AEROSPACE REPORT NO.
TOR-0073(3640)-5

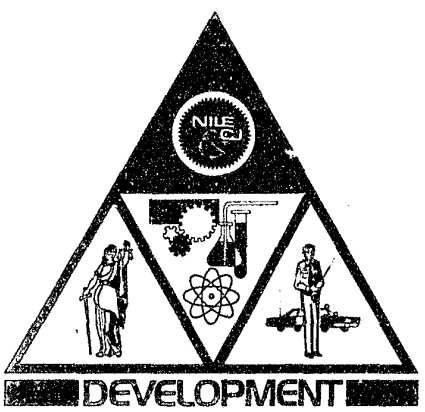
EQUIPMENT SYSTEMS IMPROVEMENT
PROGRAM - DEVELOPMENT

ANNUAL PROGRESS REPORT

FISCAL YEAR 1973

Prepared by
Law Enforcement Development Group

July 1973



Prepared for
W ENFORCEMENT ASSISTANCE ADMINISTRATION
U.S. DEPARTMENT OF JUSTICE

CONTRACT NO. F04701-72-C-0073

THE AEROSPACE CORPORATION

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Approved by

John O. Eylar, Jr., Director
Law Enforcement Development Group

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I. INTRODUCTION AND SUMMARY

In May 1972, the National Institute of Law Enforcement and Criminal Justice awarded a contract to The Aerospace Corporation to establish a Law Enforcement Equipment Development Group to translate equipment needs into practical criminal justice hardware systems through in-house or subcontracted development programs. This group was organized as one of three groups created to implement the Institute's Equipment Systems Improvement Program. The MITRE Corporation was selected as the Analysis Group and seeks to identify and formulate problems and assess the value of the systems developed to resolve those problems. The National Bureau of Standards was selected as the Standards Laboratory and prepares standards to aid criminal justice agencies in the purchase of equipment as well as in the development of guidelines for its use. This report summarizes the accomplishments of the Law Enforcement Development Group and is a companion document to similar reports by the Analysis and Standards Groups.

Mr. Burt Taylor served as Director of the Law Enforcement Development Group through December of 1972. During that period, the activity focused on becoming familiar with previous Institute-sponsored, equipment-related grants and on planning FY 1973 development projects. In order to facilitate communication with the Institute and between the Analysis, Development, and Standards Groups, the Institute requested that the Director's Office of the Law Enforcement Development Group, as well as the planning function, be located in proximity to the Institute in Washington, D. C. This necessitated personnel adjustments, including the appointment of Mr. John Eylar as the Director and his location in Washington, D. C.

The overall objective of the Law Enforcement Development Group is to define solutions to the high-priority problems identified by the Analysis Group and to technically manage the development of both improved and new equipment systems and procedures for law enforcement and criminal justice

agencies. In performing this function, the Law Enforcement Development Group utilizes the resources of industry as well as those of The Aerospace Corporation. The Aerospace Corporation is a California chartered not-for-profit corporation, technically defined as a Federal Contract Research Center, which provides engineering and scientific services to federal and local government agencies. By constraining its contractual involvement to government agencies and by maintaining a high caliber of technical competence, The Aerospace Corporation provides technically sound, unbiased and objective advice and counsel to its sponsors. The Corporation employs a 1500-member technical staff trained and experienced in scientific and engineering disciplines; 20% of the technical staff possess doctorate degrees and nearly 40% possess masters degrees. By selectively utilizing the capabilities of this staff, the Law Enforcement Development Group has an extensive resource of experts suited for a wide variety of highly technical subjects. Furthermore, by utilizing industry resources through subcontracts, the Development Group insures an orderly development process involving the most appropriate elements of industry.

The Analysis Group, through a process of identifying problems, influences the selection of specific Development Group projects. Unfortunately, the Analysis Group's activities had not yet reached sufficient maturity to be able to identify the problems against which the Development Group's projects for FY 1973 were to be directed. Hence, selection of development projects was based on coordination with the Institute, the Analysis Group, and the Standards Laboratory, and resulted in the following development projects for FY 1973:

Cost Effective Residential and Small Business Burglary Alarms. This effort is part of a program to develop reliable and low cost alarm systems for use by residences or small businesses. The 1973 activity focused on a technique for utilizing wiring in a building as the communications link between sensor and alarm. Development of appropriate hardware components was initiated under subcontract with Sylvania.

Citizens Alarm System. This program involves the development of a citizen alarm system which provides a means for reporting in real time when, where, and to whom a criminal attack or other emergency is occurring. The initial effort involves a system for use inside of buildings. Preliminary concept definition was completed and reported. A subcontract was awarded to CompuGuard, Inc. for development of feasibility hardware. Subsequent effort will address providing this same capability outside of buildings.

Protective Garments for Public Officials. This project is intended to exploit a new plastic cloth that offers the potential of being bullet proof to small-caliber handguns, and at the same time of providing a reasonably comfortable and presentable garment. The effort is being undertaken by contract with the Land Warfare Laboratory of the Army. Initial tests have been conducted with encouraging results and show that fairly thin layers of this cloth will prevent penetration by a .38 caliber bullet. A major question still to be addressed is the effect of blunt trauma resulting from unabsorbed energy being transmitted to the body of the wearer.

Speaker Identification. This project involved a review of the current state of the art in speech analysis and recognition. As a result of this study, a comprehensive follow-on program which consists of the following elements was identified: 1) investigations to improve voiceprint technology and properly validate areas for its application, 2) an interim semi-automated speaker identification system along with statistical evidence of its capabilities, and 3) a system study analyzing recording of illegal telephone calls.

Hijacked Truck Locator. The objective of this program is to develop a system for determining when a cargo-carrying truck has been hijacked or stolen and for providing information on the identity and location of the truck. Two techniques for locating a truck and several concepts for remotely disabling a truck were devised and tested. One concept for locating the truck by remotely interrogating the odometer and comparing the reply with a preplanned route proved highly successful. An alternative concept involving triangulation

on existing broadcast stations did not require preplanned routes but did not prove feasible because of multipath radio transmission problems in the vicinity of dense urban buildings.

The disabling system demonstrated consisted of a device for interrupting the ignition system and for shutting off the fuel system through a carburetor interlock.

Aerial Vehicle Study. A study to compare the capabilities of existing airborne vehicles to satisfy various law enforcement missions was completed and reported to the Institute. Alternatives to helicopters were emphasized and support equipment requirements were examined.

Body Mounted Antenna. The Aerospace laboratory conducted an investigation of the feasibility of modifying small microwave antennas for use with a police transceiver. It is intended that such an antenna be integrated into the policeman's uniform, and a major part of the development is the determination of the antenna radiating pattern. Engineering tests were completed on candidate configurations and reported to the Institute for consideration of possible field testing.

Remote Vehicle Disabling. An evaluation was initiated of techniques suitable for remotely slowing and/or stopping a vehicle attempting to flee from a police vehicle. This effort was terminated after a preliminary concept definition phase when it was recognized that the benefits to either the citizen or law enforcement community did not justify the implementation cost of such a device.

In addition to the project-oriented activities noted above, the following 20 grants were assigned to the Development Group for review and recommendations:

NI-70-003	- Public Urban Locator Service Study
NI-70-019	- The Channelling of Criminal Cases to Non-Criminal Dispositions
NI-70-034	- Police Transceiver Development

NI-70-065-PG-9	-	A Study of Voice Recognition Using Digitally Color Encoded Voiceprints
NI-70-065-PG-17	-	Pilot Computerized Infrared Data File
NI-71-026-C-1	-	Crimes in and Around Residences
NI-71-026-C-2	-	Systems for Residential Security
NI-71-040	-	Concealed Weapons Detection System
NI-71-050	-	Criminal Justice Pilot Program
NI-71-060-IA	-	Improved Neutralization System and Procedures for Improvised Bomb Neutralization
NI-71-061-C	-	An Evaluation of Small Business and Residential Alarm Systems
NI-71-078-G	-	Research of Voice Identification
NI-71-102	-	Test and Evaluation of Hydronautics Explosive Vapor Detection System
NI-71-105	-	Determination of the Age of Blood Stains by Non-Destructive Methods
NI-71-108	-	Time Dependent Electron Spin Resonance Characteristics of Gunpowder and Primer Residue
NI-71-110	-	Microchemical Methods of Assay for Erythrocite Isoenzymes in Dried Blood Through Autoradiography
NI-71-127-G	-	Architectural Design to Improve Security in Urban Residential Areas
NI-71-129-G	-	Digital Radio Telecommunications for Law Enforcement Applications
NI-71-144-1A	-	Evaluation of the All-Purpose Communications/ Protective Helmet
NI-71-147	-	Flexible Optical Inspection Device

As a third category of effort, a long range planning activity was established to perform studies and analyses leading to the selection of the most promising system concepts for improved law enforcement and criminal justice equipments. The planning activity during FY 1973 culminated in publication of an Annual Operating Plan for FY 1974. A ranking of the importance of equipment system problem areas was included in this document. Based on considerations of development risk, potential effectiveness, and economic, funding, and civil factors, as well as the importance of the problem area, an overall candidate project priority list was developed. The Institute reviewed the candidate listing and selected projects for inclusion in the Annual Operating Plan for FY 1974. This plan was published by the Development Group during June 1973.

The financial summary for the Development Group is presented in Table 1. The actual costs shown are subject to minor change as final billings, not available at the time of this publication, are paid. The actual expenditures, $1.7 million, are approximately $150,000 less than authorized. The industry subcontracts for the Citizens Alarm System and the Computer-Aided Voice Identification System contain options for expanded effort which, if exercised, would reduce the potential surplus. If these options are not exercised, the final program total will be less than the authorized total.

It should be noted that the subcontract expenditures correspond to the obligation of funds for the contracts initiated in FY 1973 and not the actual subcontract expenditures as of 30 June.

Attached, as Appendices, are the Directives received from the Institute as well as the lists of correspondence and reports submitted to the Institute by the Development Group in support of the Equipment Systems Improvement Program.

Table 1. FY 1972/73 Financial Summary

Task Number	J.O.	Title	Planned		Actuals Through 6/30/73	
			Aerospace	Subcontract	Aerospace	Subcontract
A-73-GMP-01	3649	Annual Operating Plan and Start-Up	115,600	--	115,605	
A-73-LEG-01	3640-01	Special Technical Support	139,100	--	144,672	
A-73-LEG-02	3640-02	General Program Management	90,000	--	100,710	
A-73-LEG-03	3640-03	General Project Support	20,000	--	25,743	
A-73-LEG-04	3640-04	Standardization Support	5,000	--	1,046	
A-73-CGM-01	3642	Contract/Grant Monitoring	20,000	--	23,264	
A-73-WOL-01	3641-01	Washington Office Liaison	15,000	--	14,518	
A-73-WOL-02	3641-02	Field Evaluation Test Support	8,000	--	183	
A-73-LRP-01	3643	General Planning	150,000	--	167,732	
A-73-COM-01	3653-01	Body Mounted Antenna	45,000	--	40,881	
A-73-CRM-01	3654-01	Automated Drug Analysis	2,700	--	3,137	
A-73-CRM-02	3654-02	Simplified Drug Analysis	4,200	--	4,208	
A-73-CRM-04	3654-04	Speaker Identification	25,000	--	24,801	
A-73-CRM-05	3654-05	Voiceprint Technology Extension	25,000	--	24,020	
A-73-CRM-06	3654-06	Voiceprint Equipment System Specification	50,000	--	20,475	
A-73-CRM-07	3654-07	Computer-Aided Voice Identification System	31,500	300,000	29,361	241,442
A-73-CRM-08	3654-08	Voice Recording System.	28,700	--	13,468	
A-73-SEC-01	3655-01	Low Cost/Reliable Residential and Small Business Burglar Alarm	77,000	60,000	72,315	59,207
A-73-SEC-02	3655-02	Citizens Alarm System.	10,000	--	8,319	
A-73-SEC-03	3655-03	Protective Garment for Public Officials	15,000	45,000	27,009	45,000
A-73-SEC-04	3655-04	Citizens Alarm System	20,000	200,000	25,917	133,934
A-73-MOB-01	3657-01	Aerial Vehicle Study	60,000	--	57,254	
A-73-APS-01	3658-01	Remote Vehicle Disabling System	14,400	--	14,210	
A-73-APS-02	3658-02	Truck Anti-Hijacking System	118,600	--	107,001	
			1,089,800	605,000	1,065,849	479,583
Total Aerospace and Subcontracts (FY 1973)			1,694,800		1,545,432	
FY 1972 Actual Costs (J.O. 2758)			114,200		114,298	
FY 1972 Fee (Actual			3,900		3,900	
FY 1973 Fee			37,100		37,100	
TOTAL PROGRAM			1,850,000		1,700,730	

II. GENERAL PLANNING ACTIVITIES

A. OVERALL PROGRAM PLANNING

The task plan initiating the General Planning activities was issued on July 1, 1972. The purpose of the planning activity was to assess requirements, devise concepts, perform studies, and analyze tradeoffs in order to define the equipment developments to be undertaken by the Law Enforcement Development Group.

As outlined in the Introduction and Summary Section of this report, the Equipment Systems Improvement Program was organized into three categories of effort: 1) Analysis, 2) Development, and 3) Guidelines and Standards. The Institute established three functionally specialized groups and contracted for the services of three separate organizations to carry out these activities. The flow of activities is normally expected to go from Analysis, where operational requirements and problem statements are defined, to Development, where solutions are reviewed and feasibility hardware fabricated by industry, and, finally, to Guidelines and Standards, where the information is made available to industry and law enforcement agencies.

Since FY 1973 was the initial year of operation for the Equipment Systems Improvement Program, the flow of activities could not proceed as outlined above. In particular, it was necessary for the general planning effort of the Development Group to begin by reviewing operational problems and potential solutions in order to propose development programs for initiation in the current year. Coordination of the initial programs was carried out with both the Analysis and Standards Groups to the extent of soliciting suggestions for proposed programs. The initial programs and problem areas were not defined in detail prior to selection (as is presently being done) but rather selection was by collective judgment, arrived at in coordination with the Institute and all participants in the Equipment Systems

Improvement Program. This led to initiation of the following eight projects for FY 1973:

Cost Effective Residential and Small Business Burglar Alarms
Citizens Alarm System
Protective Garments for Public Officials
Speaker Identification
Hijacked Truck Locator
Aerial Vehicle Study
Body Mounted Antenna
Remote Vehicle Disabling

These programs were broadly outlined in the FY 1973 Annual Operating Plan published in late July 1972. In addition, the FY 1973 plan defined the goals and objectives of the Development Group, described the organization of support and the management approach for technically directing the development programs, and outlined the policy and procedures for safeguarding proprietary information.

By September 1972, the planning activities began to focus on potential projects for the next fiscal year. In October, a list of over 100 projects was assembled and a rough ranking criteria was applied. This list continued to be reviewed and revised during late October and early November. In late November the overall list, along with descriptions of approximately 30 projects, was reviewed with the Law Enforcement Assistance Administration, MITRE, and the National Bureau of Standards personnel in a meeting at the Institute in Washington. Several additions and deletions were made and written comments were received in December 1972. The list of projects thus derived formed the basis of the initial FY 1974 Annual Operating Plan submitted to the Institute at the time of the Semi-Annual Review of the Development Group's activities in February 1973.

As a result of the Semi-Annual Review, an Institute-directed, coordinated effort was initiated to better define operational problems and required solutions. The Analysis Group provided a relative ranking of the importance of equipment system problem areas. Problems faced by police, courts, and correction agencies were graded on the basis of whether solution

to these problems would reduce crime and/or improve the quality of the criminal justice system. The Development Group then reviewed the overall list of projects and ranked them on the basis of:

1. The Analysis Group problem area priority.

2. Technical factors which influence the development risk and the potential effectiveness of a particular solution.

3. Application and economic factors which estimate the acceptability of a specific problem solution.

4. The expected Research and Development funding.

5. Civil factors which estimate the social, political, and legislative acceptability of a particular problem solution.

This planning effort resulted in a rank order listing of approximately 80 candidate projects. Because the new "Drug Agency" was being formed to handle all federal drug programs, projects such as drug detection systems and drug analysis equipment were excluded from the candidate project list and from further planning effort. In late March 1973, a description of the candidate projects and their rank order listing was published.

The Institute reviewed and screened these candidate projects and identified a list of 27 from which to select FY 1974 development projects. During the last quarter of the fiscal year, detailed schedules and program plans were developed for 17 of the projects. Because of budgetary limits, only 8 of the 17 were finally selected for inclusion in the FY 1974 Annual Operating Plan which was published in late June 1973. Of the 8 programs selected for FY 1974 Development Group effort, 5 were on-going programs being continued from FY 1973 and 3 were new projects to be initiated in FY 1974. The following programs are being continued:

1. Cost-Effective Security Alarm.

2. Citizens Alarm System.

3. Lightweight Body Armor (Protective Garment for Public Officials).

4. Speaker Identification.

5. Truck Anti-Hijacking Systems.

The new development projects to be introduced in FY 1974 are:

1. Study of Latent Fingerprint Research.

2. Blood and Bloodstain Analysis.

3. Explosives Detection and Identification.

The preliminary planning and detailed definition of these new projects was performed as part of the general planning effort.

B. DETAILED PROGRAM PLANNING

Although preparation of the Annual Operating Plan and determination of the project selection criteria were the major general planning activities during the year, an extensive effort on detailed backup work was also provided. In the early part of the contract year, evaluations of various proposals and concepts were included under general planning support. In the latter part of the contract year, such activity was included under Special Technical Support (Section III). Valuable inputs to the overall planning effort resulted from this activity.

An overview of the diversity of this detailed planning support activity is apparent by reviewing the appropriate correspondence transmitted to the Institute and taken from the complete correspondence list given in Appendix A. The following items of correspondence involved the more significant evaluations performed for the Institute and illustrate the diverse nature of the detailed, backup planning support provided:

1.	Review of Baird-Atomic Film Safe II X-Ray Inspection System.	11 July 1972
2.	Review of Arizona State Planning Agency Lighter-Than-Air Vehicles for Police Surveillance and Patrol Proposal.	13 July 1972

3.	Review of Adglov Research Police Car/ Policemen Locator System Concept Paper.	13 July 1972
4.	Response to a letter from Pennsylvania Research Associates regarding a proposed feasibility study of image enhancement techniques for law enforcement applications.	21 July 1972
5.	Evaluation of Operability Associates Description of an Automatic Voice Identification Device.	21 July 1972
6.	Review of proposals from the Land Warfare Laboratory and the Naval Research Laboratory and new National Institute for Law Enforcement and Criminal Justice standard from the National Bureau of Standards on body protection from handguns.	7 Sept. 1972
7.	Review of concept papers describing various techniques for anti-crime applications from Mankind Research Unlimited.	18 Sept. 1972
8.	Review of ITT Avionics Division Proposal for Gunfire Detection Systems.	21 Sept. 1972
9.	Preliminary Evaluation of Wackenhut Corp. Bloodhound Surveillance System.	22 Sept. 1972
10.	Review of H. S. Hayre, University of Houston, concept paper on Correlative Voice Speaker Identification.	29 Sept. 1972
11.	Evaluation of Panametrics Explosive Detector Proposal.	2 Oct. 1972
12.	Evaluation of IIT Research Institute Lead Detection Final Report.	31 Oct. 1972
13.	Review of Weiser/Robodyne letter describing a developed item for law enforcement.	1 Nov. 1972
14.	Review of Xetron Corporation Trafalert (Traffic Alert) Proposal.	14 Nov. 1972

15.	Review of DCM Industries Concept of Audio Monitoring of Commercial Facilities.	20 Nov. 1972
16.	Second review of concepts/ideas describing various techniques for anti-crime applications from Mankind Research Unlimited.	21 Nov. 1972
17.	Review of High Frequency Nonlethal Weapon Experiments of Dr. Heidenwolf.	21 Dec. 1972
18.	Review of Explosive Detection Techniques.	28 Feb. 1973
19.	Evaluation of Atomic Energy Commission Proposals for Explosive Tagging.	28 Feb. 1973
20.	Evaluation of Advanced Vehicle Engineers' Aircar.	3 Apr. 1973
21.	Evaluation of Chemiluminescence Concept for Detection of Explosives from Stanford Research Institute	12 June 1973

In addition to such review and evaluation of proposed projects, planning information was gathered by attending a number of key conferences and coordination meetings. The information obtained at these meetings provided valuable background which, in most cases, was summarized in correspondence to the Institute. The more important of these meetings are summarized below:

1. New Police Equipment Demonstration at Los Angeles Police Academy on 29 June 1972. Highlights were: extremely low-light level TV cameras; voice-scrambling systems shown by the Naval Electronics Laboratory; improved helmets with built-in microphone and receiver sets; hands-off, voice-operated transceiver units; and modularized and consolidated control panels for lights, siren, public address, and radio.

2. Voiceprint Meeting at Stanford Research Institute, 19 June 1972. Other attendees were from Stanford Research Institute, Texas Instruments, Michigan State Police.

3. Voice Recognition Meeting at National Security Agency, 5 July 1972, to review speaker recognition research. Other attendees were: National Security Agency, Federal Bureau of Investigation, Department of Defense, and various universities.

4. Meetings with Analytical Research Laboratories, Inc. in September 1972, on an explosives detector development funded by the Army. The key development effort is a method of concentrating TNT gases before passing through common trace detectors. The concentrator system has potential applicability to Institute explosives and drugs detection activity.

5. Meetings were held in September 1972 with Astrophysics Research Corp. on their "Scan Ray" baggage-concealed weapon detector, "SENSITRACE" tagging and detection hardware, and vehicle locator system. Potential exists in the "Scan-Ray" concept for whole body weapon detection at very low X-ray doses due to their high intensification system for the X-ray image.

6. Information exchange meeting in September 1972 with Autonetics Division of North American Rockwell on their system concepts for alarm sensors (bubble level tiltmeter), vehicle location system, and fingerprint readout.

7. At the request of the Institute, Aerospace personnel attended the three-day conference on Telecommunications for Government held at Boulder, Colorado in September 1972.

8. A technical exchange meeting was held in September 1972 with the Federal Communications Commission Safety and Special Radio Services Bureau regarding the minimum permissible transmitting power allowed for unlicensed devices in the broadcast band. This background planning information will help in assessing the feasibility of devices to alert a driver with his radio that a police vehicle is approaching and requires the right of way.

9. The Project Search International Symposium was attended in early October 1972. Valuable background and state-of-the-art information was obtained in a number of potential development project areas.

10. The Eastern International Security Conference (Washington, D. C.) was attended in October 1972. Valuable course work, a security equipment inspection, and contact with the alarm industry resulted.

11. A meeting was held at Aerospace on 16 October 1972 with Dr. James Henry, Institute for Defense Analysis, on his experience with concealed weapons detection.

12. During October 1972, a series of meetings was held with a number of contractors and agencies on related areas of interest: Boeing - voice scramblers and security systems; Security Communications, Inc. - digitally encoded message to dispatcher via telephone and to police car via RF; Astro Physics Research - whole body X-ray scanning for concealed weapons; Jet Propulsion Laboratory - various projects related to Citizens Alarm Systems; Systems Operations Support, Inc. - concept for detecting when a person is practicing deception using brain waves as an indicator.

13. A meeting was held at Stanford Research Institute on 26 October 1972 to discuss a proposed interim speaker identification system. Dr. Tosi of Michigan State University and representatives of Texas Instruments, Inc., were also in attendance.

14. Several meetings were held to discuss concealed weapon and explosive detection. A meeting was held in El Segundo on 1 November 1972 with representatives of the U.S. Army Mobile Equipment Research and Development Center.

15. Mr. B. Covington of TRACOR described his company's activities on vehicle location in a meeting on November 21, 1972 at El Segundo, California.

16. Meeting with Public Systems Inc. personnel, Sunnyvale, California on 23 November 1972 to discuss possible review of the Equipment Systems Improvement Program projects.

17. An Explosives Seeding Meeting was attended at Livermore, California on 29 and 30 November 1972.

18. An Automatic Vehicle Monitoring (AVM) Conference at Texas A&M University was attended on 15 November 1972.

19. A briefing covering the Development Group programs was given to Project Search Review Committee on 13 December 1972 in Burlingame, California.

20. Several meetings were attended in January 1973 to discuss items applicable to explosives tagging/detection. These were held as follows: 9 January 1973, Livermore, California, Livermore Lawrence Laboratory; 16 January 1973, in Chicago, Illinois at the Institute of Technology Research and Engineering; 17-18 January 1973 in Pittsburgh, Pennsylvania, with the Bureau of Mines; 19 January 1973, Picatinny, New Jersey with the U.S. Army's Picatinny Arsenal.

21. A panel discussion on Technology and Law Enforcement was attended in Los Angeles on 15 February 1973. A presentation was made by Aerospace to familiarize attendees of the Winter Convention of Electrical Engineers with the Equipment Systems Improvement Program plans.

22. The Institute's Forensic Science Symposium was attended on 19 and 20 March 1973. Discussions held with other attendees provided valuable information with respect to new forensic science development programs.

23. A meeting of the Equipment Systems Improvement Program technical review committee was attended on 18 April 1973 in Annapolis, Maryland. Several suggestions regarding new programs and revisions to presently planned programs were made by the committee.

24. A meeting of the Interagency Committee on Transportation Security was attended in Washington, D. C. on 24 April 1973. A briefing was given on the proposed FY 1974 Program to familiarize members of the Department of Transportation with the Equipment Systems Improvement Program.

25. A meeting of the Department of Defense Laboratory Consortium was attended in Crane, Indiana on 16 May 1973. An overview of the proposed FY 1974 Program was presented in order to preclude any duplication of effort and to familiarize members of the Consortium with the Equipment Systems Improvement Program and related technical developments.

26. Aerospace personnel hosted and participated in an Explosives Detection and Identification Technical Working Meeting in El Segundo on 13-15 June 1973. The purpose of the meeting was to define the requirements of federal agencies and law enforcement organizations for explosives detection and identification systems. Eight federal agencies and three police departments were represented.

Numerous other meetings were also held or attended during the contract year which involved coordination with MITRE and the National Bureau of Standards as well as reporting to the Institute and authorized review groups on the FY 1973 development projects. In addition, individual companies were visited to evaluate specific equipment and the current state of the art. However, much of this activity was in support of specific FY 1973 development programs and is, therefore, not treated in this section.

As the fiscal year ended, all of the general planning support personnel had been transferred to the Washington Office of The Aerospace Corporation in accordance with the Institute's directive. The planning activity will continue to define individual projects and coordinate these projects with the Institute and other members of the Equipment Systems Improvement Program. It is anticipated that the planning activity for the coming year will include more methodical analysis and detailed tradeoff studies of specific projects and alternatives, now that the necessary start-up work and overall project review and ranking have been accomplished.

C. DELIVERABLES

The major FY 1973 output of the General Planning activity was four reports delivered to the Institute. Three reports summarized the equipment development plans for FY 1973 and FY 1974; the fourth, the report on Candidate Projects for FY 1974, presents the rationale and selection criteria for undertaking development projects in support of the Institute's objectives. These reports and their delivery dates are listed below and are also included in the complete list of reports given in Appendix B.

10 August 1972 - FY 1973 Annual Operating Plan, Aerospace Report No. TOR-0073(3640)-1.

31 January 1973 - FY 1974 Annual Operating Plan, Aerospace Report No. TOR-0073(3640)-2.

30 March 1973 - Candidate Equipment Projects, FY 1974, Aerospace Report No. TOR-0073(3640)-3.

30 June 1973 - FY 1974 Annual Operating Plan, Aerospace Report No. TOR-0073(3640)-4.

III. SPECIAL TECHNICAL SUPPORT/GRANT MONITORING

A. SPECIAL TECHNICAL SUPPORT

In November 1972, the Special Technical Support category of effort was formally initiated. This area of activity involved technical evaluation of ideas, concepts, reports and unsolicited proposals to the Institute, especially when a rapid evaluation response was required. Prior to November, all of this type of support was provided under General Planning. The effort during this early period, as well as certain subsequent effort, is discussed and summarized in Section II. The tasks undertaken after November 1972 which fall within the Special Technical Support category are discussed in this section. The title and number of the Directive for each specific task are indicated, followed by a short summary of the effort involved and the responding Aerospace correspondence.

Directive No. 72-009 Evaluation of Fingerprint Proposal

A TRACOR proposal, dated 3 November 1971, for automatic fingerprint identification was reviewed. The proposed effort is intended to evaluate the feasibility of applying pattern recognition techniques in order to obtain a "digital signature" of individual fingerprints. If feasible, the use of the "digital signature" would greatly simplify methods for storing, retrieving, and matching single fingerprints.

It was concluded that the proposal was technically well conceived and addressed a critical problem area. It was recommended that, with modification, funding to complete feasibility testing was appropriate. Letter 1279-BLT-72-136 dated 18 December 1972.

Directive No. 72-014 Evaluation of Gulf Energy and Environmental Systems Proposal for Explosives Tagging

Gulf Radiation proposed a two-month study of the feasibility of tagging explosives with coded combinations of rare earth elements. Neutron activation analysis would be performed on the post-explosion residue, tracing the rare earths to determine origin of the explosive.

Aerospace considered the concept feasible and recommended support of programs in explosive tagging. Both the proposal and the company's experience were acceptable. A final decision for funding the proposal was deferred pending evaluation of other rare earth tagging programs already being conducted by the Atomic Energy Commission (Ames Laboratory) and the Bureau of Mines (Westinghouse) as well as the establishment of program priorities by the interagency explosive committee. Letter 1279-RPK-72-013 dated 18 December 1972.

Directive No. 72-016 LEAA Helicopter Procurement - Minimum Standards

Assistance was requested by the Institute in evaluating and commenting on a draft standard entitled, "Helicopter Procurement - Minimum Standards, Law Enforcement Assistance Administration, November 1972." Several inconsistencies and ambiguities were noted and it was recommended that appropriate revisions be made before the standard be issued. Letter dated 5 December 1972.

Directive No. 72-025 Review of Institute Report on Automatic Vehicle Monitoring Systems

Comments were provided on a paper originating within the Institute on Automatic Vehicle Monitoring Systems. The paper was considered well written and provides a generally useful overview of various automatic vehicle monitoring concepts. Letter 1279-JOE-73-004 dated 10 January 1973.

Directive No. 72-026 Review of Jet Propulsion Laboratory Proposal on Thermoluminescence

An evaluation was made of a Jet Propulsion Laboratory proposal to utilize thermoluminescence techniques in criminalistic laboratories as a means of individualizing clue materials.

A thermoluminescence program had been included as part of the Development Group effort proposed in the initial FY 1974 Annual Operating Plan report dated 31 January 1973, and it was recommended that this proposal with some modifications be included as part of that program. Letter 1279-JOE-73-027 dated 9 March 1973.

Directive No. 72-030 Evaluation of Gunshot Residue Proposal

An evaluation was made of a letter proposal dated 8 December 1972 from the Lowell Technological Institute (Professor B. A. Barnes) requesting support of a project for detecting firearm discharge residues by X-ray excitation. It was recommended that Professor Barnes be encouraged to submit a formal proposal for a small scale program to better establish the capabilities of the technique and that the Development Group consider sponsoring the effort. Letters 1279-JOE-73-009 dated 30 January 1973 and 1279-JOE-73-016 dated 22 February 1973.

Directive 73-004 Evaluation of Alarm System Proposal

A proposal for an alarm system concept involving radio frequency transmission of heart beats from bank or store employees under threat of robbery was evaluated. The proposal was made by Mr. Tibor Gorog and Mr. Frank David in a letter sent to President Nixon. The proposers were personally contacted for discussion. It was concluded that the concept does not appear feasible, and it was recommended that the Institute take no further action on their proposal. Letter 1279-JOE-73-511 dated 6 March 1973.

Directive No. 73-005 Review of Voice Identification Concept

The Texas A&M University "Pre-Proposal for Contributing to Speaker Identification by Machine Techniques" was reviewed and evaluated. The work proposed is development of an analytical technique of broad application and could be classed as basic research in pattern recognition.

At this stage of the Speaker Identification program under the Equipment Systems Improvement Program, it has not been established that special techniques are required. If it should develop that some are required, the capabilities of Texas A&M University will be considered.

Subsequent to receipt of the pre-proposal, Dr. Jones, Head of the Department of Electrical Engineering at Texas A&M visited Aerospace. The Speaker Identification program was discussed with him in order to ascertain areas of mutual interest. Letter 1279-JOE-73-021 dated 2 March 1973.

Directive No. 73-006 Evaluation of Proposal to Identify Explosives by Field Ionization Mass Spectrometer

A Stanford Research Institute proposal dated 26 January 1973 on the possible identification of explosives by means of a nonfragmenting field ionization mass spectrometer was reviewed. The proposal suggests the analysis of volatile constituents of explosives to provide a characteristic chemical fingerprint.

It was recommended that the proposed effort be considered for future Institute support in the event satisfactory progress is not obtained by the Picatinny Arsenal program to determine explosives chemical species. Letter 1279-JOE-73-052 dated 8 June 1973.

Directive No. 73-012 Evaluation of Simplified Drug Analysis Equipment

The simplified drug identification products marketed by Valley Toxicology Laboratories of Davis, California were investigated and an article in the November 1972 issue of Justice Magazine entitled "Product Manufacturers are Helping on Drug Overload" was reviewed. These products make use of microcolor and microcrystalline tests which, it is believed, are as yet insufficiently validated.

A program has been recommended to the Institute by the Development Group to aid in establishing the validity of such tests, individually or in combination. Until their validity is adequately established and the level of training required to run and interpret them is also established, such tests are open to question. Letter 1279-JOE-73-030 dated 4 April 1973.

Directive No. 73-018 Evaluation of Proposal to Enhance Photographic Evidence

A Franklin Institute proposal on "Enhancement of Photographic Evidence Collected during Bank Robberies" was evaluated. The proposed effort represents a very specific application of improved photography and image enhancement procedures to the problem of obtaining better identifying photographs of bank robbery suspects.

The proposed FY 1974 Development Program considers effort on pattern recognition and image enhancement for application to law enforcement problems and will involve competitive procurement. Letter 1279-JOE-73-050 dated 7 June 1973.

Directive No. 73-019 Evaluation of Small Turbine Aircraft Engine

A review was made of the small turbine aircraft engine and "platform" concept for which it is being developed as part of the Small Tactical Aerial Mobility Platform Program being conducted by the Naval Weapons Center, China Lake, for the Marine Corps.

A study specifically directed at law enforcement applications of the "platform" concept appears premature at present. As part of the interest in Aerial Policing, the Development Group will, however, monitor progress in the on-going Marine Corps program. Letter 1279-JOE-73-042 dated 21 May 1973.

Directive No. 73-024 Evaluation of Speaker Identification Research

A Texas A&M University preproposal entitled "Machine-Aided Speaker Identification Research" was reviewed and evaluated. The effort suggested includes study of pitch period, pitch period perturbation, intensity versus time, average word length, and average pause duration. The investigation recommended is basic research, exploratory in nature, and properly falls within a work category for which academic institutions are well suited.

This area of effort is not directly related to the current Institute-supported program on a Computer-Aided Speaker Identification System. However, if resources are available, a task on such a state-of-the-art survey could be initiated. A detailed discussion with Professor Gimlin is appropriate. Letter 1279-JOE-73-058 dated 13 June 1973.

Directive No. 73-025 Evaluation of Research Concept (Neutron Activation Analysis for Individualizing Hair)

A preproposal inquiry letter from Dr. A. A. Gordus of the University of Michigan was evaluated. Support from the Institute for studies of comparative analysis of forensic materials with the principal emphasis on human hair was solicited.

Because of the temporal variations in trace element concentrations, their analysis by neutron activation or other methods is not expected to be useful for the individualization of hair and other biological materials. The proposer indirectly acknowledged this and emphasized applying neutron

activation analysis to cases where suspects can be described by unusual trace element considerations. However, cases where peculiar trace element concentrations in hair evidence could lead to a suspect description occur relatively infrequently. It was concluded, therefore, that the study proposed does not match immediate program priorities of the Institute. Letter 1279-JOE-73-057 dated 12 June 1973.

Directive No. 73-026 Radio Frequency Allocation

Assistance was requested by the Institute in answering questions concerning frequency allocation in the 900 megahertz radio spectrum. Following review of the Federal Communications Commission Docket 18262, a position paper was prepared for the Institute which was forwarded to the Federal Communications Commission with only minor modifications. This position paper stressed the need for recognizing law enforcement requirements in reaching a final decision on frequency allocation and identified several specific areas of concern. Letter 1279-JOE-073-547 dated 25 May 1973.

Directive No. 73-035 Assessment of Stanford Research Institute Acoustic Camera Developments

A preliminary evaluation was made of the utility of an acoustic camera being developed at the Stanford Research Institute which has the same capability as an X-ray machine with none of the hazard. The camera appears promising for both concealed weapon and narcotics detection and warrants further investigation. It was recommended that a detailed examination of the theory and status of development be undertaken. Letter 1279-JOE-73-551 dated 18 June 1973.

B. GRANT MONITORING

A task plan initiating the Grant Monitoring category of effort was approved in October 1972. The effort under this task was to be devoted to reviewing various Institute grants and to recommending appropriate follow-on activities. This technical review was generally to be of grants which were equipment or technology oriented or to involve studies which could influence the design of equipment systems.

In January 1973, the task plan for Grant Monitoring was revised to include the 20 grants listed in the Introduction and Summary section of this report. The effort expended in revewing or monitoring each of these grants was dependent upon the grant completion schedule and the review points determined by the Law Enforcement Assistance Administration Project Leader. A summary of the FY 1973 Grant Monitoring activity follows:

Grant NI-70-003 Public Urban Locator Service Study

This grant was performed by the Institute of Public Administration, Washington, D.C. and Teknekron, Inc., Berkeley, California. Its purpose was to study the institutional, social, legal, economic, and technical problems associated with demonstrating a public vehicle locating system in an urban setting.

The Aerospace review of this grant addressed itself particularly to a technical analysis of the radio location systems described in the report, especially the trilateration automobile monitoring experiment and simulation performed by Teknekron, Inc. In general, it was felt that the work performed by Teknekron in deriving an accurate multipath propagation model for application in urban areas was significant. The Aerospace review did not agree, however, that the simulation was proven, since the testing of the model was very limited. Over-reliance on simulation results can be hazardous, especially where the model may not be applicable to the physical systems under study. Letter 1279-BLT-72-052 dated 21 September 1972.

Grant NI-70-019 Channelling of Criminal Cases to Non-Criminal Disposition

This grant was given to the American Bar Foundation in March 1970. The work was scheduled for completion one year later. There was no Aerospace activity to review either the grant activity or the final report during FY 1973.

Grant NI-70-034 Police Transceiver Development

This grant was initiated by the Law Enforcement Assistance Administration over two years ago and had as its goal the miniaturization of personal portable police transceivers, increasing their output power, and increasing the receiver sensitivity. Aerospace participated rather extensively during FY 1973 in monitoring this grant. The activity included attendance at technical conferences and project reviews, review of contractor results, comparison of the hardware produced with specification and work statement requirements, and detailed evaluation of the contractors' waiver requests.

The two contractors under this program, Martin and Sylvania, were not completely successful in achieving the specification originally set forth and requested waivers. It was the Aerospace opinion that the initial specification was relatively stringent and, as a specification for a research and development effort, should be subject to continual review during the course of the program. Aerospace consequently recommended in letters 1279-JOE-501 dated 25 January 1973 and 1279-JOE-73-532 dated 30 March 1973 that the contractors' waiver requests be granted.

Since the performance of the equipment ultimately developed under this grant was not sufficiently superior to other industry-developed transceivers recently introduced into the market, Aerospace recommended that these Law Enforcement Assistance Administration-developed transceivers not be introduced into a field test program. It was the Aerospace conclusion

that this grant served to stimulate other transceiver manufacturers to develop smaller and better performing equipment. In addition, publication and dissemination of the findings of the funded programs, both the positive and negative aspects, were considered to be a worthwhile contribution to the state of the art.

Grant NI-70-065-PG-9 Study of Voice Recognition Using Digitally Color Encoded Voiceprints

This grant to the Rensselaer Polytechnic Institute was for generating color encoded speech spectrograms or "Voiceprints" on a color television set in real time, starting from speech spectrograms taken with a Kay sonograph. Tests were run to evaluate whether this technique could reduce speaker identification error or improve the ease and speed with which such recordings are read.

It was determined that the feasibility of improving the identification process and developing a successful speaker identification system was not significantly influenced by color enhancement of Voiceprints. The final report under this grant was reviewed by Aerospace and it was recommended that no further work be undertaken in this area pending an assessment of other speaker identification systems and concepts. Letter 1279-BLT-72-037 dated 17 August 1972.

Grant NI-71-065-PG-17 Pilot Computerized Infrared Data Files

There was no Aerospace effort on this grant in FY 1973.

Grant NI-71-026-C-1 Crimes In and Around Residences

This project consists of two phases of a four-phase effort initiated by the Department of Housing and Urban Development (HUD) to develop architectural and security system guidelines for HUD-supported housing. Although HUD provided most of the funds for the first two phases, the

Institute has the primary responsibility for developing and monitoring these phases.

The goal of the first phase was to determine the nature and pattern of crimes occurring in and around residential areas. The contractor for Phase 1, Urban Systems Research and Engineering, Inc. of Cambridge, Massachusetts, was to collect and analyze data from neighborhoods in which crimes took place in order to assess characteristics which appear to encourage or inhibit crimes in residential settings.

No formal grant monitoring was done on Phase 1 due to the near completion of the project. Contacts were established with Dr. Blackburn and Mr. Reppetto of Urban Systems to insure data availability to the Phase 2 contractor, Security Planning Corporation. The Urban Systems final report was informally reviewed and applicable results are being used in the burglar alarm and citizens alarm projects of the Equipment Systems Improvement Program.

Grant NI-71-026-C-2 Systems for Residential Security

In the second phase of this project the contractor, Security Planning Corporation, was to develop a total security system for reducing the number and severity of the crimes identified in Phase 1 (Grant NI-71-026-C-1). Security systems were to be developed to satisfy a variety of criteria, including cost effectiveness, low false-alarm rate, reliability, and ease and acceptability of use by residents.

The Aerospace Corporation provided grant monitoring support to the Institute only on the last third of this grant. Involved were frequent phone conversations as well as short visits with the grantee every two or three weeks to review his status and offer assistance.

There were four major periods of Aerospace interaction with the grantee during FY 1973. In November 1972, Aerospace chaired a comprehensive review meeting which was held at Security Planning with the Institute,

Housing and Urban Development, National Bureau of Standards and MITRE attending. From that meeting written comments were provided to the grantee for redirection of several items including assurance that a method of evaluating residential vulnerability would be provided. In January 1973 Aerospace participated with the grantee in a review of the California "Crime Specific" program. In March 1973, the initial draft of the final report was reviewed and comments provided to the grantee. In June 1973 the final report draft was reviewed and coordinated with other reviewing agencies. Letter 1279-JOE-73-055 dated 12 June 1973.

Grant NI-71-040-C Concealed Weapon Detection System

Based on new technologies, the grantee, Illinois Institute of Technology Research Institute, was to develop and test a feasibility model of a concealed gun detector which would significantly reduce the high error rates of current systems. The system proposed consisted of a gamma ray illuminating source resulting in fluorescent X-rays from lead to be detected by a scintillation counter array.

No formal monitoring was done on the performance under this grant since the project was already completed. Aerospace did, however, provide a formal review of the final report. The technical work performed was considered excellent, but project termination was recommended due primarily to the long counting times required (30-60 seconds, minimum). Letter 1279-BLT-72-058 dated 27 September 1972.

Grant NI-71-050 Criminal Justice Pilot Program

There was no Aerospace activity on this grant in FY 1973.

Grant NI-71-060-1A — Improved Neutralization System and Procedures for Improvised Bomb Neutralization

This grant was assigned to the U. S. Naval Explosive Ordnance Disposal Facility and involved a system analysis approach to the definition and solution of problems connected with clandestine bombs. The effort was divided into four subtasks:

1. Testing and evaluation of explosive ordnance disposal techniques and products.
2. Research and development of new materials for shields and containers.
3. Modify existing military explosive ordnance disposal techniques for civilian needs.
4. Experimental study and documentation of data on critical explosive parameters.

Although no formal monitoring was performed on this grant, contacts were established with the grantee and monthly progress reports were reviewed.

Grant NI-71-061-C — An Evaluation of Small Business and Residential Alarm Systems

The grantee, Sylvania Corporation, Mountain View, California, was charged with assessing the role of alarm systems in reducing burglary, robbery, and related crimes and developing cost-effective alarm systems with minimum false alarm and failure rates. The scope of the work included a survey of the state of the art of alarm systems and a feasibility study of rentable alarm systems for use by small businesses and residences. The program was concerned with alarm system performance, reliability, design and deployment. Identifiable goals of the effort were: (1) to specify the role and design of alarm systems in a comprehensive crime deterrent system -- for example, in shopping centers, apartment buildings, or single dwellings; and (2) to develop guidelines for, and encourage the use of, effective alarm systems.

No formal monitoring was done on this grant since the project was already completed. Aerospace did, however, provide a formal review of the final report. In spite of several deficiencies, it was concluded that the grantee had produced a credible study and that the recommendations on future component hardware development should be implemented. Letter 1279-BLT-72-067 dated 29 September 1972.

Grant NI-71-078-G Research of Voice Identification

This grant was assigned to the Michigan State Police and had as its objective the development of improved automated speaker identification techniques and the evaluation of their effectiveness in law enforcement activities. One subcontract was let to the Stanford Research Institute to modify an existing computer-aided speech analysis system and to evaluate its applicability to speaker identification. A second subcontract was let to Texas Instruments, Inc. to perform speaker identification analyses on a large data base previously generated by company-funded speech research.

No formal monitoring was done on this grant since the effort had already been completed. Aerospace did, however, meet with key grant personnel and review the final report. It was concluded that the effort under this grant had shown that a semi-automatic method of speaker recognition is feasible and that a set of speaker-dependent features could be identified, entered into a computer, and used in a decision-making process. Also, it was recommended that

1. Computerized equipment with a capability of analyzing voice samples should be developed and placed in the hands of Voiceprint experts for feasibility testing and evaluation.

and that

2. Additional research should be conducted in the following five areas: Investigation to determine optimum features to be used for computerized speaker identification (including time dependent features), capability of computer systems to expose voice mimicry and disguise, effects of poor recordings, alternate analysis techniques, and voice classification systems.

Letter 1279-BLT-72-135 dated 18 December 1972.

Grant NI-71-102 — Test and Evaluation of Hydronautics Explosive Vapor Detection System

This grant, to the U. S. Army Land Warfare Laboratory, Aberdeen Proving Grounds, was for testing and evaluating the technical aspects of the hydronautics explosive vapor detection system for applicability to domestic and civilian bomb-disposal problems.

No formal monitoring was done on this grant. However, discussions were held with Mr. Cutler and his successors on the hydronautics device and the draft final report which is in process will be reviewed by Aerospace.

Grant NI-71-105 — Determination of the Age of Blood Stains by Non-Destructive Methods

There was no Aerospace effort on this grant during FY 1973.

Grant NI-71-108 — Time Dependent Electron Spin Resonance Characteristic of Gunpowder and Primer Residue

The purpose of this grant was to study the feasibility of using time-dependent characteristics of primer residues to determine the time of discharge of a firearm. The particular method selected by the grantee, EG&G Inc., of Goleta, California, was to measure the rate of decay of the free radicals generated during the discharge of the firearm.

Effort on this grant by The Aerospace Corporation consisted of a review of the EG&G preliminary study report issued in November of 1971 and their proposal for a follow-on study offered in May of 1972. In addition, a paper prepared by the EG&G principal worker, Dr. R. Mullen, was reviewed and requirements and the potential of the method were discussed with practicing criminalists. It was concluded that the data generated in the

preliminary EG&G study appeared to show considerable promise for the technique of using electron paramagnetic spin resonance (EPR) spectroscopy to time the discharge of a firearm from examination of the primer residue. These data were, however, too limited in scope to justify the extensive follow-on study proposed. In addition to more conclusive proof of the feasibility of the technique to accurately establish the time of firing, evidence that the technique is suitable for processing microgram-size residue samples would also be highly desirable. It was therefore also concluded that a short-term study to acquire a larger statistical base of radical-decay curves correlated to test firings was appropriate. Such results would provide a basis for determining whether a larger effort for utilizing EPR spectroscopy for criminalistic applications would be justified. Letter 1279-BLT-72-031 dated 4 August 1972.

Grant NI-71-110 — Microchemical Methods of Assay for Erythrocite Isoenzymes in Dried Blood Through Autoradiography

The objective of this grant to the John Jay College of Criminal Justice was the development of improved methods for identifying isoenzymes in dried blood. Autoradiography was expected to provide improvements over the currently used "activity staining" by offering a less cumbersome and time consuming procedure. In addition, the grant program was to develop support media which offered better resolution of isoenzymes in their electrophoretic analysis.

No information or Institute requests on the results of this work were received. As a consequence, there was no Aerospace activity on this grant during FY 1973.

Grant NI-71-127-G — Architectural Design to Improve Security in Urban Residential Areas

This is the second year of a grant to New York University (Dr. Newman) employing research-in-action methodology to determine whether the physical design of residential complexes and their disposition in the urban setting can significantly affect rates of serious crime and vandalism which occur within public housing units. Before-and-after studies were performed in conjunction with actual modifications to the physical plant of two New York housing projects to test whether the grouping of dwelling units, the definition of grounds, the design of elevators and lobbies, and the positioning of routes, doors, and lighting can discourage criminal entry and whether physical design can evoke behavior and attitudes that lead residents to the self-policing of their complex and to efforts at reducing vandalism and ensuring project security. Study conclusions were to provide specific design guidelines for the modification of housing projects across the country.

No formal grant monitoring was provided in FY 1973 due to the near completion of Newman's work. His reports and books on "Defensible Space" were reviewed for their impact on Development Group project areas such as design of the low-cost, reliable burglar alarm system and on the grant monitoring of the Security Planning Corporation effort on Systems for Residential Security (NI-71-026-C-2).

Grant NI-71-129-G — Digital Radio Telecommunications for Law Enforcement Applications

This grant supported an investigation of digital mobile radio communications for law enforcement applications at the Massachusetts Institute of Technology Electronic Systems Laboratory. The principal product of this effort was a final report prepared by Messrs. T. C. Kelly and J. E. Ward. The Law Enforcement Assistance Administration requested the Aerospace Corporation, under Directive No. 73-030, to review and evaluate this final report.

It was concluded that this report presents an excellent theoretical investigation of digital mobile radio communications, but is weak in its review and discussion of some of the practical facets of the problem. Letter 1279-JOE-73-045 dated 25 May 1973.

Grant NI-71-144-1A — Evaluation of the All-Purpose Communications/Protective Helmet

This grant to the U. S. Army Land Warfare Laboratory is a program covering both laboratory and field test of a helmet concept involving a radio communications capability as well as protection to the wearer's head, face, and neck. The helmet concept was configured using modified off-the-shelf components.

The Aerospace effort on this grant involved reviewing interim progress reports prepared at the Land Warfare Laboratory. Based on in-house tests at the Land Warfare Laboratory it appears that the helmet as presently designed is generally satisfactory with regard to chemical and gasoline exposure but offers no real protection against firearm projectiles. Other known materials identified in the report would give better protection. In addition, although the helmet does offer protection to the head itself, the propagated force of a blunt impact may introduce user injury.

The police field evaluation is incomplete. However, based on available comments, it was concluded that the helmet needs improvement in certain human factors areas such as bulkiness and interfering cables and antennas. Letter 1279-JOE-73-067 dated 28 June 1973.

Grant NI-71-147 — Flexible Optical Inspection Device

This grant to the Franklin Institute was for developing an optical/TV device to inspect the interior of suspected bomb-containing packages. The device was delivered to the Institute during FY 1973 and Aerospace attended the final acceptance and demonstration of the hardware. Although the system

operated as designed, it was recommended that there should be no further development of this particular device since there were serious operational limitations associated with inspecting packages which have no openings and are filled with stuffing or other filler material.

IV. DEVELOPMENT PROJECTS

During Fiscal Year 1973, the National Institute of Law Enforcement and Criminal Justice authorized the Development Group to initiate effort on eight specific programs. These were

A) Cost Effective Residential and Small Business Burglar Alarms
B) Citizens Alarm System
C) Protective Garments for Public Officials
D) Speaker Identification
E) Hijacked Truck Locator
F) Aerial Vehicle Study
G) Body Mounted Antenna
H) Remote Vehicle Disabling

The first five programs on this list are activities which are being continued beyond FY 1973, whereas the last three programs are activities completed during FY 1973. Detailed reports have been published on all three completed programs and are published at appropriate milestones for the programs extending into FY 1974. As of this date, detailed reports have also been published on phases of the Speaker Identification and Hijacked Truck Locator programs. A list of all major documents prepared by the Development Group during FY 1973 is included in Appendix B. In addition, numerous briefings were prepared and presented to the Institute and other interested agencies on each FY 1973 program.

A detailed review of the activities and accomplishments for each of the eight programs included under the Development Group effort during FY 1973 is presented in this section. Individual subsections are devoted to each program.

A. COST EFFECTIVE RESIDENTIAL AND SMALL BUSINESS BURGLAR ALARMS

Burglaries lead the list as the most prolific crime in the nation. Burglar alarm systems provide an obvious deterrent to these crimes; however,

the widespread use of burglar alarms is seriously handicapped by the relatively high cost and false alarm occurrence experienced with most commercially available systems. The objective of this program was to identify the deficiencies of currently available alarm systems, to study and develop techniques for eliminating these deficiencies, to reduce the installation costs, and, of utmost importance, to identify methods for reducing the frequency of false alarms in order to increase the credibility of alarm systems with law enforcement agencies.

Early in the identification and definition of Law Enforcement Assistance Administration programs for the reduction of crime, the need for a cost-effective and reliable burglar alarm system was emphasized as a prime candidate for the Equipment Systems Improvement Program. The widespread use of burglar alarms in this country is currently limited by the relatively high cost and frequent occurrence of false alarms being experienced by the majority of alarm users. Identification of specific areas where development effort should be directed is difficult because the alarm component industry is well established and feels quite capable of identifying and meeting consumers needs. However, the industry through its representative committee, the Alarm Industry Committee for Combatting Crime (AICCC), did respond to Aerospace Corporation inquiries and identified several industry-recognized deficiencies.

A particular item identified by several sources (including this committee) deals with the reduction in installation costs of security alarm equipment. The $400 to $1500 installation cost of residential alarm systems and the $15 to $50 monthly service charges are primarily due to the cost of hardware installation, the high cost of the home Control Center itself, and the telephone company imposed costs for a leased line tie-in to an alarm company or to the police. These costs, or for that matter the cost of any less expensive system, must be compared against the $300 to $500 average loss per burglary experienced statistically once every ten years per homeowner.

Since a major part of the installation cost is the required wiring, use of the already available power wiring offers attractive possibilities. The use of existing home wiring for alarm carrier purposes as a means of lowering installation costs and the use of the electrical transmission line characteristics for identification of a switch closure onto a passive element connected to the line were both considered under this task. Resource and statistical background data were obtained from numerous companies, and, in addition, working relationships were established with several city and county law enforcement agencies interested in the residential alarm systems false alarm problem.

The primary Aerospace in-house effort included an assessment of related industry capability and the status of commercially available equipment, and an investigation of the various transmission problems associated with carrier telephone, interactive TV and external power line carrier systems. In addition, technical evaluations were performed of a variety of proposed or funded Law Enforcement Assistance Administration experiments such as STAVS in Orlando, Florida; Digitran in Culver City, California; VARDA in Torrance, California; and the Cedar Rapids experiment. Additional effort was expended in the accumulation of statistical and hardware data necessary for planning the FY 1974 follow-on program.

Industry support for this program was also solicited. In December 1972, a seven-month contract (contract number PO35623) for $59,207 was awarded to Sylvania for both the characterization of residential power wiring systems and for the development of power line dependent low-cost alarm components. Significant progress was made under this contract to characterize typical residence wiring systems and to determine if their use as a medium for the transmission of an alarm signal by passive means is feasible. A Technical Characterization Report describing the wiring system in terms of electrical transmission line parameters has been substantially completed. Utilizing the characterization data, the contractor has designed a passive frequency-sensitive impedance device to be coupled to an alarm

sensor which is low cost (under $3.00 for parts) and utilizes the power lines instead of a hardline direct wire hookup to the home control unit.

Substantial progress was also made in establishing sources of alarm system requirements information from burglary surveys, such as that by Urban Systems Technology, and on currently available intrusion alarm systems, burglar resistant door and window hardware, and other burglar deterrent techniques. MITRE, the National Bureau of Standards, the Law Enforcement Assistance Administration, Underwriters, the state and local law enforcement agencies and the military have all contributed useful inputs. As previously mentioned, support from the Alarm Industry Committee for Combatting Crime was also obtained. The inputs from all of these sources have been utilized in defining the follow-on phases for this program.

The key items delivered during FY 1973 on this program include:

1. Task Plan Transmittals (1279-BLT-72-046 dated 8 September 1972 and 1279-BLT-72-085 dated 2 November 1972).

2. Statement of Work: Cost Effective Burglar Alarm (1279-BLT-72-087 dated 3 November 1972).

3. Procurement Package - Sylvania Contract (1279-BLT-72-139 dated 20 December 1972).

4. Minutes of Sylvania Program Review Meetings (copies of letters to Sylvania for meetings in March, April, May 1973).

5. Draft - Power System Characterization Report (1279-JOE-73-564 dated 27 June 1973).

6. Commerce Business Daily Announcement - Security Alarm Project (1279-JOE-73-047 dated 7 June 1973).

The following reports are anticipated under the Sylvania contract:

1. Power Line Characterization Final Report (31 July 1973).

2. Feasibility Demonstration Hardware (31 July 1973).

3. Sylvania Program Final Report (23 August 1973).

Recommendations

In order to complete the electrical characterization data for residential power wiring systems, additional surveys are needed of a variety of residences with ages ranging back to pre-1940 and located in tenement areas and/or older sections of various cities across the nation. After such information is available, a final characterization can be formulated for an industry design requirement directed toward the use of power lines as a transmission medium. Future programs should also include the characterization of city-wide power distribution systems as well, for they could be used as a low-cost means of transmitting alarm data to a responding agency. Application testing of the Switched Impedance Shunt being investigated under the Sylvania contract should also be considered.

An examination of the technical problems associated with competitive interfacing systems such as interactive TV and carrier telephone lines is appropriate. The design of better human engineered intrusion alarm control equipment should also be considered. Direct tie-in to the new semi-automated police dispatching equipment requires high reliability and a low occurrence of false alarms.

Financial Summary

A total of $137,000 was budgeted for this program. Of this amount approximately $60,000 was contracted to Sylvania as a single-source follow-on to their previous Burglar Alarm Study grant from the Law Enforcement Assistance Administration. For this amount, Sylvania was to conduct tests and studies to characterize building power lines for use as internal alarm transmission paths and to design and develop transmission system components that utilized the building power lines. Aerospace was budgeted a total of $77,000 to define preliminary system requirements; prepare contractual documentation; manage the Sylvania contract; and plan

detailed follow-on effort in the areas of sensors, control subsystems, and external alarm transmission developments. The Aerospace budget was underrun by $4,685, primarily due to delay in the initiation of the project.

B. CITIZENS ALARM SYSTEM

Private citizens are being subjected to criminal attack in apartments, business establishments, and schools, as well as in public parks and on the streets. Some technique which allows victims of such attacks to call for assistance is obviously desirable. The purpose of this program is to develop a citizens alarm system which provides a means for reporting in real time when, where, and to whom a criminal attack or other emergency is occurring. Initially, the intent is to provide a system for use by individuals inside of buildings; subsequently, the intent is to provide this same capability in outside spaces.

In many urban areas a citizen's needs for transmitting a call for assistance under threat of robbery, rape, murder, or aggrevated assault has never been greater. Federal Bureau of Investigation indices of crimes in these areas continue to show high rates of incidence. Citizens' fears along these lines are difficult to quantitatively measure but a number of studies, polls, marketing surveys, and news releases indicate national concern.

Responding to these fears, a number of minor marketing efforts such as canned mace and pressurized air horns for personal protection were attempted by industry. Several specialized institutional personnel protection concepts were also developed. The most noteworthy of these was the Jet Propulsion Laboratory development of a pen-sized ultrasonic actuator for teachers to summon help via a hardwire relay in the case of classroom or schoolyard strife. This particular concept is being further marketed by the Mentoris Company as a senior citizen medical emergency alarm system. A number of companies are also developing sophisticated special purpose radio-frequency systems. However, a system to meet the needs of the endangered citizen does not appear to be available.

In October 1972, the Institute directed Aerospace to initiate a Citizen Alarm System program. The initial effort was to be a concept definition phase performed by Aerospace and, if appropriate, subsequent industry support was to be solicited for a feasibility demonstration. An in-building utility and a user identification code to help control false alarms were specified for this initial effort.

The Concept Definition Phase performed by Aerospace was completed in January 1973. Preliminary requirements were established for a miniaturized, individually-coded actuator that could summon assistance within 2-4 minutes. System concepts were defined which involve subsystem elements including radio frequency or ultrasonic actuators, internal receiver relay units, internal transmission techniques, external receiver/transmission techniques, and central data processing. A technology assessment was performed and it was concluded that current technology could support a Citizens Alarm System development. A bread board feasibility model incorporating an encoded radio frequency actuator, internal receiver/relay coupling to the building power lines, and annunciator panel readout of a social security rumber was assembled and demonstrated to the Institute. Development objectives involving cost, reliability, response time, human engineering, and miniaturization parameters were defined. The basic concept and major system elements are illustrated in Figure 1.

Following Institute approval to proceed with the next phase of the effort, an announcement was placed in the Commerce Business Daily on 6 February 1973 seeking qualified industry sources for development and feasibility demonstration of hardware. A qualified bidders list was established from the 89 responses received. A statement of work was prepared and issued by Aerospace, and proposals from 8 bidders were received and evaluated. Negotiations were initiated with the CompuGuard Company of Pittsburgh, Pa., and a contract (PO-44326-V) for $133,934 was awarded in June 1973. Two miniaturization options on the final actuator size, hybrid or monolithic electronics, are being negotiated.

Figure 1. Citizens Alarm Concept

Aerospace activity during FY 1973 also involved planning for a FY 1974 program. An external Citizens Alarm System was defined and a task plan calling for a Concept Development Phase and a Feasibility Demonstration contract was prepared.

The key items provided during FY 1973 under this program include:

1. Task Plan for Concept Definition Phase (1279-BLT-72-085 dated 2 November 1972).

2. Concept Definition Phase results (semi-annual review briefing), 14 February 1973 - including bread board hardware demonstration.

3. Task Plan for Feasibility Demonstration Phase (1279-JOE-73-508 dated 5 February 1973).

4. Commerce Business Daily Announcement (1279-JOE-73-505, dated 30 June 1973, 1279-JOE-73-028 dated 22 March 1973).

5. Evaluation of Commerce Business Daily Announcement Contractor Responses (1279-JOE-73-028 dated 22 March 1973).

6. Proposal Evaluation and Negotiation Package, June 1973 (1279-JOE-73-558 dated 21 June 1973).

7. Close-Out Letter Report - Concept Definition Phase (1279-JOE-73-059 dated 22 June 1973).

The following report is anticipated early in FY 1974:

Aerospace Technical Report on Concept Definition (scheduled 15 August 1973).

Recommendations

The internal Citizens Alarm System and external Citizens Alarm System should eventually be integrated into a single system. From the user's viewpoint, it is desirable that the actuators for the two systems, as well as the alarm data handling, be common. In addition, analysis support from MITRE on the desirability of coding the originating signal to identify the user as well as an evaluation of required operating size and procedures for the responding agency is also appropriate.

Financial Summary

A total of $230,000 was budgeted for this program in FY 1973. A cost-plus contract with the CompuGuard Company was signed in June 1973 for $133,934 with negotiated options of $36,337 and $63,334 for actuator miniaturization. Aerospace was budgeted $10,000 for a Concept Definition Phase to define preliminary requirements, technical feasibility, and preliminary design of the in-building Citizens Alarm System. In addition, Aerospace was budgeted $20,000 for preproposal activities, proposal evaluation, contracting activities, and contract management. Also included was follow-on planning for the external Citizen Alarm System. A slight overrun of the total Aerospace budget for this program was experienced due to the large number of contractor responses to the Commerce Business Daily announcements.

C. PROTECTIVE GARMENTS FOR PUBLIC OFFICIALS

During the past decade, a significant number of public figures have been shot and approximately seven hundred law enforcement officers have been shot and killed. Numerous injuries and many of these deaths could have been prevented if adequate body armor had been available.

On 12 September 1972, Aerospace, at the request of the Institute, initiated a program on Protective Garments for Public Officials. The objective of the program was to develop lightweight protective garments which are inexpensive and relatively inconspicuous. Both inner and outer garments were to be considered.

Following an initial assessment of the problem, it was concluded that protection against a threat equivalent to the .38 caliber police special would be adequate between 85 to 90% of the time. Coupling this threat severity limit with the development of new and stronger synthetic fibers by the textile industry suggested the possibility of developing a flexible, lightweight, inconspicuous and relatively inexpensive protective garment.

In November 1972, the Development Group initiated a program (via interagency agreement) at the Land Warfare Laboratory (LWL) of the U. S. Army to design and test a lightweight protective garment. As an initial effort, ballistic evaluations were made of candidate materials. Forty specimens of twelve types of ballistic materials with various thread types and spacing were ballistically tested. The most promising materials were then tested on animals to evaluate blunt trauma effects. Based upon its non-penetration capabilities, light weight, and reasonable cost, a Dupont PRD-49 TL-105-26 material originally developed for use as a tire cord material was selected as significantly better than any nylon type previously tested and most promising for the intended application.

The resistance of this material to penetration by a .38 caliber bullet is illustrated in Figures 2 and 3. The deformation of the projectile with the weave pattern impressed on the blunted foresection is clearly apparent in Figure 2. Also apparent is the point of impact with the cloth. High speed X-ray photographs of the impact between the bullet and the cloth are shown in Figure 3. Instantaneous deformation equal to approximately two thicknesses of the cloth occurs, but penetration is clearly prevented. The blunt trauma resulting from such impact is, of course, dependent upon the specific body location of the impact.

In order to demonstrate the feasibility of fabricating this material into wearable garments, two different garment designs were manufactured. The first was a sport jacket intended for use by public figures and the second was a zip-in lining for a New York Police Officer reefer coat. Methods of fabrication, layup of multiple plies, and compatibility with existing machinery for clothing manufacture were successfully demonstrated. At the Institute's request, these coats were exhibited to various interested agencies.

Aerospace established close relationships on this program with the other participants on the Equipment Systems Improvement Program. MITRE is to generate the necessary operational requirements and will conduct field evaluation tests on the various garments developed. Also, the National

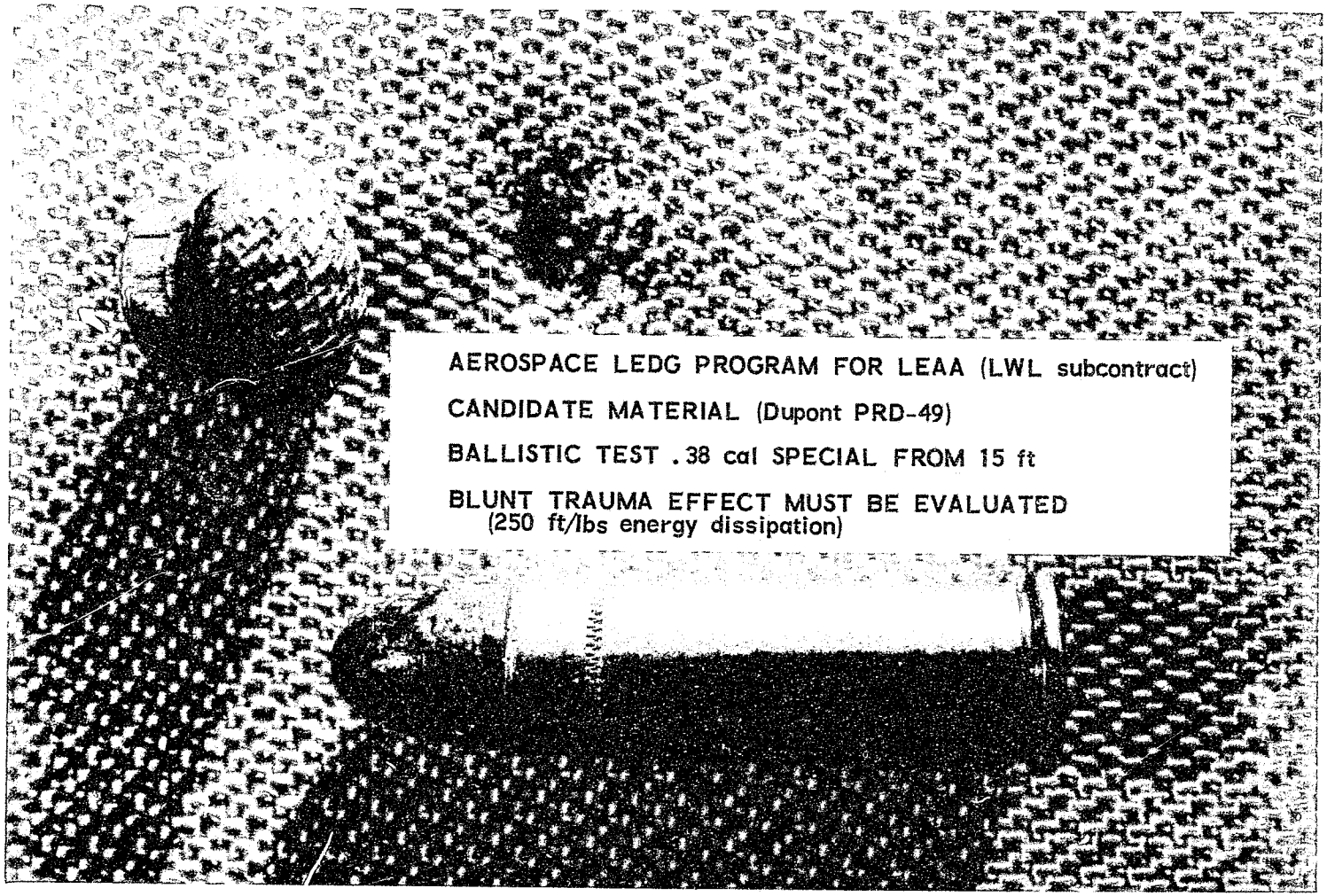
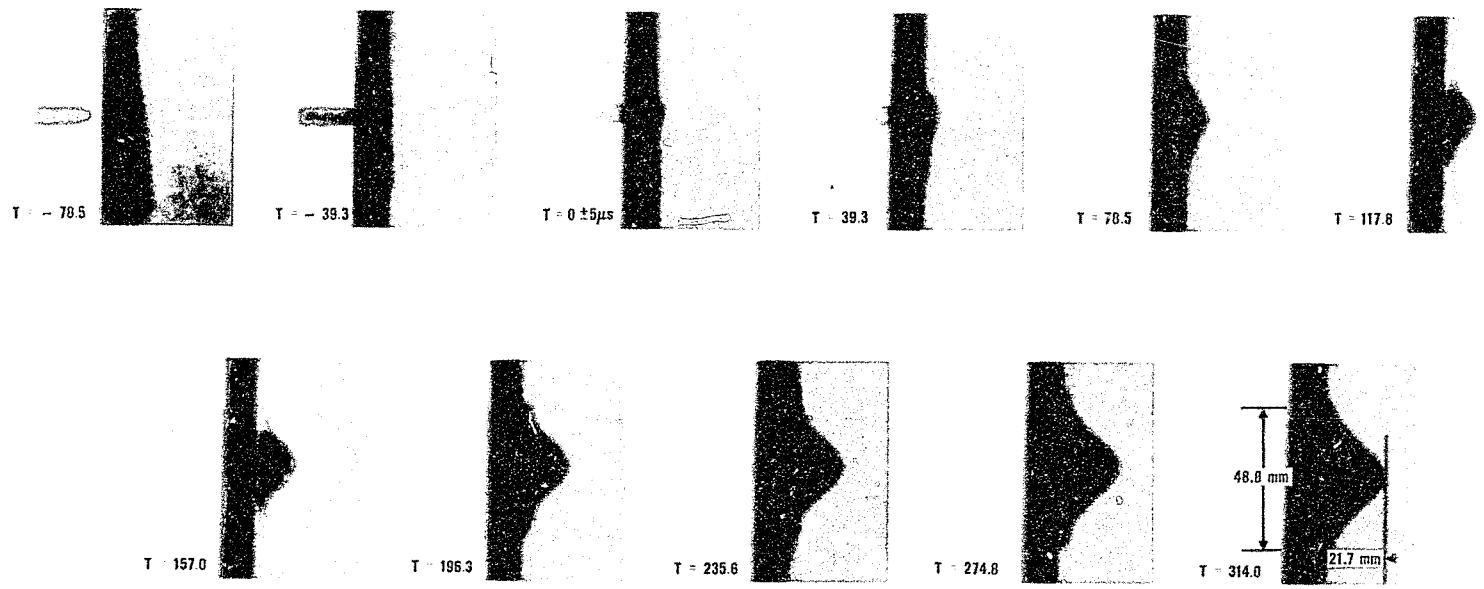


Figure 2. Specimen Material Ballistic Test



- LAWRENCE LIVERMORE LABORATORY TEST FOR AEROSPACE CORPORATION (X-ray photographs)
- .38 CALIBER BULLET AT 657 ft/sec (145 ft/lbs)
- DUPONT FIBRE B (PRD) MATERIAL

Figure 3. Specimen Material Deformation Under Bullet Impact

Bureau of Standards began anthroprometric studies to provide appropriate torso measurements of law enforcement personnel to guide the specific design and size of the field test items. Interfaces were also established with other responsible agencies outside of the Institute program. Discussions were held with key personnel of the Federal Bureau of investigation, the Secret Service, the State Department, and various police departments. In addition, working relationships were established with manufacturers of protective garments and police uniforms and protective material weavers. The inputs from all of these sources have been utilized both in guiding the FY 1973 effort on this program and in defining the subsequent follow-on effort.

The key items provided during FY 1973 on this program include:

1. Interagency Agreement Transmittal to Land Warfare Laboratory; 5 October 1972.

2. Minutes of Program Review (1279-JOE-73-008 dated 30 January 1973).

3. Delivery of Prototype Sport Jacket and Prototype Police Coat; April 1973.

4. Summary of Lightweight Body Armor Planning (1279-JOE-73-041 dated 31 May 1973).

5. Lawrence Livermore Laboratory Testing and Analysis Effort; June 1973.

6. Preliminary Statement of Work for FY 1974 Land Warfare Laboratory Support (1279-JOE-73-552 dated 19 June 1973).

The following report is anticipated early in FY 1974:

Aerospace Final Report on FY 1973 Activities (scheduled 31 August 1973.

Recommendations

A major issue arising from the FY 1973 program is the blunt trauma damage to the human body when the impact of the bullet (which is prevented

from penetrating) is absorbed by the protective garment and the underlying tissues and bones. A follow-on program directed at establishing a quantitative understanding of this phenomenon should be initiated.

Similarly, although the FY 1973 effort established the feasibility of preventing bullet penetration through soft, woven material, an analytic explanation of the mechanism involved does not exist. An analytic model of the mechanism involved should be developed and, when available, will aid in guiding additional material and garment fabrication research and development. In addition, the testing should be extended to higher energy threats (9 mm).

Sufficient progress has been achieved to justify the initiation of field testing of protective garments made of the material evaluated in FY 1973.

Financial Summary

A total of $60,000 was budgeted for this program. Of this amount, $45,000 was transferred to the Army Land Warfare Laboratory for initial material evaluation, blunt trauma testing, and garment fabrication. The in-house Aerospace budget of $15,000 was for preliminary requirements definition, contractual functions, technical management of the subcontracted effort, and follow-on planning. An overrun of the total Aerospace budget amounting to $12,009 was experienced, due to an extension in the duration of the Army activity and a more extensive follow-on planning activity on blunt trauma and backface signatures than had been anticipated.

D. SPEAKER IDENTIFICATION

Present voice identification techniques are more of an art than a science and are highly dependent upon the skill of the examiner. 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. Supported by

Institute Grant NI-70-004, Dr. Tosi of Michigan State University undertook to assess error rates associated with voice spectrogram analysis. After one month of training, 29 examiners were tested with spectrograms from 250 different speakers in a large variety of tests (34,992 trials). The results of the experiment showed significant examiner error rates.

Based on the desire to improve the use and validity of voice spectrograms in law enforcement, the Institute directed the Development Group to initiate a comprehensive program on speaker identification. The objectives of the program were:

1. To conduct investigations to improve voice spectrogram technology and properly validate areas for its applications.
2. To provide an interim semi-automated speaker identification system along with statistical evidence of its capabilities
3. To provide the basis for improved reliability of speaker identification (optimum voice feature selection).
4. To provide a voice classification system to allow the search of large files for identification purposes.
5. To provide new techniques for voice identification.

It is expected that the program would extend over several years and that most of the effort would be subcontracted.

On 17 January 1973 an announcement was published in the Commerce Business Daily to solicit industry interest in a Computer-Aided Semi-Automatic Speaker Identification System.

On 6 April 1973, an announcement was published in the Commerce Business Daily that Requests for Proposals had been sent to qualified responders to the 17 January announcement for the Semi-Automatic Speaker Identification System. To date, machine-assisted speaker identification efforts have not yet demonstrated that the results of computer analysis can be used as courtroom evidence. Michigan State Police, supported by the National Institute of Law Enforcement and Criminal Justice Grant NI-71-079G, subcontracted with the Stanford Research Institute and Texas Instruments for

machine-assisted speaker identification research. Using tape recorders and other general purpose equipment as a base, both activities developed systems for extracting features from speech and then processed those features with digital computers. Their results were comparable and indicate that (1) this technique supplements information available from the voice spectrogram and warrants further effort, and (2) additional research on feature extraction and analysis is desirable.

Nine proposals were received and on 25 June a 13-month subcontract (PO 40109) was awarded to the Electronics Research Division of Rockwell International, Inc. for research and development of a Semi-Automatic Speaker Identification System. Hardware is scheduled for completion in April 1974 followed by system demonstration in July 1974.

On 10 May 1973, an announcement was published in the Commerce Business Daily seeking sources for conducting a Voiceprint evaluation test program. The nine replies received indicated sufficient industry interest and competence to conduct this fundamentally important program. The Development Group recommended to the Institute that all phases of this effort (test design, test operations, and data analysis) be conducted by a single subcontractor. As of the close of FY 1973, the only major unresolved area is the source of Voiceprint examiners. It was recommended by Aerospace that the Institute solicit the assistance of law enforcement agencies which have a current Voiceprint examination capability.

Preparation of a statement of work for this activity has been initiated and a contract award during FY 1974 is anticipated.

In addition to the subcontracting support, selected in-house studies were also undertaken by Aerospace. A review was conducted of the theory and status of Voiceprint technology and a "Voiceprint Applications Manual" was prepared and published (see Appendix B, item 10). The purpose of this manual is to upgrade Voiceprint practice by giving potential users an understanding of the principles of voiceprint analysis and knowledge of correct practices in collecting and submitting voice samples for evaluation.

A second in-house effort undertaken at the direction of the Institute, was a system study analyzing the recording of illegal telephone calls. The results of this study were also published in June 1973 (see Appendix B, item 11). It was determined that compact, portable recording equipment costing about $700 per unit could be installed on the premises of a person receiving illegal telephone calls and could provide recordings acceptable as court evidence. However, a system analysis investigating the factors involved in recording at a customer's telephone or at the local telephone exchange showed that central recording can be done more cheaply. The Development Group also recommended that no further Institute-supported effort be expended at this time on telephone recording projects associated with speaker identification.

The key items provided during FY 1973 under this program include:

1. Recommended Speaker Identification Program (1279-BLT-72-097, dated 14 November 1972.

2. Request for Proposal: "Semi-Automatic Speaker Identification System"(30 March 1973).

3. Concept Development Plan - Voiceprint Validation Test (10 May 1973).

4. Voiceprint Applications Manual (June 1973).

5. Report - "System Analysis - Recording System for Illegal Telephone Calls" (June 1973).

Recommendations

Assuming satisfactory results are achieved under the initial subcontract effort on a Semi-Automatic Speaker Identification System, it would be appropriate to support a follow-on subcontracted effort in that area in FY 1975. The early initiation in FY 1974 of a subcontracted effort on a Voiceprint Evaluation Test Program is also recommended. There are, in addition, several other activities falling under the Speaker Identification category which should be considered for early initiation. A program to

identify the most invariant features in a person's speech should be considered. The identification and selection of such optimum speech features would aid both Voiceprint identification-techniques and computer-assisted voice analysis. An assessment of the feasibility of voice classification as a basis for classifying people by their voice characteristics should also be considered. If voice classification is feasible, a large data base could be generated that could be searched in order to identify a specific individual in much the same manner as fingerprints are now utilized. In addition, other applications for voice classification are possible. These include individual speaker verification, voice actuated locks, area access control, etc. An effort on optical/holographic voice processing techniques is especially appropriate. If successful, the complexity of analyzing voice characteristics and the time involved can be markedly reduced.

Financial Summary

A total of $460,000 was budgeted for this program in FY 1973. Of this amount $160,000 was allocated for in-house Aerospace effort and $300,000 for subcontracted effort. Of this latter amount, a subcontract for $241,442 was let on 25 June 1973 with Rockwell International for research and development of a Semi-Automatic Speaker Identification System. The balance of the subcontract budget allocation is scheduled for use in FY 1974 to supplement the analysis program which is part of the subcontract.

The Aerospace effort included a review and assessment of the current state of the art, the planning of a program for investigating Voiceprint analysis techniques and establishing examiner error rates, an investigation of Voiceprint hardware and methodology, preparation of contractual documents, and subcontractor management. Due to a reduction in the originally planned in-house effort, the Aerospace budget was underrun by approximately $48,000.

E. HIJACKED TRUCK LOCATOR

This project was initiated during the past year because hijacking of commercial cargo trucks has become a national problem. It was determined that means are needed for alerting authorities when a truck is stolen and for indicating its location so that appropriate action can be taken. The objective of this program was to develop a system capable of performing this function in an economically feasible design.

Since a significant portion of both finished and partially finished commercial goods are transported or delivered by truck, theft, pilferage, and hijacking of commercial truck cargo has reached alarming proportions. Benjamin O. Davis, Assistant Secretary of Transportation for Safety and Consumer Affairs, stated in November 1972 that cargo thefts and truck hijacking have become a national concern and account for $1 to $2 billion of the nation's $16 billion annual crime cost.

Although the preponderance of truck hijacking is in urban areas, the event occurs and the cargo is frequently disposed of before the crime is even reported to the authorities. A system is required to detect that a hijacking is under way, to provide a method of identifying and locating the specific truck, and to provide a technique for notifying the proper police agency. Such a system should require no action by the driver to rapidly detect the occurrence of a hijacking. These systems also need to provide real time information on the location of the hijacked truck so that immediate action can be taken.

A number of vehicle locator systems have been under study by various government agencies and private companies. Most of these systems, however, use very expensive equipment and/or require the use of a large segment of the radio spectrum (which is already limited in urban areas). Moreover, not one of these systems can be adjudged superior for all applications.

In response to Institute direction, an in-house program was initiated by the Development Group to assess the feasibility of devising a readily usable, low-cost truck locating system. The specific locator concepts to be considered were to be such that an individual trucking firm could assemble an antihijacking system to meet its specific needs by choosing from various options of detection devices, location devices, vehicle disablers and truck identification means.

A preliminary analysis of system requirements and constraints resulted in the selection of automatic direction finding and dead-reckoning (using a simple odometer) as two alternate concepts for assessment. Both concepts are schematically illustrated in Figure 4. Their choice reflects the desire to concentrate on systems which satisfy the functional requirements of an antihijack locator and yet would be economically acceptable for any size trucking company. This preliminary analysis effort also developed data on the equipment characteristics and capabilities needed for the hijack detection and vehicle disabling functions.

A short feasibility test program was undertaken to evaluate the use of an Automatic Direction Finder (ADF) tuned to commercial AM broadcast stations to locate a hijacked truck in an urban environment. The measurements taken with the ADF in a test truck indicated less than acceptable accuracy. The level of error correlated with the complexity of the environment and indicated that buildings, power lines, and other potential reradiators strongly influence the electromagnetic field, even at wavelengths as long as 500 meters. On the basis of these tests, the use of a vehicle-installed ADF as a means of locating a hijacked truck is not recommended. A report summarizing this effort has been published (Appendix B, item 13).

Similarly, a short feasibility program was also undertaken of the dead-reckoning odometer system. The system is very simple and employs a calibrated odometer and knowledge of a preplanned route. No direct driver interaction would be required and all operations are autonomous in

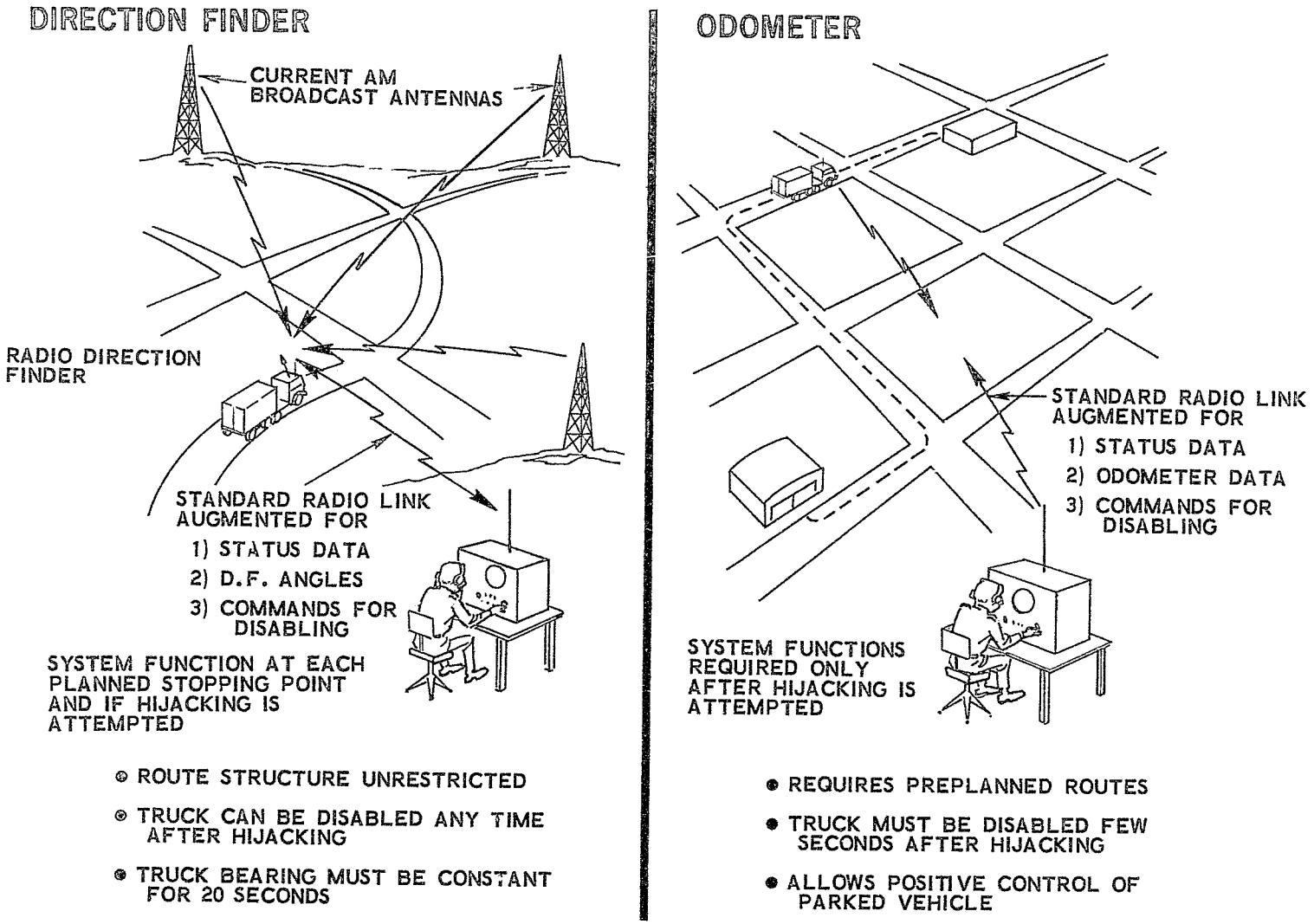


Figure 4. Alternate Truck Locator Concepts

event of a hijacking. The dispatcher and truck installation equipment requirements are simple and economical. A breadboard feasibility system was installed in a test truck and evaluated. The system performance results were encouraging. It was concluded that a relatively simple system which blends with the normal delivery truck mode of operation is feasible. Use of an already existing two-way communication link between the truck fleet and the dispatcher is involved and a truck disabling feature can also be accommodated. A report summarizing this effort has also been published (Appendix B, item 12).

The key items delivered during FY 1973 under this program include:

1. Task Report - "Feasibility Demonstration of a Truck Anti-Hijacking System", Aerospace Report No. TOR-0073(3658-02)-1, dated June 1973.

2. Task Report - "Evaluation of an Automatic Direction Finder for Hijacked Truck Location," Aerospace Report No. TOR-0073(3658-02)-2, dated June 1973.

Recommendations

In developing protection systems for truck cargos, the needs and requirements of diverse agencies and organizations must be reconciled. Among the groups are the trucking firms, the cargo insurers and the police departments. Funded programs should be aimed toward the most critical threat areas and should result in formulation of protection systems and strategies which will safeguard both cargo and drivers. For example, the theft of unguarded trailers constitutes a greater total loss to shippers than does armed seizures of trucks. Systems and devices to detect theft of and intrusion into such vehicles and to prevent or limit unauthorized movement of cargo trailers should also be considered.

It is specifically recommended that a follow-on effort for prototype development of the odometer truck locator concept be considered for FY 1974.

Financial Summary

A total budget of $118,600 was allocated for this program. The entire effort was in-house and included system analysis, exploratory concept design, and assembly and test of breadboard feasibility hardware. An underrun of $11,600 occurred.

F. AERIAL VEHICLE STUDY

The utility of airborne policing has been effectively demonstrated and is now generally accepted as a useful tool for law enforcement. The uses for which aerial vehicles are employed are varied and include patrol, surveillance, search and rescue, traffic control, and command posts. One of the most dramatic impacts of the aerial vehicle on law enforcement is the shortened response time possible.

Although the helicopter is the most frequently utilized airborne vehicle, conventional and STOL aircraft are also employed. In general, this equipment is the standard commercially available models, sometimes modified only slightly for the law enforcement mission. Similarly, the equipment carried aboard the vehicle has not usually been specifically designed for the mission and is often only slightly modified off-the-shelf hardware.

With the emergence of the aerial vehicle as a widely used police tool, law enforcement agencies were introduced to a higher level of procurement and operating costs than associated with the equipment and procedures previously used for the same functions. Since the helicopter represents the backbone of the law enforcement aerial fleet, its costs represent the major contributor to the high cost of aerial policing. Some of the more experienced police agencies are reviewing their needs and re-examining their exclusive use of helicopters.

At the direction of the Institute, an in-house effort was undertaken by the Development Group to assess available airborne vehicle technology

and utility and to determine if lower cost procedures and equipment (as compared to helicopters) might be employed. A methodology was devised for analyzing the comparative performance and cost of fixed wing, lighter-than-air, and rotary wing (helicopter and others) aircraft. Specially designed or modified aircraft and support equipment were also considered. A report summarizing the results of this study was assembled and published (Appendix B, items 14 and 15). The information contained in this report is useful for acquainting police agencies with many of the practicalities of aircraft evaluation and procurement and at the same time to introduce aircraft manufacturers to the special requirements of police agencies.

The key item delivered during FY 1973 on this program is the above-referenced report. It consists of the following volumes:

1. The Final Report is Aerospace Report No. TOR-0073(3657-01)-1, Equipment Systems Improvement Program - Development, Evaluation of Aerial Vehicles for Law Enforcement Applications, J. B. Nichols, June 1973.

2. A condensation of the Final Report is contained in Aerospace Report No. TOR-0073(3657-01)-2, Equipment Systems Improvement Program - Development, Evaluation of Aerial Vehicles for Law Enforcement Application, J. B. Nichols, June 1973 (Executive Summary).

The following specific areas are covered by item 1:

- Parametric performance determination of all aircraft types with primary emphasis on power requirements to accomplish the police missions.

- Statistical cost analyses to determine costs of various types and classes of aircraft.

- Statistical weight analyses employed to attain empty weight/useful load ratios according to aircraft type and missions and to provide a link between the performance and cost aspects.

- Typical operational cost data reflecting both the aircraft type and its operational situations.

- Operational aspects including considerations not as numerically definable as are performance and cost aspects.

Recommendations

The choice of aerial vehicles for law enforcement applications should be made on the basis of careful, deliberate field evaluation programs established under a consistent set of pertinent, well-defined measures of effectiveness which include performance as well as costs. Representative candidates of all aircraft types should be evaluated.

The Law Enforcement Assistance Administration should consider establishing a centralized aviation bureau, the purpose of which would be to collect, organize, and analyze data obtained from all the law enforcement agencies employing aircraft. The goal of this operation would be to establish accurate statistical records regarding costs of aerial operations and to provide a centralized clearing house of information regarding aircraft and equipment recommendations, deficiencies, corrective actions and optimum usage techniques.

There would appear to be a reasonable basis for the Law Enforcement Assistance Administration to consider approaching the Federal Aviation Agency for a special dispensation to fly fixed-wing aircraft at lower altitudes. This would be based on the special design of such aircraft which could provide multi-engine reliability or the alternative capability of gliding long distances to landing areas outside of congested areas.

Preliminary design studies of specialized police aerial vehicles should also be encouraged.

Financial Summary

A total budget of $60,000 for an in-house study effort was allocated to this program. The entire activity was devoted to an analysis of the performance and cost of competing aircraft types and related support equipment

to be used in airborne policing. The program was underrun by approximately $3,000.

G. BODY MOUNTED ANTENNA

It is desirable that the antenna for a police officer's personal radio be unobtrusive, noninterfering with the officer's motions, rugged, convenient to use, unattainable by grabbing to an assailant, and yet be an efficient radiator. All of the foregoing physical requirements indicate a need for a very small, compact antenna.

It was the purpose of this project to assess the technology applicable to body mounted antennas and to determine the feasibility of constructing an improved design for portable transceivers. Initial emphasis was directed towards a survey of antenna radiator technology applicable to police personal radios. Later emphasis was directed towards determining the feasibility of improved devices by constructing and testing a number of antennas. The entire program was of an exploratory nature and was carried on in-house by the Development Group.

All electrically small antennas are by nature narrow band and therefore a good deal of effort was expended in tradeoff experiments between antenna physical size, resulting bandwidth, and radiation efficiency. Another problem investigated in detail related to shadowing and loading effects of the human body and studying means to overcome these problems. The technology assessment uncovered one antenna design which was most attractive, a multiturn loop. Laboratory investigation was, therefore, focused on building and testing models of this multiturn loop and optimizing the physical size - bandwidth performance.

The multiturn loop antenna consists of 3/8" wide copper coil wound on a styrofoam form in a multiturn loop. A capacitor completes the circuit from one end of this loop to a ground plane and a second capacitor completes the circuit from the other end of the loop to a coaxial cable. The multiturn

loop is supported a small distance above the ground plane and the entire circuit resembles a π network. One of the capacitors determines the operating frequency and the second capacitor determines the antenna impedance. For multichannel operation, one of these capacitors is made variable, or, alternatively, two or more capacitors can be switched into the circuit.

The optimum location for the multiturn loop antenna was found to be on a man's shoulder. The most successful antenna developed was for single channel operation in the 150 - 170 megahertz band. This antenna measures 2.9" x 2.9" x .9" high and weighs less than three ounces (see Figure 5). Laboratory measurements demonstrated that this new antenna typically provided a 3.8 db more gain compared to a shoulder-mounted 6.6" helical whip antenna now widely used by police officers.

It was concluded that body mounted antennas for single channel operation can be readily fabricated using the multiturn loop design, and techniques for doing this are described in detail in a report prepared under this program (Appendix B, item 16).

The principal disadvantage of the new multiturn loop antenna, compared to the existing 6.6" helical whip antenna, is limited bandwidth. The loop antenna has a bandwidth of approximately 1.4 megahertz while the whip antenna has a bandwidth of about 11 megahertz. Effort was, therefore, made to devise means to broaden the bandwidth. One successful technique was to add switchable tuning capacitors and a broad-band multichannel antenna was successfully constructed using this method.

The key items provided during FY 1973 under this program include:

1. Technology Assessment Phase Results (Semi-Annual Review Briefing), dated 14 Feburary 1973.

2. "Assessment of Technology Applicable to Body Mounted Antennas", Aerospace Report No. TOR-0073(3653-01)-1, dated March 1973.

3. "Investigation of Body Mounted Antennas for Law Enforcement Application," Aerospace Report No. TOR-0073(3653-01)-2, dated June 1973.

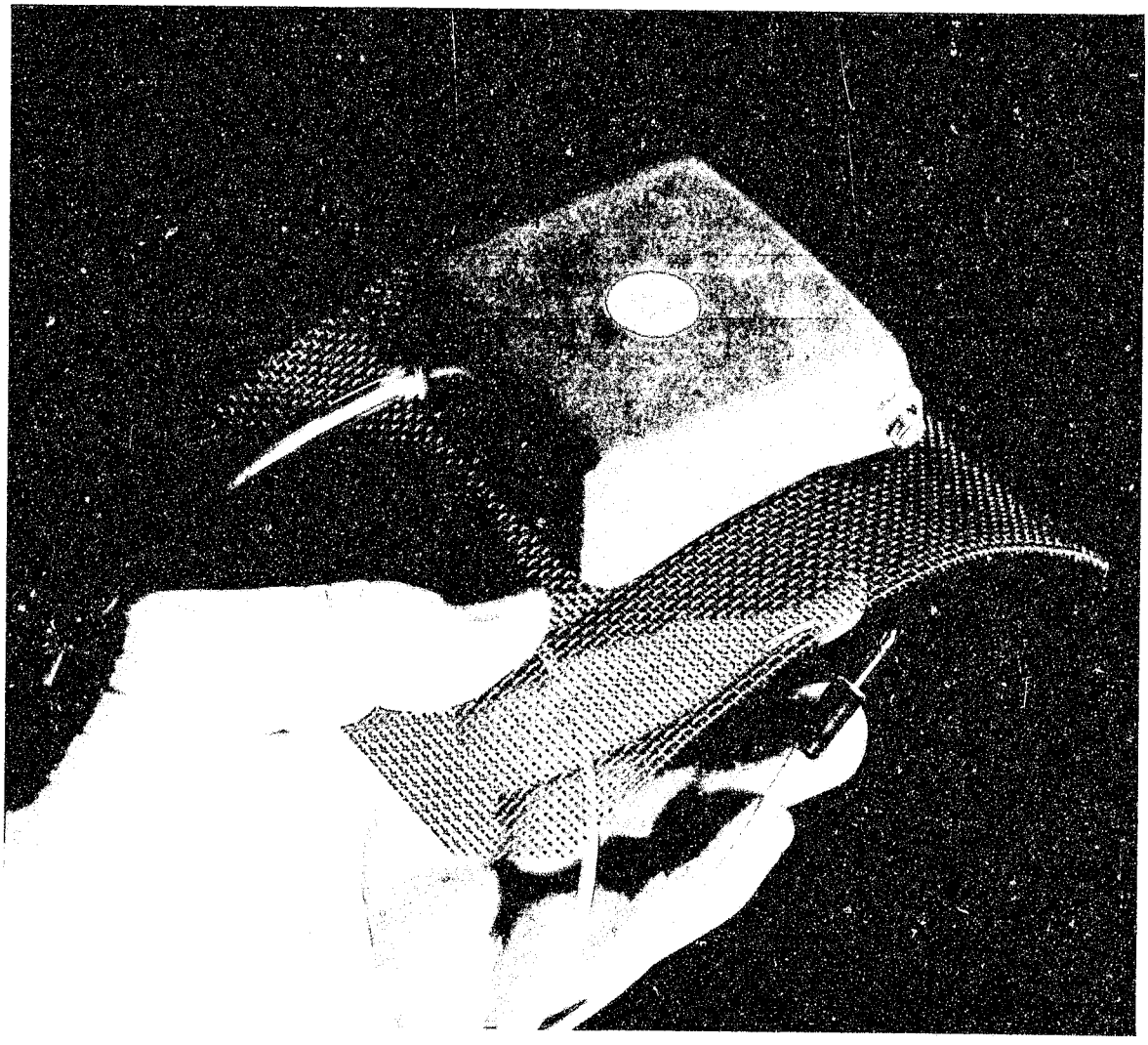


Figure 5. Compact Multiloop Antenna Assembly for Shoulder-Mounted Applications

Recommendations

There is a tendency among police to convert to multichannel operation in both VHF and UHF bands. In multichannel service the user has the option of switching to one of several channels operating at widely separated frequencies. One therefore needs an antenna capable of operating over a broad frequency range. The presently developed loop antenna is not capable of operating over a broad band unless switchable tuning elements are employed. This is one of the main disadvantages of the multiturn loop antenna. A preliminary examination of cost factors relating to the multiturn loop antenna also indicates that the cost of this antenna is substantially greater than the cost of existing simple whip antennas. In view of these two disadvantages, The Aerospace Corporation recommends that this project be concluded at this time and that a re-examination of the operational requirements be made to determine, if, in fact, a need exists for body mounted antennas with multichannel capabilities.

In addition, more should be known about the actual needs of a field user. For example, will the transceiver also be body mounted or is it generally hand held? Could the transceiver be mounted within the antenna envelope? Could the antenna and transceiver be mounted inside a helmet?

Financial Summary

A total of $45,000 was budgeted for this program. The entire program effort was done in-house at Aerospace and was primarily devoted to investigating the utility and radiation characteristics of multiturn loop antennas. The budget was underrun by $4,119.

H. REMOTE VEHICLE DISABLING

At Institute direction, an in-house Remote Vehicle Disabling program was initiated by the Development Group on 1 September 1972. The objective of the program was to investigate the feasibility of vehicle disabling systems to permit a police vehicle to slow or stop a pursued vehicle. The project was completed during the year and a final report submitted to the Institute (Appendix B, item 7).

The project was intended as a possible approach to decreasing the loss of life and property damage that results from high-speed chases by police vehicles. It has been estimated, in a Department of Transportation Report,[1] that approximately 7000 pursuit-related crashes occur each year in which 350 people are killed and 3750 received some type of injury. Another Department of Transportation report[2] provides estimates of the total costs of these accidents (property damage, and payment for personal injury and death) as approximately $200 million per year. It was the purpose of this project to analyze the feasibility of remote vehicle disabling systems to reduce these losses.

With Institute approval, an announcement was placed in the Commerce Business Daily on 5 December 1972 seeking industry research and development sources for the design, fabrication, and demonstration of an experimental model of an automobile disabling system. It was emphasized that this was not a Request for Proposal nor were proprietary items to be submitted.

During the initial phase of the in-house effort, many approaches to vehicle disabling including those suggested by industry in response to the 5 December 1972 announcement, were reviewed, summarized and technically assessed for their vulnerability to deactivation. The compatibility of various proposed systems were analyzed with respect to system requirements

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[1] "A Study of Hot Pursuit by Police" E. F. Fennessy, Department of Transportation, July 1970.

[2] "Society Costs of Motor Vehicle Accidents", Department of Transportation April 1972.

and economic considerations. A primary compatibility issue was that the disabling system should not jeopardize the safety of operation or cause damage to law-abiding vehicles, nor unduly inconvenience their drivers. This requirement dictated that the system be selective such that only the pursued vehicle would be adversely affected when the disabling system is activated.

Originally, it was assumed that the selectivity requirement would have to be satisfied by the communication link. Two basic communication concepts were considered. One concept was a highly directional and highly attenuated signal from the police patrol vehicle which would activate only the pursued vehicle. The other concept used a coded signal that would activate only the vehicle(s) with that particular code. There are technical and economic problems associated with both of these approaches. In the highly directional signal concept, the beam would have to be carefully aimed and might be required to be steerable, making it difficult to operate in a one-man police patrol vehicle. The coded signal system concept required a transceiver for each vehicle to provide the vehicle identity code. This more complex equipment would significantly increase the system cost.

Whatever the means of communication, some specific disabling technique must be activated on the fleeing car. The following five vehicle subsystems were studied as possible candidates for disabling in order to slow or stop the vehicle.

The ignition subsystem was considered the most compatible component to modify for use with the disabling system. Most private vehicles are ignition operated and not Diesel. The ignition system components are generally located in an accessible area where installation, inspection , and maintenance are facilitated.

The fuel subsystem was considered the second best candidate for disabling and any number of methods can be employed with passenger cars to shut off the fuel flow at either the carburetor or in the fuel line. Also, the fuel subsystem is the best candidate for disabling Diesel-dominated truck fleets.

Disengagement of the transmission system could be employed to cause the vehicle to stop. While this could be effected by a valve arrangement in an automatic transmission, its accomplishment on manual transmissions could be difficult and costly.

An override control of the brake system might be possible, but it is difficult to conceive of a simple and reliable design that could stop the vehicle in a predictable and controlled manner.

A valve or plug could be used to cause blockage in the exhaust system and might be an effective way to slow down and stop a vehicle. The environment in which it would have to operate, however, is quite severe and a device in this system could compromise vehicle reliability.

The economic feasibility of vehicle disabling systems was also assessed. This factor was of particular concern because of the enormous cost to fully implement any system that involves approximately 100 million vehicles. If disabling systems were installed nationwide and utilized on every high-speed chase to prevent an accident, then approximately $200 million could be saved, based on Department of Transportation estimated yearly dollar losses. This equates to $20 per vehicle. A figure considerably below even the lowest estimated cost for an installed disabling system. Thus, disabling systems are difficult to economically justify.

In April 1973, the final report summarizing the results of this system feasibility analysis was completed. It was concluded that while vehicle disabling systems are technically feasible, they are economically difficult to justify. In addition there are important legal consequences to consider before initiating any major developments. If a system was to be developed, the preferred system would probably operate on the ignition system because of its relative simplicity, ease of handling, and low projected costs.

The results of this study and feasibility analysis are described in the report: Feasibility Study, Remote Vehicle Disabling System, Aerospace Report No. TOR-0073(3658-01)-1, dated 9 April 1973.

Recommendations

As a result of the analysis effort, it was recommended that no further development be undertaken until the economic feasibility of the wide application of vehicle disabling systems is better established. The question of economic feasibility is dependent upon a better definition of the total benefit which such a system could provide. These include benefits from the reduction in deaths and injuries caused by high-speed pursuits and similar benefits from the reduction in accidents associated with other emergency vehicle operations. The cost to the public of this system could possibly be reduced if the sensors legally required for pollution control could also be utilized in the disabling systems.

Financial Summary

A total of $14,400 was allocated for The Aerospace Corporation in-house effort to support this project. The effort included a technology assessment and evaluation of techniques proposed by industry and other agencies to meet the program objectives. The program was completed on budget.

APPENDIX A

FY 1973 CORRESPONDENCE

APPENDIX A. FY 1973 CORRESPONDENCE

Letter No.	Subject	Date
1279-BLT-72-002	Transmittal of listing recording results of review of existing NILECJ grants and agreed upon action	26 July 72
1279-BLT-72-008	Review of Sylvania Report No. M-1442, Final Report on Contract J-LEAA-003-72 (Grant No. NI-71-061-C)	7 July 72
1279-BLT-72-010	Review of Baird-Atomic Film Safe II X-Ray Inspection System	11 July 72
1279-BLT-72-013	Review of Arizona State Planning Agency Lighter-Than-Air Vehicles for Police Surveillance and Patrol Proposal	13 July 72
1279-BLT-72-014	Review of Adglov Research Police Car/ Policemen Locator System Concept Paper	13 July 72
1279-BLT-72-015	Evaluation of Texas Instruments Proposal to Develop a Speaker Identification System	14 July 72
1279-BLT-72-016	Transmittal of Rough Copy of Annual Operating Plan	14 July 72
1279-BLT-72-017	Comments on MITRE Corp. Status Report for June 1972	20 July 72
1279-BLT-72-018	Monthly Progress Report for July 1972	21 July 72
1279-BLT-72-019	Reference - J. Stetson, Consultant to the Development Group	21 July 72
1279-BLT-72-020	Response to a letter from Pennsylvania Research Associates regarding a proposed feasibility study of image enhancement techniques for law enforcement applications	21 July 72
1279-BLT-72-021	Evaluation of Operability Associates description of an automatic voice identification device	21 July 72
1279-BLT-72-023	Transmittal of Dr. B. Sklar's Informal Trip Reports	24 July 72
1279-BLT-72-025	Response to MITRE Document on Role of the Field Groups	24 July 72

Letter No.	Subject	Date
1279-BLT-72-026	Review of Federal Screw Works Voice Synthesizer	27 July 72
1279-BLT-72-028	Return of Intermetrics Inc. Proposal for a Study of Advanced Computer Technology and Its Implications to Law Enforcement	27 July 72
1279-BLT-72-029	Transmittal of proposed response to Sonitrol Midwest, Inc. letter regarding Research and Development of a Wireless Audio Alarm System for Zoned Crime Analysis for Colleges and Universities	2 Aug. 72
1279-BLT-72-031	Review of EG&G, Inc. proposal to continue research on NI-71-065-PG-108 and report S-545-R on the preliminary study	4 Aug. 72
1279-BLT-72-033	Review of Cedar Rapids Alarm Project Second Year Reports	9 Aug. 72
1279-BLT-72-034	Reply to General Research Corp. in-depth briefing of Gyrocopter Tradeoff Studies	10 Aug. 72
1279-BLT-72-035	Review of Torrance Police Department proposal for the VARDA System	14 Aug. 72
1279-BLT-72-036	Review of Public Urban Locator System Study (NI-70-003)	17 Aug. 72
1279-BLT-72-037	Review of Rensselaer Polytechnic Institute Report, "Voice Recognition Using Color Encoded Voice Prints" (NI-70-065-PG-9)	17 Aug. 72
1279-BLT-72-038	Monthly Progress Report for August 1972	25 Aug. 72
1279-BLT-72-045	Review of proposals from LWL and NRL and new NILECJ standard from NBS on body protection from handguns	7 Sept. 72
1279-BLT-72-046	Transmittal of Task Plans	8 Sept. 72
1279-BLT-72-049	Review of concept papers describing various techniques for anti-crime applications from Mankind Research Unlimited	18 Sept. 72
1279-BLT-72-051	Development Program Ideas	20 Sept. 72
1279-BLT-72-052	Transmittal of Technical Reviews on Grants NI-71-003 and NI-70-065-PG-9	21 Sept. 72

Letter No.	Subject	Date
1279-BLT-72-053	Review of ITT Proposal for Gunfire Detection Systems	21 Sept. 72
1279-BLT-72-055	Preliminary Evaluation of Wackenhut Corp. Bloodhound Surveillance System	22 Sept. 72
1279-BLT-72-056	Transmittal of NBS Transceiver Discussion Meeting Notes	22 Sept. 72
1279-BLT-72-057	Review of STOL Project Evaluation Analysis Report by Dade County Public Safety Department Planning and Research Bureau	22 Sept. 72
1279-BLT-72-058	Evaluation of IITRI Lead Detection Draft Report (NI-71-040)	27 Sept. 72
1279-BLT-72-059	Evaluation of Battelle Report on Detection of Hidden Organic Materials	28 Sept. 72
1279-BLT-72-060	Monthly Progress Report for September 1972	28 Sept. 72
1279-BLT-72-064	Review of H. S. Hayre, University of Houston, concept paper on Correlative Voice Speaker Identification	29 Sept. 72
1279-BLT-72-067	Review of Sylvania Final Report on Evaluation of Small Business and Residential Alarm Systems Study (NI-71-061C)	2 Oct. 72
1279-BLT-72-068	Evaluation of Panametrics Explosives Detector Proposal	2 Oct. 72
1279-BLT-72-069	Review of CASTAR (Computerized Alarm System Transmitter and Receiver) Proposal submitted by J. Kutasovic	2 Oct. 72
(Number not assigned)	LWL Contract Implementation on Protective Garment for Public Officials	5 Oct. 72
1279-BLT-72-071	Monthly Progress Report Data	10 Oct. 72
1279-BLT-72-074	Monthly Progress Report for October 1972	20 Oct. 72
1279-BLT-72-076	Evaluation of Ohio University Material on Radio Navigation Methods	26 Oct. 72
1279-BLT-72-080	Minutes of Third Quarter Review	31 Oct. 72
1279-BLT-72-081	Evaluation of IITRI Lead Detection Final Report	31 Oct. 72

Letter No.	Subject	Date
1279-BLT-72-082	Retransmittal of Letter 1279-BLT-72-076 Data	1 Nov. 72
1279-BLT-72-083	Review of Weiser/Robodyne letter describing a developed item for law enforcement purposes	1 Nov. 72
1279-BLT-72-084	Transmittal of Directives	1 Nov. 72
1279-BLT-72-085	Transmittal of Revised Task Plans	2 Nov. 72
1279-BLT-72-087	Transmittal of draft Statement of Work for implementing contract with GTE Sylvania	3 Nov. 72
1279-BLT-72-088	Transmittal of Law Enforcement Development Personnel Vitae	6 Nov. 72
1279-BLT-72-089	Transmittal of Professor Ackerman Vitae	6 Nov. 72
1279-BLT-72-090	Program Initiation - Summary Report	7 Nov. 72
1279-BLT-72-091	Subcontract for Vehicle Disabling System	7 Nov. 72
1279-BLT-72-092	Submittal of Task Plan A-73-GMP-01 and Summary Report	7 Nov. 72
1279-BLT-72-094	Transmittal of Directives 004 through 022	9 Nov. 72
1279-BLT-72-095	Minutes of November 8 and 9 Meeting with George Shollenberger	10 Nov. 72
1279-BLT-72-096	Meeting with Dr. El Bisi, Research and Development Directorate, U. S. Army Materiel Command	13 Nov. 72
1279-BLT-72-097	Recommended Speaker Identification Program	14 Nov. 72
1279-BLT-72-098	Evaluation of Vehicle Research Corp. Proposal for a Demonstration Program of Low Speed/Low Cost Air Surveillance Police Patrol Aircraft	14 Nov. 72
1279-BLT-72-099	Review of Xetron Corp. Trafalert Proposal	14 Nov. 72
1279-BLT-72-100	Field Evaluation Test of LEAA Transceivers	14 Nov. 72
1279-BLT-72-101	Transmittal of W. J. Cadman Resume	14 Nov. 72

Letter No.	Subject	Date
1279-BLT-72-102	Technical Interchange Meeting, Aerospace and NBS	15 Nov. 72
1279-BLT-72-103	Commerce Business Daily Advertising	15 Nov. 72
1279-BLT-72-104	Review of IIT Research Institute Proposal 72-10GX, Optimization of Glass-Ceramic Armor	15 Nov. 72
1279-BLT-72-105	Review of Hollis Body Armor Concepts	15 Nov. 72
1279-BLT-72-107	Interim Activity on Speaker Recognition	15 Nov. 72
1279-BLT-72-108	Submittal of Proposed Task Plans	17 Nov. 72
1279-BLT-72-109	Comments on MITRE October Progress Report	17 Nov. 72
1279-BLT-72-110	Meeting with Bruce Givens - USN Intelligence	20 Nov. 72
1279-BLT-72-111	Review of DCM Concept of Audio Monitoring of Commercial Facilities	20 Nov. 72
1279-BLT-72-112	Reports on Meetings with FAA, DOT, HUD and SPC	20 Nov. 72
1279-BLT-72-113	Second review of concepts/ideas describing various techniques for anti-crime applications from Mankind Research Unlimited	21 Nov. 72
1279-BLT-72-114	Monthly Progress Report for November 1972	22 Nov. 72
1279-BLT-72-115	Program Listings - Transmittal of Meeting Notes to NBS and MITRE	22 Nov. 72
1279-BLT-72-118	Visit to Public Systems Inc. in Sunnyvale California	27 Nov. 72
1279-BLT-72-120	Return of Hollis Material on Body Armor Concepts	4 Dec. 72
1279-BLT-72-121	Minutes - Livermore Meeting on Explosives Tagging	4 Dec. 72
1279-BLT-72-122	Subcontract for Speaker Identification - Commerce Business Daily Announcement	5 Dec. 72
(Number not assigned)	Minimum Standards in Helicopter Procurement	5 Dec. 72

Letter No.	Subject	Date
1279-BLT-72-124	Participation in Texas A&M Automatic Vehicle Monitoring Conference	7 Dec. 72
1279-BLT-72-126	Transmittal of Vehicle Disabling System CBD Announcement	7 Dec. 72
1279-BLT-72-127	Transmittal of Rough Draft Material for Experimental Technology Incentives Program Report	7 Dec. 72
1279-BLT-72-131	Minutes of Attendance at MITRE Semi-Annual Review	11 Dec. 72
1279-BLT-72-132	Transmittal of Directives 72-23, 24 and 25	12 Dec. 72
1279-BLT-72-133	Minutes of Meetings with LEAA during week of 27 November 72	12 Dec. 72
1279-BLT-72-134	Transmittal of Minutes of various meetings attended by Development Group personnel	12 Dec. 72
1279-RPK-72-013	Evaluation of Gulf Energy and Environmental Systems Proposal on Dynamite Labeling and Identification (GRTP22-491)	18 Dec. 72
1279-BLT-72-135	Evaluation of Michigan State Police Final Report for NI-71-078-G (Voice Identification Research)	18 Dec. 72
1279-BLT-72-136	Evaluation of TRACOR Fingerprint Proposal	18 Dec. 72
1279-BLT-72-137	Minutes of meeting at National Institute on 12 December 1972	20 Dec. 72
1279-BLT-72-138	Minutes of meeting at Burlingame, Calif. on 12 December 1972	20 Dec. 72
1279-BLT-72-139	Request for Approval of GTE Sylvania Subcontract	20 Dec. 72
1279-BLT-72-140	Transmittal of Directives 72-26, 28 and 29	20 Dec. 72
1279-BLT-72-143	Review of Lovell Alarm System	21 Dec. 72
1279-BLT-72-144	Review of High Frequency Nonlethal Weapon Experiments of Dr. Heidenwolf	21 Dec. 72
1279-BLT-72-145	Transmittal of Task Plans (Duplicates)	22 Dec. 72
1279-BLT-72-147	Minutes of Meeting held with AT&T, New York City, to discuss Expanded 911 Project	22 Dec. 72

Letter No.	Subject	Date
1279-BLT-72-148	Monthly Progress Report for December 1972	26 Dec. 72
1279-JOE-72-001	Transmittal of Directives 27, 27A, 30, 31 and 32	29 Dec. 72
1279-JOE-73-002	Status of Transceiver Grant Programs	2 Jan. 73
1279-JOE-73-003	Discussions on Weapons Detection with a Number of Government Agencies	3 Jan. 73
1279-JOE-73-500	Source Qualification - Speech Identification Commerce Business Daily Announcement	8 Jan. 73
1279-JOE-73-004	Review of Mr. Philip Cheilik's paper on AVM Systems for Law Enforcement	10 Jan. 73
1279-JOE-73-007	CBD Announcement Responses to Remote Vehicle Disabling System	22 Jan. 73
1279-JOE-73-501	Review of Sylvania Electric Company VHF/ UHF Transceiver Qualification Test Reports	25 Jan. 73
1279-JOE-73-502	Speaker Identification System CBD Announcement Transmittal	26 Jan. 73
1279-JOE-73-008	Minutes of Projects Reviewed on Protective Garment for Public Officials at Edgewood Arsenal on 18 January 1973	30 Jan. 73
1279-JOE-73-009	Review of Concept from Lowell Technological Institute for Detection of Firearm Discharge Residues by X-Ray Excitation	30 Jan. 73
1279-JOE-73-010	Aerospace Discussions with Dr. Hy Lyon of the Office of Science and Technology	30 Jan. 73
1279-JOE-73-505	Transmittal of Citizens Alarm System CBD Announcement	30 Jan. 73
1279-JOE-73-012	Citizens Alarm System Requirements Definition	1 Feb. 73
1279-JOE-73-507	Development Group Semi-Annual Review Invitation	1 Feb. 73
1279-JOE-73-508	Transmittal of Task Plans	5 Feb. 73
1279-JOE-73-014	Citizens Alarm Concept Definition Study	7 Feb. 73

Letter No.	Subject	Date
1279-JOE-73-509	Transmittal of FY '74 Annual Operating Plan (Preliminary Version)	13 Feb. 73
1279-JOE-73-015	Evaluation of Weiser/Robodyne Camera Equipment	21 Feb. 73
1279-JOE-73-016	Evaluation of Lowell Technological Institute Concept for Detection of Firearm Discharge Residues	22 Feb. 73
1279-JOE-73-017	Review of Explosive Detection Techniques	28 Feb. 73
1279-JOE-73-018	Evaluation of AEC Proposals for Explosive Tagging	28 Feb. 73
1279-JOE-73-020	Schedule of Planning Activities	2 Mar. 73
1279-JOE-73-021	Review of Texas A&M University Pre-proposal for Contributing to Speaker Identification by Machine Techniques	2 Mar. 73
1279-JOE-73-022	Bidder's List for Remote Vehicle Disabling System Capabilities Demonstration	2 Mar. 73
1279-JOE-73-510	Transmittal of February 1973 Progress Report for the Development Group	6 Mar. 73
1279-JOE-73-511	Evaluation of Heart Beat Alarm System Concept submitted by Mr. Tibor Gorog and Mr. Frank David to President Nixon	6 Mar. 73
1279-JOE-73-512	Evaluation of results of Phase I of Institute Grant NI-71-026-C1	7 Mar. 73
1279-JOE-73-026	Review of NBS Report LESP-RPT-0301.00 dated Nov. 72 - Image Quality Criteria for Night Vision Devices	8 Mar. 73
1279-BLT-73-166	Transmittal of Semi-Annual Review Report	8 Mar. 73
1279-JOE-73-027	Evaluation of JPL Proposal No. 50-10 on Thermoluminescence (TL)	9 Mar. 73
1279-JOE-73-515	Topics for Standardization	12 Mar. 73
1279-JOE-73-521	MITRE Problem Definition Study for Citizens Alarm System	19 Mar. 73
1279-JOE-73-522	Clarification of NBS and Aerospace Responsibilities	16 Mar. 73

Letter No.	Subject	Date
1279-JOE-73-028	CBD Announcement Response - Evaluation for Citizens Alarm System	22 Mar. 73
1279-JOE-73-524	Citizens Alarm System - CBD Announcement	26 Mar. 73
1279-JOE-73-525	Transmittal of Development Group Progress Report for March 1973	27 Mar. 73
1279-JOE-73-526	Semi-Automatic Speaker Identification - CBD Announcement	27 Mar. 73
1279-JOE-73-529	Transmittal of Briefing Charts for Mr. Bratt's Briefing to the Administration	29 Mar. 73
1279-JOE-73-532	Review and Recommendations for Transceiver Grant Program	30 Mar. 73
1279-JOE-73-533	Transmittal of Development Group Report - Candidate Projects for Fiscal Year '74 - Number TOR-0073(3640)-3, dated 30 Mar. 73	30 Mar. 73
1279-JOE-73-536	Evaluation of Advanced Vehicle Engineers' Aircar	3 Apr. 73
1279-JOE-73-539	Participation of Aerospace in Defense Lab Meeting - 16 May 1973	5 Apr. 73
1279-JOE-73-030	Review of article "Product Manufacturers are Helping on Drug Overload" which appeared in November 1972 issue of Justice Magazine	9 Apr. 73
1279-JOE-73-031	Review of Speaker Identification Paper submitted by Professor J. M. Pickett	10 Apr. 73
1279-JOE-73-036	Body Mounted Antenna Report Date Sources	25 Apr. 73
1279-JOE-73-540	Transmittal of Development Group Progress Report for April 1973	25 Apr. 73
1279-JOE-73-037	Evaluation of Aero Resources, Inc. Gyrocopter	30 Apr. 73
1279-HWN-73-007	Transmittal of Preliminary Rough Draft Document "Evaluation of Aerial Vehicles for Law Enforcement Applications"	2 May 73
1279-JOE-73-543	Transmittal of Development Group Travel Quarterly Report	2 May 73

Letter No.	Subject	Date
1279-JOE-73-039	Listing of Aerospace Reports	14 May 73
1279-JOE-73-040	Transmittal of Directives 15A, 19, 21, 23, 24 and 26	14 May 73
1279-JOE-73-041	Lightweight Body Armor Planning Meetings among the Institute, NBS, MITRE and Aerospace during week of 23 April 1973	15 May 73
1279-JOE-73-544	Transmittal of Development Group Progress Report for May 1973	18 May 73
1279-JOE-73-042	Evaluation of Small Turbine Aircraft Engine used in the Marine Corps Flying Platform Program	23 May 73
1279-JOE-73-042	Transmittal of Concept Development Plan for a Voiceprint Validation Test	10 May 73
1279-JOE-73-043	Comparison of LEAA Transceiver Specifications with Commercially Available Transceivers for the Period 1968-1973	22 May 73
1279-JOE-73-545	Transmittal of Development Group Annual Operating Plan	23 May 73
1279-JOE-73-545	Publication of Development Group Project Plans for FY '73	23 May 73
1279-JOE-73-044	Truck Antihijacking System - Vehicle Location Techniques	29 May 73
1279-JOE-73-045	Evaluation of MIT Report ESL-R-493, Investigation of Digital Mobile Radio Communications for Law Enforcement (Grant NI-71-129)	25 May 73
1279-JOE-73-546	Actions taken on Citizens Alarm System and Semi-Automatic Speaker Identification System Statements of Work	6 June 73
1279-JOE-73-547	Proposed answer to Federal Communications Commission on Radio Frequency Allocation	25 May 73
1279-JOE-73-047	Security Alarm System Projects - CBD Announcement	7 June 73
1279-JOE-73-049	Transmittal of Directive 72-027	7 June 73
1279-JOE-73-050	Evaluation of Franklin Institute Proposal No. 12808G, "Enhancement of Photographic Evidence Collected During Bank Robberies"	7 June 73

Letter No.	Subject	Date
1279-JOE-73-052	Evaluation of Mass Spectrometric Concept to Identify Explosives submitted by Stanford Research Institute	8 June 73
1279-JOE-73-053	Evaluation of Chemiluminescence Concept from Stanford Research Institute for Detection of Explosives	12 June 73
1279-JOE-73-054	Evaluation of Personal Very High Frequency/ Ultra High Frequency Transceiver (Grant No. NI-70-034)	12 June 73
1279-JOE-73-055	Review of Security Planning Corporation Draft Final Report on Residential Security (Grant No. NI-71-026-02)	12 June 73
1279-JOE-73-056	Comments from Threshold Technology Inc. on Aerospace Semi-Automatic Speaker Identification Request for Proposal	13 June 73
1279-JOE-73-057	Review of Dr. Gordus Research Proposal Applying Neutron Activation Analysis to Hair Individualization	13 June 73
1279-JOE-73-058	Evaluation of Texas A&M preproposal titled, "Machine-Aided Speaker Identification Research"	13 June 73
1279-JOE-73-548	Subcontract Package for Semi-Automatic Speaker Identification System	15 June 73
1279-JOE-73-549	Transmittal of Directives 73-032, 033 and 035	18 June 73
1279-JOE-73-550	Transmittal of Development Group Monthly Progress Report for June 1973	18 June 73
1279-JOE-73-551	Review of Stanford Research Institute Acoustic Camera Reprints of Selected Items, No. 15, 1973	18 June 73
1279-JOE-73-552	Transmittal of Statement of Work - LWL Support During FY '74	19 June 73
1279-JOE-73-553	Projected Overrun of Special Technical Support Task	20 June 73
1279-JOE-73-554	LEAA Directive Schedules	20 June 73
1279-JOE-73-555	911 Support in Alameda County	20 June 73

Letter No.	Subject	Date
1279-JOE-73-558	Subcontract Package for Citizens Alarm System	21 ne 73
1279-JOE-73-059	Close-Out Report - Citizens Alarm System Concept Definition Phase	22 June 73
1279-JOE-73-061	eview of Meigs Laboratories Concept/ Equipment Descriptions - Portable Signal Cancelling Receiver, Signal Cancelling Adaptor, and Signal Cancellation Demonstration in Washington, D. C.	21 June 73
1279-JOE-73-063	Task Close-Out Report/Notice - Speaker Identification Task A73-CRM-04	21 June 73
1279-JOE-73-064	Specification for the Body Mounted Antenna	27 June 73

APPENDIX B

MAJOR DOCUMENTS PREPARED BY THE DEVELOPMENT GROUP IN FY 1973

APPENDIX B. MAJOR DOCUMENTS PREPARED BY THE DEVELOPMENT GROUP IN FY 1973

1. FY 1973 Annual Operating Plan, Aerospace Report No. TOR-0073 (3640)-1, dated 10 August 1972.

2. Concept Definition Phase - Citizens Alarm System, dated 29 January 1973.

3. Initial FY 1974 Annual Operating Plan, Aerospace Report No. TOR-0073(3640)-2, dated 31 January 1973.

4. Statement of Work - Feasibility Demonstration of Citizens Alarm System, dated 2 March 1973.

5. Candidate Equipment Projects, FY 1974, Aerospace Report No. TOR-0073(3640)-3, dated 30 March 1973.

6. Assessment of Technology Applicable to Body-Mounted Antennas, Aerospace Report No. TOR-0073(3653-01)-1, dated March 1973.

7. Feasibility Study - Remote Vehicle Disabling Systems, Aerospace Report No. TOR-0073(3658-01)-1, dated 9 April 1973.

8. LEAA-Aerospace Subcontracting Plan, dated 14 May 1973.

9. Final FY 1974 Annual Operating Plan, Aerospace Report No. TOR-0073(3640)-4, dated 30 June 1973.

10. Voiceprint Applications Manual, Aerospace Report No. TOR-0073 (3654-04)-1, dated June 1973.

11. System Analysis - Recording System for Illegal Telephone Calls, Aerospace Report No. TOR-0073(3654-04)-1, dated June 1973.

12. Feasibility Demonstration of a Truck Antihijacking System, Aerospace Report No. TOR-0073(3658-02)-1, dated June 1973.

13. Evaluation of an Automatic Direction Finder for Hijacked Truck Location, Aerospace Report No. TOR-0073(3658-02)-2, dated June 1973.

14. Evaluation of Aerial Vehicles for Law Enforcement Application, Executive Summary, Aerospace Report No. TOR-0073(3657-01)-2, dated June 1973.

15. Evaluation of Aerial Vehicles for Law Enforcement Application, Aerospace Report No. TOR-0073(3657-01)-1, dated June 1973.

16. Investigation of Body-Mounted Antennas for Law Enforcement Application, Aerospace Report No. TOR-0073(3653-01)-2, dated June 1973.

APPENDIX C

FY 1973 INSTITUTE DIRECTIVES TO THE DEVELOPMENT GROUP

APPENDIX C. FY 1973 INSTITUTE DIRECTIVES TO THE DEVELOPMENT GROUP

Number	Title	Issue Date Schedule Date	Status of Action
72-001	Reports to LEAA. LEAA directed attendance at general meetings, conferences, etc.	25 Oct. 72 N/A	Policy Directive. Continuously applicable.
72-002	Body Mounted Radio Antenna	25 Oct. 72 N/A	Task Plan A-73-COM-01 revised to include the "Transmission Line" which connects the antenna to radio. Reissued 2 Feb. 73.
72-003	Meeting Minutes	25 Oct. 72 N/A	Policy Directive. Continuously applicable.
72-004	Reporting	2 Nov. 72 N/A	Policy Directive. Continuously applicable.
72-005	Initial Planning for design, test and evaluation of 911	2 Nov. 72 30 Nov. 72	Requirement to prepare a Task Plan for Aerospace effort to design, fabricate, test and evaluate a 911/ALI system proposed by AT&T was postponed by LEAA until further notice.
72-006	Reallocation of funds	2 Nov. 72 15 Nov. 72	Task Plans A-73-CRM-01, 02 and 03 closed out 27 Oct. 72. Remaining funds reallocated into Task Plans A-73-LEG-02 and 03.
72-007	FY-73 Annual Operating Plan	2 Nov. 72 31 Jan. 73	FY 74 Annual Operating Plan delivered to G. Shollenberger on 13 Feb. 73, letter 1279-JOE-73-509.
72-008	Integration of LEDG Work with Other Federal Agencies	2 Nov. 72 N/A	Policy Directive. Continuously applicable.

DIRECTIVES (Continued)

Number	Title	Issue Date / Schedule Date	Status of Action
72-009	Evaluation of Concept	2 Nov. 72 15 Dec. 72	TRACOR Proposal for automatic fingerprint identification dated 3 Nov. 71 was technically reviewed. It was concluded that the proposal was technically well conceived, that it addressed a critical problem area, and,with modification, was recommended for funding to complete feasibility testing. Evaluation delivered to G. Shollenberger 18 Dec. 72, letter 1279-BLT-72-136.
72-010	Field Test Support	3 Nov. 72 15 & 25 Nov. 1972	Task Plan for Field Evaluation Test Support submitted to LEAA 17 Nov. 72, letter 1279-BLT-72-108.
72-011	Management and execution of Development Group Tasks which provide closer coordination and more immediate decision making for the National Institute and other ESIP contractors and coordination with other federal agency research activities.	3 Nov. 72 15 Nov. 72 & 1 Jan. 73	Action completed. New Task Plan A-73-LEG-04 submitted 1 Feb. 73.
72-012	Procedure for Aerospace Response to LEAA Requests for Concepts or Proposals Evaluation.	7 Nov. 72	Policy Directive. Continuously applicable.
72-013	Integration of Development Group Work with Other Federal Agencies	7 Nov. 72 Immediate	Policy Directive. Continuously applicable.
72-014	Evaluation of Gulf Energy & Environmental Systems Proposal GRTP 22-491.	7 Nov. 72 15 Dec. 72	Completed 18 Dec. 72, letter 1279-RPK-013.

DIRECTIVES (Continued)

Number	Title	Issue Date Schedule Date	Status of Action
72-015	Evaluation of Concept for Applicability to Law Enforcement Problems	7 Nov. 72 31 Jan. 73	The Weisner/Robodyne camera equipment was evaluated as part of the preparation for the FY 74 Annual Operating Plan. There was not any development program requiring this type of equipment at this time. Letter 1279-JOE-73-015, dated 21 Feb. 73.
72-016	LEAA Helicopter Procurement - Minimum Standards.	8 Nov. 72 25 Nov. 72	Completed. Letter to G. Shollenberger dated 5 Dec. 72.
72-017	Subcontracting Procedures	8 Nov. 72 Immediate	Policy Directive. Continuously applicable.
72-018	Patent Clauses for all Subcontracts	8 Nov. 72 Immediate	Policy Directive. Continuously applicable.
72-019	Copyrights and Rights in Data Clauses for all Subcontractors.	8 Nov. 72 Immediate	Policy Directive. Continuously applicable.
72-020	Patent and Copyright Infringement Clause for all Subcontracts	8 Nov. 72 Immediate	Policy Directive. Continuously applicable.
72-021	New Task Plan	8 Nov. 72 Immediate	Task Plan A-73-LEG-03, General Project Support, was opened 17 Nov. 72, letter 1279-BLT-72-108.
72-022	New Task Plan	8 Nov. 72 Immediate	Task Plan A-73-LEG-02, General Program Management, was opened 17 Nov. 72, Letter 1279-BLT-72-108.
72-023	Status Reporting	21 Nov. 72 8 Dec. 72	Status report on all grants was submitted to LEAA 8 Dec. 72.

DIRECTIVES (Continued)

Number	Title	Issue Date Schedule Date	Status of Action
72-024	Publication of Development Group Project Plans for FY 73	2 Nov. 72 30 days after all funds are obligated.	Ten copies of the FY 74 Annual Operating Plan were submitted to LEAA on 23 May 73. Considering the similarities between the FY 74 Annual Operating Plan and the document desired under Directive 72-024, it appears that the requirement of the Directive is satisfied by the FY 74 Annual Operating Plan. (See letter 1279-JOE-73-545)
72-025	Review of Institute Report	28 Nov. 72 22 Dec. 72	Comments on Philip Cheilik's paper "AVM Systems for Law Enforcement" were submitted to the Institute on 10 Jan. 73. This is a well written paper, and is useful for providing an overview of various automatic vehicles. Letter 1279-JOE-73-004.
72-026	Review of Proposal	7 Dec. 72 31 Jan. 73	Jet Propulsion Laboratories proposal on Thermoluminescence (TL) was evaluated and submitted to the Institute 9 Mar. 73. The proposal contemplated an 18-month, $172K study to advance the use of thermoluminescence techniques in criminalistic laboratories. A thermoluminescence program was included in the LEDG Annual Operating Plan (FY 74) dated Jan. 31, 1973. It was recommended that this proposal be a part of the LEDG program with some modifications. Letter 1279-JOE-73-027.
72-027	Review of Institute Report	7 Dec. 72 12 Jan. 73	Cancelled by Directive 72-027A.

DIRECTIVES (Continued)

Number	Title	Issue Date Schedule Date	Status of Action
72-027A	Modification to LEAA Directive 72-027.	20 Dec. 72 Immediate	No action required.
72-028	Small Business & Residential Security Systems	11 Dec. 72 31 Jan. 73	Action completed with delivery of FY 74 AOP on 13 Feb. 73.
72-029	FY 74 Annual Operating Plan	14 Dec. 72 31 Jan. 73	Action completed with delivery of FY 74 AOP on 13 Feb. 73.
72-030	Evaluation of Concept	20 Dec. 72 31 Jan. 73	Letter from Lowell Technological Institute (Prof. B.A. Barnes) dated Dec. 8, 1972, requesting support of a project for detection of firearm discharge residues by X-Ray excitation was reviewed. It was recommended that Professor Barnes be encouraged to submit a proposal for a small scale program to better establish the capabilities of the techniques and that the Development Group consider sponsoring the effort. Letters 1279-JOE-73-009 dated 30 Jan. 73 and 1279-JOE-73-016 dated 22 Feb. 73.
72-031	Truck Antihijacking Systems	20 Dec. 72 19 Jan. 73	Required action dropped per direction from LEAA.
72-032	Developing solutions to problems requiring equipment systems.	20 Dec. 72 Immediate	Policy Directive. Continuously applicable.

DIRECTIVES (Continued)

Number	Title	Issue Date Schedule Date	Status of Action
73-001	NI-70-034	8 Jan. 73 1 Mar. 73	An evaluation report was provided the Institute on June 8, 1973, on the Contractor Data Requirements List Items A003, A014, A020, and A021 of the Sylvania Electric Personal Very High Frequency/Ultra High Frequency Transceiver Development Contract F33657-71-C-0831. It was recommended that no further research or development work directed towards the objectives of this contract be done. Letter 1279-JOE-73-054.
73-002	Report formats	17 Jan. 73 Immediate	Policy Directive. Continuously applicable.
73-003	Review of NBS Report	17 Jan. 73 1 Mar. 73	NBS Report LESP-RPT-0301.00, dated November 1972 (Image Quality Criteria for Night Vision Devices), was reviewed and furnished the Institute on 8 March 1973. The report is a good preliminary survey of the state of the art of imaging device performance evaluation techniques and contains a good extensive bibliography. Specific detailed technical comments by our technical staff were provided for consideration by the author. Letter 1279-JOE-73-026.
73-004	Alarm System Concept	24 Jan. 73 23 Feb. 73	A proposal for an alarm system concept involving radio frequency transmission of heart beats from bank or store employees under threat of robbery was evaluated and furnished the Institute 6 Mar. 73. The proposal was made by Mr. Tibor Gorog

DIRECTIVES (Continued)

Number	Title	Issue Date Schedule Date	Status of Action
73-004 (Cont'd.)			and Mr. Frank David in a letter sent to President Nixon. The proposers were personally contacted for discussion. Their concept did not appear feasible, and it was recommended that the Institute take no further action on their proposal. Letter 1279-JOE-73-511.
73-005	Voice Identification Concept	24 Jan. 73 23 Feb. 73	Texas A&M University's "Preproposal for contributing to Speaker Identification by Machine Techniques" was reviewed. Dr. Jones, Head of the Department of Electrical Engineering at Texas A&M, visited Aerospace and the Speaker Identification Program was discussed with him in some detail in an effort to enable Dr. Jones to ascertain areas of mutual interest. Letter 1279-JOE-73-021.
73-006	Evaluation of Concept	12 Feb. 73 15 Mar. 73	Completed 8 June 1973, Letter 1279-JOE-72-052.
73-007	Travel Reporting	16 Feb. 73 Continuous	Policy Directive. Continuously applicable.
73-008	Review of ESIP Monthly Progress Reports	16 Feb. 73 Continuous	Policy Directive. Continuously applicable.
73-009	Acceleration and/or expansion of on-going projects	16 Feb. 73 2 Mar. 73	Superseded by requirements for FY 74 Annual Operating Plan.
73-010	Remote Vehicle Disabling System	16 Feb. 73 N/A	No action required.
73-011	Level of Effort, Advanced Planning	16 Feb. 73 N/A	Accomplished.

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Number	Title	Issue Date Schedule Date	Status of Action
73-012	Investigation of Simplified Drug Analysis Development	21 Feb. 73 31 Mar. 73	The simplified drug identification products marketed by Valley Toxicology Laboratories, Davis, California, were investigated; the article in November 1972 Justice Magazine "Product Manufacturers are Helping on Drug Overload" was reviewed. LEDG proposed development to determine if microcolor and microcrystalline tests, or some combination of them, are unambiguous and, if so, to publish a paper documenting proof of the validity. Letr. 1279-JOE-73-030.
73-013	Police Personal Radios	22 Feb. 73 31 May 73	A comparative report of the LEAA transceiver contract specifications and the performance specifications of commercial transceivers available in 1969 and 1973 was made and furnished LEAA 22 May 73. Commercial equipment performance specifications have been obtained from the six principle American vendors of hand-held UHF and VHF band transceivers both for those models marketed in 1968-69 and those currently available. Letter 1279-JOE-73-043.
73-014	Task Close Out Reporting	26 Feb. 73 10 Jun. 73 & Continuous	Completed. Letters No. 1279-JOE-73-059, 25 June 73 and 1279-JOE-73-063, 26 June 73.
73-015	Evaluation of Institute Proposal No. 73-066	26 Feb. 73 N/A	In progress. Delivery rescheduled after FY 74 Annual Operating Plan publication.
73-015A	Evaluation of Institute Proposal P-73-066	23 April 73 N/A	Revision/addition to Directive 73-015.

DIRECTIVES (Continued)

Number	Title	Issue Date Schedule Date	Status of Action
73-016	Evaluation of results of Phase I of Institute Grant NI-71-026-C1	26 Feb. 73 6 Apr. 73	Effort was in social studies field; report was returned to LEAA without review. Letter 1279-JOE-73-512.
73-017	Voiceprint Research	13 Mar. 73 1 Apr. 73	Professor J. M. Pickett's letter of 7 Mar. 73 enclosing a January 1973 publications draft of the paper "Speaker Identification by Speech Spectrograms - Some Further Observations" was reviewed and sent to the Institute 10 April 73. The identified shortcomings of the Voiceprint technique have been previously recognized by Aerospace, and the current Voiceprint Extension project is intended to address these problems to the extent that available budget and state of the art allow. Letter 1279-JOE-73-031.
73-018	Evaluation of Proposal 73-065	13 Mar. 73 27 Apr. 73	Franklin Institute proposal on "Enhancement of Photographic Evidence Collected during Bank Robberies" was evaluated and furnished the Institute 7 June 73. The proposal represents a very specific application of improved photography and image enhancement procedures to the problem of obtaining better identifying photographs of bank robbery suspects. FY 74 Development Program considers some effort on pattern recognition and image enhancement. Letter 1279-JOE-73-050.
73-019	Evaluation of Aircraft Engine	9 Apr. 73 31 May 73.	The aircraft engine is a small turbine aircraft engine being developed in the Small Tactical Aerial Mobility Platform Program". This program is being conducted by the Naval Weapons Center, China Lake for the Marine Corps. As part of our task

DIRECTIVES (Continued)

Number	Title	Issue Date Schedule Date	Status of Action
73-019 (Continued)			in airborne policing we will continue to monitor the Aerial Mobility Platform Program.
73-020	Evaluation of Explosive/ Firearm Detector	13 Apr. 73 15 Jun. 73	Completed 12 July 73, Letter No. 1279-JOE-73-053.
73-021	Monthly Progress Reporting	23 Apr. 73 Continuous	Being accomplished with May 73 Development Group Progress Report.
73-022	Body Mounted Antenna	23 Apr. 73 15 Jun. 73	Completed 29 June 73, Letter No. 1279-JOE-73-064.
73-023	Evaluation of Final Report on Institute Grant NI-71-026-C2 (Phase II)	23 Apr. 73 8 Jun. 73	Review of Security Planning Corporation Draft Final Report Residential Security (Institute Grant NI-71-026-C2) was reviewed and letter submitted to Institute 13 Jun. 73. This final report left several things to be desired. A modified report should be provided National Criminal Justice Reference Service. Comments received from MITRE and National Bureau of Standards did not differ significantly from the Aerospace review.
73-024	Evaluation of Proposed Research	23 Apr. 73 1 Jun. 73	Texas A&M Preproposal titled, "Machine-Aided Speaker Identification Research" was reviewed and results sent to Institute 13 Jun 73. If resources are available, a task on state-of-the-art survey could be initiated. After Institute review of our letter we will contact Professor Gimlin for more detailed discussion. Letter 1279-JOE-73-058.

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Number	Title	Issue Date Schedule Date	Status of Action
73-025	Evaluation of Research Concept	24 Apr. 73 15 Jun. 73	The research program proposed by Dr. Gordus, which applies neutron activation analysis to hair individualization, was reviewed and results submitted to the Institute 12 Jun. 73. In summary, there is no need for sponsorship of the studies proposed by Dr. Gordus within the framework of a Law Enforcement Assistance Administration program currently designed to support developments with a near-term potential for solving urgent crime problems.
73-026	FCC Docket 18262	30 Apr. 73 Immediate	A proposed answer from the Institute to the Federal Communication Commission concerning frequency allocation in the 900 megahertz radio spectrum was submitted to the Institute 25 May 73. The Development Group is prepared to assist in this effort. Letter 1279-JOE-73-547.
73-027	Format for review of concepts and/or proposals submitted to LEAA and reviewed by The Aerospace Corporation	2 May 73 Immediate	Policy Directive. Continuously applicable.
73-028	Technical data for response to IACP Inquiry	4 May 73. 11 Jun. 73	In progress.
73-029	Monthly Progress Reporting	10 May 73 June 73	Policy Directive. Continuously applicable.
73-030	Evaluation of Institute Grant NI-71-129	9 Apr. 73 18 Jun. 73	MIT Report ESL-R-493 dated March 73 "Investigation of Digital Mobile Radio Communications for Law Enforcement" was evaluated and submitted to the Institute 25 May 73. This report contains a good definition of the problems involved in designing a digital communication link for

DIRECTIVES (Continued)

Number	Title	Issue Date / Schedule Date	Status of Action
73-030 (Continued)			land mobile communication uses. If any user in the near future has serious operational problems with excessive message errors, this report can serve as a guide in planning empirical tests. Letter 1279-JOE-73-045.
73-031	Truck Antihijacking Program	18 May 73 N/A	Completed 21 June 73, Letter No. 1279-JOE-73-061.
73-032	Citizens Alarm Systems Network. Interceptor Electronics Inc.	12 Jun. 73 8 Jul. 73	Completed 12 July 73, Letter No. 1279-JOE-73-069.
73-033	Less Lethal Weapons, high frequency ray and magnetometer; Heidenwolf/Petermann	12 Jun. 73 2 Jul. 73	Completed 17 July 73, Letter No. 1279-JOE-73-562.
73-034	(None received for this number)		
73-035	Acoustic Camera, Stanford Research Institute, request for assessment of potential for detectors	12 Jun. 73 8 Jul. 73	Stanford Research Institute Acoustic Camera reprints of selected items, No. 15-1973 was reviewed. It is concluded that the concept warrants further investigation. It is recommended that technical reports on the theory and development of the acoustic camera be obtained for review. Letter 1279-JOE-73-551.
73-036	Speaker Identification Techniques for Law Enforcement. Critique of the RFP and SRI report and an outline of a program unlike the configuration required by RFP Threshold Technology, Inc.	14 Jun. 73 9 Jul. 73	Threshold Technology Inc. comments on the Semi-Automatic Speaker Identification Request for Proposal were reviewed. Aerospace is familiar with Threshold Technology's work based on a visit 6 Sept. 1972. Specific comments relative to Threshold Technology's exception to our bidder's requirements and statement of work were furnished to the Institute 13 Jun. 73. Letter 1279-JOE-73-056.

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Number	Title	Issue Date Schedule Date	Status of Action
73-037	Evaluation of Institute Grant NI 71-129 "Investigation of Digital Mobile Radio Communications for Law Enforcement"	14 Jun. 73 28 Jun. 73	Returned to the Institute unsigned. To be reissued as a Technical Instruction.
73-038	Police Transceiver Development NI-70-034; request for recommended course of action; for Shollenberger.	14 Jun. 73 28 Jun. 73	Completed 6 July 73, Letter No. 1279-JOE-73-068.
73-039	NBS/TAD Survey of Police Equipment Standards Requirements. (Shubin)	21 Jun. 73 28 Jun. 73	Completed 12 July 73, Letter No. 1279-JOE-73-565.
73-040	Less-lethal weapons. The use of Jellyfish stings, in an aerosol form, Concept Paper: Joseph Burnett, Baltimore Maryland, June 14, 1973.	21 Jun. 73 21 Jul. 73	Returned to the Institute unsigned. To be reissued as a Technical Instruction.
73-041	Grant Monitoring Support - Transceiver	27 June 73 13 Jul. 73	Completed 17 July 73, Letter No. 1279-JOE-73-074.