REPORTS, RECORDS AND COMMUNICATIONS

IN THE BOSTON POLICE DEPARTMENT

FINAL REPORT

GRANT NUMBER NI-69-007

SUBMITTED TO

NATIONAL INSTITUTE OF LAW ENFORCEMENT AND CRIMINAL JUSTICE
LAW ENFORCEMENT ASSISTANCE ADMINISTRATION
U.S. DEPARTMENT OF JUSTICE

BY

BOSTON POLICE DEPARTMENT
BOSTON, MASSACHUSETTS

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I. Introduction

The Boston Police Department has been the beneficiary of a series of three grants from the Department of Justice for the continued development of an integrated communications and information system. In this program the Department has engaged the services of Arthur D. Little, Inc. as its consultant. The study has been run as a joint effort of a unified team of police and consultant personnel.

This report serves as a final report on Grant Number NI-69-007 awarded to the Boston Police Department by the National Institute of Law Enforcement and Criminal Justice of the Law Enforcement Assistance Administration of the United States Department of Justice, and also serves as an interim report in the series of grants to implement the Boston Police Department's integrated communications and information systems.

II. Background

Grant Number NI-69-007 was awarded to the Boston Police Department by the National Institute of Law Enforcement and Criminal Justice of the Law Enforcement Assistance Administration of the United States Department of Justice in accordance with the provisions of Part D of Title I of the Omnibus Crime Control and Safe Streets Act of 1968, PL. 90-351. This grant was the third in a series of grants to the Boston Police Department to develop and implement an integrated communications and information system.

Under Office of Law Enforcement Grant Number 153, made by the Department of Justice under the Law Enforcement Assistance Act of 1965, PL. 89-197, the Boston Police Department, with the aid of its consultants, examined its records, communications, reporting, and information systems and developed a strategy for making improvements in these areas which are so vital to the effective management of a municipal police agency. The recommendations evolving from this project centered around the development of an integrated communications and information system to serve as the focal point for instituting improved management of departmental operations.

O.L.E.A. Grant Number 346 was then awarded to the

Boston Police Department to begin the design and development of the new integrated communications and information system. During this phase of the project an intensive examination was made of the department's field operations. Several changes were made in departmental systems and operating procedures in accordance with suggestions developed under Grant Number 153 and under Grant Number 346. During this grant period also the preliminary descriptions of the new systems that would have to be designed were developed. The major subsystem of the integrated communications and information system for which major design and development were programmed to take place were the following:

Command and Control
Communications
Field Reporting
Records

A phased program was developed to finalize the design and implement the various parts of the system.

The Boston Police Department applied to the National Law Enforcement Institute in June of 1969 for a grant to continue development and implementation of the system, and was awarded Grant Number NI-69-007.

III. Objectives of Grant Number NI69-007

Grant Number NI-69-007 made possible the continuation of the development of the Boston Police Department's integrated communications and information system. Based on the work accomplished under the previous grants, the continuing general goals of the project are:

> *To improve the effectiveness, management and control of the department's field operations through improvements in the information handling systems and procedures of the department.
>
> *To design a management information system for the use of departmental command and administrative personnel in the management of the department.
>
> *To examine all information-related aspects of department operations, question their purposes, and integrate them into a well-organized system that will make the proper information available to the proper units of the department at the proper time, while minimizing clerical costs and unnecessary equipment.

To achieve these goals the previous studies developed the following specific objectives

> 1. Design and implement a computer-aided command and control system for the department's field operations that would improve the handling of emergency messages, capture management data in machine readable form, and provide instantaneous access to information on the status of

field forces at the headquarters and district level.

2. Expand the Boston Police Department's radio communications system to provide for greater communication capacity to field units, to provide more flexible communications for improved control and supervision of field forces, to provide sufficient flexibility to quickly respond to incidents of major proportions such as disasters and disturbances, to provide the capability for the police officer on the street to make use of information banks available at headquarters and the district stations, and to provide a readily available means of communications to the officer's supervisors at the district level.

3. Redesign the Department's incoming emergency telephone facilities to allow for the increase in police services and to provide sufficient capability to handle large volumes of traffic during major incidents.

4. Continue implementation of a new Public Emergency Reporting System (callbox) throughout the City.

5. Experiment with new concepts in providing communications between the district stations and Police Headquarters.

6. Develop a new field reporting system that reduces the amount of required clerical work, fits the needs of the ultimate uses of the information, improves the information base available for follow-up investigation, and makes most effective use of the department's patrol resources.

7. Design a comprehensive central records system that will be capable of reducing clerical work, reducing duplication and unnecessary filing, and increasing the availability of information for investigative and management purposes.

Although the above seven objectives deal with five physically separate sub-systems, their interrelations require that the development process be carefully coordinated to achieve the ultimate goal of a communications and information system of which all parts are integrated into a unified whole which is responsible to the needs of the department.

At the start of the project period the following specific tasks were intended for completion during the grant period:

A. Command Control

1. Completion of the operational specifications for the Command and Control System.

2. Finalization of system equipment requirements.

3. Expansion of department's computer capability to accommodate requirements of command and control operations.

4. Selection of terminals to be used in command and control system.

5. Preliminary documentation and programming of software for command and control system.

6. Implementation of prototype command and control system making use of one or more terminals for test, familiarization, and experimental purposes.

7. Development of changes in software and procedures.

8. Establishment of prototype test environment comprised of several terminals using improved software.

B. Radio Communications System

1. Install equipment for continued system expansion.

2. Expand patrol usage of portable communications equipment.

3. Improve dispatcher control system.

4. Lay out design of new command and control center.

5. Develop specifications for 1970 communications budget expenditures.

C. Emergency Telephone System

1. Develop line requirements for telephone service for new command center.

2. Investigate various telephone system features for inclusion in improved emergency service.

3. Investigate implications of 911 service on proposed telephone system.

D. Emergency Reporting (callbox) System

1. Evaluate effectiveness of Emergency Reporting System in downtown area after 1 year's experience.

2. Make policy decision on system expansion.

3. Develop plan for expansion and place orders.

E. Headquarters-Station Communications

1. Continue experimentation with existing coaxial cable system.

2. Procure additional terminal equipment for coaxial cable system and experiment with new communications services.

3. Develop solutions to administrative telephone system problems.

F. Reporting System

1. Finalize design of reporting forms emphasizing compatibility with information that will be produced from and required by command and control system.

2. Develop outline of training program.

3. Begin experimental implementation in a test District.

G. Records System

1. Integrate requirements for records into design of other major sub-systems.

2. Develop functions and requirements of a truly centralized records system.

3. Investigate new developments in information storage and retrieval systems necessary to implement the system.

4. Develop specifications for records system.

5. Program physical and organizational changes to implement the system.

The next section of this report deals with the activities of the Department and its consultant in accomplishing these tasks and the progress made therein.

IV. Scope of Work Accomplished During Grant Period

Examination of the tasks enumerated in Section III of this report indicates their interdependence. The major subsystem on which all others depend and which represents the greatest demand for developmental man-hours is the command and control system. The development of the command and control system involves the complete design of the system from scratch and requires a type of technical knowledge and background that the Police Department does not posess in its own staff. For these reasons the Department directed its consultants, Arthur D. Little, Inc., to give major emphasis to this particular area during the course of this grant. In taking this action it was the belief of the Department that the development of the command and control system represented the single most valuable contribution of this project to the advancement of police science. As will be noted below, the emphasis on the command and control system, the problems encountered in developing the command and control system, and the dependence of the various other subsystems on the command and control system development resulted in less than full accomplishment of all of the tasks projected for this project at the start of the grant period.

A. Command and Control System Activities and Accomplishments

1. Functional Specifications

The basic design of the command and control system was accomplished during the project period and the Functional Specifications were completed. Both consultant and department personnel took part in several cycles of discussion, documentation, review, and modification of the functional specifications. Departmental personnel involved in the process included personnel associated with the communications function, dispatch function, field command functions, and administrative function. Paramount in the design has been the desire to develop a system that is easily adaptable into the environment with which dispatching and field personnel are familiar. In several areas system cost has been slightly sacrificed to provide flexibility, adaptability, and simplicity.

The document, Functional Specifications of a Prototype Command and Control System for the Boston Police Department, summarizes the design and operating characteristics of the system and is included as part of this final report. This report contains the detailed description of the operation of the new command and control system, a description of the Command Language developed for use in the system, a description of the basic file structure, and a description of the various displays that will be available within the system. The report can serve as the basis for the design of such a system by another police agency, but it must be

emphasized that the system cannot be considered to be in its final form since the various formats, displays, and operations have not yet been tested under operating conditions in the real command and control environment.

Since the command and control system will form the first major input for many permanent records of the department, and since the information base developed in the command and control system will undergo changes and additions as the incident proceeds through the department, several features have been built into the system that do not pertain entirely to dispatching, but have application to later linkages with the reporting and records systems.

A review of the system operation by the senior command and administrative staff of the department has resulted in enthusiastic acceptance of the recommended system. Personnel involved in the operations of the department's command and control center are satisfied that the system will meet their operational requirements and provide the functions necessary to effectively and efficiently carry out their assignment.

The problem recognized at this point by the Department and scheduled for attack in the early stages of the next phase of this project is personnel. An intensive command and control system training program will have to be developed in order to make the transition from a manual, handwritten system to an automatic system necessitating the use of terminals, keyboards, displays,etc.

It is expected that the major input of requirements for the training programs will evolve from experience gained in operation of the prototype system. There will undoubtedly be some personnel problems in implementing the new system, but administrative action is now being taken by the Department to minimize these problems and improve the quality of personnel assigned to the command and control center.

A major consideration which is not settled in the Functional Specifications is the problem of backup procedures and facilities during system failure or system maintenance periods. This is an area of concern to the department since our experience with existing real-time programs has indicated that break-downs occur not infrequently. Since complete duplex computerized backup is unrealistic economically at this time, it is expected that a manual backup system will be used.

2. Equipment Requirements and Selection

The hardware requirements for the command and control system were documented after completion of the Functional Specifications. Calculations of file storage requirements and message traffic loading are found in the Functional Specifications report. At the completion date of this phase of the project the system is scheduled to consist of an IBM 360/40 computer, disc files, tapes, Sanders 720 cathode ray tube displays and associated equipment. The decision to use Sanders terminals was based on operational characteristics necessary to the Command and Control System which could not be met by existing IBM equipment. The use of displays and computer equipment made by different manufacturers has resulted in several delays which are discussed below.

3. Expansion of Computer System

In January, 1970 a Sanders 720 terminal was delivered for experimental usage with the existing 360/30 computer in implementing the command and control programs. Several delays were experienced in getting the terminal running due to problems in coordinating the activities of two different manufacturers. After partial operation of the display for several weeks it was noticed that the 360/30 computer was going out of service more frequently than expected for such an installation. After several days of trouble shooting by personnel of both manufacturers it was determined that the problem was caused by a fundamental design defect of the terminal. In February the manufacturer withdrew all such terminals from usage for major modifications and repairs. The replacement unit had not become available at the end of this grant period. Due to these problems the consultants have renewed the search for other terminals that will satisfy the flexibility and operational requirements of the system.

At the end of this grant period the Boston Police Department's IBM 360/30 computer had been replaced with an IBM 360/40. The 360/40 had been made operational and all previously existing department programs had been run on the new computer.

4. Software and Programming

With the finalization of the functional specifications for the Command and Control System work began on the flow-charting and programming of the routines necessary to implement the system. As noted in previous reports, the programming language that was selected for the system is FASTER (Filing and Source Data Entry Techniques for Easy Retrieved). The 360/30 and 360/40 are supervised under DOS (disk operating system).

During the grant period the complete programming for a single terminal to serve as a prototype for examing formating, coding, ease of operation and other functional parameters was completed. Due to the inoperative condition of the display terminal it was impossible to debug and test this first phase of the programming effort, and it was impossible to use the terminal as a prototype display to work with dispatching personnel to get reactions and suggestions for improvements and modifications.

During the grant period also, the programming for an operational command and control system comprised of several terminals was brought to approximately 50% completion. To do this the following steps were taken:

1. An understanding and knowledge of the characteristics of the FASTER language was developed by personnel of the department and the consultant.

2. The functional specifications for the Command and Control System were translated into routines and were flow-charted.

3. Several major routines that could be programmed in FASTER were programmed.

4. Flow-charting of the major internal processing programs for the control of the command and control system was completed.

5. In the process of documenting the above major internal processing programs it was discovered that an original estimate of 30 such programs could be condensed to 5 generalized control programs.

The following remains to be completed before the system can be made operational for test purposes.

1. Completion of documentation of ancillary control programs.

2. Completion of programming of major control programs.

3. Testing and debugging of all software.

A major handicap has been the inability to have the hardware available in operating condition for the purpose of testing and debugging as the work is completed.

A major concern to the Police Department has been emphasized by the experience gained in the programming effort. The programming work has been the effort of a joint group of programmers from our consultant, Arthur D. Little, Inc., and from our own staff. The experience has underscored the Department's need for advanced systems and programming personnel to operate and update the system after the initial software package is developed and operating. The Police Department has taken steps to receive authorization to add such expertise to its staff in the near future.

5. Prototype Implementation

Due to the previously mentioned hardware problems it was impossible to implement an operating command and control terminal for use as a prototype. This hardware problem has set the project back both in the command and control area and also in other areas

such as the reporting and records systems where formats, requirements, files, etc. are dependent on the exact structure of the initial data base which results from the command and control system.

6. Management Data Reporting

Although finalization of formats has not yet been accomplished work has started on the development of batch processing routines for the purpose of reducing the data collected automatically by the command and control system to a form that will make it useful for command and administrative personnel to use in managing the department.

The ability to make use of data which is now available in non-machine-readable form, but will be captured by the command and control system, is one of the primary benefits that departmental administrative and command personnel look forward to when the system is completed. The ability to consult summary data on a near real time basis, will provide the ability to strengthen supervision and improve deployment throughout the department.

B. Radio Communications System Activities and Accomplishments

1. Implementation of Mobile Radio System Expansion

During the grant period equipment was received and made operational to begin implementation of the new UHF patrol radio system which was designed by the Department in the previous phases of this program. Two newly assigned channels were made operational immediately and operated in parallel with the existing VHF system. The conversion of the patrol fleet to UHF was started. Although the funds to purchase this equipment did not come from federal sources, the basic system design was developed as part of grants 153 and 346.

During this period also, specifications for the second phase of the implementation of the new mobile radio system were drawn up, bids solicited and contracts awarded. Equipment delivery is imminent. Through city funding it is expected that the last phase of implementation of the four channel UHF mobile patrol radio system will be completed during 1971.

2. Implementation of Portable Radio System Expansion

As developed in the previous phases of our records and communications study, the Department's use of portable communications equipment was expanded. In conjunction with the replacement of the old callbox system (which had direct connection to the District station) with the new Emergency Reporting System (which provides communication to the Command and Control Center at Headquarters) in District One,

Enough portable communications equipment was purchased to equip all personnel on the street. During this project period the system was used for officer-to-station communications.

As a result of the success of this experiment the Department expedited the program to equip all street personnel with portable communications equipment. By the end of this grant period over 300 UHF walkie-talkies were in use for patrol purposes throughout the city.

Long delivery times on certain pieces of base station equipment did not permit full realization of the potential of the system during the grant period and necessitated high loading factors on the operating channels.

The need for strong centralized dispatch control for the officer-to-station communications system had been anticipated, and was proven during this test period. Stricter supervision of message traffic than can be provided by desk officers who have other duties is necessary. In addition, the easy ability to communicate with officer on foot and in vehicles often resulted in assignments being made to cars by the station without knowledge of the main dispatcher. This resulted in a loss of up-to-date status information and the possible loss of information on the assignment from the dispatcher records.

Having anticipated this requirement the Department's new command and control center will house dispatchers for each portable

channel as well as for each mobile channel. In addition the design of the functional specifications for the new command and control system is such as to allow updating of vehicle status information by any and all dispatch terminals. The design of the proposed radio consoles for the new command and control center is such to allow cross-channel repeating so that during times when only one dispatcher is working on a particular zone the mobile and portable channels will be tied together so that all units can hear all other units.

3. Dispatcher Control System and Command and Control Center

During the grant period specifications were developed, but not finalized for the new radio dispatch consoles and for the layout of the command and control center. The radio dispatch positions will be comprised of 5 double consoles: one for each of the three zones, one "citywide," and one "supervisory console." The zone consoles and the citywide console will each have "mobile" and "portable" dispatch positions. Although these eight dispatch positions will be designated for a particular type of operation in a particular geographical area, all consoles will be identical and will have the capability of operating on any and all channels. This will not only provide considerable flexibility, but will also allow for possible future changes in operating procedures, allow combining of zones during low volume periods, and allow the system to be easily adapted to emergency situations. In addition to radio control panels identical to the other eight dispatch positions, the supervisory consoles will have additional monitoring and control equipment.

Although the basic design of the communication consoles has been completed by the department, the specifications cannot yet be

completed due to the need to know the specific requirements for the command and control system terminals two, of which will be provided for each of the ten dispatch positions. The hardware problem cited earlier and the possibility that a different type of terminal than that originally comtemplated will be used, have dictated that final specifications be delayed.

The basic layout of the command and control center has been developed. The detailed drawings and requirements will not be finalized until the above noted hardware problem is resolved and until several questions concerning physical facilities are resolved by the Department. Final layout is also dependent on the details of the backup command and control procedure and on the details and requirements of the record system. These questions will be resolved once the experience of the prototype command and control display is gained.

The Boston Police Department has allocated over $1,000,000 to communications system improvements in 1970 based on the results of this and foregoing portions of the integrated information and communications system study. Specifications for these expenditures have been prepared by the department during the grant period.

C. Emergency Telephone System Activities and Accomplishments

1. Line Requirements

As a result of work done during this grant period it was decided to reverse a tentative telephone system feature that had been developed under the last grant period (346). It is now planned to eliminate the zoning of incoming telephone calls. In other words, calls will come in to one large group of complaint positions regardless of geographical origin, rather than to three smaller separate groups of telephone positions. The reasons for making this decision were as follows:

1. Reduction in average delay time.

2. Reduction of possibility of the paralyzing of an entire zone due to one incident that may result in many calls.

3. Since the command and control system is designed in such a manner as to automatically forward incident information to the correct display based on district, there is no need to provide pre-separation of calls to the system.

4. Problems that would be encountered in adapting the city's telephone system to such geographical separation.

5. Inherent inflexibility that would be characteristic of a system with fixed geographical zones due to short term and long term changes in workload.

It has thus been decided to use a single group of telephone positions, all answering calls from the entire city. It is planned to initially install twenty incoming emergency lines.

2. Telephone Features

In cooperation with the New England Telephone and Telegraph Company the Police Department has investigated several desirable telephone system features for its emergency lines.

As a supervisory tool and as a means of reducing delays an automatic call distribution system has been programmed into the design of the communications center. Through this system incoming emergency calls will be distributed automatically to all active emergency line telephone positions.

Emergency telephone calls, however, arrive in several different manners at the command and control center. Most arrive on the Department's emergency telephone number DE 8-1212, some arrive through the department's administrative telephone number and are directed to command and control center lines, some arrive on the various ring-down "hot-lines" from the district stations, hospitals, etc. In designing the call distribution system, a decision must be made as to which telephone inputs should be distributed and which should arrive as separately identified lines. The problem arises with the hot-lines which not only provide instant connection to the

command and control center for the calling party, but also provide the complaint operator in the command and control center with location information due to his knowledge of the originating location of each line. The ideal situation would be to mix all incoming calls and retain the location information on the hot-lines. There is presently no standard telephone equipment that will accomplish this purpose. The Telephone Company is currently seeking solutions to the problem. If it cannot be solved economically then it is the department's intention to feed the DE 8-1212 calls and the administrative telephone number transfer calls into the A.C.D. system, and retain separate answering of hot-lines.

The Department has requested two other major features for improved emergency telephone system performance and serviceability. Both are not currently possible in the Boston telephone exchanges, the age of which precludes their implementation in the near future. The first is the "Dial Tone First" feature in which pay telephones would be able to reach an operator or police number without insertion of a dime. In effect, such a feature would make all street telephones into readily available callboxes to summon police or other emergency aid. The second feature is "Calling Number Identification" through which the complaint operator would receive automatic identification of the calling number and its location. In a system such as that designed, this information could be fed directly into the command and control system.

3. 911 System

Investigation of the implications of the 911 system on the design of the command and control center was conducted. The major operational features of the system are such as to be completely compatible with present plans. A major operational consideration, however, is the possible increase in telephone emergency traffic due to calls for other emergency services. A survey of cities that have implemented 911 will be made as part of the next phase of this program.

At the present time, due to technical problems, the 911 system is several years away in Boston.

D. Emergency Reporting System Activities and Accomplishments

1. Effectiveness of Pilot System

As a result of previous phases of the study program, a new Emergency Reporting System was installed in District One in November of 1968. Sixteen months of operational experience with the system has resulted in a false alarm rate of approximately 40% as opposed to a false alarm rate of 65% with the former pull-hook type of citizen alarm. In addition, these telephone-type boxes have made it possible to provide citizens on the street with a means of seeking directions or asking for information. The system also has provisions for connecting calls to the department's administrative telephone system and is used by officers of the Traffic Division and District One to communicate with their respective offices. The major traffic between street officers and stations, however, is being carried on the new portable communications system.

2. System Expansion

Based on the experience in District One a policy decision was made early in 1970 to expand the Emergency Reporting System to the rest of the City. This decision was prompted by the imminent changes in the Department's physical facilities. During late in 1970 or early 1971 two new district stations will be completed and three buildings over 100 years old will be adandoned. The cost of rewiring the old callbox

system to the new buildings would be prohibitive. In addition, the rewiring of the old system would not provide the added features of voice contact with citizens and central receipt of citizen calls at the command and control center in police headquarters. The following schedule for implementing the system throughout the City was established

District Nine
District Ten
District Eleven
District Fourteen
District Five
District Four
District Seven
District Fifteen
District Three
District Thirteen
District Six

E. Headquarters-Station Communications Activities and Accomplishments

1. Coaxial Cable System

The coaxial cable system which was installed experimentally between Headquarters and District One was used experimentally for voice services on an intermittent basis. Due to the delays caused by hardware problems in the command and control system, the teletype loop of the coaxial cable/multiplex system was not activated.

During the grant period specifications were drawn up by the department for additional multiplex equipment to provide high speed data, high speed facsimile, and video services over the coaxial cable. Since this equipment was to be used in conjunction with experiments with the reporting, records, and command and control systems, these specifications were not finalized and are being held pending finalization of hardware and procedures.

2. Administrative Telephone System

Problems of traffic volume and congestion in the department's administrative telephone system in the larger districts resulted in a joint inquiry by the department and the Telephone Company into alternative methods of providing headquarters-district telephone service. The department ruled out a Centrex system due to economic considerations and due to problems of administrative control. At the close of the current grant period the specifications for a new

semi-automatic desk-top switchboard were examined and it was tentatively decided to install one such system in District One for the purpose of evaluation and possible adoption as the standard system for all districts. It is hoped that the equipment can be installed and evaluated before the new buildings become available so that the new system, if adopted, can be installed as original equipment in the new buildings.

F. Reporting System Activities and Accomplishments

1. Finalization of Forms Design

During the grant period the basic information requirements for each of the incident-oriented report forms was finalized. The process of finalizing information content was started and the reporting system was examined for internal consistency and satisfaction of legal and investigative requirements.

The criteria for determining the final design of the system are the following:

1. Forms must be self-explanatory, easy to fill out, and require the minimum of patrol time to fill out consistent with information requirements.

2. Forms must provide all routine investigational information necessary for a detective to begin an investigation.

3. Formats of the forms should be standardized with similar types of information appearing in similar locations on all forms.

4. A sufficient, but not superfluous, amount of information must be provided to satisfy legal, investigative, management, and control requirements.

5. Information to be abstracted for indexing or for computer "pointer files" should be readily accessible.

6. System should require a minimum of clerical work after initial filling in of forms.

7. Terms and formats of data should be standardized.

The review of the preliminary report forms indicated that in several cases one or more of the originally designed reports could be combined and simplied. Work is currently still underway on the finalization of the report forms. Since the command and control system will provide the initial information concerning incidents, and since information captured therein will serve as indexing guides for all paperwork concerning the incident as it proceeds through the department, a continual feedback of design considerations between the command and control, reporting, and records system is necessary.

It is anticipated that a report on the reporting system documenting its forms, procedures, and requirements will be issued early in the next phase of this study project.

2. Training Program

Basic requirements for the training programs necessitated by the new reporting system are now being formulated. A major training effort will be necessitated for patrol personnel, clerical personnel, and investigative personnel.

3. Experimental Implementation

It was not possible during this grant period to complete the design of the reporting system, and experimental implementation is not expected to be possible for at least nine to ten months.

G. Records System Activities and Accomplishments

Although actual records system design could not proceed without final descriptions of the command and control and reporting systems, progress was made in outlining basic requirements for the centralized records system. Design considerations coming from the interface between the command and control and records systems have been taken into account in designing the functional specifications for the command and control system.

The nature and content of some of the off-line reports from the command and control system have been specified and some flow-charting has been completed. These off-line reports will form the basis for statistical reports as well as records system indexes.

The department has continued its examination of its records problem in areas other than incident-related records. Problems of accessibility of information, storage space requirements, and clerical requirements have indicated the need for centralization of several records activities that are currently physically and operationally separate.

To develop background information for the design of the central records system, the department has been working with several manufacturers of information storage and retrieval systems.. They have looked at current records activities and have reviewed the proposed command and control system and reporting system and will soon be offering suggestions to the department and its consultants to implement the centralized records system.

V. Summary, Conclusions, Recommendations, and Future Work

The work completed under National Institute of Law Enforcement and Criminal Justice Grant Number NI-69-007 has brought the Boston Police Department one major step closer to the realization of its proposed integrated communications and information system.

A major disappointment to the department was the inability to make the prototype command and control system operational due to equipment problems. A review of system operation in written form by department personnel at all levels has resulted in enthusiastic acceptance. A major problem area that will be attached as soon as a prototype system is operational and as soon as the basic display types are found satisfactory, is the area of personnel and training for command and control system operation.

During the grant period equipment problems caused delays in implementation. Problems encountered centered around compatibility of one manufacturer's CRT terminals with the computer of another manufacturer. At the close of the grant period imminent solution of these problems was anticipated. It is thus expected that early in the next phase of the project it will be possible to make a prototype system operational. The completion of all basic programming for the prototype has been accomplished, and debugging and testing remains to be completed.

The next phase of the on-going project after initial testing of the prototype command and control system is the operation of this system under actual dispatching and complaint answering conditions. The information gained from such operation will be used to finalize system characteristics and parameters before large-scale implementation.

In the area of communications the department finalized its plans for the expansion of its radio communications facilities and began implementation. Included in this program of expansion are a major increase in the use of portable communications equipment, a change in the mobile communications system which includes conversion to UHF and geographical zoning, and the complete reconstruction of the department's command and control center. Operational experience with various portions of the system made it possible to verify several operational requirements and to plan operating procedures.

An automatic call distribution system for the handling of emergency calls has been studied under this grant, and will be implemented as part of the new command and control center. Several characteristics of this system have not yet been fully decided upon. The next phase of the study will finalize the operational characteristics of the A.C.D. system. Coordination of telephone system design and telephone equipment human engineering with the design of the command and control system will be necessary.

Further implementation of the department's Emergency Reporting System, a leased telephone public callbox system, was planned as a result of work completed under this grant. Evaluation of a test system in one district of the city has led the department to a decision to expand it throughout the entire city.

Experiments with a coaxial cable system and studies of improvements in the department's administrative telephone system were continued during the grant period. Much further work remains to be done in the area of headquarters - station communications. Requirements for data communications services will be developed after the final design of the command and control system is completed. It is hoped that early in the next phase of the project, the communications requirements can be resolved and that the district interface to the command and control system can be tested in one district.

During the course of this grant, evaluation was made of several pieces of newly available telephone equipment. Additional information has been requested on one of these new products, and it is planned to implement an experimental change in the department's district station telephone facilities in one district to evaluate the equipment for possible standardization in all stations.

Work on the department's new field reporting system and records system progressed as far as possible consistent with constraints imposed by the development of the command and control system. Basic information content of field reports has been completed, but final design and format determination has been

halted pending finalization of command and control system details.

Although this project has made several direct impacts in improving the operation, control, and supervision of the Boston Police Department's field forces through improvements in its records communications, and information systems, it represents the third phase of a multi-phase program to implement an integrated command and control system which promises even greater benefits in the improvement of the operation, control, and supervision of the department's field forces. At the end of the grant period, the project had achieved substantial progress in each of the principal areas of study. There is, however, a considerable amount of further study, development, experimentation, and implementation to be done. It is for this reason that others interested in duplicating the development of similar systems are again cautioned concerning the Functional Specifications for the command and control system which are part of this report. The specifications have not yet been subjected to physical testing and will undoubtedly undergo modifications based on experience with operation and testing.

It is now estimated by the Boston Police Department and its consultants that the system developed in this continuing program can be implemented and made fully operational in approximately two years, depending on solution of hardware problems. The Department has received a major committment of funds (over $1,000,000) from the City to begin implementation. It has also

received a promise of substantial additional support from Block Grant funds for Fiscal 1970 for implementation. The Department will seek to continue the series of grants that it has received from The Justice Department to cover the developmental and engineering costs for the system by applying for a grant to the National Institute of Law Enforcement and Criminal Justice covering the costs of its consultant contract with Arthur D. Little, Inc. It is expected that the practical knowledge gained in physically implementing an operating prototype command and control system in the early stages of the next phase of this project will prove to be invaluable to providing other municipal law enforcement agencies with the full benefit of the work completed under this grant and the previous two grants.

VI. Acknowledgements

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BOSTON POLICE DEPARTMENT

Edmund L. McNamara
Police Commissioner

Steven D. Rosenberg
Director, Planning and Research Division
Project Director

Charles T. Cobb
Captain, Central Services Division
Financial Officer

END