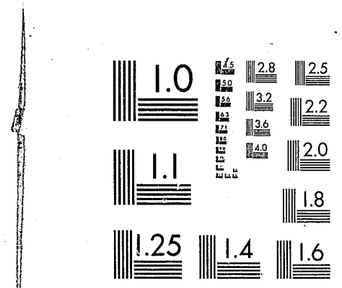


M71

ANNUAL PROGRESS REPORT
FISCAL YEAR 1974

Law Enforcement Development Group

August 1974

DEVELOPMENT

Prepared for

NAL INSTITUTE OF LAW ENFORCEMENT AND CRIMINAL JUSTICE
Law Enforcement Assistance Administration
U.S. Department of Justice

THE AEROSPACE CORPORATION

Aerospace Report No.
ATR-75(7903)-1

EQUIPMENT SYSTEMS IMPROVEMENT PROGRAM

ANNUAL PROGRESS REPORT
FISCAL YEAR 1974

Law Enforcement Development Group
THE AEROSPACE CORPORATION
El Segundo, Calif. 90245

August 1974

Prepared for

NATIONAL INSTITUTE OF LAW ENFORCEMENT
AND CRIMINAL JUSTICE
Law Enforcement Assistance Administration
U.S. Department of Justice

This project was supported by Contract Number J-LEAA-025-73 awarded by the Law Enforcement Assistance Administration, U.S. Department of Justice, as amended. Points of view or opinions stated in this document are those of the authors and do not necessarily represent the official position or policies of the U.S. Department of Justice.

Aerospace Report No.
ATR-75(7903)-1

EQUIPMENT SYSTEMS IMPROVEMENT PROGRAM

ANNUAL PROGRESS REPORT

FISCAL YEAR 1974

Approved

John O. Eylar, Jr., General Manager
Law Enforcement and Telecommunications
Division

CONTENTS

TABLE

FIGURES

I. INTRODUCTION AND SUMMARY

I. INTRODUCTION AND SUMMARY

As part of the Equipment Systems Improvement Program sponsored by the National Institute of Law Enforcement and Criminal Justice, The Aerospace Corporation has been under contract since May 1972 as the Development Group to support this program and translate equipment needs into practical systems for law enforcement and criminal justice operations.

The activities of the Aerospace Development Group include studies to identify high-priority problems and define solutions to these problems; system engineering and technical management support is provided to guide the development of new equipment to solve these problems. In meeting those objectives, the Development Group utilizes the resources of industry to fabricate hardware and prototype systems.

Aerospace Corporation is a California chartered not-for-profit corporation, technically defined as a Federal Contract Research Center; the company provides planning, engineering, and scientific services to federal and local government agencies. By limiting its contractual involvement to government agencies and not engaging in the fabrication of hardware except through industry subcontracts, Aerospace is able to provide unbiased, objective advice and counsel to its sponsors. The Corporation employs a technical staff of 1500, trained and experienced in systems operations, program management, and scientific and engineering disciplines; 60% of the staff possess master or doctorate degrees. By selectively utilizing the capabilities of this staff, the Equipment Systems Improvement Program is provided an extensive resource of experts to support the planning, systems management, contractor monitoring, and evaluation activities required to successfully develop new equipment systems. Furthermore, by utilizing industry resources through subcontracts, the Development Group can provide a broadly supported development program involving the most appropriate elements of industry.

The Development Group effort during Fiscal Year 1974 encompassed three general categories of work:

1. General Program Planning
2. Development Program Support
3. Special Technical Support/Grant Monitoring

The FY 74 activity under each category is described briefly and summarized in the next three sections.

GENERAL PROGRAM PLANNING

An important segment of the development activity involves planning studies and analyses which support on-going development projects or lead to the identification and selection of additional concepts for improved law enforcement and criminal justice equipments.

During FY 74, the activities and tasks in support of the general program planning effort changed in size and scope from that of the previous year. The effort was broadened as the equipment development program grew and became more fully integrated with other Institute activities. In addition, more general planning studies were initiated to determine the important factors involved in crime reduction and the influence specific equipment systems can have on these factors.

Preparation of Annual Operating Plans and supporting project task plans continued during the year. Several documents were published summarizing these plans. Analysis and support assessing critical planning factors associated with the citizen alarm, body armor field tests, and forensic science development programs were also completed. In addition, planning efforts were initiated in FY 74 to ensure consistency with the management by objective process implemented within LEAA during the past year.

DEVELOPMENT PROGRAM SUPPORT

During the first year of the equipment development program, eight projects were initiated. Five of these projects were continued into FY 74 and four new development projects were initiated. These nine projects are briefly outlined and summarized in the following:

Cost-Effective Security Alarm System. This effort, initiated in FY 73, is part of a program to develop reliable and low-cost alarm systems for use in residences and small businesses. The development of feasibility hardware, initiated in FY 73 under subcontract with Sylvania, was successfully completed in FY 74. Additional FY 74 activity included follow-on feasibility analysis and a report summary of the results of the survey and assessment of alarm system concepts. Procurement documentation was prepared for the award of industry subcontracts early in FY 75 for (1) development of an electrical field detection sensor and (2) evaluation of external communication links between sensors and alarms.

Citizen Alarm System. This program involves the development of a citizen alarm system which provides a means of reporting in real time when, where, and to whom a criminal attack is occurring. The development of feasibility hardware for use inside buildings was subcontracted in FY 73. This subcontract to Compu-Guard, Inc. was successfully completed in FY 74. Analysis and definition of a more sophisticated system for use in outdoor public areas (as well as within buildings) was initiated in FY 74. Preparations were made for initiating a subcontracted effort on this latter system in FY 75.

Improved Protective Armor. This project exploits the characteristics of a new plastic cloth that is bullet-proof against small-caliber handguns and can be fabricated into reasonably comfortable and presentable conventional garments. The activity was initiated during the previous fiscal year and involves the cooperation of the Land Warfare Laboratory of the Army as well as the National Bureau of Standards. The FY 74 activity focused on understanding blunt trauma effects (damage resulting from absorbing the energy of a non-penetrating bullet), environmental testing of the material, garment development and fabrication methods, and preparations for field evaluation to be undertaken in FY 75.

Speaker Identification. In response to Institute direction, a comprehensive program was initiated in FY 73 on speech analysis and speaker recognition. The state of the art was assessed and necessary test and development effort identified. The principal FY 74 activity focused on the subcontract awarded to Rockwell International, Inc. for the development of a computer-aided, semi-automatic speaker identification system. Additional FY 74 effort included in-house assessment of concepts and procedures for extending courtroom use and acceptance of voiceprints.

Cargo Security. This program was initially concerned with the development of a system for (1) determining when a cargo-carrying truck has been hijacked or stolen and (2) providing information on the identity and location of the hijacked truck. The in-house effort on assessing truck-locating concepts initiated in FY 73 was continued during FY 74. In addition, the development effort was expanded during this past year to include consideration of theft of partial loads while the vehicle is in transit or parked. Steps were initiated for a future development subcontract of systems for detecting vehicle intrusion or partial cargo theft or pilferage.

Blood and Bloodstain Analysis. This project involves a review of the current state of the art for relating blood or bloodstain samples to a specific individual. The blood analysis techniques currently used in Great Britain and other countries were assessed, and the statistical validity of blood individualization was examined. As a result of this effort, steps were initiated to award a subcontract for research and development on a bloodstain analysis system. A subcontractor was selected, and contract negotiations were in progress by the end of the fiscal year.

Explosives Detection and Identification. In response to Institute direction, a program was initiated for developing improved equipment for detecting explosives and investigating explosions. Concepts for tagging explosives to permit their detection prior to use and identification of

manufacturing sources after use are being examined. The feasibility of establishing identifying vapor signatures for untagged explosives was considered. A subcontract was awarded to Case-Western Reserve University to study the feasibility of a laser optoacoustic device for explosives detection. In addition, a Request for Proposal was released for competitive procurement, to evaluate an effort to characterize vapors which emanate from explosives. All activities under this general program category are closely coordinated with the Ad Hoc Interagency Explosive Technical Subcommittee established under the Bureau of Alcohol, Tobacco, and Firearms.

Detection of Gunshot Residue. Aerospace scientists conducted an investigation into the feasibility of developing reliable techniques and inexpensive laboratory equipment for detecting gunshot residue on hands and on the body area surrounding bullet wounds. Currently available methods either lack sensitivity and reliability or are expensive and inconvenient to use. The FY 74 effort included (1) data collection by literature search and survey, (2) evaluation of a concept utilizing a molecular luminescence detection technique, and (3) assessment of the feasibility particle analysis concepts.

Latent Fingerprint Research. Police departments and crime laboratories spend tens of millions of dollars annually in classifying, searching, and matching latent fingerprints The purpose of this program was to explore the application of advanced technology for improving the coding, file search, and matching of latent fingerprints in order to provide cheaper and more rapid methods for fingerprint tracing and identification. Concepts involving mathematical transforms of the fingerprint image, image enhancement, and pattern recognition were examined, and a comparative survey and assessment of both automatic and semi-automatic concepts were completed.

SPECIAL TECHNICAL SUPPORT/GRANT MONITORING

In addition to the hardware development activities described on the previous pages, technical support was provided on three special projects for evaluation of unsolicited proposals and concepts. Brief discussions of the three Special Technical Support projects are presented below along with a brief summary of the other evaluation support.

Police Vehicle Study. The occurrence of a petroleum fuel shortage early in FY 74 led LEAA to request a short, rapid-response study on the adaptability of small cars as police vehicles. With cooperation of consultant support, all known possibilities for reducing police car fuel consumption, including car size and weight, driving habits, vehicle configuration, and vehicle maintenance, were examined and potential improvements in fuel consumption were estimated. It was concluded that smaller cars have greater utility as police vehicles than current use would imply. It was further concluded that if other possible fuel economy measures are combined with wider use of smaller cars, a 40% reduction in police fuel consumption might be achieved.

Energy Task Force. The petroleum fuel shortage led Mr. Donald Santarelli, the Law Enforcement Assistance Administration Administrator, to establish an Emergency Energy Committee in December 1973. The function of this Committee was to assess the effects of the energy crisis on law enforcement and criminal justice systems and to develop and disseminate information to local agencies on effective means for responding to the crisis. The Aerospace Development Group provided technical support to the Committee during the final seven months of FY 74 and developed information on methods for energy conservation, prevention of energy-shortage-related crimes, and procedures for obtaining adequate fuel supplies.

Project 911. Early in FY 74 the Alameda County (California) Regional Criminal Justice Planning Board received a one-year grant

from LEAA for a study to determine the feasibility of implementing an automated 911 telephone system in the county. Cost, legal issues and the technical issues of automatically routing emergency calls to the appropriate responder and identifying the calling number and location were to be examined. The Development Group provided technical consultant services for this study. Specific tasks undertaken include analysis of 911 equipment and design options, cost, traffic characteristics and volume, system vulnerability to false alarm or saturation, and response time assessment.

Additional activity in Special Technical Support involved grant monitoring and technical evaluation of reports and unsolicited proposals to the Institute. During the year a total of 56 Technical Instructions was issued by the Institute to the Development Group for support in this area.

Four active grants were monitored during the year, and 10 reports and summary letters were written in support of the grant monitoring and evaluation effort. Technical evaluations were made of approximately 35 reports and unsolicited proposals and concepts. A discussion of the specific tasks performed in response to the Technical Instructions is presented in Section IV of this report.

APPENDICES

There are three appendices in this report summarizing the correspondence, documentation, and meetings attended in the course of supporting the Equipment Development Program in FY 74. These appendices provide a reference list for all the information related to individual task activities.

II. GENERAL PROGRAM PLANNING

The purpose of the General Program Planning activity is to conduct studies and analyses to define new systems and guide developments undertaken by the Law Enforcement Development Group. This requires analysis of law enforcement problems and assessment of the potential of new systems to solve these problems and reduce crime.

During the past year, the activities and tasks in support of the general planning effort changed in size and scope from that of the previous year. The Planning Group became better established in the Washington office, and the activity was broadened as the equipment development program grew and became more fully integrated with other Institute work. While the FY 74 effort continued to be heavily oriented to review of the potential new programs and the formulation of operating plans, additional planning tasks were undertaken to relate equipment development effort to the goals and objectives established for the Institute and LEAA. In particular, planning efforts were initiated to make the development program consistent with the management by objective process which was implemented during the past year within LEAA and the Justice Department.

Five major components of the general program planning activity evolved during the second year of the equipment development program operation.

Annual Operating Plan/Task Plans

An Annual Operating Plan is prepared which describes the Development Group projects and highlights the efforts planned for each major subtask in the individual development. Subcontracted efforts and estimates of scheduled deliveries are provided to indicate the major milestones of the program. Each program is also described by task plans which contain current-year objectives, a statement of work, delivery schedules, and a

fiscal year budget summary. These task plans were updated during the year as the program scope, cost, or schedules changed.

Analysis Requirements for On-Going Projects

A review is made of on-going projects to determine the data and analysis required from the Analysis Group of the Equipment Systems Improvement Program - MITRE Corporation. The data requirements generally relate to the identification of user needs, including surveys and assessments of user operations. This is information which the MITRE field operations can supply to assist in guiding the development programs.

Analytical Assessment of Current Projects

Equipment systems currently under development require continual planning support as the program progresses. This effort is conducted jointly by planners and the equipment development engineers and usually involves assessment of specific problems or critical design parameters which affect a current development project. These could involve studies such as acceptable false alarm rates for alarm systems or the number of prototype units required for meaningful field tests.

General Analytical Studies

Studies of a broad nature are conducted to analyze various factors influencing the development of new equipment systems. These involve activities such as analysis of crime statistics, review of criminal justice, R&D expenditures, modeling of the criminal justice system, or review of recommended standards and goals for law enforcement and criminal justice agencies.

Institute Planning Support

This is a new planning subtask for FY 74, and it is intended to better integrate the equipment development program with other Institute work. This support is also responsive to the new management by objective methods which were initiated throughout the Department of Justice in FY 74.

The planning support continued to be a challenging effort during FY 74 as the equipment program completed its second year of operation. As described below, the planning functions involving formulation of operating plans and program documentation continued, but increasing emphasis was placed on studies to determine the important factors involved in crime reduction and the specific equipment systems which can influence these factors.

The summary which follows provides an overview of the major planning activities conducted during the past year. Specific details concerning individual studies and analyses should be obtained from the referenced reports and other documents.

A. ANNUAL OPERATING PLAN/TASK PLANS

The Annual Operating Plan and Project Task Plans are contractually required documents which describe the nature and content of the individual equipment development projects. Considerable effort is involved in the preparation of these documents, because of the importance of adequately describing specific subtasks and formulating realistic development program schedules.

The initial work in this area involved completion of the FY 74 Annual Operating Plan and task plans. The FY 74 Annual Operating Plan was released and approved in June 1973. In July final corrections were made, and 20 copies were delivered to the Government Project Monitor (GPM). Final versions of task plans for the eight development projects outlined in the FY 74 Annual Operating Plan were also completed and forwarded to the GPM in July.

In August 1973 a supplement to the FY 74 Annual Operating Plan was prepared and submitted to the Institute. This additional submission included the following nine new development projects for possible funding support:

- Individualization of Hair
- Improved Airborne Policing
- Detection of Gunshot Residue
- Office and Inmate Security System

- Police Emergency Call Warning System
- Improved Institution Locking System
- Thermoluminescence Techniques
- Automated Inmate Accountability System
- Analysis of Non-Blood Body Fluids

In November 1973 further revisions were made to the task plans for all on-going development projects. In addition, task plans for the following five new programs were written and submitted to the Institute:

- Detection of Gunshot Residue
- Police Vehicle Study
- Automatic Radio Caller Identification
- Integrated Property Protection and Accountability System
- Law Enforcement Protective Armor

In December two of the five new tasks were approved for inclusion in the FY 74 development effort. These were the development of new methods for detection of gunshot residue and the police vehicle study.

In December 1973 work began on the preparation of the FY 75 Annual Operation. The planning effort concentrated on the FY 74 projects having a high probability of continuation. As a reflection of the evolutionary nature of the Equipment Systems Program, three field evaluation programs and eight development programs were described in the first draft, submitted to the Institute in January 1974.

During February and March 1974, the FY 75 Annual Operating Plan was revised in accordance with comments from the Government Project Monitor. Preliminary task plans for the 11 development and evaluation programs were prepared and submitted. On 5 April 1974 the FY 75 Annual Operating Plan was approved by the LEAA Contracting Officer. The Annual Operating Plan included the following projects:

- Development Programs
  - Explosives Detection and Identification
  - Protective Armor

  - Cost-Effective Security Alarm System
  - Citizen Alarm System
  - Truck Anti-Hijacking and Trailer Security System
  - Speaker Identification
  - Blood and Bloodstain Analysis
  - Detection of Gunshot Residues
- Evaluation Programs
  - Citizen Alarm Field Evaluation
  - Body Armor Field Evaluation
  - Energy Evaluation

These projects became the FY 75 equipment development program; task plans were written, revised, and submitted on the 11 programs by the end of the year.

The following documents were produced in support of this planning subtask during FY 74:

Final FY 74 Annual Operating Plan and Task Plans - July 1973
Supplement FY 74 Annual Operating Plan - September 1973
FY 75 Annual Operating Plan - January 1974
FY 75 Task Plans - June 1974

B. ANALYSIS REQUIREMENTS FOR ON-GOING PROJECTS

In early 1974 a review was made of all on-going development projects to determine the data required from MITRE Corporation, the company performing problem analysis for the Equipment Systems Improvement Program. These data and analysis information would improve the understanding of user requirements and provide additional information to guide equipment development. The following examples illustrate the type of information requested.

For the security alarm program, data were requested on the description and characteristics of the victims suffering the greatest burglary losses. The requested data included:

- The average losses per year for various targets and description of high-risk targets, including architectural information, location within the city, neighborhood characteristics, etc.
- Methods of breaking and entering, minimum and maximum time for breaking and entering, points of entry, etc.

It was anticipated that most of this information would be available from police reports at the various MITRE field sites.

As another example, data were required for the truck anti-hijacking system development related to (1) percentage of thefts in which the driver is detained, (2) method of theft, (3) number of hijackings in which another truck is at the scene, (4) number of hijackings in which the truck is driven to a warehouse, (5) total time for the hijacking to take place, etc. These and other data related to the type and manner of hijackings would assist in designing the second-generation prototype anti-hijacking system.

In support of the FY 74 forensic science programs, data were requested on the frequency which physical evidence is found at the index crimes and the percentage of the index crimes which involve analysis of crime scene evidence, such as fingerprints, bloodstains, or hair identification. Information on the significant operational problems involved in collecting evidence at the scene of the crime was also requested. It was hoped that the analysis field representatives could obtain these data from police reports and interviews with crime laboratory personnel.

In total, 39 analysis tasks and data requirements were identified for the eight on-going development projects. These tasks and required data were summarized in a document transmitted to the Institute in early August 1973.

Before the analysis work and the collection of data were fully under way, MITRE Corporation's field operations were phased out of the Equipment Systems Improvement Program, leaving the collection and the analysis of these data to the Development Group. During the latter half of the year, the collection and review of data for various analysis tasks were initiated on most of the on-going development projects.

The summary of the analysis data requirements was contained in Aerospace correspondence 3330-JOE-73-589, transmitted to the Institute on 16 August 1973.

C. ANALYTICAL ASSESSMENT OF CURRENT PROJECTS

In conjunction with the collection of statistics and crime-related data, several analytical studies were initiated to support the current development projects. Typically, these were studies that planning personnel conduct jointly with development engineers to analyze the influence of various factors on current equipment developments. This effort generally requires analysis of field data and statistics and assessment of the effect of new equipment on law enforcement operations.

The principal analytical assessments in FY 74 involved the Citizen Alarm, Burglar Alarm, Lightweight Body Armor and the Forensic Science Development Programs.

Review of Citizen Alarm Design Requirements

A general review was made of the Citizen Alarm System to reassess key design parameters relative to system costs and projected impact on police resources. The analysis included a review of the violent crime statistics according to geographic distribution and specific locations of these crimes (alleyways, streets, inside buildings, etc.). This information was used to analyze the relationship between response force requirements and frequency of use of the Citizen Alarm System.

The initial review showed that while the citizen alarm system is technically feasible, its overall effectiveness was dependent on police response forces and their timely arrival at the crime scene. Since one of the important system design parameters affecting the size of the response forces is the false alarm rate (assuming a response is made to all calls transmitted), a more detailed analysis was made to understand the relationship between false alarms and the required patrol forces.

A response model was developed for analyzing the interrelationship between system use, false alarm rates, police response times, and police resources. The model contained baseline data from the RAND-Larson study of a precinct in New York City having a population of about 125,000. From these data, the baseline for the analysis (no citizen alarms/no false alarms) was formulated to determine the patrol cars required versus service calls per hour, travel time, car utilization factors, etc.

The model also contained data on the precinct crime rate and typical durations for the various index crimes (murder, rape, assault, robbery, and burglary) to take place. From this information and calculations of police response time, the probability of arrest was estimated.

Figure II-1 illustrates a typical result of this study. Calculations were made to determine the number of patrol cars required to service the precinct if every citizen were provided a citizen alarm. The precinct presently averages 10 crime-related calls/hour and assigns approximately 14 cars on patrol. It was assumed the citizen alarm was used whenever an index crime occurred and that the police were provided with sufficient cars to respond. The curves illustrate the sensitivity of the overall system to false alarms; the number of police cars required increases significantly if there is only one false alarm per person per year.

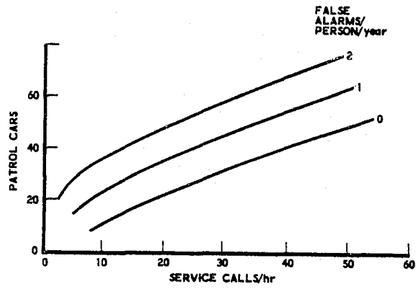


Figure II-1. Citizen Alarm Review

An estimate was made, using the response model, to project the potential improvement in arrest rates citizen alarms could provide. The results of this assessment indicated that significant improvements in arrest rates are possible (assuming an arrest was made in those cases where the police arrive before the crime is completed), particularly when the citizen alarm is used at the start of the longer-duration index crimes, such as rape.

The results of this review and analytical assessment of the Citizen Alarm System were presented to the Institute in a report in November 1973.

Body Armor Field Test Requirements

In coordination with the development engineers on the body armor project, an assessment was made to determine the number of protective garments required to conduct a meaningful field test evaluation. A meaningful field evaluation was defined as one having a high probability of preventing one or more injuries (or deaths) of assaulted police officers during the period of the test.

Statistics were reviewed relevant to police assaults, from both FBI reports and data from police departments in large cities. From this, probabilities on the rate of occurrence of lethal and injurious assaults to police from handguns were established. Probability curves for the number of garments required to ensure that 1, 5, or 10 or more assaults would occur during the course of the tests were generated. These calculations are summarized in the curves shown in Figure II-2.

The number of expected assaults in one year that would occur from handguns of .38 caliber or less are shown by the curves. As an example, approximately 5000 garments would provide a high probability of preventing five or more injuries per year. The results of this analysis and assessment, presented to the Institute in October 1973, formed the basis for the recommendation that 3000-5000 body armor garments are required for the body armor field tests.

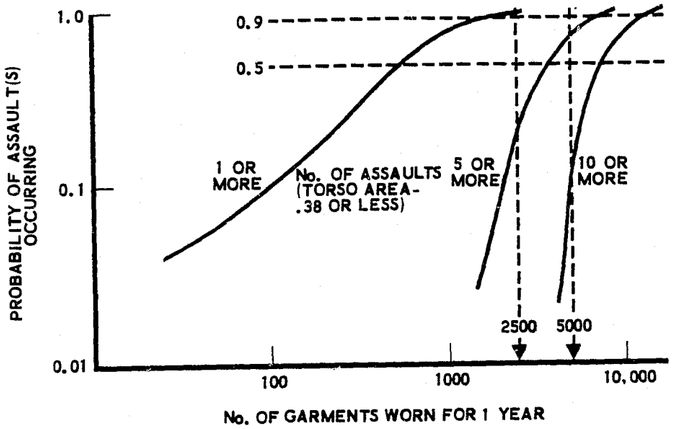


Figure II-2. Probability of Handgun Assault

Burglary Alarm Systems

A study of the crime of burglary was conducted, in order to survey the available data on the subject and provide a reassessment of the design and applicability of burglar alarm systems. This study, conducted jointly by planning and development engineers, analyzed statistics data on burglary, including rates, geographical patterns, methods of entry, and total losses. Profiles of the suspect and victim were derived, and concepts of defenses were evaluated. The present status of alarm systems and the potential for improvement were assessed. An analysis of the impact of the widespread use of alarms on police resources was made.

The results of this study were utilized in further refinement of system concepts and performance requirements for a low-cost burglary system for residences and small businesses. These systems and new hardware requirements are summarized in Section III.A, describing the low-cost security alarm development. The study effort highlighted the need for additional data

in areas such as the distribution of loss versus income, the percent of recidivism versus offender age, and the scope and character of fencing.

The final report summarizing the results of this survey and assessment was submitted to the Institute in June 1974.

Utility of Forensic Techniques and Offender Identification

A study was initiated to estimate the impact or arrest and conviction rate if improved methods are developed to identify offenders from crime scene evidence.

The initial effort on this study, which is being continued into FY 75, was to review statistics on the frequency which physical evidence is found at the scene of a crime. Data were obtained from a study conducted in Berkeley, California in which 750 crime scenes were carefully searched and all fingerprint, blood, and hair evidence which could possibly be involved in the criminal activity was recorded.

The data from the Berkeley study indicated that fingerprint evidence can be found in over 40% of the burglaries; blood was found at 60% of the assaults and murders; hair at 50% of the rapes. These percentages were used to project possible increases in arrest and convictions if systematic use were made of the evidence and techniques were available to use this evidence for positive offender identification. Potential increases in conviction rates of 14% for burglary, 16% for rape, and 11% for murder were conservatively estimated. An interim report was made on the results of this study to the Institute in April 1974.

D. GENERAL ANALYTICAL STUDIES

The general analytical studies provide the development program with analyses of the broad factors affecting law enforcement operations and crime reduction. These studies provide insight into areas associated with the size of law enforcement, R&D expenditures, crime and population trends, crime reduction goals, and other areas where the results of the analysis can provide overall direction to equipment developments. There were four principal studies in support of this effort during FY 74.

Review of Technology, R&D, and Law Enforcement

A review and analysis was initiated in September 1973 of the total expenditures in the United States by Federal, state, and local government to support the law enforcement and criminal justice operations. This included a review of total equipment expenditures and supporting law enforcement R&D programs. Past expenditures by the Institute and LEAA were compared to expenditures by other government agencies.

The effort was aimed at establishing perspective on equipment R&D as influenced by factors such as total equipment expenditures, past R&D effort and similar expenditures by other government agencies. Table II-1 summarizes the FY 73 Federal research and development budget for the major functions of government, including law enforcement.

Table II-1. Fiscal Year 1973 Federal R&D Distribution

Function	Dollars (millions)	Percent of Total R&D	Percent of Function Budget
National Defense	$ 9,626.6	58.0	12.2
Space Research and Technology	3,132.4	18.9	98.2
Health	1,476.4	8.9	8.1
Education and Manpower	696.0	4.2	6.2
Commerce and Transportation	557.1	3.4	4.8
Natural Resources and Environment	463.6	2.8	18.9
Agriculture and Rural Development	301.7	1.8	4.4
Community Development and Housing	118.2	0.7	2.2
Income Security	80.5	0.5	0.1
Veterans Benefits and Services	73.1	0.4	0.6
General Government	31.8	0.2	0.6
(Law Enforcement and Justice)	(23.3)	(0.1)	(0.1)
International Affairs and Finance	27.0	0.2	0.7
	$16,584.4	100	

Sources: NSF Report 72-313; U.S. Budget, 1974

The total spent for law enforcement R&D is the lowest on the list in both total amount and as a percentage of the total budget allocated for that function.

The analysis also explored various approaches to determine appropriate resource levels for law enforcement research and development. In addition, management problems associated with directing large R&D projects were reviewed, and recommendations were made with respect to improving equipment development program. The results of this study were presented to the Institute Director in October 1973.

Study of NILECJ Goals, Objectives and Programs

Following the analysis of R&D expenditures discussed above, a comprehensive review of past LEAA and Institute goals and objectives was undertaken in October 1973. This effort was aimed at (1) relating the equipment development programs to the appropriate research objectives and (2) allocating resources to these programs and objectives in an orderly and rational fashion.

Approximately 500 goals, standards, and recommendations were extracted from the major crime commission reports including the President's 1967 Crime Commission Report and the five major Standards and Goals reports completed in 1973. A correlation of past Institute expenditures with this goal structure was also performed. Coincident with this effort to define Institute-wide goals and objectives, a review and analysis of the Equipment Systems Improvement Program goals and objectives and programs was conducted in November. The result of this effort was a rank ordering of over 90 research and development objectives, including equipment improvement objectives, for possible Institute support.

The results of this review and analysis highlighted the need to develop explicit and coherent research objectives in support of LEAA and Institute goals. These results were presented to the Institute Director in early December along with specific recommendations for the FY 75 Equipment Development Program. This analysis highlighted the need to set reasonable objectives and to manage individual programs according to detailed milestones. Also highlighted was the need to integrate Equipment Development projects with other Institute-sponsored research activities. A detail briefing summarizing this study was presented to the Institute Director in December 1973.

Correlation of Population Changes and Crime Rate

A brief study was conducted to determine the correlation between the increase in crime and the growth in population of the lower age groups during the period 1960 to 1970. It has been frequently stated that the primary reason for the growth in crime in the 1960's was the "baby boom" brought on by World War II and the growth of the under-24 age group. There are substantial data showing that approximately 75% of all crimes are committed by individuals under 24.

Data from the 1970 census were reviewed along with crime statistics from the 1972 FBI Uniform Crime Reports. This growth of index crimes (murder, rape, robbery, burglary, and assault) during the 1960's was compared to the growth of the age group 11-24 years.

The analysis indicated that there was a relatively weak correlation between the growth of the younger age group and the increase in crime. This is illustrated in Figure II-3, which shows index crimes increased by a factor of three (200%), while the 11 to 24 age group only grew approximately 30%. There are obviously other more important factors influencing the increase in crime than the growth of this younger age group.

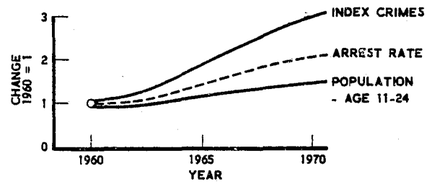


Figure II-3. Population and Crime Rate Change, 1960-1970

The implication of this conclusion on equipment development programs is that (1) current equipment and procedures are obviously not reducing crime, (2) the reasons for the increase in crime are not patently obvious, and (3) planning for new equipment developments must be closely coordinated with studies to determine the major crime increase factors. The results of this analysis were presented to the Institute in March 1974.

Modeling and Selection of Alternative Programs

An analysis was performed to determine the feasibility of applying modeling techniques for selecting equipment development programs. Mathematical models of certain parts of the criminal justice system could be useful

in analyzing the relative impact of new systems and procedures. As an example, models of the flow of information and the paper work through the courts have been useful in pinpointing problem areas and needed improvements.

The study used the crimes of burglary as an example and a simplified model of the flow of burglars through the community and the criminal justice system was devised. This model, schematically illustrated in Figure II-4, allows the burglaries per year in a typical city to be calculated from (1) the flow of burglars into and out of the community and (2) the rate at which an individual burglar commits burglary.

At certain points in this flow, there are actions which the community or the criminal justice system can take to change the rate of burglary. This is mathematically represented and estimates (usually obtained from research and statistical analysis) are made of the relative impact which each of these actions would have on arrest and conviction rates. A calculation can then be made to determine the effect new equipment and procedural changes would have on the burglary population and hence the rate of burglary. It was hoped that the general trends if not the absolute magnitude of the effect on the system could be determined.

The principal conclusion of this effort was that modeling such as this is useful in determining the relative importance of various equipment development projects or other crime reduction techniques. For example, in Figures II-5 and II-6 the burglaries per year for a hypothetical city of one million is plotted against a variety of factors affecting the rate of burglary. Figure II-5 shows that for this city (20,000 burglaries per year, 3.5% arrest and conviction rate, 80% recidivism, 1 year average sentence length, 500 new burglars enter society per year, etc.) the length of incarceration is not a strong influence (assuming no deterrent effects) on decreasing the number of burglaries. This is primarily because the arrest and conviction in the hypothetical city is low, 3.5%, which is typical in many cities.

Figure II-6 illustrates the effect of the arrest and conviction rate on burglaries per year along with various programs and alternative strategies

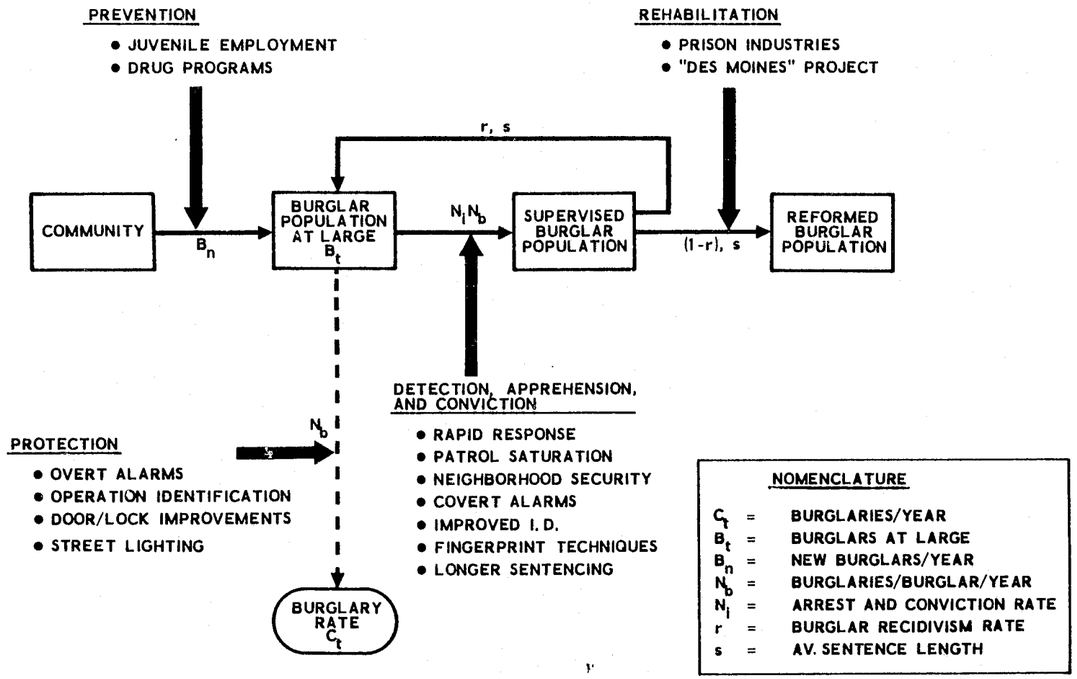


Figure II-4. Burglary Model and Possible Strategies to Reduce Burglary

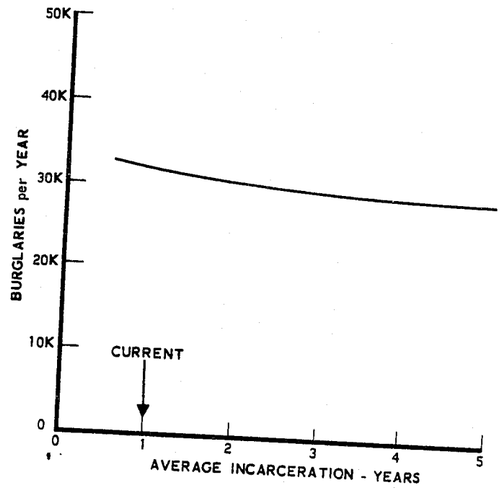


Figure II-5. Burglary Model - Effect of Length of Incarceration

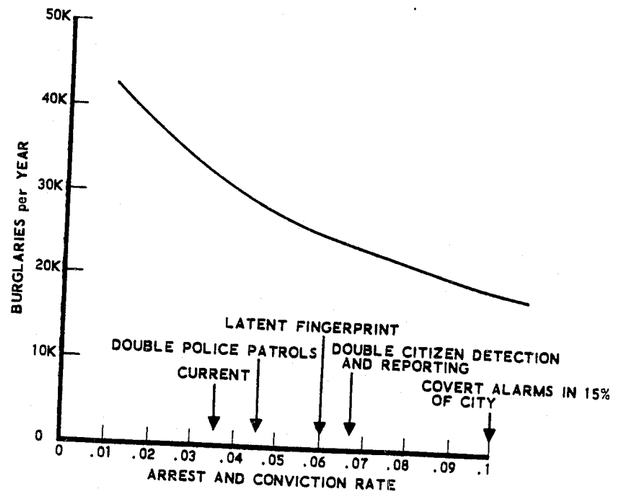


Figure II-6. Burglary Model - Effect of Arrest and Conviction Rate on Burglaries per Year - City of 1 Million

which could influence arrest and conviction and the burglary rate. The impact of each strategy is separately indicated.

The analysis and model served to indicate the relative importance of the various proposed programs for reducing burglary. The work also highlights the importance of providing a coordinated strategy, since, as indicated in Figure II-6, several programs may be required to control and measurably reduce a crime such as burglary. The results of this study were presented to the Deputy Director of the Institute on 1 July 1974.

E. INSTITUTE PLANNING SUPPORT

In the latter half of FY 74 support was provided to coordinate the Equipment System Improvement Program objectives with other LEAA planning activities. This included preparation of planning material to assist the Institute in meeting management by objective methods adopted by the Justice Department. Objectives encompassing FY 75 Equipment programs and new FY 76 programs were formulated. In conjunction with this work the review of the over 500 standards and goals for law enforcement agencies was utilized to formulate possible new equipment development projects.

In April this planning support effort focused on the revision and refinement of over 80 candidate objectives including equipment and other research programs. A two-volume summary of these objectives along with supporting programs and milestones was compiled and submitted to the Institute in April. The results of this activity provided an integrated plan for FY 75 and FY 76 programs compiled in accordance with the management by objectives methods. Documentation was assembled on the equipment development programs for inclusion in the Institute/LEAA Management by Objectives plans submitted to the Office of Management and Budgets in June 1974.

As part of the FY 74 Institute planning support activity, a limited effort was provided in support of the LEAA Office of National Priority Programs (ONPP). Assistance was provided in identifying goals and objectives for

priority programs, and supporting a pre-start survey in Compton, California for the Initiative Oriented Technical Assistance Project. Familiarity with these ONPP activities aided in establishing priorities for equipment-oriented research and development objectives. Several briefing reports and summary documents were submitted in late FY 74 in support of this effort.

III. DEVELOPMENT PROGRAM SUPPORT

III. DEVELOPMENT PROGRAM SUPPORT

During Fiscal Year 1974, the Development Group was authorized to proceed with the following nine development programs:

A. Cost-Effective Security Alarm System
B. Citizen Alarm System
C. Improved Protective Armor
D. Speaker Identification
E. Cargo Security
F. Blood and Bloodstain Analysis
G. Explosives Detection and Identification
H. Detection of Gunshot Residue
I. Latent Fingerprint Research

The first five programs on the list are activities continued from FY 73, and the last four are new programs initiated in FY 74.

These programs represent a mix of development activities aimed at supporting the needs of citizens to report and reduce crime, as well as the needs of law enforcement agencies for new and improved equipment. Appreciable effort had been devoted in the previous fiscal year (FY 73) to selection of these projects in order to provide a balanced program within the necessary budget limitations.

A complete equipment development program is normally a three- to five-year effort, involving:

- Problem assessment
- Identification and evaluation of potential solutions
- Prototype feasibility assessment
- Hardware development
- Field testing and evaluation.

FY 74 represented the second full year of Equipment Improvement Program activity. As the year ended, many of the development projects were reaching the prototype feasibility assessment stage. Also, by the end of FY 74 two of the projects, Citizen Alarm System and Improved Protective Armor, were preparing to go into field testing and evaluation.

A review of the activities and accomplishments for the nine projects included in the FY 74 effort is presented in this section. Each project is separately discussed in individual subsections to provide a brief overview of past activities and a summary of the FY 74 progress. Also included in each subsection is a list of all items delivered during FY 74 on each project. Included in this category are Aerospace reports, subcontractor reports, and hardware fabricated. If more detailed information is needed on the project, reports listed under "Delivered Items" should be consulted.

A summary of all major documents completed on the project during FY 74 is given in chronological order in Appendix B. In addition to the detailed reports prepared at appropriate milestones for each project, numerous status briefings for reviewing problem areas and summarizing progress were also prepared. These were presented primarily to the Institute and other interested agencies.

The major briefings prepared by the Development Group during FY 74 are listed by project in Appendix C. Also included in Appendix C is a listing of the more important meetings and conferences attended during FY 74. The information obtained at these meetings and conferences was useful to the development effort and was summarized, as appropriate, in correspondence and monthly progress reports.

A. COST-EFFECTIVE SECURITY ALARM SYSTEM

The crime of burglary in homes and small businesses is a recognized national problem. Although the burglar alarm is one effective means of coping with the problem, its widespread use has been constrained by relatively high cost and high false alarm rates. When the Equipment Systems Program was started in FY 72 the need for a low-cost, reliable burglar alarm system was recognized. Steps for developing such a system were initiated during FY 73.

During FY 73 a technology assessment of alarm industry capability and a survey of commercially available equipment were completed. It was concluded that installation represents a large part of the burglar alarm initial cost. Since a major part of the installation cost is the required wiring, use of the already available electrical power wiring offered attractive possibilities. If successful, the current alarm installation costs, which are typically in the order of 50% of the total cost, might be reduced to 10% of that total. A subcontract was awarded by Aerospace in FY 73 to the Sylvania Corporation to define the alarm transmission characteristics of home electrical wiring systems and to develop a low-cost alarm transmission concept which would use this wiring.

The subcontracted Sylvania effort was completed in September 1973, and a final report on powerline characterization was completed. Demonstration hardware of a "passive switched impedance shunt" transmitter and alarm signal receiver was also completed by Sylvania.

A photograph of the feasibility hardware is shown in Figure III-1. The transmitter is packaged in a cylinder 1.5 inches in diameter and 1.4 inches long. It plugs into an ordinary 110 volt electrical wall receptacle. Alarm sensors which involve the closing of a switch are wired directly to the transmitter. The signal is carried over the house electrical wiring to a remote receiver also plugged into the house wiring at another wall outlet. The receiver senses the closing of an alarm sensor switch and can be linked to any one of several methods for covertly indicating burglary and notifying authorities.

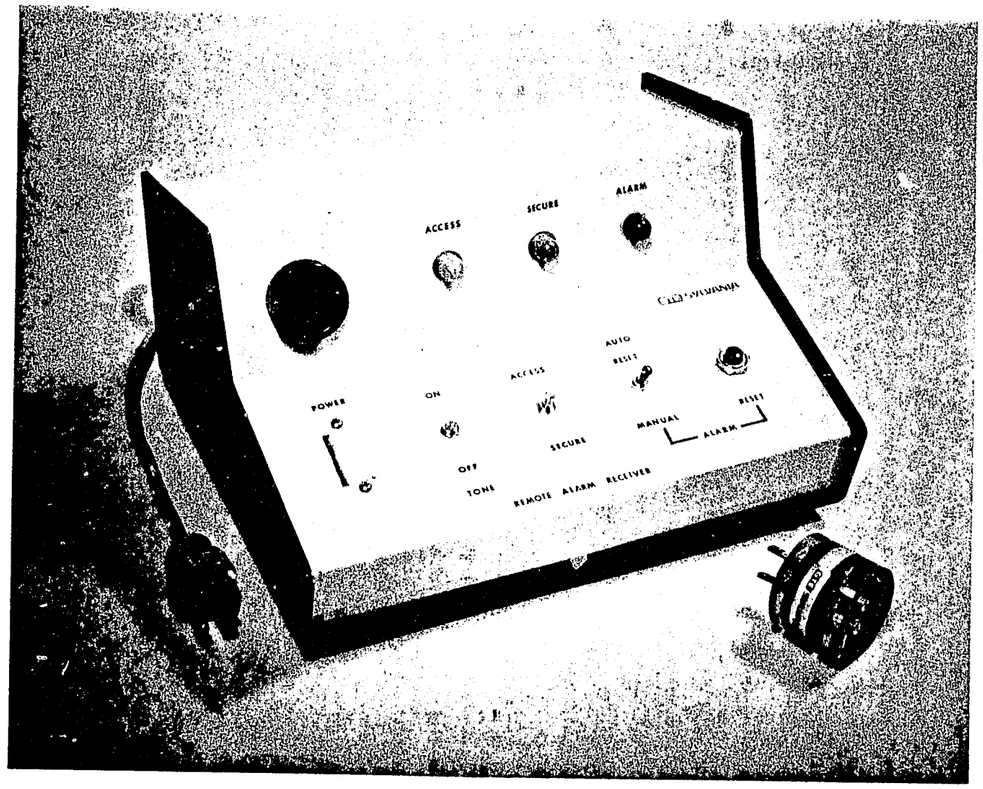


Figure III-1. Feasibility Hardware - Transmitter Shown in Lower Right

A large effort in FY 74 was devoted to identifying desired industry support and taking preliminary steps for defining desired subcontracted activity. In August 1973 a Commerce Business Daily announcement was released, requesting research and development and feasibility demonstration sources for alarm systems and system components. This announcement resulted in over 100 responses, which indicated strong industry interest in the program.

During FY 74 Aerospace planners and development engineers conducted a survey and assessment of low-cost alarm system technical requirements, in order to identify new or innovative concepts. This effort resulted in identifying a number of specific hardware areas for industry support. These include electric field intrusion detection sensors, alarm signal transmission media for use external to buildings, and large-scale integration (LSI) chip development for burglar alarm applications. A burglary computer model was also developed, based on data from various government and industry sources. It was used to examine burglar apprehension rate versus alarm callings, false alarms, and police response times. This study concluded that an arrest probability as high as 80% (as compared to a current arrest level of 18%) is possible with proper alarm coverage. A rough draft report summarizing these Aerospace activities was submitted to the Institute for review in April 1974.

In order to illustrate the integrated burglar alarm system concept, the demonstration model shown in Figure III-2 was completed in FY 74. Included in the model are perimeter sensors which respond to foot pressure or the opening of doors or windows, a volumetric sensor which responds to motion in a contained volume such as a room, and a panic button for direct alarm. Each sensor transmits its signal along a different path and involves separate control logic to reduce false alarm frequency. Other features to reduce false alarms include a three-delay feature: operating hour selection, integrated alarm controls, and a self-testing capability. To reduce system cost, the circuitry was designed for manufacture as an LSI component. Thus,

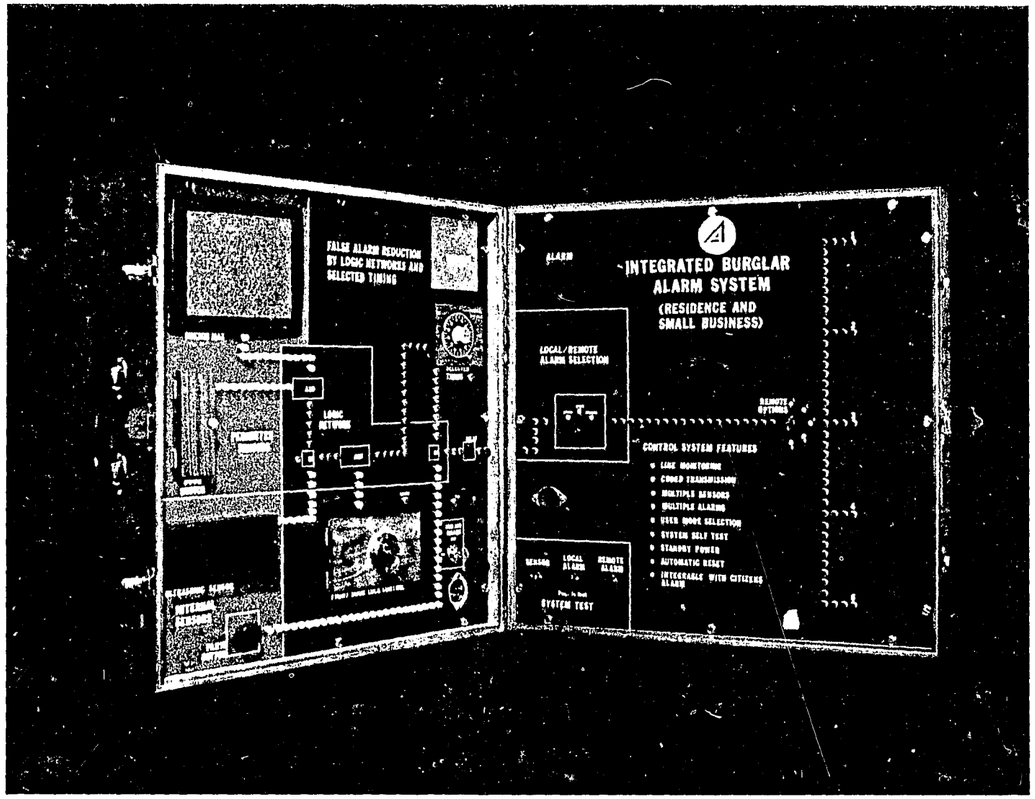


Figure III-2. Burglary Alarm Demonstration Model

an expensive system component can be reduced to possibly a single electronic chip with an estimated production cost of about $12.

The hardware items shown in Figures III-1 and III-2 were displayed by LEAA at the Third Urban Technology Conference in Boston, sponsored by the American Institute of Aeronautics and Astronautics during September 1973.

In anticipation of the awarding of industry subcontracts in FY 75, procurement packages were prepared for three separate procurements. Each package includes a work statement, supporting background on the need and intended application of the procurement item, and proposal evaluation criteria.

One package involved a request for proposals for an Electric Field Intrusion Detection Sensor Program which would encompass technical studies, analyses, and field measurements in order to develop a technical basis for assessing human body influence (including dielectric and charge collecting properties) on the earth's static electric field. Development of prototype sensors for a planned FY 75 pilot testing program of an integrated alarm system was also included.

A second package involved a request for proposals for an External Alarm Transmission Media Evaluation Study, which encompasses a comprehensive comparison of methods for transmitting alarm data outside of buildings. Specific elements to be treated include:

- Definition of alarm transmission parameters
- Assessment of feasible transmission media and current state of the art
- Tradeoff comparison between available media involving cost, availability, reliability, and compatibility
- Conclusions and recommendations for development

The media to be considered should include but not be limited to telephone, radio frequency wireless, external powerline carrier, and two-way cable T.V.

The third procurement package was for the development of a low-cost, highly reliable security alarm system to include concepts and equipment resulting from the other two procurements. This third subcontract cannot be awarded until after the first two contracts are under way. Elements of this procurement include:

- A requirements analysis, system definition, and user study
- Hardware development (including a design option for an LSI chip)
- System hardware integration and testing
- Pilot testing of a complete system involving an electric field sensor and external alarm signal transmission

All three procurement packages were sent to the Institute for approval. Authority to proceed was given on the first two procurement packages, and a formal Request for Proposal was published for each in the Commerce Business Daily on 3 May 1974. It is anticipated that contractor selection will occur early in FY 75. Authority to proceed with the third procurement package is also expected early in FY 75.

Delivered Items

In addition to formally published reports, hardware and other documentation such as procurement packages and briefings were also prepared and delivered. The key items delivered on this program during FY 74 include:

Documents

1. "Powerline Alarm Transmission System: Phase I Report - Power System Characterization," GTE Sylvania, Inc., August 1973.

2. "Powerline Alarm Transmission System: Final Report," GTE Sylvania, Inc., 28 September 1973.
3. "Survey and System Concepts for a Low-Cost Burglary Alarm System for Residences and Small Businesses," Aerospace Report No. ATR-74(7904)-1, June 1974.
4. Procurement Package - Electric Field Sensor Development, April 1974.
5. Procurement Package - External Alarm-Transmission-Media Study, April 1974.
6. Procurement Package - Burglary Alarm System Development, Integration, and Testing, June 1974.

Hardware

1. Powerline transmission hardware developed under Sylvania contract.
2. Demonstration hardware of integrated burglar alarm system concept.

B. CITIZEN ALARM SYSTEM

In response to national concern over crimes involving personal attack (rape, robbery, murder, assault), a project was initiated in FY 73 in the Equipment Systems Improvement Program to develop a miniaturized personal alarm for individual use. It is intended to be carried by a person to provide a means for signaling for help when a criminal attack occurs. The actuator would have an identification code, and location of the attack is provided by local pickup stations. The principal components of the system are a miniature transmitter actuated by the wearer, nearby local receivers, a relay, and a central station that receives the alarm and notifies appropriate authorities. In FY 73 a breadboard feasibility model was assembled and successfully demonstrated by Aerospace. In June 1973 a subcontract was awarded to Compu-Guard Security Systems, Inc. of Pittsburgh, Pennsylvania for a requirements analysis and development and feasibility testing of citizen alarm hardware.

Since 47% of all violent crimes occur within buildings, initial development effort was focused on the "in-building" application. However, growth potential for use in outdoor public areas was also to be considered in the design concepts selected.

During FY 74 project effort was focused on two principal activities:

- Development of hardware under the Compu-Guard subcontract of a prototype system for use within buildings
- Analysis and concept definition of an increased utility system for use in outdoor public areas as well as within buildings

Each phase of the FY 74 activity is treated separately in the discussion which follows.

Prototype Development of In-Building System

The Compu-Guard effort was divided into three phases:

I Establishment of requirements and specifications for a Citizen Alarm System

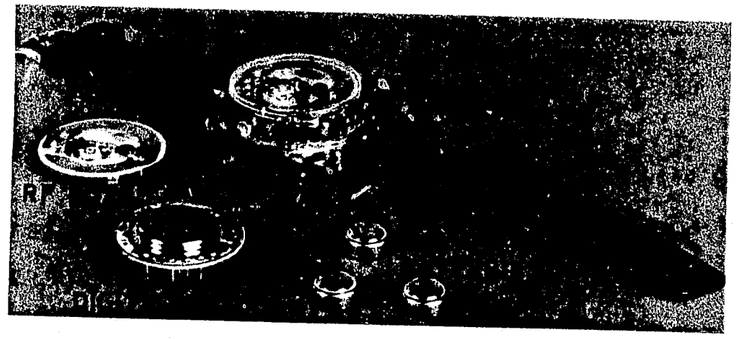
II Citizen Alarm System design and prototype hardware development

III Component testing and system pilot testing and evaluation

An analysis of user needs was conducted under Phase I as a basis for establishing system specifications and hardware requirements for the in-building application. Initial requirements previously established by Aerospace on reliability, false alarm rate, and response time were confirmed or upgraded. In addition, human, environmental, and FCC regulatory constraints were defined. A report summarizing Phase I results was submitted by Compu-Guard in October 1973.

Based on the results of the Phase I effort, key system components were designed and prototype hardware fabricated. The system consists of four basic hardware elements: an actuator, an internal receiver relay, an external receiver relay, and a central station subsystem. A photograph of the prototype hardware developed by Compu-Guard under Phase II is shown in Figure III-3. The actuator is actually a small signal transmitter designed to be operated by the wearer. The selected design incorporated the actuator in a wristwatch-like device. An exploded view of the actuator is also shown in Figure III-3. Previous tradeoff analysis guided the selection of the transmission frequency (462 MHz), the message modulation technique, the power supply, and the packaging of actuator components.

To mitigate against accidental false alarm, transmission is initated by depressing two side-mounted buttons simultaneously, which transmits a 32-bit identification code 15 times in 0.9 second. Following a 35-second off period, the actuator retransmits, and this action is repeated until turned off.



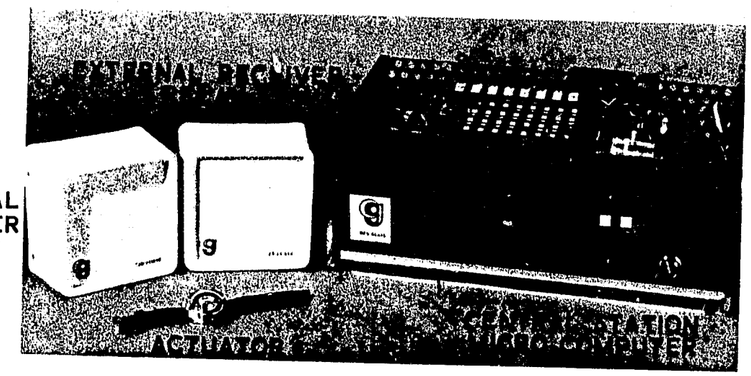


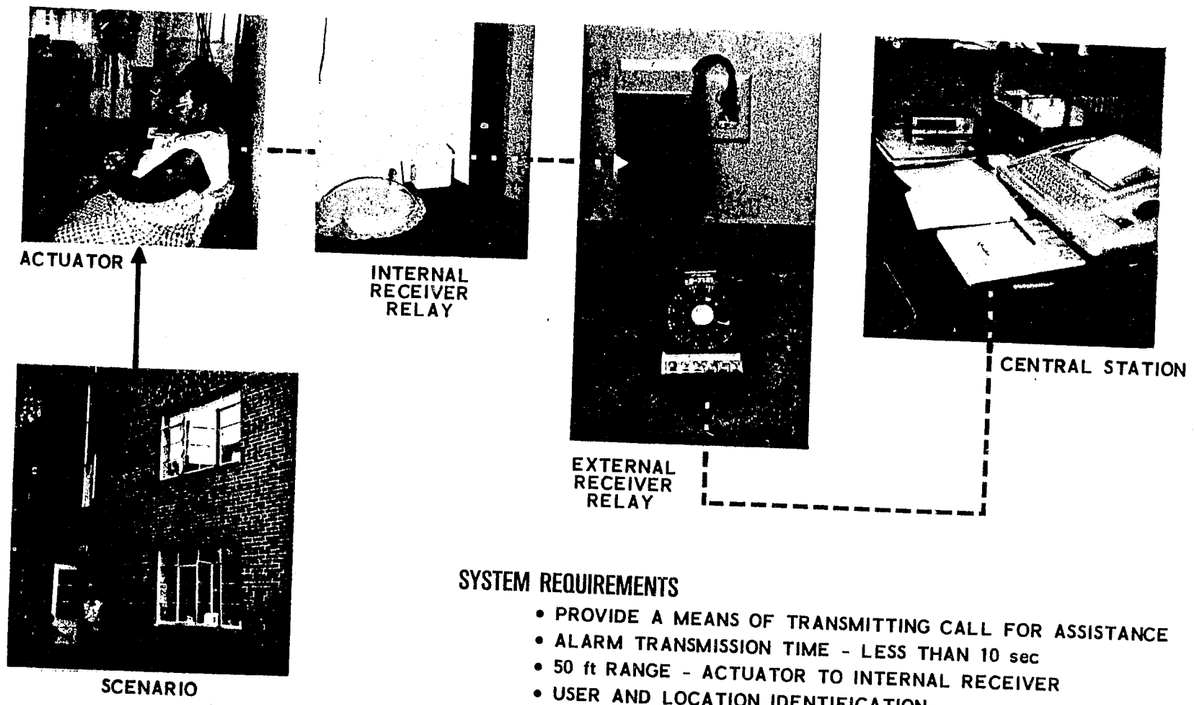
Figure III-3. Citizen Alarm System Prototype Hardware

The internal receiver relay is designed to detect and store the alarm signal and then retransmit the alarm message. The relay location code is added to either an external receiver relay or the central station. The capability to retransmit the alarm message and location code on command from the central station was incorporated in the internal receiver relay as a system reliability measure. The initial design objective was a range of 50 feet for the wireless link between the actuator and the internal receiver relay. Numerous relays, each with its own location code, would be strategically located within the building to provide adequate coverage.

As currently configured, the internal receiver relay transmits over building internal power lines (similar to the concept described in the discussion of Low-Cost Burglar Alarm systems) to a central substation located in the building complex. For long-distance transmission to a central station, an external relay is employed to relay the alarm message over a telephone line. Logic circuitry for the external relay was also developed and fabricated under Phase II.

The fourth hardware item developed and fabricated as part of Phase II was the central station module to receive and process relayed alarm data. The function of this component is to display information on the identity of the alarm initiator (obtained from the alarm code), his location, and verify that a valid alarm has been received. As currently configured, the central station module can handle inputs from 32,000 receiver relays. A report summarizing the Phase II results was submitted by the contractor in March 1974.

Initially, the Phase III effort involved laboratory testing of the elements developed under Phase II. When completed, a feasibility and operational demonstration of the entire system was undertaken. Tests were conducted in a public housing complex, a high-rise apartment, and in a small business establishment. In the public housing complex, security guards responded to calls for assistance. Photographs of the Citizen Alarm System components and test scenario are shown in Figure III-4. Parameters assessed included aesthetics, ease of use, user confidence, building



SYSTEM REQUIREMENTS

- PROVIDE A MEANS OF TRANSMITTING CALL FOR ASSISTANCE
- ALARM TRANSMISSION TIME - LESS THAN 10 sec
- 50 ft RANGE - ACTUATOR TO INTERNAL RECEIVER
- USER AND LOCATION IDENTIFICATION
- RELIABILITY OF 99.8%
- LOW COST, MODULAR DESIGN
- GENERAL PUBLIC USAGE

Figure III-4. Citizen Alarm System, Basic Hardware

coverage, response time, and system and component reliability. The system operated reliably and proved to be acceptable to users in a real environment.

A demonstration of the system was presented in Washington during March 1974 to members of the House Appropriations Committee.

A final report covering the entire subcontracted effort is in the rough draft stage, and its formal submittal is scheduled for early FY 75.

Improved Citizen Alarm System

The second major activity during FY 74 was an Aerospace effort and addressed the feasibility of improving the capability of the system under development by Compu-Guard, in order to extend the system's utility to outdoor public areas. On the basis of analysis, laboratory demonstrations, and results of the Compu-Guard prototype development, it was concluded that sufficient improvements in capability can be obtained so that outdoor application of the Citizen Alarm System is feasible.

Discussions were held with numerous planning agencies and law enforcement groups to aid in identifying system performance requirements, user acceptance criteria, and anticipated effects on the criminal justice system. Utilizing the analyses and technology assessment results, an improved Citizen Alarm System concept was defined. Major differences between the improved system concept and the in-building system prototype are:

- Additional miniaturization of the actuator to improve its covert use
- An order of magnitude increased in actuator range
- A receiver relay designed to operate in the outside environment

A report summarizing the survey and concept definition activities was published in June 1974.

Because of the many similarities between the existing prototype system and the proposed improved system, negotiations were initiated with Compu-Guard for a follow-on activity on the improved system. These negotiations were completed near the end of FY 74, and the results were transmitted to the Institute for review. It is anticipated that development of a prototype improved system will be authorized early in FY 75. Detailed planning for a large-scale field evaluation of the improved system is also expected to be initiated in FY 75.

Delivered Items

In addition to formally published reports, hardware and other documentation were also provided under this program. The key items delivered during FY 74 include:

Documents

1. "Feasibility Demonstration of Citizen Alarm System: Phase I Final Report," Compu-Guard Security Systems, Inc., October 1973.
2. "Feasibility Demonstration of Citizen Alarm System: Phase II Development Report," Compu-Guard Security Systems, Inc., March 1974.
3. "Feasibility Demonstration of Citizen Alarm System: Final Report," Compu-Guard Security Systems, Inc., Rough Draft, June 1974.
4. "Survey and Concept Definition for an Improved Citizen Alarm System: Volume I, Technical Summary," Aerospace Report No. ATR-74(7905)-2, Vol. 1, June 1974.

5. "Survey and Concept Definition for an Improved Citizen Alarm System: Volume II, Technical Appendices," Aerospace Report No. ATR-74(7905)-2, Vol. II, Rough Draft, June 1974.
6. Procurement Package - Improved Citizen Alarm System, April 1974.
7. Citizen Alarm System Data Package, Compu-Guard Security Systems, Inc., May 1974.
8. Procurement Package - Field Evaluation Planning Support, June-July 1974.

Hardware

Prototype hardware for the basic Citizen Alarm System:

- 20 actuators
- 20 internal receiver relays
- 2 external receiver relays
- 2 central stations

(Blank page)

C. IMPROVED PROTECTIVE ARMOR

The Equipment Systems Improvement Program initiated a project for developing protective garments for law enforcement and public officials in early FY 73. During FY 73 a threat assessment was made, and it was concluded that newly developed lightweight, high-strength, synthetic fibers offered great potential for improving existing protective armor designs. An interagency agreement was subsequently processed by LEAA for the Army's Land Warfare Laboratory (LWL) to design and test lightweight garment elements made of this new material against a handgun threat of .38 caliber or less.

Forty specimens of 12 types of material with various types of thread of different spacings were ballistically tested in FY 73. Gelatin block and animal tests were then conducted on the most promising specimens for blunt trauma effects. On the basis of ballistic protection properties as well as weight and cost considerations, a Dupont "Kevlar" material, originally developed for use as a tire cord material, was selected as most promising for the intended application. To demonstrate its fabrication feasibility, a sport jacket and a zip-in lining for a police reefer coat were manufactured. At the Institute's request, these prototype garments were exhibited to various interested agencies.

The follow-on activity undertaken in FY 74 involved broadening the scope of the protective armor program and included preliminary steps for an extensive field evaluation. The Development Group continued its role as technical manager and overall program integrator and, in addition, initiated Aerospace supporting research. Specific items included in the FY 74 effort were:

- Further evaluation of blunt trauma phenomena
- Mechanics of ballistic protection
- Environmental testing of materials

- Garment development and fabrication
- Evaluation program and field demonstration planning

A separate discussion on each of these five general areas follows.

Blunt Trauma

Body wall and underlying viscera deformation which occurs following non-penetrating bullet impact represents a major consideration influencing the use of "soft" body armor. Under interagency agreement, the U.S. Army Edgewood Arsenal Biomedical Laboratory expanded the preliminary blunt trauma animal tests performed in FY 73. The purpose of the expanded effort was to assess animal response to blunt trauma loading and to provide a basis for a method of correlation to humans. Seventy goats were impacted during the test program, and the protection provided by the test material prevented any lethality due to either penetration or ballistic impact.

The blunt trauma experienced in goats behind the protective material was correlated with expected injury if a human were the target instead. It was concluded that without protection the mortality probability after a random hit with a .38 caliber bullet would be between 7 and 25%. With the tested material covering the torso area, the mortality probability is reduced to between 1 and 5%. Without protection the probability of needed surgery would be between 82 and 100%; with protection this probability is reduced to between 7 and 10%.

Mechanics of Ballistic Protection

To complement the simulated field tests performed with animals in the laboratory, Aerospace initiated an analytical and experimental investigation in order to better understand the physical interaction between bullet, soft armor, and backing material. The major objective of this effort was to assess the means by which the bullet energy is distributed and absorbed and

to identify the critical parameters controlling the energy distribution. The experimental effort included:

- Determining uniaxial and biaxial baseline data for determining the stress-strain relation and ultimate behavior of Kevlar
- Static and dynamic biaxial testing to simulate ballistic loading
- Correlating ballistic testing (at Sierra Engineering, Lawrence Livermore Laboratories, and Edgewood Arsenal)

Based on results from these tests, biaxial stress-strain data for the Kevlar-29 fabric were incorporated into large-deformation solutions based on membrane theory. These solutions yielded the distribution of energy between fabric and backing and the influence of the critical material parameters on ballistic protection. This analysis and stress testing resulted in recommendations to change weaving specifications in order to maximize energy absorption in the material.

Environmental Testing of Materials

Since virtually no information regarding the effect of environmental exposure on woven Kevlar-29 was available, Aerospace initiated a brief exposure test program prior to distributing experimental garments (discussed in the next section) to police for wearability testing. The effects on the fabric of laundering, dry cleaning, ozone, salt water, and humidity were investigated.

Both ballistic and mechanical (tensile strength) testing revealed that dry cleaning solvents, household bleaches, and certain detergents significantly degrade the material. As a result, it was recommended that the fabric be washed only in cold-water Woolite or Ivory soaps, both of which showed insignificant material degradation. No fabric degradation was found when Kevlar-29 was exposed to ozone, salt water, humidity, or hot or cold water.

Cloth and Garment Development

Visual inspection of the sample woven fabric showed major flaws resulting from poor quality control in the weaving operation. In conjunction with Dupont and the U.S. Army Natick Laboratory, a weaving specification was written which incorporates both visual and mechanical inspection techniques to ensure consistent quality control. Utilizing these procedures, cloth was procured from Fabrication Development Corp. of Souderton, Pennsylvania, and fabricated into prototype protective garments acceptable to law enforcement agencies participating in preliminary garment wearability tests.

Several independent manufacturers were consulted to obtain estimates on the difficulty of garment fabrication with Kevlar. Although the material is somewhat difficult to cut and sew, no major fabrication problems were anticipated or encountered. A variety of police uniform components (leather and vinyl jackets, scooter coats, short vests), a number of plainclothes garments (sport coat, dress vest), and special-purpose items (undershirt, bodyshirt) were manufactured from protective material or with the protective material as a liner element. Some of these garments are illustrated in Figure III-5. Those in the upper row are uniform components into which ballistic protection material has been incorporated. The lower row of photographs illustrates plainclothes and special-purpose garments.

The sport coat and dress vest were manufactured by the Rochester Coat Makers of Los Angeles, California. The police uniforms, undershirts, bodyshirts, and outer vests were procured from Transcontinental Sales Co. of Los Angeles and E&E Fabratex of Costa Mesa, California.

Evaluation

The program to evaluate the improved protective armor developed under this project consists of two phases: preliminary wearability and user acceptance tests and full-scale field testing. The first phase, preliminary wearability and user acceptance testing, was initiated in March 1974. Prototype garments are being worn by police under actual field conditions in

Figure III-5. Sample Garments

Columbus, Georgia, Inglewood, California, Jacksonville, Florida, and New York City. The purpose of these tests is to obtain information which may influence the design of the approximately 5000 garments to be procured for the second phase, full-scale field testing. Questionnaires concerning wearability, user acceptance, and experience were provided at each field site and will be returned to Aerospace during early FY 75 for review and analysis.

The initial evaluation phase will be completed early in FY 75. It is anticipated that the second phase will then be initiated. Preliminary planning for the second phase was begun in March 1974. Sixteen cities were identified as potential field test sites, and inquiries were made concerning their interest in participating in the program. In addition, a data package was prepared which provides a description of the planned full-scale field tests.

Delivered Items

The items delivered under this program during 1974 included formally published reports, other documentation, such as briefings, meeting minutes, procurement and data packages, and a variety of manufactured protective garments. In addition, numerous meetings and conferences were attended. Individual items of significance are listed below.

Documents

1. Protective Garment Implementation Plan, Aerospace Letter 3330-JOE-73-108, 12 November 1973.
2. "Improved Protective Armor Wearability Test and Evaluation Plan," Aerospace Report No. ATR-74-(7906)-1, March 1974.
3. Procurement Production Plan and Kevlar Weaving Specification, Aerospace Letter 3330-LGK-74-023, 24 May 1974.
4. Procurement Package - Army Land Warfare Laboratory Follow-On Studies, July 1973.

5. Procurement Package - Lawrence Livermore Laboratory Testing and Analysis Effort, November 1973.
6. Procurement Packages - Prototype Protective Garments, March and April 1974.

Hardware

Eighty prototype protective garments of different types for pilot wearability tests.

D. SPEAKER IDENTIFICATION

The increasing use of voice spectrograms as courtroom evidence requires the development of improved scientific methods for identifying a specific individual from his recorded voice and speech pattern. Identification techniques currently in use are more of an art than science and are highly dependent upon the skill of the examiner. Consequently, in FY 73 the Institute directed the Development Group to initiate a comprehensive and coordinated program on speaker identification. The purpose of this program was to develop equipment and techniques by which a specific individual could be identified from his recorded voice and speech in an objective, quantitative, and scientifically acceptable manner.

A development effort was initiated, and in June 1973 a contract was awarded to the Electronics Research Division of Rockwell International, Inc., for the development of a Semi-Automatic Speaker Identification System. Selected Aerospace studies were also undertaken in FY 73. A Voiceprint Application Manual was prepared and published, and a system study analyzing the recording of illegal telephone calls was completed.

The focus of FY 74 activity in this area was on the development of the Semi-Automatic Speaker Identification System under contract to Rockwell. The contract called for definition within 60 days of certain analytical tasks which were to be added to the basic contract. The intent of this added analytic effort was to provide for a more effective and useful hardware development. On 12 November 1973 a subcontract change was negotiated to include these additional analytic tasks. Involved was the collection and utilization of a larger data base, including Black urban and Chicano dialects, and telephone channel conditions from diverse caller locations.

By June 1974 the hardware shown in Figure III-6 had been assembled and tested. Subsequent contractor activity was devoted to the development of complementary operational software, including generation of a speaker data base containing the variations among different speakers. The data base will also include temporal variation for the same speaker, dialect differences,

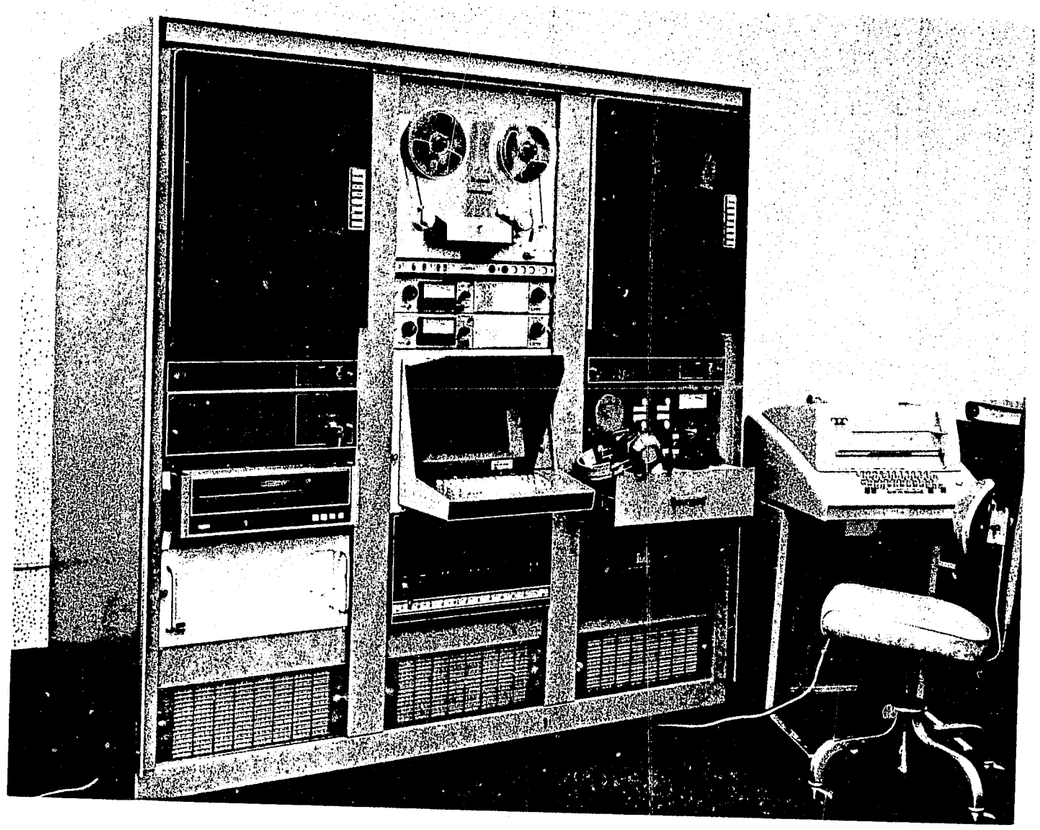


Figure III-6. Semi-Automatic Speaker Identification System

channel variations, and the effects of co-articulation on individual speech variation. These data will be used to conduct laboratory testing and provide the base for statistically establishing the accuracy of individual voice identification tests.

Supporting FY 74 Aerospace effort included an independent assessment of the feasibility and concepts upon which the semi-automatic system development is based. From the data base assembled by Rockwell, Aerospace analyzed the algorithm used to select and process specific phonetic events. A high-speed computer coupled with a stepwise discriminant analysis program was used to select the best subset of features for each such event. It was concluded that, by utilizing the best features, a decision based on a single phoneme can achieve an accuracy of 60% in selecting one out of 25 speakers. If six phonemes are used in making the decision, an accuracy very close to 100% can be achieved. Noise, distortion, and other influences occurring in the field are expected to influence this accuracy. Nevertheless, the discriminating power of the features chosen was confirmed, and the overall design of the system was validated.

It is expected that the prototype Semi-Automatic Speaker Identification System hardware will enter a pilot test phase early in FY 75. In anticipation of needed subcontract support, Aerospace prepared and submitted a procurement package to the Institute for a laboratory and pilot test program of the hardware.

In addition to support for the Semi-Automatic Speaker Identification System, an Aerospace study was also made of means for extending the courtroom use of Voiceprints as evidence. Methods for obtaining test data and the statistical basis for a test program to ensure test result acceptability were considered. A concept development plan was subsequently published, and a procurement package for subcontract support of a Voiceprint Validation Test was submitted to the Institute.

Delivered Items

The items provided under this program during FY 74 include prototype hardware, formally published reports and other documentation, such as briefings, meeting minutes, and procurement packages. In addition, appropriate meetings and conferences were attended. Individual items of significance are listed in the following.

Documents

1. Amended Concept Development Plan: Voiceprint Validation Test, 21 September 1973.
2. "Preliminary Investigation of Applications of the Computer-Aided Speaker Identification System," Aerospace Report No. ATR-74(7907)-1, Rough Draft, June 1974.
3. "Discriminant Analysis of Voice Features for Speaker Data Base No. 1," Aerospace Technical Memorandum, 4 June 1974.
4. Procurement Package - Additional Analytical Support Effort for Semi-Automatic Speaker Identification System, October 1973.
5. Procurement Package - Voiceprint Validation Test, October 1973.
6. Procurement Package - Laboratory and Pilot Test Program, Semi-Automatic Speaker Identification System, June 1974.

Hardware

Semi-Automatic Speaker Identification System prototype hardware.

E. CARGO SECURITY

Theft of cargo from trucking companies is a recognized national problem. Accordingly, in FY 73 a cargo security project was initiated as part of the Equipment Improvement Program. The initial development for this project was a truck anti-hijacking system which would have the capability to detect a hijacking and provide the vehicle identity and location to a monitoring authority with no action by the driver. In addition, the system should meet the operational, technical, and cost requirements for a typical trucking firm.

During FY 73 the technical feasibility of various low-cost truck locating systems was assessed. Two approaches were selected for the feasibility assessment. The first was an automatic direction finder (ADF) concept utilizing existing AM broadcasting stations and a radio direction finder aboard the truck. The second was a dead-reckoning determination of vehicle position, based on the transmission of vehicle odometer readings for comparison with preplanned route information. This latter approach proved to be the more promising and was recommended for the follow-on effort.

In FY 74 the cargo security project was broadened to include the detection of all categories of vehicle-related cargo theft, including that from parked cargo trailers. This project modification was motivated by an analysis of trucking cargo losses which revealed that hijacking, while important, is not the major contributor to cargo loss. In addition, it became apparent from discussions with law enforcement and trucking industry representatives that the cargo security system should not be dependent on preplanned routes for its successful operation because (1) the majority of vehicle-related thefts occur in pick-up and delivery operations where routing is random, and (2) knowledge of the truck's position at the time that a hijack or theft is detected reduces the time required for interception by the police and materially increases the probability of cargo recovery and apprehension of the thief.

Based on this broadening of the program scope, the FY 74 development effort was focused on two vehicle location system alternatives:

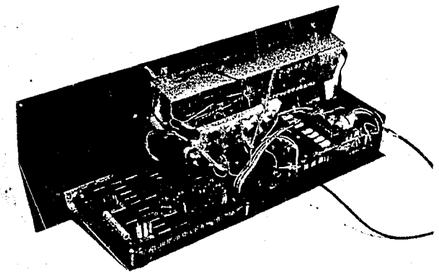
- An RF navigational system employing existing AM broadcast stations, modified to provide a stable position grid for an urban area. Truck equipment receives and compares these phase-locked AM signals and transmits location data to the dispatcher for position determination.

  Because of signal fading and other potential sources of error in an urban environment, the position grid system is supplemented by a sign-post system in which inexpensive low-power transmitters installed at strategic locations provide position data via a receiver in the truck.

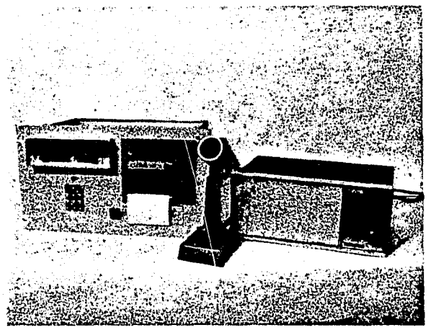
- A hybrid dead-reckoning system composed of vehicle heading sensors and an odometer, and supplemented by a sign-post system for the correction of errors in computed position. The position coordinates relative to starting position are computed on the truck and transmitted to the dispatcher for position determination.

Prototype sign-post transmitter units for use in the sign-post location system were procured, and the complementary truck-installed and dispatcher breadboard equipment was designed, assembled, and tested. Photographs of the truck-installed equipment and the dispatcher station equipment are shown in Figure III-7. The system was demonstrated to representatives of trucking firms during December 1973 and January 1974. As a corollary to this activity, a survey of commercially available intrusion detectors was made, and also a prototype low-profile, concealable antenna was designed, fabricated, and tested.

Studies to determine the feasibility and to establish the technical requirements for the navigational grid and the hybrid dead-reckoning systems were also performed during FY 74. Discussions with the management of several local AM broadcast stations and with the Federal Communications



(a) Truck-Installed Data Transmission Equipment - Prototype Hardware



(b) Dispatcher Station Components

Figure III-7. Breadboard Elements of Sign-Post Location System

Commission resulted in agreements to participate in the test and evaluation of the navigational system. In support of the hybrid dead-reckoning system, measurements of the magnetic variations encountered in urban trucking environments were conducted. These measurements revealed intolerable short-term errors, particularly for vehicle azimuth measurements in the proximity of large metal structures. The inclusion of inertial components appeared necessary. These studies led to the subsequent initiation of the assembly of breadboard versions of these two system concepts for demonstration testing and evaluation.

In addition to the Aerospace effort, steps to initiate a subcontract activity were also taken in FY 74. A Commerce Business Daily announcement seeking qualified sources was published on 4 December 1973. A subcontract procurement package was prepared, and on 8 May 1974, after Institute approval, requests for proposal were mailed to 64 potential bidders. Proposals were due by 14 June 1974, and four proposals were received for consideration. It is anticipated that contract negotiations with the submitter of the winning proposal will be initiated during August 1974. The purpose of the contracted effort will be to provide a definitive development and test effort on an integrated cargo security system.

Delivered Items

In addition to formally published reports, other documents and breadboard hardware were provided in FY 74 under this program. Key items include:

Documents

1. "Concept Definition for the Truck Anti-Hijack and Trailer Security System," Aerospace Report No. ATR-74(7908)-1, January 1974.
2. "Survey and Technical Assessment - Cargo Security System," Aerospace Report, Rough Draft.

3. Procurement Package - Prototype Cargo Security System, 19 February 1974.

Hardware

1. Breadboard elements of Sign-Post Direct Proximity System.

2. Breadboard Low-Profile Antenna Unit.

F. BLOOD AND BLOODSTAIN ANALYSIS

Human blood contains systems of genetic variants of antigens, enzymes, and proteins. Since at least one variant of each system is present in everyone's blood, these variants offer a high potential for identifying a specific blood source. In fact, with the genetic marker systems already discovered, it is theoretically feasible to identify a blood specimen as originating from a specific individual out of the entire world population. Correlation of specific variants in certain systems with the ethnic origin of the individual is also possible, as is some correlation with his geographic origin.

Since human blood is among the clues frequently found at a crime scene, relating the blood sample (either dried stain or liquid) to a specific individual could become an effective means of identification. In spite of this potential for "individualization", a fully practical application of blood analysis to law enforcement has not yet been developed in the United States. In Great Britain, however, where forensic blood analysis work was pioneered and its application refined, analysis of enzyme and protein polymorphisms is routinely performed. Advances achieved in Britain on the identification and use of genetic marker systems for bloodstain analysis are summarized in Figure III-8. From an initial bloodstain analysis capability of just one genetic marker system in 1961, a capability to analyze 10 genetic markers was achieved by 1973. Among the serum proteins routinely analyzed (using serological techniques) in the London Metropolitan Police Laboratory are hemoglobin, haptoglobin, erythrocyte acid phosphatase, polyphosphoglucomutase, and adenosine kinase.

LEAA has encouraged greater domestic use in criminalistics of serological techniques for analyzing evidence. Although interest has been generated, the use of serological results is still very limited due to a need to simplify and accelerate analytical methods and to accumulate more data on the U.S. population distribution of genetic variants. Accordingly, Aerospace was authorized to initiate, as part of the FY 74 Equipment Improvement Program, a program for raising blood analysis methodology to the level

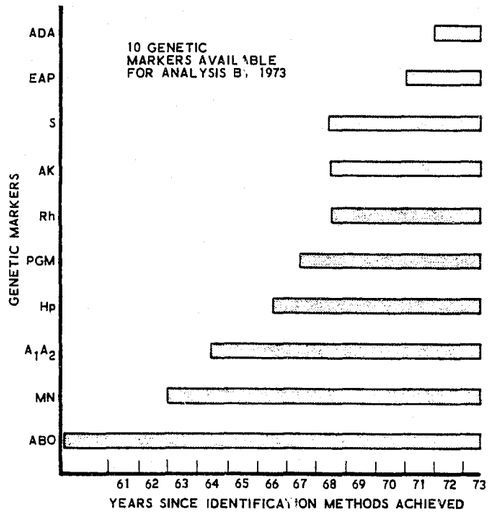


Figure III-8. Advances in Blood Analysis

of performance required for ensuring greater utilization of blood individualization in law enforcement. Specific program objectives include:

- Development of reliable and easy-to-use analysis procedures and equipment suitable for crime laboratory use
- Organization of a statistical data bank on blood composition and frequency of occurrence of specific data items in the general population
- Development of reliable reagents required for blood analysis

The initial FY 74 program effort involved a survey and assessment of the state of the art of forensic blood analysis, definition of the problems to be overcome in increasing the use of blood analysis for identification purposes, and identification of promising solutions to these problems. In the course of this survey, 27 criminalistics laboratories, nine blood bank centers, and 41

industrial suppliers of equipment or analytical reagents were contacted. In addition, various scientific organizations and technical experts were contacted and an extensive literature search performed. Contact was also established with British forensic laboratories at London and Aldermaston to obtain current information on their bloodstain analysis capability and procedures.

On the basis of this initial effort, it was concluded that a need exists for improved analysis procedures to allow a reduction in operator skill requirements, analysis time, and cost of reagents. In addition, new results available from medical and genetic research can be applied to the needs of the criminalistics laboratory. Possible sources for blood composition frequency data were also identified. A report on the results of the survey and assessment activity has been published.

Because of the unique nature of this program, the consulting support of several specialists experienced in blood and bloodstain analysis was obtained. Dr. R. Sparkes of the University of California at Los Angeles Medical School, Dr. G. Sensabaugh of the School of Criminology at the University of California at Berkeley, and Mr. J. Cadman, Director of the Orange County Crime Laboratory, participated in several phases of the FY 74 activity. The medical test services of Dr. P. Terasaki, director of the Histocompatability Laboratories at the U.C.L.A. Medical School, were also obtained.

It was recognized early that the aging characteristics of bloodstain components may limit any identification procedure. Research programs to study bloodstain component persistence were clearly necessary. Because of the high individualization potential of the HL-A (human leukocyte) system of antigens, persistence tests on HL-A antigens and development of methods capable of detecting them in dried bloodstain were undertaken. The results of preliminary work showed that many HL-A antigens persist at least 30 days, and it was concluded that the system is a promising candidate for further development.

Also undertaken was a persistence testing program of red cell antigens, enzymes, and proteins of interest in blood individualization. Twelve volunteer blood donors from Aerospace personnel were used to provide bloodstains on six different substrates, including textiles and glass. Samples were stored at two different humidity levels as well as in the frozen state for aging periods up to six months. An analysis of the fresh blood composition (nine red blood cell antigens, seven enzymes, and two blood proteins) provides the reference basis for the aged samples. It is anticipated that analysis of four-week old stains will occur in July 1974. Those results will then be used to guide analyses of one-week, 13-week, and six-month-old stains. This test series will involve the combined capabilities of Aerospace and a subcontractor.

An announcement soliciting qualified sources for research and development work on bloodstain analysis was published in the Commerce Business Daily on 24 October 1973. Responses were received from 27 qualified industrial and institutional organizations. A procurement package was subsequently prepared and approved for release by the Institute in March 1974. The Request for Proposal, published in the Commerce Business Daily on 8 April 1974, resulted in additional supplier interest and 43 RFP's were mailed to potential bidders. Evaluation of the seven proposals actually received was begun on 6 May 1974. Subcontractor selection was completed in June 1974, and negotiations are in process with the winning bidder. Contract award is expected early in FY 75.

Aerospace research and experimentation were initiated in October 1973. Emphasis of this work is on experimental familiarization with blood analysis techniques in preparation for the subsequent bloodstain persistence test program to be jointly performed with a subcontractor. Immunological typing and electrophoretic separation of the blood constituents of interest were performed. Substrates for the latter included starch, acrylamide gel, agarose gel, and cellulose acetate membrane. Three different types of electrophoretic analysis equipment have been used, as well as several variations of immunological typing techniques.

An additional Aerospace activity addressed the planning of a data collection effort involving the frequency of occurrence in blood composition of the constituents of interest to this program. Preliminary planning was also completed on a computerized data program for providing, on a periodic basis, updated frequency of occurrence, data on blood constituents useful in individualization to criminalistics laboratories and other interested organizations.

Delivered Items

This program was initiated in FY 74. As a result, all key items delivered during the period covered by this report fall into the category of documents. No hardware was produced or provided.

Documents

1. "Survey and Assessment - Blood and Bloodstain Analysis Program, Volume 1: Technical Discussion," Aerospace Report No. ATR-74(7910)-1, Vol. I, April 1974.
2. "Survey and Assessment - Blood and Bloodstain Analysis Program, Volume 2: Appendices," Aerospace Report No. ATR-74(7910)-1, Vol. II, April 1974.
3. Procurement Package - Development of a Bloodstain Analysis System, December 1973.
4. Briefing - Blood and Bloodstain Analysis Program Presentation to NILECJ Forensic Science Consultants, 8 March 1974.
5. Briefing - Blood and Bloodstain Analysis Program Review, 28 June 1974.

(Blank page)

G. EXPLOSIVES DETECTION AND IDENTIFICATION

The increasing international use of explosives in skyjackings and inflight airplane bombings, letter bombs, extortions, and militant attacks upon the public is of serious concern. In the United States the President's Special Study on Terrorism concluded that the illegal use of explosives is a major threat to the country, especially since adequate detection systems are not available. There exists an obvious need for rapid and reliable methods of detecting clandestine explosives and identifying explosives used in bombing incidents.

There are numerous principles upon which explosives detection and identification systems can be based. These are summarized and categorized in Figure III-9 according to whether a "tagging" principle is employed and whether the input is provided by vapors, the explosive cartridge itself, the detonator, or the lead wires. Devices based on the concepts listed in Figure III-9 are in some cases still in the experimental stage. Other devices have already been tested under field conditions, and in some cases commercial (detection) devices with limited capabilities are available. However, explosives detection systems which are reliable and sensitive to a variety of explosives have yet to be demonstrated.

In June 1973 the Development Group initiated a project for developing new and improved equipment for explosives detection and investigation as part of the FY 74 program. The scope of this project was subsequently enlarged to include explosives disposal as well. Program priorities were established by an Ad Hoc Interagency Technical Subcommittee under the chairmanship of the Bureau of Alcohol, Tobacco, and Firearms, U.S. Treasury Department. Aerospace provided a representative to this subcommittee throughout FY 74. An Explosives Advisory Committee also chaired by the Bureau of Alcohol, Tobacco, and Firearms consists of representatives from LEAA and other concerned government agencies. This group reviews the recommendations of the Technical Subcommittee and formulates Interagency Action Plans.

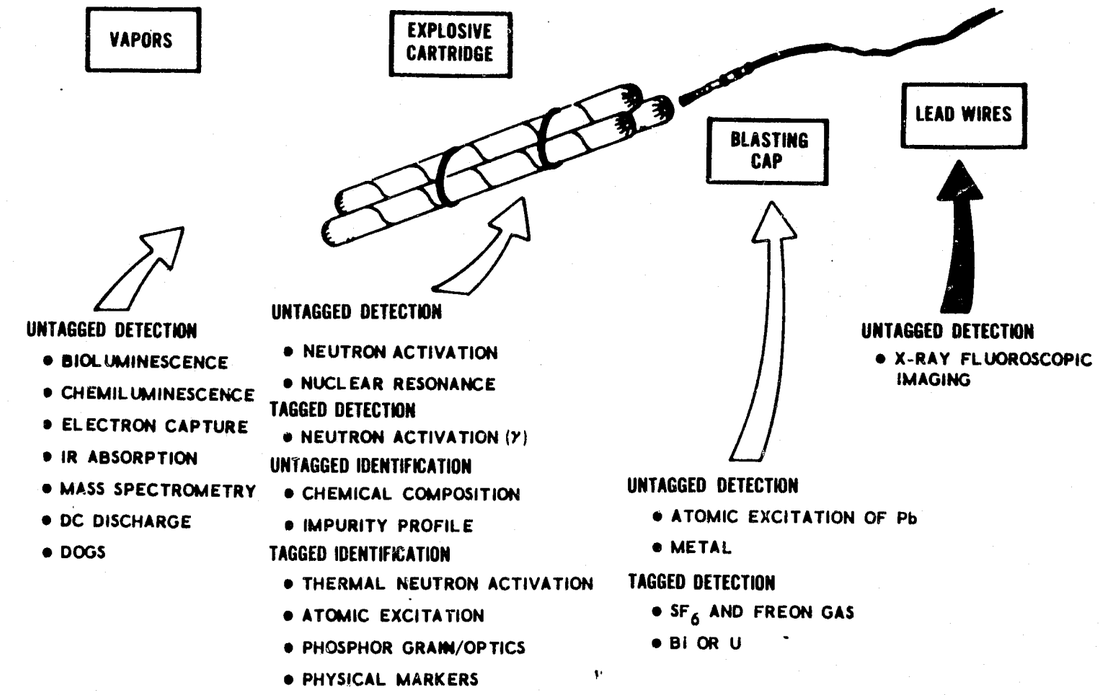


Figure III-9. Explosives Features for Detection and Identification

The initial effort on this program involved a survey of user agency needs and currently available commercial devices for explosives detection and identification.

An assessment of those explosives control concepts requiring further development was also conducted. A report on the results of this effort was published in November 1973.

Based on the conclusions reached and the priorities specified by the Interagency Explosives Subcommittee, effort on three separate system concepts was initiated in FY 74, namely:

- A system for detecting explosives by the sulfur hexafluoride vapors emanating from a "tag" of this compound added to the explosive at the time of its manufacture
- A system to be used with detonated explosives involving taggants added to the explosive during manufacture which identify the manufacturer and source of the explosive
- A system for detecting "untagged" explosives by sensing vapors which are inherently characteristic of explosives

The Subcommittee placed emphasis on the two tagging concepts for their promise of providing near-term advances in explosives control. Acquiring a capability for detecting untagged explosives is expected to be a longer-term effort, but does not require cooperation from explosive manufacturers and does not interfere with the established manufacturing processes.

In March 1974 LEAA entered into an interagency agreement with the Atomic Energy Commission for a 12-month program at the Brookhaven National Laboratory to determine the feasibility of using sulfur hexafluoride as a pre-detonation "taggant". Aerospace aided in preparing technical documentation for this agreement and will assist in the technical management, direction, and evaluation of the effort. The principal FY 74 activity on this study was to assess the effect typical materials used to wrap or package

CONTINUED

1 OF 2

clandestine explosives have on the diffusion of sulfur hexafluoride from the impregnated explosive detonator cap in the atmosphere. It was concluded that, except for the most severe packaging conditions (for example, a teflon-sealed pipe bomb), the level of diffusion was high enough to be detected by currently available equipment.

In April 1974 LEAA entered into a second interagency agreement with the AEC for another 12-month program. The purpose of this work is to investigate explosive taggants as a means of identifying the manufacturing source after detonation. Responsibility for this effort was assigned to the AEC's Lawrence Livermore Laboratory. Again, Aerospace aided in preparing technical documentation for the interagency agreement and will assist in the technical management, direction, and evaluation of the effort.

Three materials are to be investigated as explosives taggants which are added during the manufacturing process in proportions that uniquely identify the manufacturer and which are capable of being detected after detonation. The three taggants to be investigated are rare earth materials, phosphor chips, and polyethylene microspheres and represent concepts generated by the Ames Laboratory of NASA, Westinghouse, and the 3M Company, respectively. Livermore has generated work statements for taggant procurement and identification procedures from each of these three sources. A task statement was also proposed for the Institute of Makers of Explosives to cover manufacturing compatibility testing of these taggants. Detonation testing of tagged explosives will be performed by Livermore and will occur during FY 75.

In support of the long-range goal to develop a capability for detecting explosives to which no taggant has been added, two activities were initiated in FY 74: an analysis of the vapors which emanate from explosives and investigation of the feasibility of utilizing an infrared laser optoacoustic device for detecting such vapors. On 2 April 1974 an announcement was published in the Commerce Business Daily for sources to participate in a competitive procurement for a program to characterize vapors which emanate from explosives.

A procurement package for this subcontract was prepared and submitted to the Institute for approval on 29 April 1974. The scope of the effort includes the determination of the amount of vapors which are emitted and the effect of time since manufacture, the quantity of explosive, and the type of packaging utilized. The RFP for this study is expected to be released in July 1974.

Although a complete characterization of vapors which are emitted was not yet available, one concept which appears capable of detecting explosive vapors is already known. An infrared laser operated at selected wavelengths is highly absorbed by explosive vapors. The beam selectively heats the molecules of explosives vapor, if they are present, and microphones then detect the characteristic atmospheric pressure fluctuations caused by such heating. On 9 August 1973 an announcement was published in the Commerce Business Daily seeking sources for competitive procurement of a feasibility study on the use of an infrared spectroscopy laser optoacoustic device. On 6 November 1973 an RFP announcement was published in the Commerce Business Daily. Three bidders responded, and on 4 March 1974 a 10-month subcontract was awarded to Case-Western Reserve University in Cleveland, Ohio. Program progress to date includes definition of the infrared spectra of typical explosives constituents as well as those spectra for typical interference species. Encouraging results are being obtained. In addition, a preliminary test yielded an acoustic signal which correctly indicated the presence of dinitrotoluene explosive.

It is anticipated that this program will be completed and that a subcontract will be let on the vapor characterization study during the next fiscal year.

Items Delivered

All key items delivered during the period covered by this report fall into the document category. No hardware was produced or provided during FY 74.

Documents

1. "A Review of Methods for the Detection and Identification of Explosives," Aerospace Report No. ATR-0074(7902)-1, November 1973.

2. Procurement Package - Feasibility Investigation of a Laser Optoacoustic Device for the Detection of Explosives, November 1973.

3. Procurement Package - Characterization of Vapors Emanating from Explosives, April 1974.

4. "Statement of Work - Feasibility, Investigation of the Use of Sulfur Hexafluoride as a Taggant for the Detection of Explosives," August 1973, Letter 1279-JOE-73-084.

5. "Statement of Work - Feasibility Investigation and Test of Coded Taggant Materials for the Identification of Explosives," August 1973, Letter 1279-JOE-73-085.

H. DETECTION OF GUNSHOT RESIDUE

This program was initiated in FY 74 and has the objective of developing fast, reliable, and inexpensive techniques and equipment for use by criminalistics laboratories to detect gunshot residue on suspects' hands and around bullet wounds. Most previous methods of residue detection are no longer used because of their lack of sensitivity and reliability. Neutron activation analysis is the only currently accepted method. However, it is not widely used because of the inconvenience associated with having to send samples to one of the few laboratories capable of providing neutron irradiation services. There are other promising trace analysis techniques which might be applied to the detecting of gunshot residue, and it is the purpose of this program to investigate their utility.

The FY 74 effort covered the following three principal activities:

- Survey and literature search for data on existing and new alternate detection methods
- Evaluation and assessment of a molecular photoluminescence detection method
- Development of particle analysis detection concepts

Institute authority to proceed was received in January 1974, and the survey and assessment activity was immediately initiated. A preliminary survey was made of criminalistics laboratories concerning gunshot residue detection methods. Twenty-nine U.S. and two foreign crime laboratories responded with information concerning their current practices. Among this group, 13 laboratories were using neutron activation techniques and eight were using atomic absorption techniques on an experimental basis. X-ray methods were being experimentally used by two laboratories, and the less reliable color test was in use at eight laboratories.

Based on the results of this preliminary survey, a more extensive survey was undertaken in May 1974. A report summarizing the results of

both surveys, and the literature search performed during FY 74 is planned for early FY 75.

Prior to the initiation of this Institute-sponsored program on gunshot residue detection, experiments in Aerospace's laboratory were performed, in which handwashings taken after firing a gun were analyzed by molecular luminescence techniques for antimony. A marked difference in emission signal strength was noted between the gunholding hand and the other hand. This research was expanded under Institute sponsorship to include experiments for making molecular photoluminescence detection techniques effective at room temperature, rather than at the cryogenic temperatures normally used. Lead detection was successfully achieved at room temperature. Work on detection of antimony is still in progress and will be carried into FY 75.

Also undertaken as part of the FY 74 program was the test firing of a variety of handguns to develop sensitivity requirements for the luminescence analysis method. It was determined that this method successfully met the sensitivity requirements for antimony and lead. Continued effort is planned to review and assess detection residue techniques for other elements of interest.

Research on particle analysis methods consisted of laboratory evaluation of a concept for the detection of lead, barium, and antimony using the scanning electron microscope and X-ray analyzer. A concept for the detection of hydrocarbons with the use of an ion probe was also evaluated. The work with the scanning electron microscope and the X-ray analyzer disclosed that constituents of the residue, such as lead, barium and antimony, tended to collect into small spherical particles, which were embedded in the larger residue particles. This provides a useful characterization of gunshot residue and assists in its identification. The experimentation with an ion probe proved successful in detecting hydrocarbons in gunshot residue.

In preparation for subcontract procurement action planned for FY 75, an announcement soliciting qualified sources was published on 26 April 1974

in the Commerce Business Daily. The announcement requested sources to perform an exploratory assessment and possible development of at least two of the more promising gunshot residue detection concepts. Eighteen responses had been received by the end of the fiscal year.

A number of presentations and reviews were provided during the fiscal year. A briefing and demonstration of the luminescence analysis method were given to Institute personnel during January 1974. A program review briefing and laboratory tour were provided to the Institute's Board of Forensic Science Consultants and other Institute personnel during a visit to Los Angeles in March 1974. A program status review was presented at the Institute in May 1974.

Delivered Items

This program was initiated during the last half of FY 74. As a result, all key items delivered during the period covered by this report fall into the category of documents.

Documents

1. "A Photoluminescence Technique for the Detection of Gunshot Residue," Aerospace Report No. ATR-74(7915)-1, June 1974.

2. Briefing - Detection of Gunshot Residue, Presentation to NILECJ Forensic Science Consultants, 8 March 1974.

3. Briefing - Gunshot Residue Detection Program Review, 7 June 1974.

I. STUDY OF LATENT FINGERPRINT RESEARCH

Classifying, coding, and matching of latent fingerprints are presently done manually and are both slow and excessively dependent on the skill and memory of the operator. The problems of classifying latent prints and of matching single prints for identification have led police departments to establish separate latent print files of habitual criminals so as to reduce the scope of the search effort. Often these files have additional classifications pertaining to type of crime, sex, age, etc., to further reduce the scope of the search effort. In spite of this, latent prints are rarely used to identify criminals. For example, latent prints are responsible for solving only about 0.1% of all burglaries, although it has been estimated that fingerprint clues can be found in about 40% of such crimes. The primary reason is that the searching task is too laborious, and there are presently no reliable and operationally practical systems to speed up the process.

The objective of this study was to explore the application of advanced technology to improve the coding, file searching, and matching of latent prints. This was a study of the applicability of advanced technology and not a state-of-the-art review or assessment of present off-the-shelf technology. A complementary study by Project SEARCH reviewed present equipment and operational problems.

The study and analysis of advanced technology concentrated in the areas of pattern recognition and image processing. The various technical approaches to the encoding, filing, and searching problem are summarized in Figure III-10 on the next page. While both analog and digital technology were considered, the analog techniques received less emphasis, since these have been relatively well developed for fingerprint applications.

A major part of the study was devoted to investigating the capabilities of digital transforms for reducing the amount of redundant or irrelevant information contained in a fingerprint pattern. The goal of this effort is to

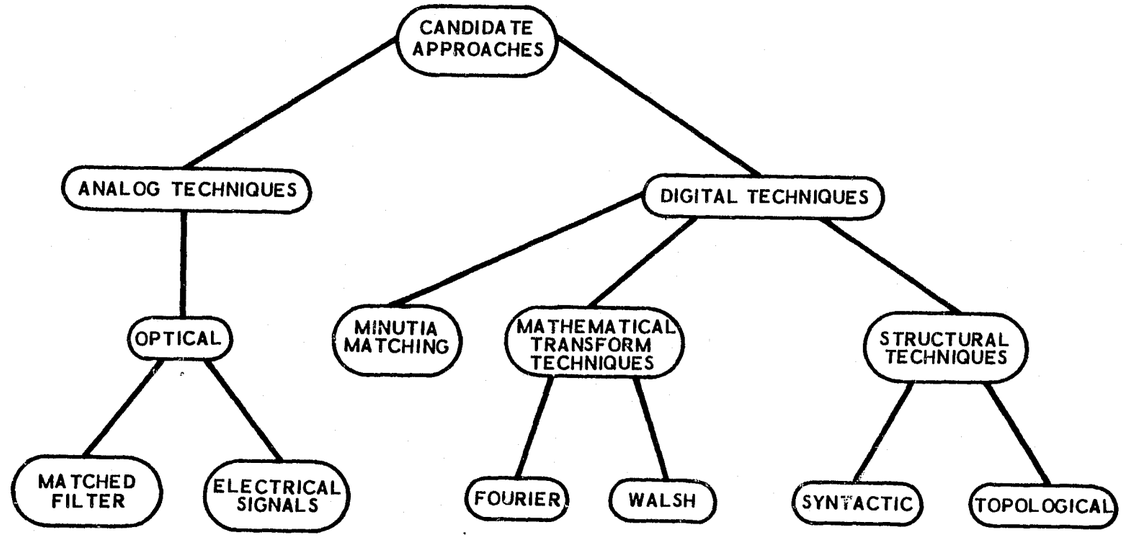


Figure III-10. Latent Fingerprint Developments - Technical Approaches

assess a technique whereby only the information required to perform identification is extracted from the fingerprint pattern. The Fourier, Hadamard, and Haar mathematical transforms were considered in this study.

The Fourier transform represents essentially the decomposition of the two-dimensional fingerprint density pattern into a corresponding two-dimensional matrix. The values of the matrix represent the coefficients of sinusoidal intensity functions of varying frequencies. For the Hadamard transform, the matrix values represent the coefficients of square pulses (Walsh functions) of varying numbers of zero crossings. The values of the Haar transform are derived from the sampling of the fingerprint pattern at varying rates.

The analysis and experimental tests indicate that the Haar transform does not appear to provide a suitable mechanism for fingerprint processing. However, both the Fourier and Hadamard transforms appear to have great potential and merit further development. For example, the combination of image enhancement and transform space filtering using the Hadamard transform has enabled the reduction in the number of bits required to describe a single print to 1500 bits. This result is extremely encouraging, particularly when (1) approximately 50,000 bits are required by current techniques to reproduce a print for visual comparison and (2) the FBI's Finder System requires 3000 bits to store minutae location data for only one print.

Another technique, examined in the study, which appears to have potential for fingerprint applications involves syntactic pattern recognition. This method uses ideas taken from linguistics and computer science to provide a means to analyze a fingerprint structure for inherent properties. This is essentially a modern-day Henry encoding system designed to utilize high-speed computers. Particular minutia patterns would be defined (like words in a language), and the rules whereby the minutia patterns were interrelated would be determined (similar to the grammer of the language). Each individual fingerprint would be analyzed according to the overall rules governing each fingerprint category.

The syntactic methods allow recognition of patterns independent of their orientation. At the time a computer recognizes that a fingerprint belongs to a certain category by determining its structure, it has also determined the location in the files of all other fingerprints in that category. Therefore, the time spent defining the structure of a fingerprint is effectively cutting down the file-search time. Syntactic pattern recognition provides a directly accessible method for file searching, and this is its main advantage over matching techniques.

The study also investigated techniques to reduce the amount of information in a fingerprint without losing the visual representation. This is important, since many situations exist where an already digitized fingerprint must be reconverted so that it can again be viewed in its original form. Algorithms for performing bandwidth reduction were evaluated and were found to be capable of a 6:1 reduction in the number of bits needed to represent a fingerprint while maintaining an acceptable level of visual distortion.

The study of advanced technology indicates that both digital transforms and syntactic pattern recognition have potential application to the problem of coding, filing, and searching for latent fingerprints. The next step is to test systems using these techniques against "real life" files in order to obtain statistical measurements of effectiveness.

Delivered Items

Since this was a six-month study project, the major delivery was the summary briefing and the final report.

Documents

1. Briefing - Advanced Technology for Latent Fingerprint Identification, 24 May 1974.

2. Final Report, "Advanced Technology for Latent Fingerprint Identification," Aerospace Report No. ATR-75-7922-1, Rough Draft, July 1974.

IV. SPECIAL TECHNICAL SUPPORT

IV. SPECIAL TECHNICAL SUPPORT

The activity in this category of effort covers special tasks requested by the Government Project Monitor (GPM) and normally authorized through the formal issuance of Technical Instructions (T. I. 's). Included are tasks such as special development and/or testing of designated equipment; technical review, evaluation, or monitoring of various Institute grants; and evaluation of proposals under consideration for support on Institute grant or contract. In addition, special short-term technical support to the Institute for which an unanticipated need arises during the contract period is provided under this category of effort.

Generally, Special Technical Support/Grant Monitoring items usually involved technical evaluation of ideas, concepts, reports, and proposals to the Institute, expecially when a rapid evaluation response was required. The use of a Technical Instruction allowed rapid authorization to proceed, and the response, usually in letter form to the Government Project Monitor, was also designed to permit a rapid input to the Institute.

In a few cases, and at the option of the Institute, formal reports for wide distribution are submitted for some of the larger Special Technical Support activities. For example, Technical Instruction 74-022 required a final report summarizing a study of the possible use of smaller cars for police patrol. Two additional items were sufficiently large to become Special Technical Support projects requiring final reports. A review of the activities and accomplishments for these three projects is included in Part A of this section.

A total of 56 Technical Instructions were issued by the GPM during Fiscal Year 1974. Only the initial 51 required a response during FY 74; the remainder had FY 75 due dates. The efforts covered by these 51 Instructions are discussed in this section. The title, number, and date of each individual Instruction are given in Part B of this section. This includes a short summary of the effort involved and the responding Aerospace correspondence. Frequently, a draft response letter for proposal evaluation was also provided.

A. SPECIAL TECHNICAL SUPPORT PROJECTS

Three Special Technical Support activities were authorized during FY 74, large enough to be reported separately. Each of these required one to two man-years of effort and resulted in one or more final reports. These projects were:

Project 911
Police Vehicle Study
Energy Task Force

The consulting support on Project 911 was initiated early in the year and was included in the FY 74 Annual Operating Plan. The second project was initiated in response to Technical Instruction No. 74-022. The third activity was established to provide support for a special Emergency Energy Committee established by the LEAA Administrator following the petroleum fuel shortage which developed in October 1973.

A detailed review of the activities and accomplishments under each of these three projects is presented below.

911 EMERGENCY PHONE SYSTEM STUDY

The 911 Emergency Phone System could become the universal emergency call system throughout the United States. While pending legislation exists in many states for implementing the 911 system, these are significant technical problems involved in reworking existing telephone systems to accommodate a fully automatic 911 operation. For example, a problem is introduced because of numerous branches operated by police, fire, and medical responding agencies in most metropolitan areas. Dialing 911 does not ensure that the appropriate branch of the desired agency within a large city will be automatically reached.

As a result of an AT&T recommendation to LEAA that a pilot system for an "automated" 911 be established before any other automated system is authorized, a one-year study grant (73-NI-99-0059-G) was awarded to the Alameda County (California) Regional Criminal Justice Planning Board early in FY 74. The intent of the grant was to study the feasibility of implementing

an advanced 911 system in the Oakland, California metropolitan area and, in addition, to plan a 911 system for the entire county.

The Institute directed the Aerospace Development Group to provide technical consultant services and appropriate guidance to the study team organized under this grant. Specific tasks undertaken by Aerospace during FY 74 included:

- Technical analysis of 911 equipment options and synthesis of new configurations
- Identification and analysis of buy-or-provide options
- Statistical analysis and modeling of call traffic
- Vulnerability analysis - false reports, security, saturation, catastrophies
- Response time assessment

Numerous individual studies were performed in support of these tasks, and the results were transmitted to the study team in informal interim reports. Figure IV-1 illustrates the results for a typical study, namely, the effect of call frequency and number of answering stations on the probability of getting a busy signal. Obviously, emergency calls should have a low probability of getting a busy signal. The curves are based on a call duration of 50 seconds, which is the average 911 call length experienced in Oakland during a three-day observation period. Since the busy hour for 911 traffic in Alameda County was estimated at 240 calls per hour, 11 stations would be required to handle this traffic at a probability of one busy signal for every 1000 calls.

Among the major issues considered by Aerospace were the problems faced by telephone companies in providing automatic number identification (ANI) of the caller. It was concluded that:

- Approximately 80% of the telephone subscribers presently terminate in central offices already equipped with ANI for billing purposes.

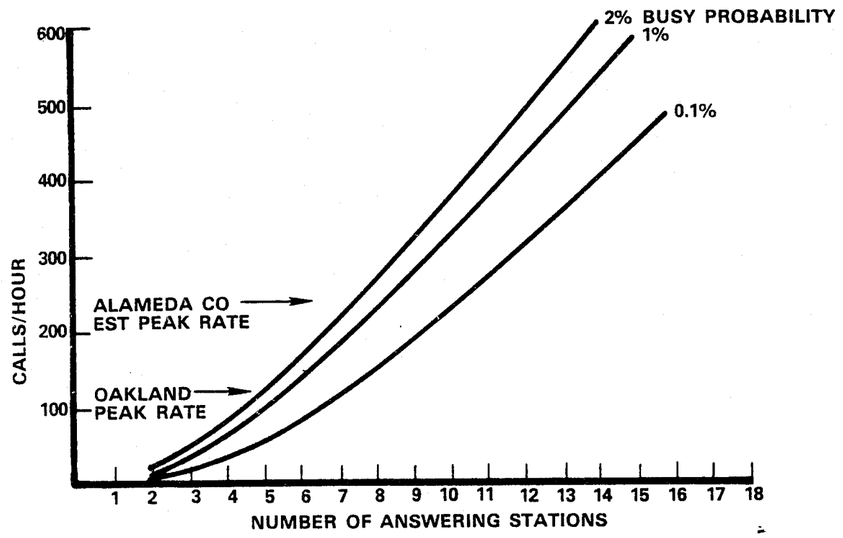


Figure IV-1. Required Answering Stations versus 911 Calls per Hour and Various Busy Signal Probabilities

- Central offices which do not now have ANI are in low-population areas where selective routine of 911 calls is not a pressing need.
- ANI could be provided at 911 answering points with little difficulty and at modest cost.

Several major suggestions were offered the study team at the close of FY 74 for follow-on activity and recommended procedures:

- Undertake, in cooperation with the Public Utilities Commission and/or the Federal Communications Commission, a cost study for a leased line with ANI.
- Prepare for city and state use the requirements, specifications, and guidelines for purchasing 911 equipment.

- Except for the leased line with ANI, purchase the 911 equipment competitively, even for trial demonstrations.

As of the date of this report, the Development Group support for this grant has been completed, and no additional support is planned for FY 75.

Delivered Items

In addition to a formally published final summary report, numerous technical notes on the results of specific analyses were prepared and delivered to the project director. The significant documents prepared and submitted by the Development Group were:

1. "Final Report, Equipment Options and Cost in 911 Emergency Phone Systems," Aerospace Report No. ATR-74(7912)-2, July 1974.
2. Project Review, Briefing presented to J. Kochanski, G. Shollenberger, and R. Donlan of NILECJ, 7 June 1974.

POLICE VEHICLE STUDY

The national shortage of petroleum fuel which occurred in FY 74 led to an Institute request in November 1973 for a study on the utility of smaller cars for police vehicle use. In December 1973 this initial effort was incorporated into a broader task to consider all possibilities for reducing fuel consumption by police cars, including size, driving habits, vehicle configuration, and maintenance.

The effort involved contacting numerous sources, including automobile manufacturers, police agencies, and specialists for information on police car applications, types of cars used, procurement and maintenance policies, and attitudes toward using smaller cars. In addition, other factors

influencing police vehicle fuel economy were identified, and potential police car fuel economy estimates were developed based on test data reported for passenger cars. Consulting support on automotive matters and police car requirements was provided by G. Ray Wynne, Department of Transportation, Los Angeles Police Department. Survey data on police car applications and the potential utility of smaller cars as police vehicles were obtained by subcontract to Arthur D. Little, Inc. Consulting support on strategies for overcoming barriers to the use of smaller police cars was provided by Overly, Schell Associates of Washington, D. C.

Police cars generally fall into the standard or intermediate-size categories. As illustrated in Figure IV-2, it has become a characteristic of American-designed and produced cars to become larger and heavier and to have larger engines with each succeeding model year. Only when a new model concept is introduced does this trend change. Interestingly, the intermediate-size car is essentially as large and heavy now as a standard-size car of a few years ago.

It was concluded that even though compact-size cars equipped for police patrol use were not yet available, smaller cars have a far greater application than present use would suggest. The present distribution of standard, intermediate, and compact-size cars in the police fleet is given in Figure IV-3. Also included in Figure IV-3 are two alternate distributions, both of which are based on a judgmental interpretation of this study's survey results. Alternative 1 primarily involves increasing the number of smaller cars in non-patrol use and shifting to a significant number of intermediate cars for urban patrol. Alternative 2 is primarily based on a maximum substitution of smaller cars, given present automobile technology and no significant change in police operation capability (i. e., high-speed freeway chases). Alternative 2 would permit substituting compact-size cars for about one-half the standard-size cars in the present police fleet. This would permit

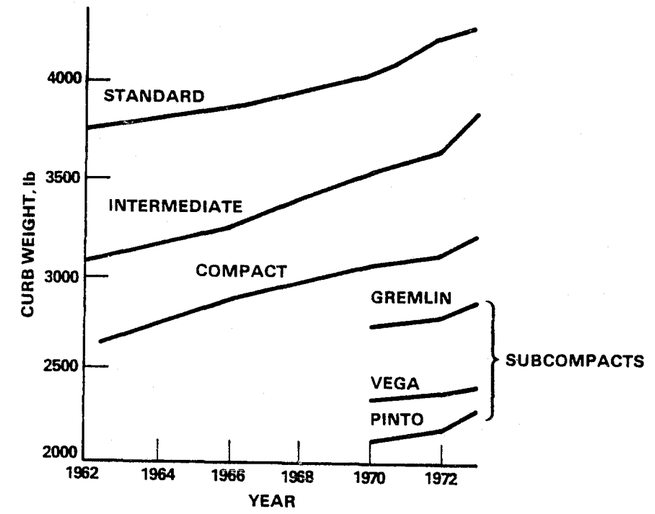


Figure IV-2. Vehicle Weight History Trend

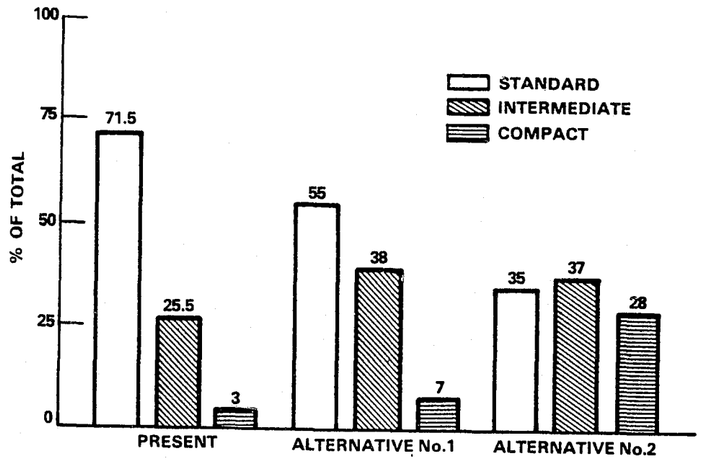


Figure IV-3. Present Distribution and Possible Redistributions of the Police Fleet Mix

converting 95,000 cars to compacts, since there are about 150,000 standard-size police cars presently in operation.

If the distribution of Alternative 2 be combined with other possible fuel economy measures, a total fuel consumption reduction of 40% appears achievable. As apparent from the following tabulation, some of the other possible measures offer even greater potential for fuel economy than smaller cars.

Contributing Factor	Reduction in Fuel Consumption, %
Driving Techniques	11
Patrol Operations	10
Optional Equipment	9
Smaller Cars	5
Improved Maintenance	5

A feasibility demonstration program to obtain an in-service evaluation of prototype compact-size police cars was recommended and with Institute endorsement was planned for initiation by June 1974. The use of four vehicles in each of two police departments was planned for a six-month period to demonstrate their overall utility and assess their fuel economy. The request for contractual authorization to procure the required vehicles was not approved by LEAA due to restrictions on the independent procurement of vehicles by Federal agencies, and the program was therefore terminated.

Delivered Items

The major documents delivered under this program include:

1. Press release material, Police Patrol Cars and the Energy Crisis, 2 December 1973.

2. Briefing package No. D80127, Police Car Study, 7 December 1973.
3. "Final report, Methods for Reducing Police Car Fuel Consumption," Aerospace Report No. ATR-74(7914)-1, Vols. I and II, January 1974.

Briefings presented on this program include:

1. Presentation to D. Santarelli and G. Caplan, 7 December 1973.
2. Presentation to LEAA Energy Task Force and Regional Directors, 12 December 1973.

ENERGY TASK FORCE

The petroleum fuel shortage led the LEAA Administrator, Donald E. Santarelli, to establish in late November 1973 a LEAA Emergency Energy Committee. The function of this Committee was to assess the effects of the energy crisis on law enforcement and criminal justice systems and to develop and disseminate information to local agencies on effective means for responding to the crisis. The Development Group provided technical staff support to this Committee from December 1973 until the Committee was disbanded in June 1974. A team of five technical personnel was assigned on a temporary basis to the Aerospace Washington office from El Segundo to provide this support.

The activity of the support group fell into three general categories:

- Prepare summary papers on crucial or topical issues for Committee review and possible release to state and local law enforcement agencies through the National Criminal Justice Reference System, which acted as the clearing house for energy-related bulletins.

- Perform studies and recommend options on energy-related matters.
- Recommend appropriate changes which are responsive to energy crisis considerations to LEAA-sponsored programs.

Numerous individual studies were performed by the staff support group. The results and conclusions reached were documented and either transmitted to the Emergency Energy Committee for publication or published as reports by Aerospace directly. Liaison was maintained with the Federal Energy Office throughout the entire period of support group activity. Highlights of the major studies performed under this task follow.

Since police patrol vehicles are a major energy consumer, an assessment of the factors affecting their fuel economy was made in conjunction with the previously initiated police vehicle study. Rapid acceleration and prolonged periods of engine idling are the two major contributors to poor fuel economy. The emission control system and the use of an air conditioner are lesser contributors. A packet of training material suitable for police roll call use, which discusses how to reduce patrol car gasoline consumption, was prepared for distribution by the Emergency Energy Committee.

Courts and correctional institutions also use significant amounts of energy, primarily for electricity and space heating. A summary of conservation measures suitable for use by these institutions was also prepared.

Due to the concern that fuel shortages could require electric power companies to reduce power to selected areas (i.e., "rolling blackouts"), an assessment of the impact of such blackouts on law enforcement was prepared. It appears that many law enforcement agencies lack contingency plans and sufficient auxiliary power sources to deal effectively with this problem. A

recommendation that LEAA assist local enforcement agencies in obtaining auxiliary power equipment was made.

In response to a request from an Inter-Federal Agency Study Group examining the impact of introducing winter daylight saving time, an assessment of its effect on crime was undertaken. Based on available data and the informed opinion of responsible law enforcement officials, it was concluded that daylight saving time has little impact on crime in the United States.

Concern was also expressed over the reduced street lighting steps taken in some communities as an energy-saving device. Examination of this issue revealed that the energy savings achieved by reduced street lighting are small, and the effect on crime was not clear. A survey of three cities where street lighting reductions were made (Portland, Seattle, and Los Angeles) indicated no perceptible crime increase attributable to the lighting reduction.

A report providing guidelines to minimize the impact on the crime rate for reduced street lighting was prepared. Also included in the report was information on the use of more efficient street light units as a means of reducing the energy consumed.

The energy crisis caused certain visible criminal actions and civil disturbances such as fights at gas stations, the truckers' strike and accompanying violence, gas theft by siphoning, and gas price gouging. An initial assessment of this developing trend suggested that such disturbances and economic crime could be expected to expand during an energy crisis. Contact was therefore established with both the National District Attorney's Association and the National Association of Attorneys General to coordinate activities for dealing with energy crisis-related crimes.

On 15 January 1974 the Federal Energy Office put petroleum allocation and price regulations into operation in order to control pricing and distribution of petroleum to bulk and wholesale purchasers. A summary and

analysis of these regulations were prepared as a guide to local law enforcement units for meeting their fuel needs.

During February and March 1974, there existed the very real possibility that a gasoline rationing plan would be implemented. An assessment of the consequences of gasoline rationing was made and it was concluded that:

- The plan would result in major increases in illegal and lawless activities.
- The plan would not enjoy public support, and violations would not be regarded as a criminal act.

Although the fuel crisis was shortlived and the spectre of gas rationing disappeared, the possibility of a future recurrence remains. The support group was therefore directed to prepare an overview report on the compliance and enforcement problems associated with any gasoline rationing plan. The report included review of World War II gasoline rationing experience and the U. S. Department of Agriculture food stamp program, as well as the 1973-74 gasoline crisis.

Delivered Items

The following seven reports published by the LEAA Emergency Energy Committee were prepared for the Committee by the Development Group:

1. LEAA Emergency Energy Committee, Energy Report No. 1: "Summary Results of Spot Survey of Selected Law Enforcement Agencies," 1 March 1974.
2. LEAA Emergency Energy Committee, Energy Report No. 2: "Street Lighting, Energy Conservation and Crime," 1 March 1974.
3. LEAA Emergency Energy Committee, Energy Report No. 3: "Preliminary Report on Rolling Blackouts," 1 March 1974.

4. LEAA Emergency Energy Committee, Energy Report No. 4: "Police Cars and Energy Conservation," 1 March 1974.
5. LEAA Emergency Energy Committee, Energy Report No. 5: "Suggested Energy Conservation Measures for Courts and Correctional Institutions," 1 March 1974.
6. LEAA Emergency Energy Committee, Energy Report No. 6: "Petroleum Allocation and Pricing Regulations for Law Enforcement Agencies," 1 March 1974.
7. LEAA Emergency Energy Committee, Energy Report No. 7: "Preliminary Report on Crime and the Energy Crisis," 1 March 1974.

Additional reports were also prepared for publication by Aerospace:

1. "Status Report on LEAA Emergency Energy Committee Activities for December 1973 through February 1974," Aerospace Report ATR-74(7919)-1, March 1974.
2. "Compliance and Enforcement Aspects of Various Retail Gasoline Distribution Schemes," Aerospace Report ATR-74(7919)-2, 1 July 1974.
3. "Effect of Gasoline Shortages on Selected Law Enforcement Agencies," Aerospace Report ATR-74(7919)-3, 1 July 1974.
4. "Final Report on the LEAA Emergency Energy Committee Activities," Aerospace Report ATR-74(7919)-4 (in publication).

B. SUMMARY OF TECHNICAL INSTRUCTIONS

T.I. No. 74-001 (24 July 1973) — Proposal Evaluation: Trace Gas Acquisition System

Analytical Research Laboratories, Inc., of Monrovia, California has developed a system for concentrating trace amounts of higher molecular weight vapors from sampled air streams. Under Army sponsorship the system is being evaluated for the sensing of buried TNT-containing devices. The firm proposed a six-month feasibility study to the Institute, using this same concept for detecting vapors emanating from concealed accumulations of certain types of narcotics.

The Aerospace Development Group is precluded from narcotics detection activity, and no comment was offered on that specific application. For explosives detection, this system and other available vapor concentration systems are being evaluated at Research Triangle Institute, Raleigh, North Carolina. It was recommended that any LEAA decision be deferred until the results of this evaluation become available. Letter 3330-JOE-73-626, dated 8 October 1973.

T.I. No. 74-002 (24 July 1973) — Technical Information: Request for Inputs to MITRE FY 74 Annual Operating Plan

Information was provided on the operational requirements and operational evaluations needed for planning and implementing the Development Projects to be undertaken in FY 74.

A general statement of the support desired from MITRE for each project and specific questions for which answers would be helpful were supplied. In addition, an estimate of the level of analytical support required and the dates by which information is needed were also provided. Letter 3330-JOE-73-589, dated 16 August 1973.

T.I. No. 74-003 (2 July 1973) — Grant Monitoring: Transceiver Grant Program Waiver (NI-70-034)

This Technical Instruction was originally issued on 27 June 1973 as Directive No. 73-041 and subsequently reissued for FY 74 accounting purposes as T.I. No. 74-003.

Aerospace was asked to review the reasonableness of a contract specification Waiver Request submitted by Martin Marietta Corporation. After a careful review of each of the items contained in the contractor's Request for Waiver, including the contractor's explanation as to why the waiver is necessary, both the contractor's explanation and recommendation were found to be reasonable.

There was one exception, however, with respect to the provisions of the waiver. This had to do with the provision of tone squelch features. The original specifications called for multiple-tone squelch control; however, the contractor was not successful in achieving even a single channel of squelch control. It was recommended that the contractor's Request for Waiver should be granted, but that the contractor should provide at least one channel of tone squelch.

A further point was made that even if the performance of the LEAA-developed transceiver were not in question, there is still serious doubt as to whether these newly developed transceivers would significantly impact the equipment purchased by local law enforcement agencies. Therefore, it was recommended that the Institute-developed transceivers not be introduced into field test. Letter 3330-JOE-73-074, dated 17 July 1973.

T.I. No. 74-004 (4 August 1974) — Proposal Evaluation: Less Lethal Weapons; Use of Jellyfish Stings in Aerosol Form

This Technical Instruction was originally issued on 21 June 1973 as Directive No. 73-040 and subsequently reissued for FY 74 accounting purposes as T.I. 74-004.

Review and recommendations were provided involving a concept for a less-than-lethal weapon, proposed in a letter to the Institute from Dr. Joseph Burnett of the University of Maryland Hospital. The concept involves the use of jellyfish stings in an aerosol form, as a riot control agent. Although it was found to be technically feasible, this concept did not appear to have any distinct advantage over presently available chemical agents. Moreover, considerations with respect to possible side effects as well as public reaction led to the recommendation that the proposed research program be disapproved. Letter 3330-JOE-73-627, dated 17 October 1973.

T.I. No. 74-005 (2 July 1974) — Report Review: NBS Survey of Police Equipment Standards Requirements

This Technical Instruction was originally issued on 21 June 1973 as LEAA Directive No. 73-039 and subsequently reissued for FY 74 accounting purposes as T.I. 74-005.

Comments and a recommended course of action were provided for a proposed report on the results of a nationwide mail survey conducted by the National Bureau of Standards. The purpose of this survey was to assist in establishing priorities for development under the Equipment Systems Improvement Program.

The survey upon which the report was based was comprehensive, and the conclusions reached were considered useful to the development phase of the Equipment Systems Improvement Program. Publication of the report was recommended. Letter 1279-JOE-73-565, dated 12 July 1973.

T.I. No. 74-006 (2 July 1974) — Grant Monitoring: Police Transceiver Development (NI-70-034)

This Technical Instruction was originally issued on 14 June 1973 as LEAA Directive No. 73-038 and subsequently reissued for FY 74 accounting purposes as T.I. 74-006.

By agreement with the Government Project Monitor, attendance of an Aerospace representative at a meeting on 25 June 1973 at Hanscom Air Force Base satisfied the intent of this T.I., and no further action was required. The enclosures sent to Aerospace with this T.I. were for background information only. Letter 1279-JOE-73-068, dated 6 July 1973.

T.I. No. 74-007 (2 July 1973) — Grant Monitoring: Institute Grant NI 71-129, Investigation of Digital Mobile Radio Communications for Law Enforcement

This Technical Instruction was originally issued on 14 June 1973 as LEAA Directive No. 73-037 and subsequently reissued for FY 74 accounting purposes as T.I. 74-007.

As requested by the Government Project Monitor, a research evaluation report was prepared on Report No. ESL-R-493 submitted by the Massachusetts Institute of Technology under Grant NI 71-129. It was concluded that the report was well written and that the grantee performed an excellent task in (1) defining the problems involved in the design of digital mobile communication links and (2) in constructing a realistic theoretical model of the channel. However, the report did not answer the question of digital data link feasibility in an operational environment. Also, although the data appear theoretically accurate, some doubt may exist in the reader's mind, since there are insufficient experimental data to substantiate the theoretical findings. Letter 3330-JOE-74-101, dated 24 October 1973.

T.I. No. 74-008 (2 August 1973) — Report Evaluation: Technique for the Evaluation of Less-Lethal Weapons, Volume I

Comments were provided on an evaluation of the subject U.S. Army Land Warfare Laboratory Report. The report discusses methodology developed for evaluating impact kinetic energy devices and based on physiological effects. Use is made of computer programs and data banks and involves medical assessment as well.

It is acknowledged that the report is not yet ready for the intended user, and suggestions were offered by Aerospace on improving the utility of less-lethal weapon evaluation techniques for police agency users. Letter 3330-73-JOE-602, dated 31 August 1973.

T.I. No. 74-009 (27 August 1973) — Technical Support: NILECJ Participation in American Institute of Aeronautics and Astronautics 3rd Urban Technology Conference Exhibit, 23-25 September 1973

Technical support was requested in developing a NILECJ exhibit for the 3rd Urban Technology Conference. An exhibit on the problem of home burglary was designed, assembled, and delivered. In addition, Aerospace personnel aided in manning the exhibit during the conference.

T.I. No. 74-010 (7 September 1973) — Grant Monitoring: Request for Review Comments (NI-70-034)

A review was made of the Sylvania "Technical Status Report Document," dated 10 August 1973. This report contained the test data and results from the acceptance tests of six transceivers. The test data presented are deemed accurate, and the performance deficiency explanations are understandable and probably reasonable. The granting of Waiver Requests was recommended. Letter 3330-JOE-73-100, dated 5 October 1973.

T.I. No. 74-011 (9 October 1973) — Proposal Evaluation: Holographic Storage Device

A proprietary proposal by the Carson Laboratories for the development of an optical holographic memory, dated 6 September 1973, was evaluated. In support of this evaluation, a visit was made to Carson Laboratories to examine capabilities, facilities, and previous work accomplished in this field.

A very high-density storage system of the type proposed would be of value to law enforcement and other agencies. However, it is estimated that a practical operational memory of the required capacity is 5-10 years from production, and would necessitate $5-10 million for test and development.

Because of the high development risk and costs involved, and because of the limited resources available at the Carson Laboratories, it was recommended that no action be taken with respect to the proposal. Letter 3330-JOE-73-107, dated 21 November 1973.

T.I. No. 74-012 (9 October 1973) — Proposal Evaluation: A Radar Detector for Small Arms Concealment on the Person

A proprietary proposal by the Lockheed Electronics Company, dated 25 July 1973 and concerned with detection of small arms, identified as RADAM (Radar Detection of Agitated Metal Targets), was evaluated. Although the concept is novel, there were insufficient supporting technical data to determine proper assessment. Also, there was no indication of the required level of effort and other costs. Without such information, it is not possible to assess the utility, success probability, and funding requirements for such a project. Institute support was not recommended, unless a more substantial proposal is submitted. Letter 3330-JOE-73-646, dated 13 October 1973.

T.I. No. 74-013 (19 October 1973) — Proposal Evaluation: NASA Bullet Identification Technique

An evaluation was made of a NASA Research and Technology Operating Plan (RTOP), entitled "Bullet Identification Using Optical Fourier Transforms," which presents two approaches to the problem of bullet-pattern classification. Technical judgment on the soundness of approach and feasibility of the plan was requested. Both approaches are considered technically feasible. However, exclusive funding of this RTOP by the Institute was not recommended, since similar work on the applicability of Optical Fourier techniques for

identifying fingerprints is presently funded by LEAA. Letter 3330-JOE-73-647, dated 14 November 1973.

T.I. No. 74-014
(24 October 1973)

Proposal Evaluation: Detection of Explosives Wrapped in Non-Metallic Casings

An unsolicited letter proposal from the Thermo Electron Corporation (Proposal TECO 2443-320), dated 24 August 1973, for developing a portable instrument to detect explosives wrapped in non-metallic casings, was evaluated. The concept to be utilized was based on the light emitted from a chemiluminescent reaction of nitric oxide and ozone.

Although the concept is considered feasible, practical limitations cause it to be unattractive. The potential sensitivity and specificity of such an instrument are considered to be of no greater merit than that of the dual-gun electron capture detector already developed at the Transportation System Center in Cambridge, Massachusetts. It was therefore recommended that this proposal not be funded. Letter 3330-JOE-73-105, dated 12 November 1973.

T.I. No. 74-015
(23 October 1973)

Proposal Evaluation: Aerosol Indicator Kit for Detecting Explosives

An evaluation was made of a letter R&D proposal by the U.S. Army Land Warfare Laboratory (LWL), dated 25 October 1973, soliciting support for development of an aerosol indicator kit for detection of trace quantities of selected explosives. There is a need for a portable kit to detect explosives. However, the probability of developing a useful aerosol device is considered low, due to potential problems with toxicity, corrosiveness, and specificity. Since the Naval Explosives Ordnance Development Facility is currently funding (under LWL direction) feasibility work in this area at the Franklin Institute, it was recommended that the decision on a development program be deferred until feasibility has been demonstrated. Letter 3330-JOE-74-118, dated 31 January 1974.

T.I. No. 74-016
(23 October 1973)

Proposal Evaluation: Acoustic Fingerprint Transcription

An evaluation was requested of an unsolicited proprietary proposal, dated 29 September 1973, by Dr. Stephen Kowel of Syracuse University, entitled, "Acoustic Fingerprint Transcription." The proposed system would use diffraction of acoustic surface waves by the skin ridges on a quartz substrate to characterize the finger pattern. The diffraction pattern is to be detected by transducers producing electronic signals, thus providing a non-photographic basis for fingerprint identification. The evaluation is in progress.

T.I. No. 74-017
(29 October 1973)

Technical Information: Suggestion for Support of Fingerprint Processing Pilot Program

An evaluation was requested of an unsolicited inquiry from Calspan Corporation, dated 19 October 1973, concerning the feasibility of developing a LEAA-sponsored pilot program for medium-to-large-size law enforcement agencies using Calspan's approach to fingerprint processing and latent print file searching. Involved are the optical scanning of the fingerprint card impression and its conversion to electrical signals of varying intensity. The signals are enhanced and stored on magnetic tape for use in matching test print minutiae against a fingerprint library.

Calspan activity has been supported by the Federal Bureau of Investigation and the National Bureau of Standards, and the processing of the 10-fingerprint card has been successfully demonstrated. The Calspan approach appears technically feasible for latent fingerprint processing and file searching and should be considered a candidate system should the Institute undertake a latent print program. Comments concerning the Calspan system and its adaptation to latent fingerprint use were orally given to the Institute at the Latent Print Review Meeting on 24 May 1974.

T.I. No. 74-018
(2 November 1973)

Grant Monitoring: Review Final Report, Personal VHF/UFH Transceiver (NI-70-034)

As requested by the Government Project Monitor, Part 2 of the Research Evaluation Report on the subject final report by the Martin-Marietta Corporation was submitted by Aerospace. The Martin report was considered very well prepared and fully discusses and documents development effort and the end product. Although the report does not meet LEAA format standard I-1432.1, it does meet the format requirements of the Air Force contract under which Martin-Marietta performed this work. Letter 3330-JOE-73-121, dated 27 December 1973.

T.I. No. 74-019
(7 November 1973)

Proposal Evaluation: Speed Pattern Studies from a Nonlinear Model for the Ear

A proposal, submitted by Dr. J. L. Stewart of Av-Alarm Corporation, Santa Maria, California, was reviewed and evaluated. It is based on the premise that, since the human ear is capable of extracting identifying information from human speech, an electrical model of the ear may aid in attaining machine recognition of speech and identification of speakers. The proposal is intuitively appealing but of an exploratory nature. The approach yet remains to be validated by the scientific community, and effort is needed to confirm that the model is correct. In addition, there is no basis for assuming that the information obtained from a model of the human ear would be of greater value than that obtained by conventional methods. In view of the exploratory nature of the proposed effort, it was concluded to be beyond current Institute interest, and funding support was not recommended. Letter 3330-JOE-73-116, dated 27 December 1973.

T.I. No. 74-020
(12 November 1973)

Proposal Evaluation: Phonplex Corporation Literature on Voice Multiplexing Systems

Review for possible application to Institute programs was requested of seven documents submitted by the Phonplex Corporation of Huntington, New York. Described were a series of products whose principal feature is the utilization of a single telephone channel for the simultaneous transmission of several voice and/or data messages. The equipment is relatively novel and employs a sophisticated signal processing means to compress each of the multiple inputs prior to multiplexing them. Phonplex has been successful in compressing four voice channels into a single telephone channel of less than four kilohertz bandwidth and suggested possible application to the Institute-sponsored Speaker Identification Project. Assessment and discussions with Phonplex revealed that these techniques have no application to any of the ongoing Institute projects under Aerospace cognizance. It was recommended that no action be taken. Letter 3330-JOE-73-124, dated 24 January 1974.

T.I. No. 74-021
(12 November 1973)

Proposal Evaluation: Acoustic Phased Array Riot Control System

Analytics, Inc. of Jenkintown, Pennsylvania submitted a proprietary proposal, dated 25 September 1973, to design and deliver an experimental prototype of a riot control and key personality protection system. It consists of a master command and control vehicle and nine portable stations, each containing high-intensity sound-generating equipment. The equipment is designed to control crowds by focusing high levels of sound to interrupt verbal exchange and even higher levels of sound to achieve dispersal by causing severe annoyance or sound-induced pain. The operational utility of the system sppears to be severely limited, and it was recommended that the Institute take no action on this proposal. Letter 3330-JOE-75-504, dated 24 July 1974.

T.I. No. 74-022
(13 November 1973)

Technical Information: Adaptability of Small Cars for Police Vehicles

As a result of the petroleum fuel crisis, Aerospace was requested to perform an analysis on the adaptability of small cars in the Nova-, Pinto-, and Vega-class to police use. It was concluded that both compact- and intermediate-size cars have a far greater application than current use would suggest. Alternate fuel-saving measures that involve operating procedures and driving habits were also examined, and the potential benefits from applicable alternatives were quantitatively assessed. This effort is detailed in Section IV.A. of this report. Detailed results are presented in Aerospace Report No. ATR-74(7914)-1. Letter 3330-JOE-74-676, dated 18 January 1974.

T.I. No. 74-023
(13 November 1973)

Proposal Evaluation: Determination of the Origin of Explosives by Field Ionization Mass Spectrometry

Review and comments were requested on a Stanford Research Institute (SRI) proposal previously reviewed in response to Technical Directive No. 73-006, dated 15 February 1973 (see Letter 1279-JOE-73-052, dated 8 June 1973).

Upon re-evaluation, including discussions with Picatinny Arsenal and Dr. Anbar of SRI, the previously submitted recommendations are still considered valid. Specifically, the use of field ionization spectroscopy should be considered both as a means for determining the origin of explosives chemical species, as well as detecting the presence of explosives in any future Institute-funded project addressing either of these issues. Letter 3330-JOE-73-117, dated 26 December 1973.

T.I. No. 74-104
(13 November 1973)

Proposal Evaluation: The Aerobody, a Proposed Solution for the Police Patrol Mission

Comments were provided on an Aereon Corporation concept titled "Aerobody," which resembles a combination blimp and airplane, requires

very little power to remain airborne at low speeds, and is characterized by slow landing approach speeds. It was concluded that the Aerobody design does not offer significant improvement in performance, maintenance, and operating efficiency over available short-takeoff-and-landing airplanes and helicopters. Moreover, the Aerobody is currently only a conceptual design, and extensive experimental and production costs must be borne. The law enforcement market is insufficient to justify such a development, and LEAA sponsorship is not recommended. Letter 3330-JOE-73-112, dated 27 December 1973.

T.I. No. 74-025
(13 November 1973)

Report Evaluation: Environmental Aspects of Trace Metals on Human Hair

Comments were provided on Report ORA-011538-2, prepared by Prof. A.A. Gordus, University of Michigan, under National Science Foundation (NSF) Grant No. G.I.-35116. The report addresses criminalistics implications of trace metal concentrations on human hair and not only presents the results of excellent research but also provides highly interesting correlations. Unfortunately, analysis of aberrant trace elements in hair only very infrequently provides useful criminological clue information, and there is no urgent need to encourage trace analysis research, including the neutron activation and atomic absorption analysis methods utilized. However, the refractive index work is considered to be of considerable forensic value, and it was recommended that the NSF be encouraged to continue support of this effort. It was also concluded that the hair collection assembled in performing the study reported would have significant utility for forensic research on hair individualization. Letter 3330-JOE-73-114, dated 26 December 1973.

T.I. No. 74-026
(13 November 1973)

Proposal Evaluation: Forensic Applications of Field Ionization Mass Spectrometry

Stanford Research Institute proposed exploration of forensic applications of field ionization mass spectrometry and the development of a field ionization

spectrometer designed specifically for forensic use. Although a field ionization spectrometer can perform direct analysis of complex mixtures without first separating molecular species by some other method, the importance of this capability for forensic applications has not been evaluated as yet. In addition, it is not known whether the mass resolution attainable is sufficient for forensic needs. It was therefore recommended that, prior to a decision to develop such an instrument, a thorough competitive evaluation of various types of mass spectrometers be conducted to determine their relative values for analyzing physical evidence. Commercially available field ionization spectrometers should first be evaluated, and the decision to develop a new instrument specifically for forensic application should be deferred pending this general evaluation. Should a need for such an instrument exist, Dr. Anbar and his associates at Stanford are well qualified to undertake its development. Letter 3330-JOE-73-120, dated 27 December 1973.

T.I. No. 74-027 (13 November 1973) — Proposal Evaluation: Computerized Single Print Personnel Identification

T.I. No. 74-028 (13 November 1973) — Proposal Evaluation: Addendum to T.I. No. 74-027

A proprietary proposal and addendum by the Sperry Research Center, SCRC 244-19 and SCRC 244-27, dated 4 September 1973 and 2 November 1973, respectively, were evaluated. An adaptation of Sperry's 10-fingerprint search system into another system designed to search for single prints in latent print files is proposed. The approach is technically sound and represents one of a number of possible methods for searching latent print files.

It was recommended that the proposal be considered as a candidate for Institute support, should a development program in the latent print area be undertaken. Letter 3330-JOE-74-129, dated 13 February 1974.

T.I. No. 74-029 (13 November 1973) — Report Evaluation: Properties of a Non-Linear Model for the Human Ear

This paper by John L. Stewart of Av-Alarm Corporation, Santa Maria, California was submitted as an addendum to the proposal treated under T.I. No. 74-019. Comments on this paper were included as part of the reply for T.I. No. 74-019. Letter 3330-JOE-73-116, dated 27 December 1973.

T.I. No. 74-030 (19 November 1973) — Concept Evaluation: Electric Vehicles

A suggestion by the Pacific Gas and Electric Company to use electric vehicles as an energy-saving procedure for law enforcement transportation needs was evaluated. It was concluded that "meter-maid" use is the most reasonable police application. Since electric vehicles for meter-maid application are currently available off the shelf and the impact of electric cars on total energy consumption is believed to be considerably less than suggested, it was concluded that no additional research or development of electric vehicles for law enforcement applications is warranted. The Postal Service evaluation program for electric vehicles is comprehensive and will provide adequate results for meeting law enforcement needs. Letter 3330-JOE-74-137, dated 7 March 1974.

T.I. No. 74-031 (2 December 1973) — Proposal Evaluation: Application of Space Age Security, Inc. Tel Star System to Voice Identification

The Tel Star system is a burglar or vandal alarm device which utilizes an on-line listener from an alarm response company to determine, based upon the noise he hears, if an alarm is real or false. Although the concept has certain innovations (it uses an audio threshold level detector located next to the telephone for triggering), it is equivalent to a number of approaches currently commercially available.

It was proposed to the Institute that voice recordings could be made with this device during a burglary, and that a voiceprint analysis of such recordings could be used later to identify the suspect(s).

Evaluation of this as well as other applications is planned for the FY 75 Speaker Identification Program to be undertaken by the Development Group. Decisions will subsequently be made concerning the support for specific concepts. Letters 3330-JOE-74-125, dated 31 January 1974, and 3330-JOE-74-134, dated 26 February 1974.

T.I. No. 74-032
(2 January 1974)

Report Evaluation: Voice Identification Research

Evaluation was requested of a concept paper submitted to the Institute by Auburn University via the LEAA Regional Office and the Alabama State Planning Agency. The Auburn University proposal included a two-year program (1) to investigate the reliability of voice identification using present techniques, as well as a program (2) to develop and test an experimental computer-assisted voice identification scheme. Unfortunately, the documentation submitted did not present the concepts and proposed approaches in sufficient detail to allow complete evaluation.

It was recommended that Auburn University be informed of speaker identification programs currently supported by the Institute and that the University be requested to provide additional information on their proposal, so that it may be judged in relation to other planned or proposed voice identification projects. Letter 3330-JOE-73-113, dated 26 December 1973.

T.I. No. 74-033
(10 January 1974)

Report Evaluation: MITRE Study of Transmission Times and Messages Characterizing the Radio Communications System of the Miami Police Department, 23 August 1973

The subject report was prepared as part of the MITRE effort under the Equipment Systems Improvement Program. Its purpose was to document and

discuss message characteristics and radio transmission times for both field unit and dispatcher communications. The data and its presentation appear complete and meet the stated objective. The report should be useful to the criminal justice community, and its approval was recommended. Letter 3330-JOE-74-135, dated 26 February 1974.

T.I. No. 74-034
(29 January 1974)

Grant Monitoring: Lightweight Body Armor Program (Interagency Agreement LEAA-J-1AA-005-4)

The December 1973 monthly progress report from the Army Land Warfare Laboratory was reviewed and comments were provided for Institute consideration. The report followed the Statement of Work task breakdown and provided acceptable technical content. However, in view of the great interest by the Development Group in this subject, monthly technical interchange meetings were suggested, in order to augment the information contained in the progress reports. Letter 3330-JOE-74-136, dated 27 February 1974.

T.I. No. 74-035
(29 January 1974)

Concept Evaluation: Digital Quadrature Demodulator

An evaluation was provided on a proprietary digital demodulator concept proposed to the Institute by Webb Digital, Inc. of Littleton, Colorado. The concept suggests digital processing of FM receiver signals at the IF output to improve transceiver performance. This concept was previously explored by the Philco-Ford Corporation in 1968 and can conceivably improve the apparent impulsive noise of a receiver. However, the claim of a reduction in signal fading as a result of the proposed approach was not substantiated. It was recommended that, because of higher priority needs in the area of FM transceiver improvement, no Institute action be taken. Letter 3330-JOE-74-149, dated 26 April 1974.

T.I. No. 74-036 (19 February 1974)

Proposal Evaluation: Fingerprint Classification Methodology

An informal, unsolicited proposal for investigating a fingerprint classification methodology was submitted to the Institute by George A. Olive, a professional engineer, and was reviewed. The proposed concept is based upon measuring ridge direction parameters at specified points on each print. These measurements are then supplemented with minutiae information.

This approach is inherently similar to a number of other fingerprint identification systems either under development or completed. Since this proposal is in effect redundant, it was recommended that no action be taken. Letter 3330-JOE-74-143, dated 24 July 1974.

T.I. No. 74-037 (9 January)

Proposal Evaluation: Planning Policy for Spectrum Utilization for Mobile Communications and Remote Vehicle Location in an Urban Environment

An evaluation was requested by the Institute of unsolicited Proposal No. P74-026, dated 17 December 1973 and submitted by Alabama Agricultural and Mechanical University. According to Prof. Glen Weathers, the principal investigator for the proposed effort, the proposal was originally prepared in response to a problem identified by the National Science Foundation. The subject involved encompasses many issues which are not only technically complex but also have many political and social implications. The proposal is complete and includes a good technical discussion, research and management plans, and brief descriptions of related programs at Alabama A&M. A total of 24 man-months would be involved.

Since the problem to be addressed is substantial, there is question whether adequate treatment can be provided with so small an effort, especially in view of data already available as a result of work at the Jet Propulsion Laboratory, the MITRE Corporation, Texas A&M, and in private industry. It was therefore recommended that no Institute action be taken on this

proposal but that Alabama A&M be considered as a potential source for future effort in this area. Letter 3330-JOE-74-151, dated 15 July 1974.

T.I. No. 74-038 (6 March 1974)

Proposal Evaluation: EPR Spectrometry of Primer Residues; Evaluation of Thermal and Mass Effects

An unsolicited proposal (P663E04, February 1974) was submitted to the Institute by the Mission Research Corporation, Santa Barbara, California to use electron paramagnetic resonance (EPR) spectrometry for the study of burnt gunshot primer residues in order to predict the time of firing. It was specifically proposed to study a large number of residue samples in order to determine the reliability of such time estimates. It was also proposed to investigate the correlation between free radical concentrations as a function of time and the mass and temperature of the primer residue.

It was concluded that the proposed program is technically sound, and its support was recommended, since, if successful, a valuable tool for the investigation of crimes involving guns which are fired would result. It was further recommended that, if initiated, the program should also include a broad survey of the decay of free radicals in residue from a large variety of cartridge primers. Letter 3330-JOE-74-153, dated 23 April 1974.

T.I. No. 74-039 (12 March 1974)

Report Evaluation: Analysis of Implemented AVM System

Evaluation was requested of a concept paper, dated 25 January 1974, submitted by Dr. Richard Larson. The paper had been submitted in response to the Institute's new program, "Innovative Research in Criminal Justice." It suggested a project to evaluate the Boeing Co. FLAIR automatic vehicle monitoring (AVM) system to be installed by the St. Louis, Missouri Police Department. Modelling of the St. Louis police operations, an attitudinal survey, and a hardware performance evaluation were proposed.

The concept of establishing methods of performance analysis and evaluation for police AVM systems is considered timely. However, the proposed hardware evaluation and the attitudinal survey tasks duplicate those being planned by the Boeing Company and by Prof. Zannes of the University of New Mexico. Moreover, the scope of the modelling task appears to be of limited value to the Institute, for its nature is not general-purpose. Therefore, it was recommended that this task be expanded to a general-purpose model, utilizing data from the Montclair, California and the St. Louis AVM systems, and that Institute support be provided. Letter 3330-JOE-74-161, dated 10 June 1974.

T.I. No. 74-040 (12 March 1974) — Concept Evaluation: Evaluation of an Optical Fingerprint Device

An informal letter proposal, dated 13 February 1974, was submitted by the California Crime Technological Research Foundation requesting Institute support under the Equipment Systems Improvement Program for studies related to an inkless fingerprint recording machine developed by RCF Systems, Inc.

Review of the proposal, examination of the machine, and discussions with Mr. R.C. Fowler, the machine's inventor, revealed that the studies identified in the proposal have already been essentially completed. It was therefore concluded that Institute support for the proposed study appears unnecessary.

Mr. Fowler has recently submitted a new proposal to the California Crime Technological Research Foundation. Since the RCF system concept appears technically sound and may produce valuable results, it was further recommended that this latter proposal be considered for Institute support. Letter 3330-JOE-74-163, dated 20 May 1974.

T.I. No. 74-041 (15 March 1974) — Grant Monitoring: Lightweight Body Armor Program (Interagency Agreement LEAA-J-IAA-005-4)

The January 1974 monthly progress report from the Army Land Warfare Laboratory was reviewed and comments were provided for Institute consideration. This report was an update of the activity described in the December 1973 monthly progress report previously reviewed under T.I. No. 74-034 and describes the progress made by the Edgewood Arsenal Biomedical Laboratory during the reporting period. The report is considered technically acceptable, although, as indicated under the response to T.I. No. 74-034, a more in-depth discussion to augment the information contained in the monthly progress reports remains desirable. Such meetings have been initiated between Institute representatives and the Army Project Officer and will obviate the need for formal review of future monthly reports. Letter 3330-JOE-74-165, dated 20 May 1974.

T.I. No. 74-042 (25 March 1974) — Concept Evaluation: Automatic Route Control System

An evaluation was made of a route comparison concept suggested by Avcon, Inc., of Fort Worth, Texas, as applicable to the Institute's truck anti-hijacking program. A route comparison system is utilized which compares vehicle position against a data tape previously recorded in the same vehicle during a calibration run over a specific route.

It was concluded that the concept has application to fixed-route operations, such as newpaper and milk delivery or telephone company pay-booth cash pickup. For the random route characteristics typical of urban cargo delivery service, the concept does not appear feasible. Since the principal targets of the cargo thief do not operate on a preplanned route basis, it was recommended that no Institute action be taken. Letter 3330-JOE-74-158, dated 18 July 1974.

T.I. No. 74-043 (2 April 1974)

Grant Monitoring: Transceiver Development Program (N.I. 70-034)

Participation was requested in reviewing the status of the Transceiver Development Program and formulating an Institute position on future direction. Discussions were held with Institute personnel and with the Martin Marietta Corporation, developer of the high-performance, low-cost receiver funded under this grant. As a result of these discussions, Martin management decided to submit an unsolicited proposal to LEAA describing suggested future activity to reduce the unit cost and improve its utility. It was recommended that the Institute decision on this grant await the receipt and evaluation of this proposal. Letter 3330-JOE-74-185, dated 18 July 1974.

T.I. No. 74-044 (8 April 1974)

Technical Information: Subtask Under General Planning for Electric Vehicle Study

The reply to Technical Instruction No. 74-030 recommended that Institute support to electric vehicle research and development is not warranted. Nevertheless, a request was made by the Institute to conduct a survey and assessment of electric vehicles and initial technology utilization studies for applying electric vehicles to law enforcement activities. Accordingly, a task plan to survey the general state of the art of electric vehicles and the assessment of their applicability to law enforcement activities was prepared and submitted. The survey would also summarize activities of other government agencies, such as the Postal Service, in the field of electric vehicle utilization. A cost-benefit analysis was included to permit tradeoffs between electric vehicles and conventionally powered vehicles for those applications found to have greatest promise. Preparation of a program plan for appropriate follow-on activities was also specified. The estimated cost for the effort was $70,000. Letter 3330-JOE-74-182, dated 18 July 1974.

T.I. No. 74-045 (10 April 1974)

Technical Information: FCC Regulations Affecting LEAA and Its Constituents

As a result of Institute concern regarding the impact of FCC decisions on LEAA activities, review of selected FCC dockets was requested. It was concluded that coordination between LEAA and the FCC would be appropriate in certain areas of mutual interest.

A draft letter was prepared for submittal by the Institute Director to the LEAA Administrator recommending that a committee be organized to provide coordination within the Department of Justice and other key law enforcement agencies having policy interest in communication issues and regulations. Also submitted per Institute request was a draft Annual Operating Plan for Development Group support in this area. Letter 3330-JOE-74-172, dated 18 July 1974.

T.I. No. 74-046 (22 April 1974)

Technical Information: Publication/ Dissemination of Technical Information Produced by the Institute's Advanced Technology Division

The Institute requested an assessment of bulletins issued by federal agencies, intended to encourage the transfer of technology developed under their sponsorship to industry and the public sector. In addition, procedures by which such bulletins are produced were to be examined. Also requested was identification of topics from Aerospace, MITRE, and the National Bureau of Standards, resulting from their support of the Equipment Systems Improvement Program, which could be the subject of such bulletins from the Advanced Technology Division. Recommendations for procedures to enable and execute a bulletin program, including publication schedules and funding requirements, are to be provided.

The effort on this Technical Instruction is in progress.

T.I. No. 74-047
(8 May 1974)

Proposal Evaluation: Performance of Voiceprint Examiners Under Field Conditions

Evaluation and comments were requested of Stanford Research Institute proposal ISU 74-17, dated 3 April 1974. The proposal was considered to be well conceived, and the proposed tests would provide data readily applicable to actual forensic situations. Several modifications were suggested which, if made, would increase the statistical validity of the results by increasing the size of the speaker data base and the number of tests. Discussions with SRI personnel were held and resulted in the subsequent submission of a revised proposal incorporating the suggested changes.

As presently structured, the proposal represents a needed and valuable project which would provide information leading to acceptance of the voiceprint technique by speech scientists and in legal proceedings. It was recommended that the proposal be supported when funds become available. Letter 3330-JOE-74-175, dated 28 June 1974.

T.I. No. 74-048
(6 May 1974)

Concept Evaluation: Lighter-Than-Air Remotely Piloted Mini-Blimp

An evaluation was requested of an unsolicited concept discussed in an article entitled "Remotely Piloted Mini-Blimp for Urban Applications" by Gerald R. Seeman, et al., of Developmental Sciences, Inc., City of Industry, California. The development of miniature blimps equipped with television cameras for use in airborne surveillance, monitoring, and measurement is proposed. Anticipated advantages include low fuel consumption, low capital investment and operating costs, and a high level of safety.

It was concluded that the concept does indeed offer promise as a low-cost air surveillance vehicle for law enforcement application. Disadvantages relate to the limited field of view and resolution of television cameras and the requirement for multiple, steerable broadband microwave television links. In view of the uncertainties of such a development and the lack of available

funding, Institute support was not recommended at this time. Letter 3330-JOE-74-186, dated 26 July 1974.

T.I. No. 74-049
(6 May 1974)

Proposal Evaluation: Protective Body Armor Material Development

Evaluation and comments were requested of an unsolicited letter proposal, dated 22 April 1974, submitted by Mr. Russell E. Hollis, a technical consultant of New Carlisle, Ohio. The proposal suggested a titanium mesh filled with boron carbide pellets as a body armor. To augment the brief description contained in the letter proposal, contact was established with Mr. Hollis for a more detailed explanation of his work and the proposed concept.

It was concluded that armor of titanium alloys is not consistent with the objectives of the current Institute lightweight body armor program due to lack of commercial availability, questionable fabrication feasibility at low areal densities, and existing availability of hardened inserts such as Doran. Institute support was not recommended (letter in process).

T.I. No. 74-050
(13 May 1974)

Proposal Evaluation: Research Program on Speaker Identification

An evaluation was made of a proposal submitted by the University of Florida Communications Sciences Laboratory. A five-year research program was proposed to investigate the factors which determine how accurately a person can be identified from recorded speech samples. The proposed program is well planned, and the staff involved is highly qualified and competent.

While certain aspects of the proposed study could produce potential benefits for law enforcement, the bulk of the proposed effort involves basic research of a fundamental nature. In view of the existing Institute commitment to support the development of a computer-aided speaker identification system and the current budget limitation, it was recommended that no Institute action be taken. Letter 3330-JOE-74-184, dated 25 July 1974.

T.I. No. 74-051
(5 June 1974)

Report Evaluation: Citizen Alarm System Design and Field Test; Redundancy Monitoring of System

A request was received from the Institute to review comments made on the Citizen Alarm Field Evaluation by Prof. Leslie Wilkins of the Institute Advisory Committee. The comments were in the area of planned message redundancy at the central station end of the system.

Discussions were held with Prof. Wilkins on his hypothesis that human reactions to machine-supplied data are more efficient if redundant data are presented in different forms. He was informed of the various redundant information sources being built into the Citizen Alarm System and the combination of visual (light), audible, and hard printout data supplied to the central station operator. A draft letter for transmittal to Prof. Wilkins with preliminary briefing material on the field evaluation plans was supplied to the Institute. Letter 3330-JOE-74-150, dated 2 July 1974.

APPENDICES

APPENDIX A

FISCAL YEAR 1974 CORRESPONDENCE

FY 1974 CORRESPONDENCE

Letter Number	Subject	Date
1279-JOE-73-066	Concept Development Plan for Voiceprint Validation Test	3 July 73
1279-JOE-73-563	Return of LEAA Directives 73-039, 040 and 041 for Reissue as Instructions	5 July 73
1279-JOE-73-564	Transmittal of Sylvania Power Line Alarm Transmission System Phase I Report on Power System Characterization and Test Plan for Power Line Transmission System	6 July 73
1279-JOE-73-065	Return of LEAA Directives 73-037 and 038 for Reissue as Technical Instructions	6 July 73
1279-JOE-73-068	Police Transceiver Directives 73-038 and 041	6 July 73
1279-JOE-73-069	LEAA Directive 73-032, Interceptor Electronics Letters to LEAA	6 July 73
1279-JOE-73-565	Review of National Bureau of Standards Report on Survey of Police Equipment Standards Requirements (Directive 73-039)	12 July 73
1279-JOE-73-568	Commerce Business Daily Announcement - Security Alarm Systems	13 July 73
1279-JOE-73-070	Transmittal of Report, "Evaluation of an Automatic Direction Finder for Hijacked Truck Location"	17 July 73
1279-JOE-73-071	Transmittal of the Feasibility Study on a Truck Anti-Hijacking System	17 July 73
1279-JOE-73-072	Transmittal of Report, "Evaluation of Aerial Vehicles for Law Enforcement Application"	17 July 73
1279-JOE-73-073	Task Closeout Report for the Remote Vehicle Disabling System, Task No. A-73-APS-01	17 July 73
1279-JOE-73-074	LEAA Directive 73-041, Transceiver Grant Program Waivers	17 July 73

Letter Number	Subject	Date
1279-JOE-73-076	System Analysis - Voice Recording System for Illegal Telephone Calls	17 July 73
1279-JOE-73-077	Transmittal of Report, "Assessment of Technology Applicable to Body Mounted Antennas"	17 July 73
1279-JOE-73-078	Transmittal of Report, "Investigation of Body-Mounted Antennas for Law Enforcement Application," Task No. A-73-COM-01	17 July 73
1279-JOE-73-079	Voiceprint Equipment System Specification, Task No. A-73-CRM-06	17 July 73
1279-JOE-73-566	Transmittal of FY 74 Annual Operating Plan	17 July 73
1279-JOE-73-567	Transmittal of Draft Task Plans (FY 74)	17 July 73
1279-JOE-73-569	Use of Technical Instructions	17 July 73
1279-JOE-73-571	Monthly Progress Report Transmittal - June 1973	18 July 73
1279-JOE-73-080	Commerce Business Daily Announcement, Explosive Vapor Detection Device Investigations	23 July 73
1279-JOE-73-082	Revisions to FY 74 Annual Operating Plan	23 July 73
1279-JOE-73-084	Transmittal of Statement of Work for Sulfur Hexafluoride	23 July 73
1279-JOE-73-573	Commerce Business Daily Announcement - Explosives Detection and Tagging	23 July 73
1279-JOE-73-575	Transmittal of Protective Garment Statement of Work	23 July 73
1279-JOE-73-577	Transmittal of Aerospace newspaper - The Orbiter	23 July 73
1279-JOE-73-085	Transmittal of Statement of Work for Explosives Tagging Concepts	3 Aug. 73

Letter Number	Subject	Date
1279-JOE-73-086	Task Closeout Report /Notice - A-73-CRM-08	Aug. 73
1279-JOE-73-087	Task Closeout Report/Notice - A-73-CRM-05	Aug. 73
1279-JOE-73-088	Task Closeout Report/Notice - A-73-CRM-07	Aug. 73
1279-JOE-73-089	Task Closeout Report/Notice - A-73-CRM-06	Aug. 73
1279-JOE-73-578	Transmittal of executed Technical Instruction 73-008	6 Aug. 73
1279-JOE-73-579	Transmittal of executed LEAA Technical Instruction 74-002	6 Aug. 73
1279-JOE-73-593	Transmittal of executed LEAA Technical Instruction 74-001	6 Aug. 73
1279-JOE-73-582	Transmittal of FY 73 Annual Progress Report	10 Aug. 73
1279-JOE-73-583	Request for Proposal 008, "Environmental Design"	14 Aug. 73
1279-JOE-73-090	Commerce Business Daily Announcement - Reliable, Low-Cost Security Alarm System	15 Aug. 73
3330-JOE-73-589	Inputs to MITRE FY 74 Annual Operating Plan (Technical Instruction 74-002)	16 Aug. 73
3330-JOE-73-580	Transmittal of July Monthly Progress Report	20 Aug. 73
1279-JOE-73-091	Review of Atomic Fluorescence Spectrometry Concept Paper	21 Aug. 73
1279-JOE-73-092	Task Closeout Report/Notice A-73-CRM-04	21 Aug. 73
3330-JOE-73-595	Commitment of Funds	22 Aug. 73
3330-JOE-73-596	Citizen Alarm System Subcontract Options	22 Aug. 73
3330-JOE-73-597	Aerospace Technical Reporting System	22 Aug. 73

Letter Number	Subject	Date
3330-JOE-73-093	Commerce Business Daily Announcement - Explosives Vapors Detection Device Investigation	24 Aug. 73
3330-JOE-73-599	Supplement to FY 74 Annual Operating Plan	28 Aug. 73
3330-JOE-73-602	A Multidisciplinary Technique for the Evaluation of Less-Than-Lethal Weapons, Technical Instruction 74-008	31 Aug. 73
3330-JOE-73-609	Transmittal of executed LEAA Technical Instruction 74-003	13 Sep. 73
3330-JOE-73-610	Transmittal of executed LEAA Technical Instruction 74-007	13 Sep. 73
3330-JOE-73-612	Technical Support for NILECJ Participation in American Institute of Aeronautics and Astronautics Third Urban Technology Conference	13 Sep. 73
3330-JOE-73-613	Transmittal of executed LEAA Technical Instruction 74-006	13 Sep. 73
3330-JOE-73-614	Transmittal of executed LEAA Technical Instruction 74-005	13 Sep. 73
1279-JOE-73-615	1973 New York International Security Conference	13 Sep. 73
3330-JOE-73-095	Delivery of Body-Mounted Antennas	18 Sep. 73
3330-JOE-73-611	Transmittal of executed LEAA Technical Instruction 74-004	18 Sep. 73
3330-JOE-73-616	Transmittal of August Monthly Progress Report	18 Sep. 73
3330-JOE-73-617	Transmittal of executed LEAA Technical Instruction 74-010	18 Sep. 73
3330-JOE-73-618	Semi-Automatic Speaker Identification System	19 Sep. 73
3330-JOE-73-096	Source Qualification - Blood and Bloodstain Analysis	20 Sep. 73

Letter Number	Subject	Date
3330-JOE-73-621	Commerce Business Daily Response Evaluation for Laser Optoacoustics for Explosives Vapor Detection	3 Oct. 73
3330-JOE-73-622	Concurrence on Optoacoustic Devices Procurement Package	3 Oct. 73
3330-JOE-73-624	Equipment Purchase for Explosive Detection Project	4 Oct. 73
3330-JOE-73-100	Review Comments - Sylvania LEAA Transceiver, LEAA Technical Instruction 74-010	5 Oct. 73
3330-JOE-73-625	Equipment and Equipment-Related LEAA R&D Grants	8 Oct. 73
3330-JOE-73-626	Explosives Detection: Trace Gas Acquisition System developed by Analytical Research Labs, Inc., Technical Instruction 74-001	8 Oct. 73
3330-JOE-73-628	Aerospace Subcontract No. 40109-V, Negotiations Summary for Change Notice No. 1 with Rockwell International Corp.	11 Oct. 73
3330-JOE-73-646	Evaluation of Lockheed Electronics Proposal, LEAA Technical Instruction 74-012	13 Oct. 73
3330-JOE-73-627	Review of Jellyfish Stings for Use as a Riot Control Agent, LEAA Technical Instruction 74-004	17 Oct. 73
3330-JOE-73-629	Transmittal of September Monthly Progress Report	18 Oct. 73
3330-JOE-73-631	Request for Concurrence on Voiceprint Evaluation Test Program	19 Oct. 73
3330-JOE-73-101	Evaluation of Institute Grant Investigation of Digital Mobile Radio Communications for Law Enforcement, LEAA Technical Instruction 74-007	24 Oct. 73
3330-JOE-73-633	Transmittal of executed LEAA Technical Instruction 74-013	24 Oct. 73

Letter Number	Subject	Date
3330-JOE-73-634	Transmittal of enclosure notice for protective garments fabricated under Aerospace contract	24 Oct. 73
3330-JOE-73-635	Equipment and Equipment-Related LEAA and R&D Grants	24 Oct. 73
3330-JOE-73-641	Transmittal of executed LEAA Technical Instructions 74-015 and 016	31 Oct. 73
3330-JOE-73-109	Commerce Business Daily Announcement - Truck Anti-Hijacking System	1 Nov. 73
3330-JOE-73-642	Transmittal of executed LEAA Technical Instruction 74-017	1 Nov. 73
3330-JOE-73-104	Commerce Business Daily Response Evaluation for the Security Alarm System	5 Nov. 73
3330-JOE-73-110	Voiceprints requested by J. Kochanski (transmittal of)	8 Nov. 73
3330-JOE-73-105	Evaluation of Thermo Electron Corporation Proposal, "Detection of Explosives Wrapped in Non-Metallic Casings"	12 Nov. 73
3330-JOE-73-108	Implementation of Protective Garment Tasks	12 Nov. 73
3330-JOE-73-647	Evaluation of NASA Proposal, "Bullet Identification Using Optical Fourier Transforms," LEAA Technical Instruction 74-013	14 Nov. 73
3330-JOE-73-648	Adaptability of Small Cars for Police Vehicles Study	19 Nov. 73
3330-JOE-73-107	Evaluation of Carson Laboratories Proposal, LEAA Technical Instruction 74-011	21 Nov. 73
3330-JOE-73-650	Transmittal of executed LEAA Technical Instructions 74-020, 021, 022, 023, 024, 025, 026, 027, 028 and 029	21 Nov. 73
3330-JOE-73-649	Letter Confirming Telecon of November 19, Regarding Value of Sylvania Antenna Information	28 Nov. 73

Letter Number	Subject	Date
3330-JOE-73-651	Transmittal of executed LEAA Technical Instruction 74-030	28 Nov. 73
3330-JOE-73-656	Transmittal of Press Release to be used in Aerospace newspaper, The Orbiter	10 Dec. 73
3330-JOE-73-111	Closeout Report - FY 73 Army Land Warfare Laboratory Effort on Protective Garments for Public Officials	12 Dec. 73
3330-JOE-73-654	Transmittal of November Progress Report	18 Dec. 73
3330-JOE-73-113	Voice Identification Research Project, Auburn University, Auburn, Alabama	26 Dec. 73
3330-JOE-73-114	Evaluation of Proposal, "Environmental Aspects of Trace Metals on Human Hair" submitted by Dr. A. A. Gordus of University of Michigan, LEAA Technical Instruction 74-025	26 Dec. 73
3330-JOE-73-117	Review and evaluation of Stanford Research Brief by M. Anbar on determination of the origin of explosives by field ionization mass spectrometry, LEAA Technical Instruction 74-023	26 Dec. 73
3330-JOE-73-659	Transmittal of Reports on Explosives	26 Dec. 73
3330-JOE-73-112	Evaluation of Aerobody Concept, Technical Instruction 74-024	27 Dec. 73
3330-JOE-73-116	Evaluation of Av-Alarm Corporation and Santa Rita Technology, Inc. proposed work, LEAA Technical Instruction 74-029	27 Dec. 73
3330-JOE-73-120	Evaluation of Preproposal for Research covering Forensic Applications of Field Ionization Mass Spectrometry by Dr. M. Anbar of Stanford Research Institute, LEAA Technical Instruction 74-026	27 Dec. 73
3330-JOE-73-121	Review of Final Report for Personal VHF/ UHF Transceiver, LEAA Technical Instruction 74-018	27 Dec. 73

Letter Number	Subject	Date
3330-JOE-74-122	Recommendations Relative to Martin Marietta Transceiver Follow-On Activity	4 Jan. 74
3330-JOE-74-663	Thank you letter	4 Jan. 74
3330-JOE-74-667	FY 75 Contract Data	11 Jan. 74
3330-JOE-74-674	Transmittal of December Progress Report	17 Jan. 74
3330-JOE-74-675	Bloodstain Analysis System Development Program - Subcontract Procurement Package for Review and Approval	18 Jan. 74
3330-JOE-74-676	Methods for Reducing Police Car Fuel Consumption Report	18 Jan. 74
3330-JOE-74-126	Protective Clothing for Public Officials	22 Jan. 74
3330-JOE-74-677	Blood and Bloodstain Project	22 Jan. 74
3330-JOE-74-124	Evaluation of Phonplex Corporation Data Voice Multiplexing System, LEAA Technical Instruction 74-020	24 Jan. 74
3330-JOE-74-679	Transmittal of Volume II of Report, "Methods for Reducing Police Car Fuel Consumption"	25 Jan. 74
3330-JOE-74-680	Transmittal of FY 75 Annual Operating Plan	30 Jan. 74
3330-JOE-74-118	Review and evaluation of proposal for the development of an aerosol explosive indicator kit submitted by Mr. Joe A. Swisher of U.S. Army Land Warfare Lab, LEAA Technical Instruction 74-015	31 Jan. 74
3330-JOE-74-125	Review of Space Age Security, Inc., Tel Star System	31 Jan. 74
3330-JOE-74-123	Completion of Subcontract No. 35623 with GTE Sylvania, Inc., Mountain View, Calif.	11 Feb. 74
3330-JOE-74-129	Evaluation of Sperry Research Center Proposal,"Computerized Single Print Identification," LEAA Technical Instruction 74-027 and 028	13 Feb. 74

Letter Number	Subject	Date
3330-JOE-74-680	Transmittal of January Monthly Progress Report	15 Feb. 74
3330-JOE-74-681	Request for Approval to Consent to Purchase Order of Subcontract	15 Feb. 74
3330-JOE-74-128	Truck Anti-Hijack and Trailer Security System Program - Subcontract Procurement Package for Review and Approval	19 Feb. 74
3330-JOE-74-682	Distribution of Report, "Smaller Cars as Police Vehicles"	21 Feb. 74
3330-JOE-74-683	Transmittal of executed LEAA Technical Instructions 74-035 and 037	21 Feb. 74
3330-JOE-74-132	Provision of Material for LWL	25 Feb. 74
3330-JOE-74-134	Study of Voiceprint Identification and Proposed (Tel Star) System, LEAA Technical Instruction 74-031	26 Feb. 74
3330-JOE-74-135	Review of MITRE Report, "A Study of Transmission Times and Messages Characterizing the Radio Communications System of the Miami Police Dept.," LEAA Technical Instruction 74-033	26 Feb. 74
3330-JOE-74-136	Review of Letter Reports on LWL Task 30-B-74, LEAA Lightweight Body Armor Program, LEAA Technical Instruction 74-034	27 Feb. 74
3330-JOE-74-130	LEDG Monthly Progress Reporting	28 Feb. 74
3330-JOE-74-137	Evaluation of Pacific Gas and Electric Co., Proposal to use electric vehicles for law enforcement and transportation needs, LEAA Technical Instruction 74-030	7 Mar. 74
3330-JCD-74-687	Transmittal of Aerospace Report TOR-0073 (3657-01)-1, "Evaluation of Aerial Vehicles for Law Enforcement Application"	8 Mar. 74
3330-HWN-74-067	Transmittal of Draft Minutes of Review of Gunshot Residue Detection and Blood and Bloodstain Analysis Programs Meeting - 8 March 1974	14 Mar. 74

Letter Number	Subject	Date
3330-JOE-74-691	Transmittal of February Monthly Progress Report	19 Mar. 74
3330-JOE-74-133	Transmittal of Statement of Work for a Bloodstain Analysis System	20 Mar. 74
3330-JOE-74-140	Revision of Statement of Work for Explosives Tagging Concepts	21 Mar. 74
3330-JOE-74-145	Truck Anti-Hijack and Trailer Security Program - Approval of Proposed Procurement Action	21 Mar. 74
3330-JOE-74-692	Transmittal of executed LEAA Technical Instructions 74-041, 040, and 039	22 Mar. 74
3330-JOE-74-701	Transmittal of Tabulations of Reports delivered/to be delivered under LEAA contract	26 Mar. 74
3330-JOE-74-146	Commerce Business Daily Announcement - Explosives Vapors Characterization Study	26 Mar. 74
3330-JOE-74-144	Improved Citizen Alarm System - Procurement Package	28 Mar. 74
3330-JOE-74-147	Source Qualification - Gunshot Residue Detection	28 Mar. 74
3330-JOE-74-138	Electric Field Sensor Subsystem Program Subcontract Procurement Package	29 Mar. 74
3330-JOE-74-139	Alarm Transmission Media Evaluation Subcontract Procurement Package	29 Mar. 74
3330-JOE-74-697	Transmittal of executed LEAA Technical Instruction 74-042	1 Apr. 74
3330-JOE-74-698	Aerospace support of Special Technical Support and Grant Monitoring Tasks	4 Apr. 74
3330-JOE-74-700	Transmittal of contractual data to the Institute	4 Apr. 74
3330-JOE-74-702	Aerospace reporting on LEAA/USAF Inter-Agency Agreement (IAA) LEAA-J-IAA-025-2	4 Apr. 74

Letter Number	Subject	Date
3330-JOE-74-703	"Make/Buy" decisions for work under current LEAA/Aerospace Contract No. J-LEAA-025-73	4 Apr. 74
3330-JOE-74-704	Approval of Subcontract Packages by the Institute	4 Apr. 74
3330-JOE-74-699	Expenditures for Evaluation of Proposals and Concepts	5 Apr. 74
3330-JOE-74-705	Voiceprint Technology Extension	5 Apr. 74
3330-JOE-74-706	Preparation of Annual Operating Plan	5 Apr. 74
3330-JOE-74-707	Body Armor Project - Response to Letter from Institute dated 6 February 1974	Apr. 74
3330-JOE-74-690	Submission of New and Revised Task Plans	8 Apr. 74
3330-JOE-74-708	Transmittal of Revised Task Plans	8 Apr. 74
3330-JOE-74-709	Transmittal of "Cost to Complete" Data	8 Apr. 74
3330-JOE-74-710	Transmittal of Revisions to Task Plans	8 Apr. 74
3330-JOE-74-712	Blood Program - Response to Letter from the Institute dated 6 February 1974	8 Apr. 74
3330-JOE-74-714	Transmittal of Citizen Alarm and Truck Anti-Hijacking Projects, Draft Reports	11 Apr. 74
3330-JOE-74-715	Transmittal of "Employee Outside Activities" Data	11 Apr. 74
3330-JOE-74-716	Contract Negotiations with IACP	12 Apr. 74
3330-JOE-74-154	LEDG Monthly Reporting	15 Apr. 74
3330-JOE-74-718	Subcontract Procurement Package, Blood and Bloodstain Analysis Project	15 Apr. 74
3330-JOE-74-720	Transmittal of executed LEAA Technical Instruction 74-044	18 Apr. 74
3330-JOE-74-719	Transmittal of FY 75 Task Plans	19 Apr. 74

Letter Number	Subject	Date
3330-JOE-74-722	New York School Security	19 Apr. 74
3330-JOE-74-725	Action Item Responses	19 Apr. 74
3330-JOE-74-723	Transmittal of March Monthly Progress Report	22 Apr. 74
3330-JOE-74-153	Mission Research Corporation Proposal, "EPR Spectrometry of Primer Residues," LEAA Technical Instruction 74-038	23 Apr. 74
3330-JOE-74-728	Agenda for Institute Personnel Visit to Aerospace	24 Apr. 74
3330-JOE-74-726	Transmittal of executed LEAA Technical Instruction 74-043	25 Apr. 74
3330-JOE-74-149	Review of Proposed Digital Demodulator Concept, LEAA Technical Instruction 74-035	26 Apr. 74
3330-JOE-74-159	Concurrence on Explosives Vapors Characterization Study Procurement Package	29 Apr. 74
3330-JOE-74-727	Body Armor Candidate Site Selection Recommendations	10 May 74
3330-JOE-74-729	Body Armor Wearability Test	10 May 74
3330-JOE-74-731	Transmittal of executed LEAA Technical Instructions 74-046, 047, 048 and 049	14 May 74
3330-JOE-74-163	Review and evaluation of RCF Systems Fingerprint Machine, LEAA Technical Instruction 74-040	20 May 74
3330-JOE-74-165	Response to LEAA Technical Instruction 74-041, Review of LWL January 1974 Progress Report	20 May 74
3330-JOE-74-730	Transmittal of executed LEAA Technical Instruction 74-050	20 May 74
3330-JOE-74-732	Transmittal of April Monthly Progress Report	21 May 74

Letter Number	Subject	Date
3330-JOE-74-737	Transmittal of Planning Guide for Task Plans	29 May 74
3330-JOE-74-734	Commerce Business Daily Announcement-Study of the Economic and Rehabilitative Aspects of Prison Industries	30 May 74
3330-JOE-74-735	Commerce Business Daily Announcement - Sources Sought for the Fabrication of Law Enforcement Protective Garments	30 May 74
3330-JOE-74-739	Comments on Development of Candidate Areas in Pursuit of LEAA Goals	7 June 74
3330-JOE-74-740	ONPP Support	10 June 74
3330-JOE-74-173	Request for Statement of Work by the Urban Mass Transportation Administration	11 June 74
3330-JOE-74-746	Institute Burglar Alarm System Briefing	11 June 74
3330-JOE-74-747	Transmittal of executed LEAA Technical Instructions 74-045 and 74-051	11 June 74
3330-JOE-74-749	Security Alarm System Development Procurement Package Transmittal	12 June 74
3330-JOE-74-751	Transmittal of Revised FY 75 Task Plans	13 June 74
3330-JOE-74-754	Transmittal of Task Plan Errata Sheets	18 June 74
3330-JOE-74-174	Report Transmittal of Survey and Assessment Report Under the Blood and Bloodstain Analysis Program	21 June 74
3330-JOE-74-755	Transmittal of Revised FY 75 Task Plans	27 June 74
3330-JOE-74-757	Transmittal of May Monthly Progress Report	27 June 74
3330-JOE-74-175	Evaluation of Voiceprint Examiners Under Field Conditions, LEAA Technical Instruction 74-047	28 June 74
3330-JOE-74-758	Transmittal of Revised FY 75 Task Plans	28 June 74

APPENDIX B

SUMMARY OF MAJOR DOCUMENTATION

SUMMARY OF MAJOR DOCUMENTATION PREPARED IN 1974

1.	FY 74 Project Task Plan	July 1973
2.	FY 73 Annual Progress Report, Aerospace Report No. TOR-0073(3640)-5.	July 1973
3.	Procurement Package - Army Land Warfare Laboratory Follow-On Studies.	July 1973
4.	"Statement of Work - Feasibility Investigation and Test of Coded Taggant Materials for the Identification of Explosives," Letter 1279-JOE-73-085,	Aug. 1973
5.	"Statement of Work - Feasibility Investigation of the Use of Sulfur Hexafluoride as a Taggant for the Detection of Explosives," Letter 1279-JOE-73-084.	Aug. 1973
6.	"Supplement FY 74 ADP," Aerospace Report No. ATR-74(7901)-1.	Aug. 1973
7.	Powerline Alarm Transmission System: Phase I Report - Power System Characterization, GTE Sylvania, Inc.	Aug. 1973
8.	Powerline Alarm Transmission System: Final Report, GTE Sylvania, Inc.	Sept. 1973
9.	Amended Concept Development Plan: Voiceprint Validation Test.	Sept. 1973
10.	Criminal Justice R&D Assessment - Planning Report	Oct. 1973
11.	Procurement Package - Additional Analytical Support Effort for Semi-Automatic Speaker Identification System.	Oct. 1973
12.	Procurement Package - Voiceprint Validation Test.	Oct. 1973
13.	"Feasibility Demonstration of Citizen Alarm System: Phase I Final Report," Compu-Guard Security Systems, Inc.	Oct. 1973
14.	Procurement Package - Feasibility Investigation of a Laser Optoacoustic Device for the Detection of Explosives.	Nov. 1973
15.	"A Review of Methods for the Detection and Identification of Explosives," Aerospace Report No. ATR-0074(7902)-1.	Nov. 1973
16.	Citizen Alarm System Report - Requirements.	Nov. 1973
17.	Protective Garment Implementation Plan, Aerospace Letter 3330-JOE-73-108.	Nov. 1973
18.	Procurement Package - Lawrence Livermore Laboratory Testing and Analysis Effort.	Nov. 1973
19.	Press release material entitled "Police Patrol Cars and the Energy Crisis."	Dec. 1973

20.	Briefing Package No. D80127 entitled "Police Car Study."	Dec. 1973
21.	Procurement Package - Development of a Bloodstain Analysis System.	Dec. 1973
22.	Analysis of Goals, Objectives, and Programs - Planning Report.	Dec. 1973
23.	Final Report, "Methods for Reducing Police Car Fuel Consumption," Aerospace Report No. ATR-74(7914)-1.	Jan. 1974
24.	"Concept Definition for the Truck Anti-Hijack and Trailer Security System," Aerospace Report No. ATR-74(7908)-1.	Jan. 1974
25.	"Survey and Technical Assessment - Cargo Security System," Aerospace Report (Rough Draft).	Jan. 1974
26.	FY 75 Annual Operating Plan.	Jan. 1974
27.	Procurement Package - Prototype Cargo Security System.	Feb. 1974
28.	Briefing Report - Detection of Gunshot Residue, Presentation to NILECJ Forensic Science Consultants.	Mar. 1974
29.	Briefing Report - Blood and Bloodstain Analysis Program, Presentation to NILECJ Forensic Science Consultants.	Mar. 1974
30.	Analysis of Forensic Science Utility - Interim Planning Report.	Mar. 1974
31.	Crime Prediction Analysis - Interim Planning Report.	Mar. 1974
32.	LEAA Emergency Energy Committee, Energy Report No. 1: "Summary Results of Spot Survey of Selected Law Enforcement Agencies."	Mar. 1974
33.	LEAA Emergency Energy Committee, Energy Report No. 2: "Street Lighting, Energy Conservation and Crime."	Mar. 1974
34.	LEAA Emergency Energy Committee, Energy Report No. 3: "Preliminary Report on Rolling Blackouts."	Mar. 1974
35.	LEAA Emergency Energy Committee, Energy Report No. 4: "Police Cars and Energy Conservation."	Mar. 1974
36.	LEAA Emergency Energy Committee, Energy Report Nol 5: "Suggested Energy Conservation Measures for Courts and Correctional Institutions."	Mar. 1974
37.	LEAA Emergency Energy Committee, Energy Report No. 6: Petroleum Allocation and Pricing Regulations for Law Enforcement Agencies."	Mar. 1974
38.	LEAA Emergency Energy Committee, Energy Report No. 7: "Preliminary Report on Crime and the Energy Crisis."	Mar. 1974

39.	"Status Report on LEAA Emergency Energy Committee Activities for December 1973, January and February 1974," Aerospace Report No. ATR-74(7919)-1.	Mar. 1974
40.	"Improved Protective Armor Wearability Test and Evaluation Plan," Aerospace Report No. ATR-74(7906)-1.	Mar. 1974
41.	"Feasibility Demonstration of Citizen Alarm System: Phase II Development Report," Compu-Guard Security Systems, Inc.	Mar. 1974
42.	Procurement Packages - Prototype Protective Garments.	Mar.-Apr. 1974
43.	Procurement Package - Electric Field Sensor Development.	Apr. 1974
44.	Procurement Package - External Alarm-Transmission-Media Study.	Apr. 1974
45.	Survey and Assessment - "Blood and Bloodstain Analysis Program, Volume 2: Appendices," Aerospace Report No. ATR-74(7910)-1, Vol. I.	Apr. 1974
46.	Procurement Package - Characterization of Vapors Emanating from Explosives.	Apr. 1974
47.	Survey and Assessment - Blood and Bloodstain Analysis Program, Volume I: Technical Discussion," Aerospace Report No. ATR-74(7910)-1, Vol. I.	Apr. 1974
48.	Procurement Package - Improved Citizen Alarm System.	Apr. 1974
49.	Briefing Summary Report on Latent Fingerprint Research.	May 1974
50.	FY 74/FY 75 Institute MBO Plans.	May 1974
51.	Procurement Production Plan and Kevlar Weaving Specification, Aerospace Letter 3330-LGK-74-023.	May 1974
52.	Citizen Alarm System Data Package, Compu-Guard Security Systems, Inc.	May 1974
53.	Briefing Report - Gunshot Residue Detection Program Review.	Jun. 1974
54.	Briefing Report - Blood and Bloodstain Analysis Program Review.	Jun. 1974
55.	Procurement Package - Burglary Alarm System Development, Integration, and Testing.	Jun. 1974
56.	"Survey and System Concepts for a Low-Cost Burglary Alarm System for Residences and Small Business," Aerospace Report No. ATR-74(7904)-1.	Jun. 1974
57.	"A Photoluminescence Technique for the Detection of Gunshot Residue," Aerospace Report No. ATR-74(7915)-1.	Jun. 1974

58.	"Feasibility Demonstration of Citizen Alarm System: Final Report," Compu-Guard Security Systems, Inc. Rough Draft.	Jun. 1974
59.	"Survey and Concept Definition for an Improved Citizen Alarm System: Volume I, Technical Summary," Aerospace Report No. ATR-74(7905)-2.	Jun. 1974
60.	"Survey and Concept Definition for an Improved Citizen Alarm System: Volume II, Technical Appendices," Aerospace Report No. ATR-74(7905)-2, Vol. II, Rough Draft.	Jun. 1974
61.	"Preliminary Investigation of Applications of the Computer-Aided Speaker Identification System," Aerospace Report No. ATR-74(7907)-1, Rough Draft.	Jun. 1974
62.	"Discriminant Analysis of Voice Features for Speaker Data Base No. 1," Aerospace Technical Memorandum.	Jun. 1974
63.	Procurement Package - Laboratory and Pilot Test Program, Semi-Automatic Speaker Identification System.	Jun. 1974
64.	Procurement Package - Field Evaluation Planning Support.	Jun.-Jul. 1974
65.	Final Report: "Latent Fingerprint Identification Technology," Aerospace Report (Rough Draft).	Jul. 1974
66.	Final Report: "Equipment Options and Cost in 911 Emergency Phone Systems," Aerospace Report No. ATR-74(7912)-2.	Jul. 1974
67.	Statistical Planning and System Modeling - Interim Planning Report.	Jul. 1974
68.	"Compliance and Enforcement Aspects of Various Retail Gasoline Distribution Schemes," Aerospace Report No. ATR-74(7919)-2.	Jul. 1974
69.	"Final Report on the LEAA Emergency Energy Committee Activities," Aerospace Report No. ATR-74(7919)-4.	Jul. 1974
70.	"Effect of Gasoline Shortages on Selected Law Enforcement Agencies," Aerospace Report No. ATR-74(7919)-3.	Jul. 1974

APPENDIX C

BRIEFINGS AND MEETINGS

BRIEFINGS AND MEETINGS

This appendix is divided into two parts. In both parts the items tabulated are organized according to program and task. Part I provides a listing of the major briefing presentations made during FY 74. These are briefings in support of status reviews or program summaries.

Part II presents a listing of the various meetings and conferences attended by members of the Development Group during FY 74. These are not the hundreds of meetings and visits with industrial concerns, law enforcement agencies, or Institute personnel required in the normal course of technically directing the development programs. Rather, these are conferences and seminars where information was obtained or coordination was provided in support of the overall development program.

PART I - BRIEFINGS

Program Planning and Management

Subject	Presented to	Date
Indoctrination Briefing	Institute Director	13 Aug. 73
FY 73 Annual Review	Institute Director	5 Sep. 73
Technology, R&D and Law Enforcement - Planning Study	Institute Director	2 Oct. 73
Indoctrination Briefing	New Gov't Project Monitor	14, 15, 16 Nov. 73
ESIP Program	W. Layman, A. F. Lab Director	26 Nov. 73
Aerospace Support of NILECJ	LEAA Administrator	7 Dec. 73
Goals, Objectives, and Programs	Institute Director	12 Dec. 73
Proposed FY 75 Program	Institute Director	7 Jan. 73
FY 75 Program Plans	Institute Director	21 Jan. 74

Subject	Presented to	Date
Status of Planning Support	Institute Director	18 Mar. 74
Summary of Management by Methods Objectives	Institute Director	10 May 74
FY 75 Institute Workplan Support	Institute Deputy Director	31 May 74
FY 75/76 Program Plans	Institute Deputy Director	6 June 74

Development Programs

	Subject	Presented to	Date
Cost-Effective Security Alarm System	Exhibit Presentation Third Urban Technology Conference	AIAA Conference	25-27 Sept. 73
	Project Status Review	Gov't Project Monitor	15 Nov. 73
	Project Review	LEAA Administrator	7 Dec. 73
	Project Summary	Alarm Industry Committee for Combatting Crime	23 Jan. 74
	Project Status Review	Gov't Project Monitor	13 Feb. 74
	Work Statements on Planned Procurements	Gov't Project Monitor	18-19 Apr. 74
	Project Status	Institute Director	1 May 74
	Project Review	Institute Staff	13-14 June 74
Citizen Alarm System	Program Review	Compu-Guard, Inc.	31 July 73
	Project Summary	Institute Director	14 Dec. 73
	Hardware Demonstration	Institute Staff	28 Feb. 74
	Equipment Demonstration	Congress	7 Mar. 74

	Subject	Presented to	Date
Citizen Alarm System (Cont)	Project Status Review	Gov't Project Monitor	2 May 74
	Field Test Planning Review	Institute Staff	23 May 74
	Field Test Planning Review	Institute Staff	6 June 74
Improved Protective Armor	Project Status Review	Gov't Project Monitor	15 Nov. 73
	Project Review	LEAA Administrator	7 Dec. 73
	Project Summary	Alarm Industry Committee for Combatting Crime	23 Jan. 74
	Project Status Review	Gov't Project Monitor	13 Feb. 74
	Field Evaluation Planning	Gov't Project Monitor	18 Apr. 74
	Project Status	Institute Director	1 May 74
	Project Review	Institute Staff	13-14 June 74
Speaker Identification	Project Status Review	Gov't Project Monitor	16 Nov. 73
	Project Status Review	Gov't Project Monitor	2 May 74
	Program Review	Institute Staff	17 May 74
	Program Overview	Pasadena P.D.	14 May 74
	Program Overview	L.A. P.D.	13 May 74
Cargo Security	Project Summary/ Demonstration	Institute Director	20 Jan. 74
	Program Review	Institute Director	21 June 74

	Subject	Presented to	Date
Blood and Bloodstain Analysis	Project Review	Institute Staff	29 Jan. 74
	Project Status Review	Gov't Project Monitor	25 Feb. 74
	Project Summary	NILECJ Forensic Science Consultants Panel	8 Mar. 74
	Project Status Review	Institute Staff	28 June 74
Explosives Detection and Identification			
Detection of Gunshot Residue	Luminescence Analysis	Institute Director	21 Jan. 74
	Project Review	NILECJ Forensic Science Consultants Panel	8 Mar. 74
	Demonstration of Gunshot Residue Analysis	LEAA Deputy Administrator	16 May 74
	Project Review	Institute Staff	31 May 74
Latent Fingerprint Research	Project Review	Institute Staff	31 Oct. 73
	Project Status Review	Gov't Project Monitor	27 Feb. 74
	Project Status Review	Gov't Project Monitor	2 May 74
	Project Review	Institute Staff	24 May 74
Special Technical Support			
Project 911	Project Review	Institute Staff	7 June 74
Police Vehicle Study	Project Summary	LEAA Administrator	7 Dec. 73
	Project Summary	LEAA Energy Task Force and Regional Administrators	12 Dec. 73
IOTA Program	Status Report, Compton Pre-Start Survey Assessment	LEAA Administrator	19 June 74

PART II - MEETINGS

Program Planning and Management

31 July 1973	NBS Seminar on Results of Police Equipment Survey, Washington, D.C.
16 Sept. 1973	International Security Conference, New York.
30 Apr. 1974	Project Search Meeting on Standards and Goals, San Francisco, Calif.

DEVELOPMENT PROGRAMS

Cost-Effective Security Alarm System

16 Aug. 1973	Alarm Industry Committee for Combatting Crime, Washington, D.C.
13 Nov. 1973	Alarm Facilities Committee, Phoenix, Ariz.
12 Feb. 1974	Alarm Security Conference, Los Angeles, Calif.

Citizen Alarm System

21 May 1974	Police Foundation, Washington, D.C.
22 May 1974	Urban Institute, Washington, D.C.

Improved Protective Armor

No special meetings although numerous meetings were attended with industry, police, research laboratories, and the Institute in the in-house support provided this project.

Speaker Identification

No special meetings although numerous meetings were held with industry, police, and the Institute on various aspects of subcontract monitoring for this project.

Cargo Security

6 Sept. 1973	National Cargo Security Conference, Chicago, Ill.
17 Sept. 1973	Organizing Conference on Automatic Vehicle Identification, Washington, D.C.

23 Sept. 1973	Annual Meeting, Association of Transportation Security Officers, Anaheim, Calif.
25 Sept. 1973	IEEE Conference, Electronic Security System Seminar, New York.
10 Oct. 1973	National Security Conference, Cargo Loss Prevention, Los Angeles, Calif.
3 Dec. 1973	Transportation Data Coordinating Committee, Washington, D.C.
17 Apr. 1973	Carnahan and International Crime Countermeasures Conference.

Blood and Bloodstain Analysis

21 Sept. 1973	Southern Association of Forensic Scientists, Key Biscayne, Fla.
19 Oct. 1973	California Association of Criminologists, Palo Alto, Calif.
13 Feb. 1974	26th Annual Meeting, American Academy of Forensic Sciences, Dallas, Tex.
15 Feb. 1974	Institute of Forensic Science, Dallas, Tex.
9 May 1974	43rd Semi-Annual Seminar of the California Association of Criminologists, Long Beach, Calif.

Explosives Detection and Identification

18-20 Oct. 1973	42nd Semi-Annual Seminar of the California Association of Criminologists.
13 Nov. 1973	Annual Meeting, American Nuclear Society.
12-14 Dec. 1973	duPont Blasting and Explosives Safety Course.
12-15 Feb. 1974	Annual Meeting, American Academy of Forensic Sciences.
12 Feb. 1974	Project SEARCH Committee Meeting.
15-17 May 1974	Technical Subcommittee of the Advisory Committee for Explosives Tagging.

20-21 June 1974	Explosives Technical Subcommittee Meeting.

Detection of Gunshot Residue

12 Feb. 1974	Annual Meeting, American Academy of Forensic Sciences, Dallas, Tex.
26 Apr. 1974	Mid-Atlantic Association of Forensic Scientists, Arlington, Va.

Latent Fingerprint Research

29 July 1973	Annual Meeting, International Association for Identification.

Special Technical Support/Grant Monitoring

Police Vehicle Study

26 Feb. 1974	Annual Meeting, Society of Automotive Engineers.

Project 911

25 Sept. 1973	Telecommunications Convention, San Diego, Calif.

Energy Task Force

4 Mar. 1974	Crisis Intervention Center, International Association of Chiefs of Police.

END