officers can speak directly to one another using their own radios.

How do officers normally communicate when they are on different radio systems?

Under most circumstances, an officer of one agency, desiring support from an officer of a different agency, asks his dispatcher to contact the other agency and request help. If the response is positive, the second agency's dispatcher contacts an officer to respond and then takes guidance and direction from the first dispatcher and relays the information to the second officer. The two dispatchers are generally speaking to each other on a regular phone system and are talking to their respective officers through the radio system. As a consequence, each side of a conversation is repeated through the dispatchers. The added delay can result in incomplete or inaccurate responses being received by the officers in the field. Further, in a fast-moving incident, the second officer can be responding to old information, which becomes a safety issue for both officers.

How does BORTAC change the normal radio communication between agencies?

BORTAC seeks to remove part of the delay and consequently improve safety by patching the two officers directly together so that they can communicate more efficiently and can create strategy and procedures on the fly without fear that one piece of a conversation may be missed by either of the two dispatchers. The dispatchers remain on the patch, but are relieved of the conversation relay and are free to concentrate on the safety of their respective officers and the needs of the officers.

When is BORTAC used?

BORTAC is used when jurisdictions abut one another and an incident in one jurisdiction naturally spills into the adjoining area. In these cases, agencies are required to work together at the patrol or field level, and it is here where BORTAC is most utilized, since is here where the radio systems of the agencies overlap, enabling BORTAC to work.

What started BORTAC in the first place?

The motivating force for the development of the BORTAC system was the desire of the US Attorney for the Southern District of California to improve interoperability amongst law enforcement agencies in his district. The numerous task forces created from local, state, and federal agencies required large amounts of money be spent on radios for the participating agents.

Usually, extra radios from one of the participating agencies

were purchased and distributed to the members of the task force from other agencies. Some of the task force members then carried two or more radios in order to participate in the task force.

The US Attorney asked the US Navy and the Border Research and Technology Center (BRTC), an organization funded by the National Institute of Justice (NIJ), to work together to come up with a cost-effective solution to the radio interoperability problems along the southwest border. The US Navy representative assigned to this project had background in the telecommunications field, which included Radio Trunking System Manager and Mountaintop Manager for the Navy. This background in the field proved beneficial to pulling the right points of contacts together for the law enforcement agencies in the San Diego area. The BRTC representative's background in the program management area also proved beneficial to this program.

Ultimately, funding from the Counterdrug Technology Assessment Center within the Office of National Drug Control Policy put the ideas and procedures into operation. Once hardware was purchased and phone lines connected, operations commenced and procedures were developed to use the system effectively.

Why couldn't more sophisticated solutions be used instead of handing out radios?

Other solutions exist but they are generally expensive. These solutions require moving all of the agencies to a common radio system, or buying a sophisticated master controller to supervise all of the participating radio systems. These and other solutions are expensive and they have the additional drawback that agencies are no longer in complete control of their radio systems. This is an impediment to merging everyone onto a common system or to having a super-controller manage an existing radio system.

Why couldn't all the agencies just pool their funds?

Numerous designs were examined that might achieve the interoperability desired by the US Attorney. These designs required buildout of large infrastructures with the latest in control architectures and technologies. However, these answers came with large price tags (eight figures), which were out of reach of the participants. In order to pool funds, the US Congress, many city councils, county supervisors, and most importantly voters would all have to agree to the combining of funds. This is extremely difficult to achieve and so was rejected as a solution.

What convinced the agencies to participate in BORTAC?

It became apparent that the agencies were interested in participating if the costs were low and there was not a significant change in their operating conditions. In general, the technical staff responsible for the communications systems were advised of the design concepts and it was this group of people who

explained the concepts to management. Having the agency's own technical staff involved from the beginning helped in the general acceptance of the system concept by the individual agencies.

Is BORTAC the long-term answer to radio interoperability for public safety agencies?

No. BORTAC is an interim answer until the many issues facing public safety radio systems are addressed. Public safety radio systems probably need to be combined to share scarce resources, but the problem is difficult. BORTAC provides an interim answer and it gives the agencies an opportunity to share their limited resources while maintaining control. Eventually, the agencies may find a way to combine their radio systems. Generally that has to wait until someone has to rebuild or modernize an existing system.

What is the architecture of the BORTAC radio system?

BORTAC is really a hub-and-spoke system. At the hub is a public safety radio console, which has a central electronics bank (CEB). At the end of the spokes are the participating public safety agencies and their radio control systems. The hub is connected to the other radio controllers via a base interface module (BIM) card and a regular voice-grade phone line that are dedicated to the interconnection. This means that there is no dial tone on the line and it is leased only for making this connection between the hub and one public safety agency. Some agencies provided radio control stations or base stations that were hardwired to the hub's CEB for interface. This approach eliminated the phone line interconnect that some systems cannot support.

What is the function of the hub?

The hub radio system is the terminus for all of the phone lines coming from the spokes. The hub radio system has software in its central electronics bank (CEB) that can cross-connect any combination of the phone circuits, creating a patch. The patch is a modern update of the telephone switchboard that was used to connect callers in the days before automated circuit switching. When the patch is activated, all of the agencies that want to be on the patch have their dedicated BORTAC phone circuits or radio equipment connected.

How does having a phone circuit connected to a patch help radio interoperability?

Once an agency, one of the spokes, has its phone circuit or radio equipment patched to other circuits, the agency can assign one of its radio frequencies to be connected to the circuit. All of the voice transmissions on the frequency automatically transmit down the phone circuit. This means that an officer on the agency's frequency can have his or her voice heard by all of the other agencies connected to the patch. The officer does not have to do anything different with the radio. It is all taken care of by the dispatcher, who connects the frequency to the phone circuit.

What happens to the agency's radio modulation when the patch is made?

When the officer's radio transmission comes to his agency's central control area, the only pieces left are his or her voice and a small, inaudible signal, which tells the transmitter to broadcast. The radio modulation was used to carry the officer's voice from his or her radio to the repeaters and other antennas used

by the radio system. The modulation protects and isolates the voice so that it is recognized by the radio equipment and sent to the correct radio location, in this case the dispatch center. Once the voice reaches the dispatch center, the modulation has done its job and is no longer needed.

How does the voice of an officer in one agency reach the other agencies?

When the officer's voice reaches his/her dispatch area and travels down the phone circuit, it is automatically connected to all of the other phone circuits. The voice travels down each of these phone circuits and comes into the dispatch center for all of the connected agencies. The voice, along with its inaudible tone, looks like a voice input from the dispatcher at the agency. Each agency's radio system takes the voice input and modulates it in a format that is specific to that agency's radio system. The modulation then carries the voice on a specific frequency assigned by the dispatcher (in a trunked radio system the voice becomes part of a talk group). All officers listening on that frequency hear the voice from the other agency on their own radios.

Doesn't the modulation of a listening agency get confused by the first agency's modulation?

Remember, the modulation of the first radio system was discarded before it was sent down the phone line. The first agency's modulation was dropped once its officer's voice reached his or her central radio system. The other agencies only hear the voice and they do not have to know anything about the modulation used by the first agency.

Does using BORTAC mean that if my agency has VHF radios I can talk to UHF radios?

Yes, as long as the voice is transmitted through the patch. Once the voice is sent through the patch all of the specific information about the modulation format is discarded. BORTAC currently has low band, VHF, UHF conventional and trunked, and 800-MHz systems interconnected.

If my officers only need their own radios, what do I have to tell them about using the patch?

First, you have to tell your officers that your dispatcher has to help set up the patch. Until your dispatcher interconnects one of your frequencies to the audio circuit, your officers cannot communicate to the other agencies (unless, of course, you have their frequencies in your radio system). Your officers have to be familiar with the operating procedures of the other agency they are talking with and they have to be careful about using special code words that may not be understood by the other agency.

What kind of training is required for dispatchers and field units?

In San Diego we approached the training in two separate ways.

First, we conducted tabletop exercises and simulated disaster scenarios with the help of tabletop exercise instructors from the San Diego Police Department to help the field units on BORTAC operations and procedures.

Second, we had members from our technical team, who volunteered their time, go out and train taskforce team members as well as agencies dispatchers on BORTAC operations and procedures. These members provided valuable assistance and training to the dispatchers and field units for the use of BORTAC.

What do the dispatchers have to do?

The dispatcher, once he or she determines that assistance from another member of the patch system is appropriate, has to contact the dispatchers at the hub as well as the dispatcher at the other agency who may help. Once two agencies agree to be patched, the dispatcher at the hub uses a computer mouse to click on the symbols representing each agency. This simple procedure then connects the phone circuits from the hub to the participating agencies. The agencies' dispatchers in turn connect a frequency to the circuit. Once connected, officers in the field can communicate directly with one another.

How long do the setup procedures take?

The setup procedures take about one minute or less today in San Diego. At first, before training, it took several minutes. Now, the agencies have all of the required phone numbers on speed dial and they all recognize that when a BORTAC request comes in there are a few special procedures to follow, i.e. the phone calls and determining the availability of officers to assist on the incident.

Can patches be arranged in advance?

Certainly. In many cases, joint operations amongst San Diego agencies anticipate the need for the patch and plan accordingly. The agencies all inform their dispatchers that there will be a patch for a certain period of time (sometimes several days), and then agree to the terminology that will be used during the patch. These agencies inform the hub dispatchers as well so that once the operation commences everyone understands the procedures.

Do the hub dispatchers monitor all of the frequencies of the participants?

Not in San Diego. The hub dispatchers are members of a public safety agency and they have their own responsibilities. The hub dispatchers wait for the phone call from the spoke dispatchers. Since the patching is simple and they do not have to monitor the patch once it is established, it is relatively easy for them to assist and make the connection. The hub's logging recorders do record all aspects of the conversation because all of the audio is passing through their central electronics bank.

What if my dispatcher gets a request for a patch and is already busy?

The BORTAC rules in San Diego say that if your agency is too busy to assist another agency, then you can decline the patch request. In this case the first agency is no worse off than before. They may go to a second agency for assistance if it makes sense or they may just continue to handle the incident on their own.

Can I use encryption on the BORTAC system?

The San Diego BORTAC has not done formal testing on encryption. If the encryption scheme is removed once the voice transmission reaches the central dispatch area of an agency's radio system, then the voice could, in theory, be encrypted again by the other agencies on the patch. From a practical sense, though, engineers seem to feel that the quality of the voice will be poor after going through two different types of encryption and decryption. In some systems the encryption would not be removed at the console and therefore the voice would be unintelligible to the other agencies.

Does having a BORTAC system mean that I can fill in "holes" in my radio system coverage?

No. BORTAC does not add any towers or repeater locations to your radio system. It only connects your dispatch centers. Consequently, your officers' radios still have to communicate to the dispatch center by using your existing radio system. If you have a "dead zone" in your coverage but another agency covers that zone, you will not be able to use that agency's coverage to help yourself. If you try to use the other agency's radio coverage, your modulation will not be recognized by that radio system and it will ignore your radio signal. Since your system cannot hear your radio in the "hole," your field radio will not reach your dispatcher, either. In either case you will not be able to communicate with anyone else.

How do I know if BORTAC is suitable for my area?

There is one fundamental assumption that has to be answered positively: do the agencies considering the BORTAC concept need to work together from time to time and are then interested in improving interagency communications? If the answer is yes, then BORTAC is suitable for your area.

There must be more than willingness to cooperate. What other issues need answers?

In addition to a willingness to cooperate, the potential BORTAC group needs to have an agency that is willing to be the hub. Without some agency willing to be in the middle of the patching and make the connection, it is very difficult to have a BORTAC-type system. In general, this hub probably needs to be staffed twenty-four hours per day, every day. The hub should also have a modern radio system that can accept the phone circuits and make the patches via a computer-controlled console. A 911 public safety answering point (PSAP) is an excellent candidate for a BORTAC hub, since PSAPs manage emergency calls on a seven-day-per-week, 24-hour-per-day basis.

Are there technical issues to be understood in order to use BORTAC?

The technical issues focus on the existing radio systems of the potential participants. First, there has to be some overlap in radio-system coverage, because it is in the overlap areas that two officers can each talk to their own radio system and therefore be patched together. Second, someone has to collect information about the radio systems that will be patched so that equipment can be purchased to make the connections.

What sort of equipment has to be purchased?

Generally, the participating "spoke" agencies will need an base interface module (BIM) card that will connect to the phone system. The form and shape of this module varies depending on the age and make of the radio system. In most cases it is a relatively simple device, costing about \$800-\$1,000. The hub radio system needs to have "capacity" to accept the phone circuits that are coming in from all of the spokes. This generally requires "slots" in the electronics bank that hold circuit boards that have phone connections on them. The number of these slots can be increased somewhat in a modern radio system, but the increased capacity may cost tens of thousands of dollars. The answer is specific to the current design of the hub radio system.

Where do I get these phone lines and are they special?

The phone lines are not special, not in the sense of the phone lines used for high-speed computer interconnect. These phone lines have to be able to carry voice signals, which is about the simplest phone circuit you can order. However, the circuit cannot have a dial tone on it and it has to be capable of carrying the inaudible signaling tones that accompany the voice. Generally, the radio-system maintenance technicians can determine the type of signaling tones and therefore order the correct phone circuit. The type of signaling tone also affects the BIM card mentioned above. There is not a great change in price, just a different formulation of the components on the BIM card.

What has been the role of the federal government in BORTAC?

The federal government has been highly involved in the San Diego BORTAC. However, different levels of involvement can be attained, depending on your agencies. In San Diego the US Attorney requested help in solving communications interoperability problems. He went to the National Institute of Justice (NIJ), which operated a Border Research and Technology Center (BRTC) in San Diego, and the US Navy Public Safety Office (NPSO) and asked for technical assistance. The BRTC and NPSO are now the BORTAC Joint Program Managers. The NPSO offered to become the hub of the BORTAC.

A critical item in the buildout of the system was funding for equipment and phone circuits. The Counterdrug Technology Assessment Center (CTAC) of the Office of National Drug Control Policy (ONDCP) provided funding for these items, and it was this funding that took the ideas generated by the other agencies and made them a reality.

It is conceivable that a group of agencies, using their own funds, could design and build a BORTAC-type system with no federal involvement at all. If the hub system does not require funds to expand or upgrade, then the cost of phone circuits and interface cards become the major expenditure, and these items would cost a few thousand dollars per agency.

If we use federal funds for BORTAC, what strings are attached?

The only requirement for using CTAC funds for starting BORTAC is that there be some counterdrug mission in the agencies that are connected, and that the agencies make an honest effort to try the system and evaluate its utility for their needs.

If we get BORTAC do we have to create an administrative bureaucracy?

There will have to be one agency responsible for organizing the BORTAC system locally. This is not a federal requirement, it is just an obvious necessity for a multiagency activity. In general, the hub agency should provide the administrative coordination, which generally means ensuring that any memoranda of under-

standing be signed and agreed to. Agencies generally prefer to have a written document that indicates their role and responsibilities in a joint venture such as BORTAC.

It might well be that the participating agencies would combine their recurring phone line charges into a single package price or that they may wish to reimburse the hub agency for some dispatcher or recorder expenses. All of these arrangements are made independently of the federal government. From time to time CTAC may request information regarding use of the system and examples of the benefits to explain how CTAC funds have been expended. However, no formal reporting requirement is levied upon the participating agencies by the Federal government.

Do you have some examples of how BORTAC is used?

BORTAC has been used for two basic types of law enforcement operations. In the first, the most obvious, an incident from one agency spills over into an adjoining agency's jurisdiction and the first agency would like assistance. Pursuits are an example, particularly when the second jurisdiction has detailed knowledge, say of roads, that the first agency may lack.

In San Diego pursuits started by the California Highway Patrol (CHP) may end up in the City of San Diego. The San Diego Police Department has, in some cases, been able to patch one of their helicopter units to the CHP cruiser, providing the CHP officer with a resource unavailable normally. Canine units from the city have also assisted other agencies when a pursuit terminates and the suspect flees into the urban environment.

In the second type of operation, agencies agree in advance to conduct a joint operation and have all of their officers on the BORTAC patch. In San Diego there have been as many as one hundred officers from five or six agencies on a patch to coordinate a drug sweep or a parole-and-probation sweep. The more complicated the operation, the more planning is required.

What are the minimal expenses required to start a BORTAC System?

If a group of agencies wish to interconnect and have a hub radio system that is suitable and does not need expansion, then each agency will have to spend \$3000 to \$4000 to install a phone circuit and buy a base interface module (it may be a base station if the radio system has no electronics bank). The phone circuit may require a monthly service fee that depends on the distance of the circuit. If the Hub agency needs to expand or upgrade in order to accept and manage all the phone circuits, then the costs rise substantially to six figures.

Do I have to call it BORTAC?

No. Your group of agencies can refer to the system as they please. However, it is important that everyone agree on a common name. Otherwise, there can be much confusion when the dispatchers are requesting a patch from another agency, which calls it something different.

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National Criminal Justice Reference Service (NCJRS)
Box 6000
Rockville, MD 20849-6000