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POLICE AND COMPUTER TECHNOLOGY:
USE, IMPLEMENTATION, AND IMPACT

A Summary Report
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EXECUTIVE SUMMARY

by Kent W. Colton

The use of computer technology by the police has expanded rapidly since the mid-1960s. A number of factors have fueled this growth. Given the labor-intensive nature of police work and the tradition of devoting only a very small percentage of departmental resources to research and development, interest focused in the 1960s on improving police services by allocating dollars for equipment and technology. Recommendations from the President's Commission on Law Enforcement and the Administration of Justice (The Crime Commission) suggested that technology might be an important tool for police work, and federal funding from the Law Enforcement Assistance Administration (LEAA) provided added resources to purchase such equipment. The pressure from vendors to sell their product -- heightened as the Vietnamese war ended and technology-oriented industries sought to increase their domestic market -- contributed to the expansion of computer-related innovations.

A number of unanswered questions about the use of this technology remain. Critics claim that much of the money has been wasted and that such innovations do not significantly increase the efficiency or effectiveness of crime control. Advocates are more optimistic that the costs are justified. However, although considerable attention has been devoted in the police literature to promoting technology, surprisingly little has been written about its implementation. Despite prestigious recommendations from the Crime Commission, the process of introducing change requires more than directives from the top. Important behavioral and power relations are

involved and the law enforcement community must address such questions as: how are decisions to implement technology made; how do various groups within the police react; and what impacts result? Such questions address the consequences and the diffusion of innovation.

With these issues in mind, this report has examined the use of computer technology by the police in the United States. Our three objectives were:

(1) To document the current use and evolution of computer technology;

(2) To analyze the implementation of such innovations in law enforcement; and

(3) To assess the impact of computer-related technology.

In addressing such concerns, researchers probe for understanding and explanations. Answers and relationships sometimes appear, but often results uncover new questions and the process of inquiry continues. Some of the issues raised in this report have clear answers--for example, those pertaining to the use and change of computer innovation. Answers to other questions--particularly those on the implementation and impact of technology --are less straightforward. In some cases the data are inadequate to reach a conclusion; in others, even if better data were available, a final opinion would depend on perspectives and value judgments.

More important, although computer technology is here to stay and expanding, it would be a mistake to think such innovations will play a major role (at least in the short run) in revolutionizing the police or many of the major issues they face. Law enforcement, to a large extent, is deter-

mined by the conditions of our society and its people.[1] Crime and law enforcement have a momentum of their own. Computer technology may have a marginal role in influencing and shifting relationships, but the major law enforcement issues must be resolved in the context of society as a whole.

With these caveats in mind it is possible to begin to determine where computer technology is now and where it might be headed. It is not enough for advocates to refer to particular success stories or for critics to claim that hardware innovations have failed to reduce the crime rate. First, we must identify and classify how police use computer technology and how this use has evolved over time. Based on this classification, we can begin to assess implementation and impact. To analyze impact, though, a framework for evaluation is necessary. There is a wide range of issues to be addressed, and at least four levels of questions have been examined in this study:

1. Does the application work? That is, does it stay in operation for a period of years, and does it meet the objectives that were specified at the time of implementation?
2. What have been the technical impacts of technology through changes in the input, processing, or output of information? For example, does it provide lower costs of processing data, availability of new or better information, greater speed of processing, or wider collection or distribution of information?

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1. For a discussion of this position see James Q. Wilson, Thinking About Crime, (New York: Basic Books, 1975).

3. What have been the service impacts, if any? How has the application affected the tasks and services of the police? Since technical impacts provide no measure of changes in performance, the evaluation of service impacts must seek to examine the process and results of technological innovations.[2]

4. Have there been any power shifts through changes in the structure of decision making? Does technology affect internal balances of power? For example, does it provide greater centralization or decentralization, shifts of power to higher-level officers, loss of electoral power to the bureaucracy, or loss of individual control over information that impinges on privacy?

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2. In evaluation research a range of evaluation measures have been identified to review impact. In this study at least two levels of service impacts have been useful: process measures and results measures. "Process measures" refer to changes in the process of delivering public services such as changes in the time it takes to answer the telephone because of a new communications system or changes in the time required to provide the police officer with information about a stolen car or wanted person. The emphasis with process measures is on efficiently delivering services with an improving ratio between inputs and outputs. "Results measures," on the other hand are more interested in the actual effectiveness and quality of innovations in terms of their impact on police service. Telephone calls may be answered more rapidly, but what difference does it make. If information is delivered to the officer in the field in seven seconds, what is the result. Because they move from simply quantity of service to quality, results measures are often difficult to establish and more costly to collect. For one discussion of measuring performance of public programs see Robert N. Anthony and Regina E. Herzlinger Management Control in Nonprofit Organizations, (Homewood, Ill.: Richard D. Irwin, Inc., 1975), especially Chapters VI and XII.

This report has not been able to answer all of these questions concerning each application of computer technology. Still, such a framework provides a useful beginning for review. The questions are more than monetary factors as to whether the benefits justify the costs. Because of the fragmentary nature of police work and the variety of styles of police behavior, the circumstances in each police department differ. Some have put up more resistance than other, and some achieve greater success than others. Although this report will try to draw general conclusions, ultimately costs and benefits depend on individual goals, priorities and structures.

Using this four-part framework for evaluation, the Executive Summary is divided into five sections covering the use and implementation of computer technology. The first section will review the use and evolution of information technology; the second will assess routine computer applications; and the third will analyze computer technology in selected nonroutine uses. The fourth section will discuss the implementation of technology in the law enforcement environment; and the fifth will include some final thoughts about impact and implementation. The Appendix to the summary outlines a series of recommendations to the LEAA regarding the use and implementation of computer technology.

A. The Use and Evolution of Computer Technology by the Police

The first real-time police computer system in the U.S. was installed in the St. Louis Police Department in the mid-1960s. Since then the growth of computer technology by the police has been widespread. However, surveys conducted as part of this study in 1971 and 1974 revealed that

implementation has been slower than expected. The 1974 survey was mailed to all U.S. police departments in cities with populations over 50,000. Of the 326 (80 percent) that responded, 193 (56 percent) were using computers. Although this was an increase of 12 percent over 1971 responses, it was only about half the growth predicted by the earlier survey.[3]

Some of the difference may be explained by a slight variation in response rate between the two studies and by varying interpretations of survey questions. But, more important, estimates of future growth tend to be overly optimistic. The slower rate may also indicate that some police departments are taking a more careful and sophisticated approach to computer use. A healthy pragmatism -- and sometimes even skepticism -- exists in many departments.

1. The range of computer use. As part of the survey, police departments with computers were asked to identify which of 24 applications they were using. The 24 applications were grouped into eight areas: police patrol and inquiry, traffic, police administration, crime statistical files, miscellaneous operations, resource allocation, criminal investigation and command and control. (See Figure 1.)

In evaluating use and impact, a useful distinction can be made between routine and nonroutine applications of computer technology. Routine applications involve the relatively straightforward, repetitive manipulation and inquiry of prescribed data, often by means of a definite procedure. The same manipulation was usually done by hand before the advent of the computer.

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3. The 1971 and 1974 ICMA surveys were designed by the author and administered by the International City Management Association (ICMA).

Technology simply makes the process quicker and easier. For example, although police patrol and inquiry applications are technically advanced and provide rapid retrieval of information to the field officer, such inquiry systems are relatively straightforward and the tasks can be labelled routine. Other routine application areas comprise traffic files, crime statistical files, police administration, and miscellaneous operations, as Figure 2 illustrates.

Nonroutine applications are more elusive to define. In this area, the machine becomes a tool for decision-making, strategic planning, and man-machine interaction. There are no absolute methods for handling problems, either because the area is complex or because they require custom-tailored treatment. The human decision-maker plays a vital role in judgment, evaluation, and insight. Nonroutine application areas in law enforcement include resource allocation, investigation of crime, and command and control, including among others, computer-aided dispatch and automatic vehicle monitoring. (See Figure 2.)

Rather than viewing routine and nonroutine categories as sharply distinct classifications, though, they should be regarded as converging from opposite ends of a spectrum. As applications move toward the nonroutine end of the spectrum, systems design becomes more intricate, and behavioral, personality, and organizational considerations become more significant. Several applications fall between two extremes. The best example is crime statistical files, which, though generally routine in collection and processing, provide the basic data for a number of nonroutine activities, such as resource allocation. Command and control applications also have both routine and nonroutine dimenstions.

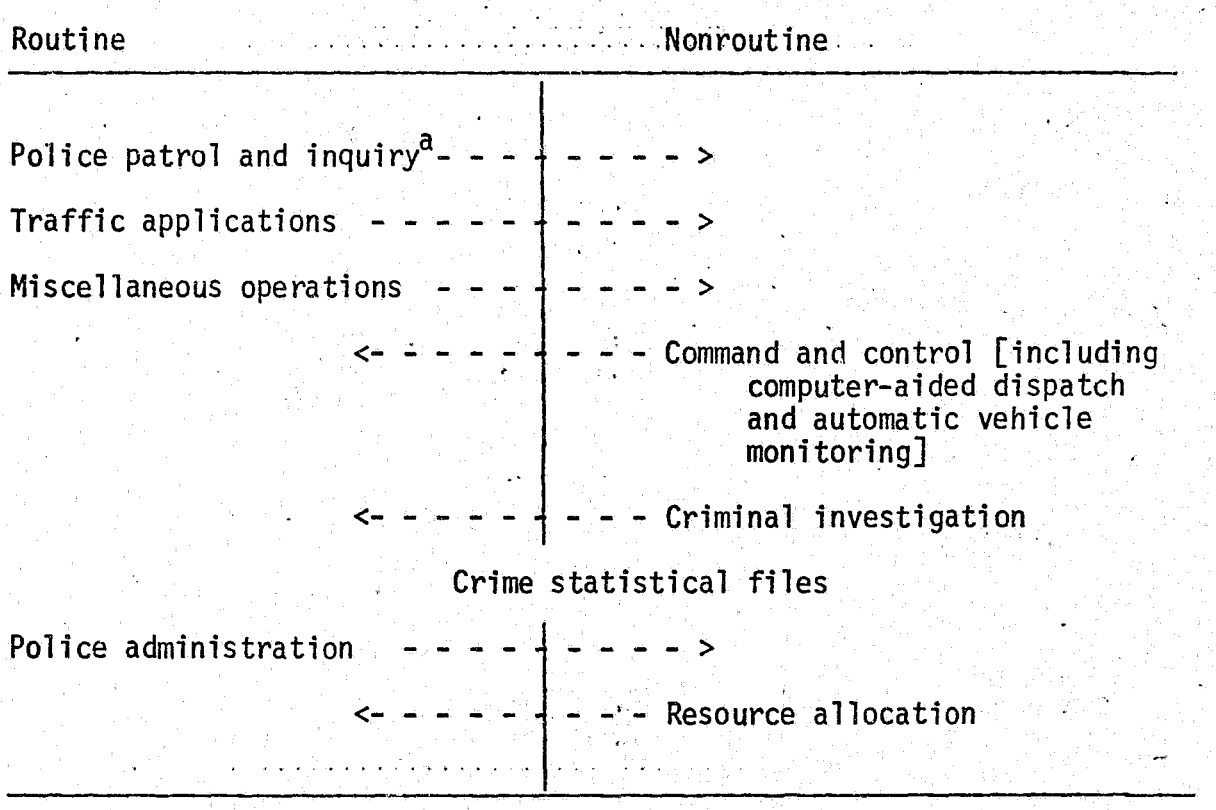
Figure 1

Computer Application Uses

Application areas	Computer applications
Police patrol and inquiry	Warrant file Stolen property file Vehicle registration file
Traffic	Traffic accident file Traffic citation file Parking violation file
Police Administration	Personnel records Budget analysis and forecasting Inventory control file Vehicle fleet maintenance Payroll preparation
Crime statistical files	Crime offense file Criminal arrest file Juvenile criminal activity file
Miscellaneous operations	Intelligence compilation file Jail arrests
Resource allocation	Police patrol allocation and distribution Police service analysis Traffic patrol allocation and distribution
Criminal investigation	Automated field interrogation reports Modus operandi file Automated fingerprint file
Command and control	Computer-aided dispatching Geographic location file

Figure 2

Routine and Nonroutine Uses of Police Computer Technology



a. The dotted arrows reflect the fact that routine and nonroutine categories are not sharply defined classifications. Rather, they should be regarded as converging from opposite ends of a spectrum.

2. The evolution of computer technology. The growth of computer use by the police may be divided into four periods: 1960-1966, 1967-1971, 1971-1974, and 1974-1977. The primary uses of the computer between 1960 and 1966 were in the routine areas of traffic, police administration, and crime statistical files. In fact, by the end of 1966, traffic and police administration applications represented 54 percent of the total computer use.

However, between 1967 and 1971 shifts in emphasis occurred in the use of computers. Though traffic, administration, and criminal statistics applications experienced strong development, even more striking was the tremendous growth in police patrol and inquiry applications. Such inquiry uses increased sevenfold between 1967 and 1971. By 1971, almost one-fifth of all reported police computer use was devoted to the rapid retrieval of information on outstanding warrants, stolen property, or vehicle registration. In the late sixties, one nonroutine area of computer technology -- resource allocation -- received increasing attention. In absolute numbers, resource allocation still represented only a small fraction of total police computer operations at the end of 1971, but its greater than sixfold increase between 1966 and 1971 suggested that it would soon become a major application area.

Between 1971 and 1974, significant variations appeared between the computer use anticipated by police and actual implementation. By 1974 four of the five most common application areas were routine. In each case, though, actual implementation was significantly less than predicted. Resource allocation was the only area, routine or nonroutine, in which the predicted use level was actually met and surpassed. The 1971

survey results predicted that by 1974 12 percent of all computer applications would be in the resource allocation area; the actual percentage was 16. An additional survey question in both 1971 and 1974 asked police departments to rank the relative importance of different computer applications. There was little shift between the two years, and in both 1971 and 1974 resource allocation applications were ranked first (Figure 3).

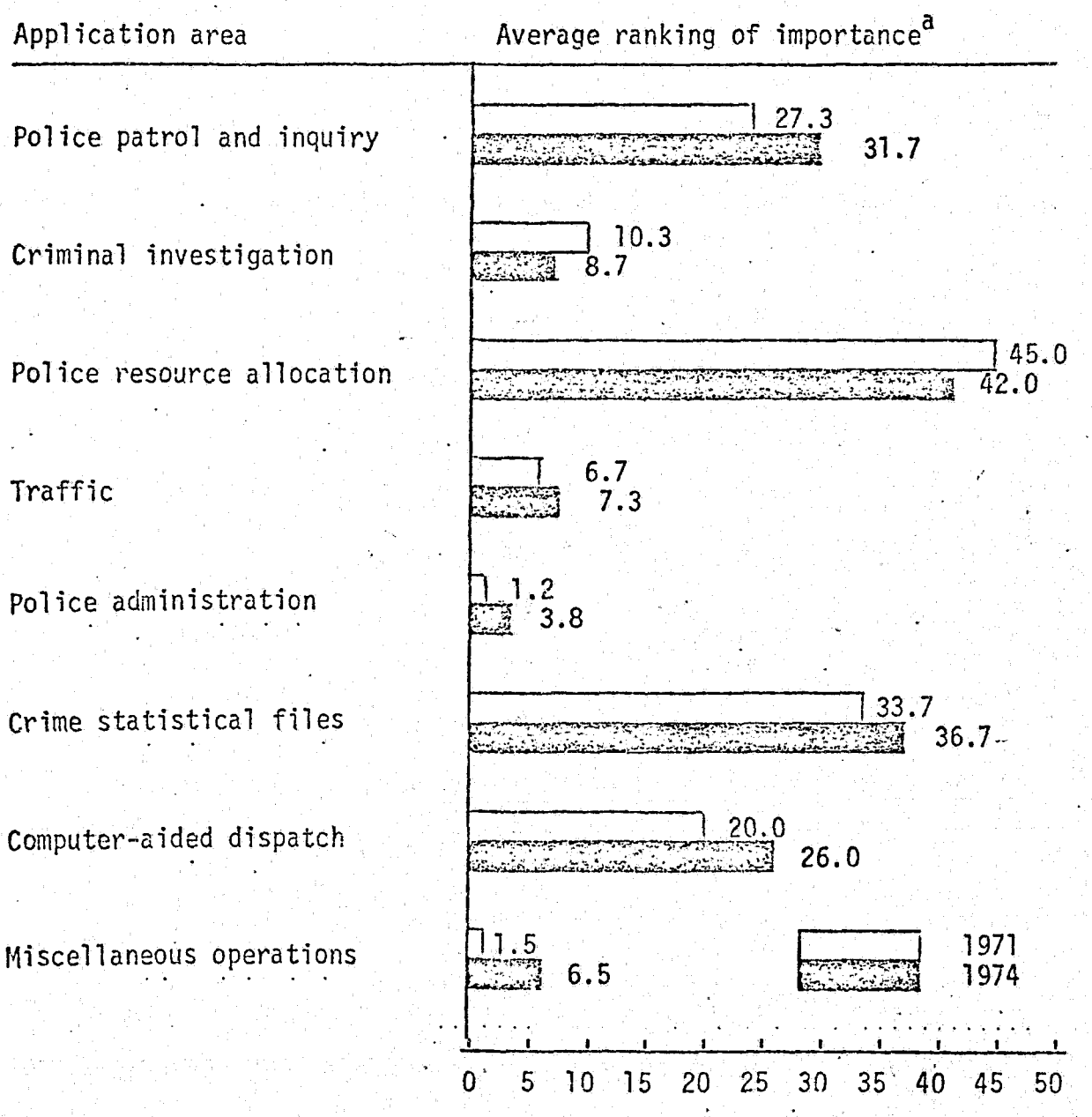
In two other nonroutine applications -- criminal investigation and computer-aided dispatch -- 1971-1974 use fell far below initial expectations. In 1971, survey responses predicted that 9.5 percent of all computer applications would be in criminal investigation by 1974, but the actual percentage was only 4.7. Similarly, 61 departments predicted that they would implement a computer-aided dispatch system by 1974. However, only 15 such systems had been installed by 1974 -- less than 1 percent of the total computer applications. The general failure of departments to acquire such systems despite earlier ambitions reflects the difficulty, time, and costs involved in implementing such applications.

Based on estimates for 1974-1977, similar patterns seem likely in the future. Many routine uses, which are still far more widespread than nonroutine applications, have evolved since the early 1960s. Nonroutine applications are also receiving increasing attention, although implementation has been slower than predicted, and a number of such uses are still in the planning and testing stages. Resource allocation continues to be the primary nonroutine computer use that has been consistently implemented across the country.

After a decade and a half of use the computer, with all its

Figure 3

Importance of Computer Applications in 1971 and 1974,
As Ranked by Police Departments



[a]Ranking is based on the average number of times applications were selected by police departments as one of their three most important applications.

interesting implications and problems, has unquestionably become a permanent part of law enforcement technology. The issue now is how computer technology will be used and with what impact.

B. Routine Applications

In analyzing police computer use routine applications (including applications for police patrol and inquiry, traffic activities, police administration and miscellaneous operations) will be examined against the four-part framework for evaluation outlined earlier in the chapter, even though the data are limited.

Although results vary greatly, routine applications have often succeeded at the first level of evaluation--successful operation and meeting objectives. Numerous police patrol and inquiry applications and crime statistical files are working around the country today, as shown in Chapter III. For example, seven-second retrieval of information to the officer in the street has been a reality in Kansas City, Los Angeles, and other police departments for a number of years. On the other hand, as the 1974 survey results indicate, the rate of implementation has been slower than expected; and even with routine uses of computer technology, the success varies significantly among police departments, often because of human rather than technical considerations. Furthermore, large resources from the LEAA have in some cases served as a "seductive stimulant" for police departments to get involved with computer technology in the absence of an intrinsic desire for understanding. As one police data processing manager put it, "Millions of dollars have been spent, but there's still an awful lot of garbage coming out of police computer systems." Although no

one knows how much waste and misuse exists, police computer hardware has undoubtedly been sold to police departments who don't know how to use it or for nonessential applications.

At the second level of evaluation--technical impacts--computer technology has provided a number of positive benefits. In at least some departments extensive amounts of new or better information are available more rapidly for broader distribution, although, again, results vary among police agencies. Real-time information is not only available to the officer in the field, but also traffic, police administration, and crime statistical records are more accessible. However, technical benefits do not address how information is actually used, nor do they measure changes in police performance. As far as this report is concerned, the more important questions relate to service impacts.

At the service impact level, though, the information available is less clear. In reviewing more narrow process oriented measures of efficiency, a number of routine applications have improved service to the public and shown to be cost-effective. Although full-scale analyses of costs and benefits were not covered in this project, illustrations of the process service benefits were discussed in Chapter III. In Tulsa, Oklahoma, an additional $180,000 in estimated revenue was returned after the first year's operation of a new automated traffic citation system. In Long Beach, California, membership in an automated want/warrant system in the Los Angeles area increased the number of 1970 warrant arrests 31.5 percent over 1969 figures. In Kansas City, Missouri, the ALERT (Automated Law Enforcement Response Team) system was installed in 1969, and the number of monthly inquiries per police officer concerning stolen cars or wanted persons rose from 36 in January 1970 to 90 by May 1971, and in 1975 police officers were

averaging 250 inquiries per officer per month. In Oakland, California, after digital computer terminals were installed in half the patrol cars in 1971 and 1972, units with terminals in their cars made more than seven times as many information requests, received more than three times as many "possible hits," and were three times as productive in warrant arrests and vehicle recoveries as nonequipped units.

However, when one examines the actual service results or effectiveness of such nonroutine applications, several unexpected impacts and influences become evident. For example, the Kansas City Chief of Police reported that after installing their ALERT system, one of the most advanced police patrol and inquiry systems in the country, the police department experienced an overload of police officers making stolen car checks, thereby creating a potential manpower drain and shifting concentration from other vital police tasks such as preventive crime patrol. In addition, it is extremely difficult to measure the effectiveness of technological innovations in combatting crime. Crime statistics are a product of a wide range of influences such as time of day, season, weather, unemployment and economic condition, neighborhood development patterns, political activity, community unrest, and reporting requirements. Relating the use of routine technological innovations to changes in crime statistics requires an enormous and unwarranted "leap of faith." A number of evaluations of technology have attempted to relate the impact of such innovations to crime pattern changes. It is the conclusion of this report that such efforts are wasted, and we are far better off to simply admit the difficulty of trying to correlate technological, or for that matter, many other law enforcement changes, with broad social indicators of crime. Further, even if we discard crime as a yardstick and try to evaluate performance based on other measures of police

activity, there is always the risk that undue emphasis will be given to those indicators which can be most easily measured--such as the number of car checks or arrests for stolen property.

Finally, as far as service impacts are concerned, it seems that routine computer uses by the police have almost entirely been devoted to the crime control and law enforcement functions of the police. In Chapter I it was pointed out, though, that only a small portion of police time was devoted to law enforcement activities (burglary in progress, check on car, make an arrest, etc.) and that the large majority was devoted to service (personal requests, animals, ambulance calls, utility problems, accidents, lost or found property, etc.) or order maintenance activities (family trouble, gang disturbances, neighborhood trouble, fights, etc.). By over-emphasizing the application of technology on crime control, law enforcement agencies neglect possible applications to social service activities, for example computer files to assist with referral information, medical assistance, or listings of agencies and names of people who might provide social service assistance. Some police agencies have already devoted attention to such applications, but if departments were to compare the dollars allocated for computer technology in each of the three areas of police activity--service, order maintenance, and law enforcement--to the actual time spent by officers in the street in these three areas, a shifting and reordering of priorities might result.

In the fourth area of evaluation--power impacts--the results of computer technology are the fuzziest. Individuals could potentially lose control of personal information, so safeguards to assure privacy and security are necessary. Further, computer technology may shift power within police departments, allowing those who are more quantitatively and

technologically oriented to gain influence. (The implications of such shifts will be discussed in the final section of the chapter.)

C. Nonroutine Applications

Although the service and power shifts of routine computer applications raise certain questions and concerns, in general, in terms of operational performance and technical impact, a number of routine applications have been successful. However, nonroutine uses of computer technology bring greater complexity both in terms of implementation and evaluation. In this report case studies have been conducted in two areas of nonroutine use--resource allocation and command and control. Each will be discussed below.

1. Resource allocation. In surveys in both 1971 and 1974, police departments considered resource allocation to be their most important area of computer use. Resource allocation was also the only area in which the number of applications reported in the 1974 survey actually exceeded 1971 predictions. All police departments must make deployment decisions and the interest in the use of technology to aid in this allocation process is growing. However, the interest in automated police deployment should be placed in the context of a realistic understanding of the law enforcement environment. First, the resource allocation applications noted in the surveys generaly refer to using tabulations of crime statistics to determine deployment, not to more sophisticated models; and even where modeling efforts have been tried, many of the cases have met with only limited success.

In the 1974 survey, 147 police departments characterized their resource allocation process. Seventy (48 percent) indicated that they use no

mathematical techniques in deciding how best to deploy their patrol force. Fifty (34 percent) indicated that they rely on some version of a hazard or quantitative formula for distributing resources.[4] Only 27 (18 percent) indicated that they used an advanced mathematical method, such as a computer simulation or another computer-aided resource allocation approach. In those departments which reported they were not using a mathematical method, though, more than half (60 percent) said they were using a computer to collect and store information for police service analysis. In other words, police use computers to keep track of law enforcement statistics and in a number of cases these data are undoubtedly used to assist in resource allocation decisions. However, the number of modeling projects is limited.

The case studies in this report have demonstrated the difficulty of actually implementing more advanced resource allocation techniques in police patrol operations. In St. Louis the use of the computer model that was implemented in the late 1960s is now purely optional, and no district captains currently request computer-generated reports. The command staff and the Board of Police Commissioners are essentially doing nothing to encourage use of the system by other commanders. In Boston, the proposed deployment techniques utilizing computer modeling were dropped

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4. A hazard formula identifies a series of factors that are felt to be significant in determining the demand for police patrol service. Generally, an attempt is then made to deploy units so that each sector has about the same hazard values. Most departments simply determine the anticipated work load, but some have more sophisticated approaches that entail the computation of total service times or consider a number of additional factors. Some of the most commonly used factors in calculating the hazard value of an area include the number of crimes against persons, total of all crimes, calls for service, population, juvenile delinquency, accidents and aided cases, school crossings, and licensed premises.

several years ago, and questions have been raised within the police department concerning the manual resource allocation procedures that were implemented.

Of the three cases reviewed in this report, the Los Angeles Police Department (LAPD) has the only resource allocation system utilizing computer technology which is actually operating and established as a part of its deployment process. The first level of evaluation--having an operating system--has been met. However, even there, the objectives of the resource allocation project were substantially modified. The LEMRAS/ADAM deployment model was dropped in 1974 to be replaced by the ADAM historical reporting system which was implemented in June, 1975. The current ADAM package no longer includes forecasts of future needs, and deployment recommendations are based on manual calculations using computer generated reports of historical data. The LAPD has achieved technical benefits in terms of reducing the manpower required to analyze workloads and to calculate deployment plans, but many of the service impacts are still unclear, for example, in terms of responding without delay to calls-for-service. Finally, one of the original service objectives of the LEMRAS/ADAM system, improved crime prevention, has been virtually abandoned.

Efforts in police departments to utilize computer technology in resource allocation go far beyond the St. Louis, Boston and Los Angeles case studies examined in this report. The modeling techniques used in these three cases are now outdated, and improved models have been developed. For example, as discussed in Chapter VII, a number of projects are currently underway to implement the Patrol Car Allocation Model (PCAM) and the Hypercube Model. These models allow the user to identify a wide range of performance measures--for example, mean travel times to various locations,

workload balances, response to calls-for-service and other dispatching strategies--and based on the relative importance of these various measures, alternative deployment strategies are provided. As a consequence, some of the objections in St. Louis and Los Angeles--that those modeling efforts did not consider enough of the relevant factors--have been overcome. The actual results of most of these efforts still must be evaluated, though. Further, the implementation problems encountered in the three cases in this report do not seem to be isolated instances. Rather, there is strong evidence that such difficulties are commonplace. For example, according to a 1975 report by the RAND Corporation that examined a number of attempts to implement computer models in the criminal justice area: "Through a series of interviews with model builders and personnel in agencies that attempted to implement models, a picture of the implementation process was obtained. In general, criminal justice models have failed to achieve any notable level of use for policy decisions."[5]

What can be said, then, about the various efforts to utilize computer technology in police resource allocations? Five conclusions have been drawn.

a. Many of the early predictions and promises concerning computer-aided resource allocation systems have not come true, and our expectations for the future should be altered accordingly. At one time some advocates argued that the use of computers and technology might result in the almost daily reallocation of police units. An officer reporting for duty would

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5. J. Chaiken, T. Crabill, L. Holliday, D. Jaquett, M. Lawless, and E. Quade, Criminal Justice Models: An Overview, RAND Report R-1859-DOJ, (Santa Monica, Calif.: Rand Corporation, October, 1975), pp. xii.

call in and be assigned to patrol or to answer calls in an area designated through the analysis of available data and the aid of modeling technology. It is apparent that this type of "fluid patrol" is not going to occur. This is illustrated by the St. Louis experience. At one point in the St. Louis resource allocation, patrol beats were changed every four hours, a practice long since abandoned for two reasons: behavioral factors worked strongly against such shifts (which were confusing and unsettling to the officer on patrol), and the benefits were questionable, especially since workload needs did not seem to warrant such dramatic action).

Past experience, then, should appropriately temper our future expectations. Rather than looking for the long-term implementation of computer aided resource allocation to redesign police deployment on a quarterly basis, we should expect the use of modeling techniques on a more limited, almost one-time basis, where police departments use computer technology to redesign their patrol structure once and then wait for several years before using the model again.

b. Many of the problems in implementing computer models are the result of behavioral and organizational difficulties. Past experience has shown both a misunderstanding of the nature and environment of technological change, and a failure to properly manage innovation. The case studies in this report demonstrate the difficulty of getting police users involved in modeling efforts. Although the ADAM/LEMRAS system in Los Angeles has been altered substantially since its inception in 1967, the ADAM historical reporting system is currently in operation, partially because of the sensitivity and approach of LAPD personnel. Chapter VII outlines how the eventual approach in Los Angeles contrasted with the project

management efforts in St. Louis and Boston. Still, it took eight years for changes to be made in Los Angeles which highlights vividly the need for a long-term timeframe, the involvement of command leadership, the continuity of personnel over time, and a number of other factors that will be dealth with in more detail later in this chapter.

c. Despite past disappointments, police computer modeling efforts should not be abandoned. We should continue to seek improved methods for police resource allocation, but with a more realistic perspective. All police departments must deploy their resources in some manner or other. The two surveys in 1971 and 1974 demonstrated that there was an increased use of quantitative data in making manpower decisions. According to one chief of police: "I used to feel that the only criteria in police work was to get more officers on the street. Now I have come to realize that other standards of performance should also be considered. There is more to resource allocation that seat-of-the-pants observations." If the right criteria are built into the models, technology may assist in more effectively identifying and responding to future needs.

Further, in order to develop police models, detailed review and analysis of the criminal justice system is required. Use of the technology may aid the operations of the police, not because the model per se will improve the system, but because law enforcement personnel may become more educated and involved in the decision-making process. However, if this education process is to be meaningful, it must be two-way, not only involving the model builders, but extensively involving the model users as well. It is difficult to involve law enforcement decision makers in such a process, not only because of differences in style and approach, but because the complex world of policy management faces immediate demands. The police commander who faces

day-to-day decisions is often unable or unwilling to afford the luxury of model building and analysis.

The last few years have seen the development of several new and more flexible approaches to computer-aided police deployment such as the Hypercube or PCAM models, and in fact, according to recent estimates, since September, 1975, 12 police departments have used, or are using PCAM (with an additional seven departments as possible future users), and approximately 24 police departments have used or are using the Hypercube Model, at least on an experimental basis.[6] However, in designing and implementing such models hopefully we can learn from the past so that our expectations will be realistic and we will remember that the quality of the outputs of the model are highly dependent upon inputs, design, and assumptions.

d. <u>As computer modeling work is continued, evaluation is essential, and careful consideration should be given to a more systematic program to evaluate such technology</u>. Any claim about the impact on performance of advanced deployment models will remain largely speculative until more careful research and evaluation is carried out. The time may be appropriate to develop a more systematic program of evaluation, and the Law Enforcement Assistance Administration should design such an experiment to test alternative resource allocation strategies. It is only through such an experiment that it can be determined whether, or to what degree, development and implementation of such police technology is warranted. If such evaluation is forthcoming, though, it must be independent; and pretest conditions must be analyzed, implementation monitored, and the effects of

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6. Jan M. Chaiken, "Implementation of Emergency Service Deployment Models in Operating Agencies," RAND Paper Series, Paper Number P-5870, (Santa Monica, Calif.: Rand Corporation, May, 1977), pp. 13-17.

the technology reviewed. The evaluation must be multi-disciplinary with attention paid to the local citizenry's perception of changes in the overall quality of service in all three dimensions of police performance--law enforcement, service and order maintenance. However, the case studies have highlighted the inability to relate innovations to changes in crime statistics, and success or failure will need to be measured in other terms, such as evaluating the impact on workload distribution, the response to calls-for-service, and officer and citizen satisfaction.

e. Finally, and perhaps most important, there is no one best way to allocate law enforcement resources. Rather, there is a range of alternative strategies, and each implies a different, sometimes subtle, set of consequences. The computer cannot prescribe the ideal method. When embarking on the implementation of innovation, it is important to review and understand the consequences of alternative policing strategies and to realize that the use of technology is not value-free. The experience in the LAPD is especially informative in demonstrating this point. Team policing and the resource allocation model, ADAM, represented two separate philosophies of police work. ADAM placed priority on responding to calls-for-service, generally irrespective of patrol beat assignments. Team policing focused on assigning patrol officers to one area of the city to prevent crime. The conflict appeared when ADAM was implemented in the team policing environment. The problem was not the ADAM system, per se; rather, there were two different strategies involved, both with very different objectives.

Any resource allocation system is obviously based on some basic set of criteria or decision rules used to deploy police forces. To obtain the best results a department must select rules compatible with their basic

objectives. A department must be espeically careful in buying a preprogrammed package from a vendor that relies on a set of decision rules which are essentially unknown to the department. The result may be unexpected or yield the wrong consequences. Certain criteria--for example, responding to calls-for-service--may be given emphasis when, indeed, they do not have the highest priority. Emergency response to calls-for-service comprise only a small portion of the actual police work, yet it is possible that such measures can become primary criteria for allocating resources if departments fail to take the time to think carefully about their deployment strategy.

Earlier it was stated that if the right criteria were used, technology might assist in meeting future needs. However, in deploying manpower, no single criterion will bring magic results. Goals and objectives vary, depending on the focus or emphasis which is desired. There is more to police work than crime-related activities; service and order maintenance functions are also of primary importance. Unless the use of computer technology can reflect this insight, oversights may develop and subtle and undesired impacts may arise.

2. Command and control. The potential for automating aspects of police cammand and control operations were first pointed out by the Crime Commission in 1967. Computer-aided dispatch (CAD) systems provide the framework for bringing together many of these new tools through the partial automation of the call answering and dispatch process. Other command and control technological changes that have been considered or tried include mobile and portable digital terminals to allow officers in the street to communicate digitally with headquarters, automatic vehicle location (AVL) and automatic vehicle monitoring (AVM) systems to keep track of the

location and monitor the status of police units, and 911 emergency telephone services.[7] A CAD system may include AVM or AVL systems, 911 telephone service or mobil digital terminals.

Some of these innovations in command and control are routine; the technology basically replaces a previously manual activity such as with digital terminals or the automated transfer of information from the telephone operator to the dispatcher. However, CAD also provides the framework for a number of nonroutine activities, such as tracking and monitoring vehicle location, automatically timing the length of calls and raising a "flag" if a call takes over a specified time (say 30 minutes), or providing new information to be used for management. Command and control as discussed in this report, then, relates not only to dispatch deployment, but to the ability of police administrators to control and modify the manner in which police operations are conducted.

This study documents four cases within the command and control area--three CAD systems in New York City, San Diego, and Boston, and one AVM system in St. Louis. As such this report has only begun to examine the many dimensions of such innovations. First, the implementation of CAD will be reviewed, then AVM.

a. Computer-Aided Dispatch. As reported earlier, the 1971 and 1974 ICAM survey results indicated that the implementation of CAD systems has been far slower than initial anticipations. As further confirmation, a 1975

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7. A distinction has been drawn in this report between AVL and AVM systems. An AVM system provides a police dispatcher with real-time location estimates of each vehicle in a fleet and, through its monitoring function, provides additional vehicle status information (for example, "in pursuit," "enroute to scene," etc.). An AVL system provides only location estimates without additional status information.

study found that of the 135 police departments in jurisdictions with a population of more than 100,000, only about 10 percent had a CAD program.[8] The use of CAD systems is just beginning, and a number of obstacles have been encountered in the installation process. However, in San Diego and New York City working systems have been developed, although in Boston the problems of introducing the new technology have been more significant. The successes and failures of the three case studies provide seven insights for the future.

First, it is possible to establish ongoing, operational CAD systems. The SPRINT system in New York City has been working since 1970 and the CAD system in San Diego has been operating since 1975. Second, both cities experienced technical benefits such as increased information availability, rapidity in matching addresses with geographic location, the effective transfer and recording of data in the dispatch process, and the retrieval of information from the dispatch system.

Third, in terms of process measures, both cities have experienced certain positive service impacts: telephone calls are answered and serviced more rapidly (telephone talk time in San Diego has dropped from 3 minutes to 77 seconds, and the average time required to answer the telephone is 2.5 seconds); standards can be set for communications and field backlogs (New York City has met its standard of answering 98 percent of telephone calls within 30 seconds, and air-time delay and field backlogs are monitored and recorded); and the workload has been more evenly distributed within communications divisions. However when it comes to measuring the actual service results attributed to CAD, the conclusions are inconclusive. In the New

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8. R. L. Sohn, et al., Application of Computer-Aided Dispatch in Law Enforcement, An Introductory Planning Guide, (Pasadena, California: Jet Propulsion Laboratory, 1975), p. 3.

York City and San Diego police departments there is a general feeling that dispatch time has been reduced, but the data are inadequate to prove or disprove such a hypothesis. Further, the police departments have essentially not analyzed the CAD system's influence in such areas as improving police productivity by enabling patrol officers to respond to more calls per shift or providing a better match between police service needs and available resources. Also, the impact of the new technology on crime has not been evaluated (although, as pointed out earlier, such a review of the influence on crime would have major limitations).

Fourth, the power impacts of the CAD systems are also clouded. CAD systems highlight the importance of the dispatcher in the delivery of police services. As greater information increases the ability of the dispatcher to carry out his or her job, it also increases influence and power of communications personnel. In Boston some of the resistance to CAD technology resulted because of a fear of increasing the power of the dispatcher. Another potential power shift relates to the ability of police administrators to control and modify the manner in which police operations are carried out. Both the New York City and San Diego CAD systems provide a wide range of new information to managers. A number of reports are regularly produced and distributed in New York City, and in San Diego lists of available reports are circulated to police personnel with further documents provided upon request. Such data offer a rich potential for the better management of police field resources and dispatch personnel and for bringing greater authority and control to police managers. However, the ultimate impact will depend on the ability of law enforcement administrators to analyze and use this information effectively as a resource.

The question remains, then, as to whether the benefits of CAD justify the costs. Although the expenses of much of this technology seem high, when placed in the overall context of the costs of police operations, the comparative magnitude of the dollars seems to diminish. In New York City, for example, the annualized costs for developing and operating the SPRINT system are about $2.7 million. Because the 1975 police budget in New York City was approximately $625 million, this means that 4/10ths of 1 percent of the annual budget was devoted to the CAD system.[9]

In both New York City and San Diego technical and service benefits have been achieved to help offset such costs, and it seems highly likely that the use of CAD systems will continue to expand. Whether their full potential is achieved, though, will depend on the skills of the management personnel. Police chiefs have seldom considered themselves as managers in the past; rather, their responsibility has been to balance pressures within and without the city and to promote the need for law enforcement and police resources. Consequently, it is still unclear as to whether they or their assistants will be able to channel the potential technological talents of the computer to do more than simply perform routine operations.

The fifth conclusion from the three CAD cases points to the complexity and importance of implementation. In Boston a number of factors were identified which contributed to the problems of installing a CAD system in the police department: lack of involvement by career department personnel in in formulating the program; prohibition of outside consultants from

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9. Stated in another way, the costs of operating SPRINT are roughly equivalent to maintaining 10 police patrol units on an annual basis. (Cost estimates are discussed in more detail in Chapter IX.)

working closely with department staff and field personnel who would use the new system, and lack of progress reviews with field personnel. Police officers are often suspicious of change, and CAD has the potential for huge modifications in police operations. Where possible police must be involved in identifying the need and designing the operation of technological innovations. It is possible that the CAD system in Boston will someday become fully operational, but first, behavioral, technical, and political obstacles must be overcome. In San Diego great care was made to train personnel and to involve dispatchers and operational officers in the design of the new system, and this approach certainly contributed to their apparent success. Even in San Diego, though, the primary problems to date relate to behavioral difficulties (such as boredom, monotony, and the isolation of the personnel in the communications center from the rest of the police department). A special 90-hour training program was developed for telephone and dispatch operators but in 1976 personnel shortages forced the department to rely on on-the-job training instead, at least in the short run.

Sixth, the relationship between the user and the vendor must be clearly defined and performance standards for CAD technology must be specified. Although San Diego had a very clear set of vendor specifications in the request for proposal for the CAD system, the Boston proposal lacked the same clarity and misunderstandings inevitably developed. In the long run, both the police and the vendors of technology will benefit from a clear framework and set of standards and specifications. In fact, it is the conclusion of this report that effective implementation necessitates such standards.

Seventh, and finally, the time is appropriate for a more thorough evaluation of CAD technology in the law enforcement community. Although

some systems are still in operation, others have met with only limited success and the reality is far below initial expectations. Still the interest in CAD among law enforcement agencies appears to be high, and a number of vendors are out actively promoting their products, sometimes without standards, checks and balances. The LEAA should consider funding a thorough evaluation of such technology to identify both the advantages and problems that have occurred to date and to outline a clear set of performance standards for users and vendors in considering the implementation of a new CAD system. Such an evaluation could play an important role in the process of technology transfer (or non transfer) both in terms of realistically educating interested departments in the benefits and the costs of such innovations and in terms of identifying possible "pools of resources" to aid in the transfer process.

b. Automatic Vehicle Monitoring. The application of AVM highlights a number of additional dimensions in the evaluation of computer technology related to police command and control. In analyzing the St. Louis experiment, four objectives were reviewed: (1) reduction in voice-band congestion through digital communications, (2) response time reduction, (3) improved officer safety, and (4) increased command and control capabilities. The evaluation in Chapter XI of this report reviews only the Phase I AVM experiment in one police district in St. Louis, District 3. (The Phase II citywide implementation of the system was underway as of 1977.) Based on the Phase I experience, though, only one of the initial four objectives--digital communication--has achieved positive results. Although the level of voice-band congestion was not materially changed through the use of the digital communication components of the AVM system (called FLAIR), the system experienced high usage, allowed a far greater number of

communications between the field and the dispatch center, provided both field officers and dispatchers with greater communications flexibility, and was generally accepted positively by officers in the field.

Regarding response time, the Phase I AVM tests did not support the expected reduction in response time. Although further careful review is needed during Phase II, current evidence does not suggest that savings in travel time due solely to AVM will significantly improve police operations or reduce costs. This is particularly true when one realizes that little is known about the relationship between response time and apprehension probability,[10] and that in an urban environment, travel time as a component of total system response time rarely exceeds about 50 percent of total system response time. Thus, a 10 percent reduction in travel time is not likely to decrease total system response time by more than 5 percent. Since a significant amount of time often passes before a crime is even reported to the police, this further dilutes the impact of a travel time reduction due to AVM.[11]

Regarding improved officer safety, the St. Louis AVM system includes a special feature to alert the dispatcher visually and audibly that an officer has pushed a button indicating that he or she is in trouble. However, during Phase I the rate of cars that were "lost" or mislocated by the system was so high that the confidence of patrol officers in the emergency aspects

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10. Two studies on this subject include Herbert H. Isaacs, "A Study on Crimes and Arrests in a Metropolitan Police Department," Appendix B, Task Force Report, Science and Technology, President's Commission on Law Enforcement and Administration of Justice, Washington, D.C., 1967,pp. 88-106; and by Clawson and Chang in Seattle to appear in a special issue of Management Science on Criminal Justice, A. Blumstein and R. Larson, co-guest editors.

11. See for example Deborah H. Bertram and Alexander Vargo, "Response Time Analysis Study: Preliminary Findings on Robbery in Kansas City," The Police Chief, May, 1976, pp. 74-77.

of AVM decreased significantly. Also, the number of actual emergency alarms during Phase I was small, making a proper evaluation difficult due to small size.

Although it is premature to state a final conclusion regarding the officer safety aspects of AVM, the St. Louis case does provide an excellent opportunity to review the human aspects of adding location information to police command and control. Behavioral and organizational factors are important in implementing CAD applications, but they are essential for installing AVM systems. A crucial link exists between attitudes and system technical performance. Before using the Phase I system, 64 percent of the officers in the experimental area --District 3--thought AVM was a "good idea." Because of operational problems discussed above, after the Phase I implementation, only 39 percent still felt positively. If new systems are to receive the support of police personnel, hardware vendors must be accountable for system accuracy, maintenance and repair standards, system capacity and system adaptability. Also, the operation of AVM relies heavily on well-motivated and trained dispatchers. Because the capabilities and motivations of dispatchers were mixed, this uneven quality contributed to the shift in attitudes. One of the most important aspects in implementint new technology is developing the proper human/technology interface. The point at which this is especially vital with command and control is the link between the dispatcher and the new system. If the Phase II system being implemented city wide in St. Louis is to succeed, several behavioral and managerial factors must be considered. These include: priority attention to the role of the dispatcher, an effort by vendors and top management to keep from "overpromising," the development of detailed standards for evaluation, ongoing dialogue and feedback

concerning the system, careful involvement of top police supervisors, and a long-term commitment and continuity of personnel. Further, sensitivity is required concerning the potential for disciplinary abuse. The patrol officers' association in St. Louis has referred to AVM as a "fancy cow bell for cops." To the extent that AVM is used primarily as a means to justify discipline it will face strong officer resistance. On the other hand, if used as a means of encouraging better management and deployment of police personnel, officers may be more receptive to change.

In fact, since the response time improvements of AVM seem dubious the final evaluation will generally depend on shifts in command and control capabilities pertaining to the ability of the dispatcher to deploy (command) vehicles, especially under extraordinary circumstances, and the ability of patrol administrators to control and modify the manner in which patrol operations are conducted. Few results were available during Phase I regarding the potential of AVM for affecting patrol operations. The average cost of fielding a round-the-clock one-person patrol car usually exceeds $100,000 per year or, for a two-person patrol car, $200,000 per year. The total AVM cost at $2,000 per year, then, represents no more than 2 percent of the cost for a one-person car (or 1 percent for a two-person car). Compared to the one-person car, if it could be shown in Phase II that AVM will increase the efficiency and effectiveness of the force by x percent (because of better management of the forces), then AVM will provide at least x:2 return on the investment. If x is equal to 10 percent, for example, this would produce a 5:1 return on investment.

Such analysis indicates that there is potential for management improvement, but again, the results will depend upon the ability of police administrators to utilize the new resource. An evaluation is being

conducted of the Phase II implementation, and an attempt will be made to measure changes, if any, on patrol operations. More conclusive findings must await this evaluation.

Finally, more than just monetary factors must be considered when evaluating the advantages and disadvantages of AVM. The implications that such innovations might have for police policy and approach must also be considered. To the extent that AVM stresses rapid response to calls-for-service and dispatching the closest car, it may conflict with an alternative approach to policing--the "one-person, one beat" approach that gives a patrol officer or team responsibility for a particular area. Therefore, a definitive review of costs and benefits that will be applicable to all police departments is probably impossible. Rather, the costs and benefits for each city will vary and must be reviewed depending on individual goals and priorities.

D. The Implementation of Computer Technology

Throughout the report we have noted that how computer technology is implemented is crucial to success. Even with routine computer applications the success has varied widely among police departments because of styles of implementation and the fragmented nature of law enforcement activities. With nonroutine applications, where the success has been far more limited, the process of implementation has been particularly important. The main problems have generally not been technical, per se; rather they have often been behavioral, organizational, and dependent upon the relationship between vendors and users. The LEAA has spent large sums of money to support computer technology, and comparatively speaking, they have

neglected the process of implementing these innovations.

The time is now ripe to change this orientation. The conclusions of this report regarding the importance of implementation have been verified by numerous studies conducted both in law enforcement and in the more general applications of technology in the public sector.[12] The question is: "What should be done?"

First, it is worth noting that people involved in promoting computer technology often make certain implicit or explicit assumptions. Some of these have been identified in this report:

- If the technology exists, there must be a need and implementation should proceed.
- If only the technical problems can be resolved, the implementation can move forward.
- Time constraints mean that implementation must rely on a small group of supporters.
- Law enforcement supervisors really don't need to understand how innovations work, they simply need to know how to use them.
- The quicker the innovation can be installed, the better.
- If new technology is installed, positive results will automatically occur.

Such assumptions often cause implementation to fail. Although sometimes partially true and often undoubtedly expedient, they generally return to

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12. See, for example, Garry D. Brewer, Politicians, Bureaucrats, and the Consultant (New York: Basic Books, 1973); and Martin Greenberger, Matthew A. Crenson, and Brian L. Crissey, Models in the Policy Process, Public Decision Making in the Computer Era (New York: Russel Sage Foundation, 1976).

haunt the implementer and to bring the eventual demise of the effort.

Based on the case studies and survey work in this report it is possible to develop a set of recommendations concerning the important factors to consider when implementing computer technology. The factors are divided into two categories: those related to the nature and the environment of the innovation, and those related to the project management of the innovation. Each of these factors is a necessary but not sufficient aspect of successful implementation.

1. Conditions related to the nature and environment of the innovation. Four factors seem especially important in this regard.

   - A clear and realistic understanding at the outset of the project of the policy issues involved. For example, when the LAPD first began the LEMRAS project, they failed to appreciate the policy conflict between the model and team policing.
   - A perceived need for change among those influenced by the innovation--both police administrators and officers in the street. One of the best indicators of this perceived need is a willingness to pay for change. Both San Diego and New York City "used their own money," so to speak, when installing CAD systems. Many of the recent Hypercube and PCAM police resource allocation modeling efforts have been funded directly by the departments involved. Although projects funded from the outside may still succeed, often there is less commitment and support than in self-funded efforts.
   - Effective timing and system design so as to meet user needs. The first attempt at CAD in San Diego failed miserably because those involved in the design failed to identify the needs of users. The second effort focused special attention on user

concerns and was implemented at a time when change seemed essential. The outcome was far more successful.

- The proper selection of priorities in implementing computer technology. The most important formula seems to be to start with innovations that assist the officer in the street. After that more nonroutine innovations can be developed. As we discussed earlier, computer technology has often been devoted to a narrow range of officer needs. The focus has been on crime and law enforcement activities. Perhaps if greater attention were devoted to service or order maintenance objectives, acceptance would increase.

2. Factors related to the project management of innovation. Eight elements are included in this checklist for innovation.

- A long term time framework and perspective. Eight years were spent in the implementation of the ADAM historical reporting system in Los Angeles. Such projects inevitably take longer than initially planned, and if an adequate timeframe is not allowed, frustration and rejection will ensue.
- Involvement and quality of top-level leadership. Police departments tend to be fairly rigid organizations with well established chains of command. Understanding, involvement and support from the top is essential if technological innovations are to be implemented and used. More than support from the Chief is required, though. In addition, a core of agency leaders is necessary if commitment is to be maintained over time.

- Involvement of other police personnel. Besides the top commanders, police at the operating level must be involved in the design and development of computer technology. One reason the resource allocation system faltered in St. Louis was because the field officers strongly resisted a shift of only one hour in their daily schedules because it would have required them to commute to work during the normal rush hour traffic.
- Caliber of computer systems and technical staff. Individuals are required who have both technical skills as well as a broad perspective which will allow them to see beyond computer technology to law enforcement needs and to communicate successfully with the police department. In order to attract such individuals, cities must be willing to pay competitive wages.
- Continuity of personnel. Experience has shown that, as advocates for technological innovation move, the innovation often dies. Change in personnel is inevitable, but at the same time, a certain degree of continuity must be maintained.
- Effective training, education, and information dissemination. The process of communication is often at the heart of effective innovation. Carefully designed training programs provide an important link in such communication. However, innovators must also be prepared to listen to feedback and the dialogue process must be two way.
- Emphasis placed on human-computer interaction. There is sometimes a tendency to consider computer technology as a

replacement for people. This is both unrealistic and inefficient. One of the most critical variables for the efficient and effective operation of any computer system is the development of the proper balance in the interaction between man and machine.

- Unbiased evaluation. A careful (and, if possible, independent) evaluation should be an integral part of any implementation effort.

Twelve conditions for effective implementation have been outlined above. Obviously it is impossible to expect that they can all be met whenever computer technology is implemented. However, they are a checklist to keep in mind when considering the implementation process. There is no one simple answer to assure success. On the other hand, it is clear that in the past we have failed to devote adequate attention to the implementation and diffusion of innovation in law enforcement. While trying not to raise our expectations beyond reach, it should be possible to concentrate our efforts at more effective evaluation and transfer, where appropriate.

One of the first steps is to facilitate a better quality control over transactions between vendors and users. By far, the primary promoters and agents for technological change in law enforcement are those who are marketing and selling their products to the police. Although I do not advocate strict legislation or government regulation, it may be the time to begin to establish informal "truth in technology" standards. In the CAD area, for example, San Diego and New York City both developed standards to evaluate vendor performance. A broader evaluation of CAD could help to identify the utility of such systems for different police departments and to outline

detailed specifications that could be applied in various circumstances. With AVM, the experience in St. Louis has already assisted in spelling out possible performance measures that could be applied concerning accuracy, maintenance and repair, system capacity and system adaptability.[13] Such standards will not only help to establish a basic level of performance, they will help to encourage the development of better technology and better models.

In addition, a good deal of attention in the literature is given to trying to "bridge the gap" between the builders of technology and the users. For example, some have argued for the need for more "engineers" in the technology process[14] and others have called for the development of a new breed of researchers/pragmatists--model analyzers--as highly skilled professionals and astute practitioners able to review both the needs for modeling and for controlling and directing the model builder: "The model analyzer would be neither model builder nor model user, but in a middle position between the two, empathetic with both."[15] I am skeptical about the possibility of institutionalizing either of these on a large scale in the law enforcement community. Police are often suspicious of change, particularly change promoted from the outside.

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13. See Richard C. Larson, Kent W. Colton and Gilbert C. Larson, "Evaluation of a Police Implemented AVM System: Phase I, with Recommendations for Other Cities," pp. 61-63, summary report of work performed by Public Systems Evaluation, Inc., Cambridge, Mass., funded by Grant No. 75NI-99-0014, National Institute of Law Enforcement and Criminal Justice, LEAA, U.S. Department of Justice.

14. Jan Chaiken, et al.; Criminal Justice Models: An Overview.

15. Martin Greenberger, et al., Models in the Police Process, Public Decision Making in the Computer Era, p. 339.

However, it has become apparent in analyzing the implementation of law enforcement technology, that a new breed of police officers is beginning to emerge. These officers have "come up through the ranks" and have, therefore, "paid their dues" and are respected within the police community. At the same time, they have experienced both the advantages and the limitations of new technology. Rather than trying to teach outside engineers about police practices and policies, it may be more profitable to cultivate this inside set of "police technology experts." For example, there may be ten or twenty members of police departments around the country who have developed real expertise in implementing CAD systems and a sense of the standards that should be applied. Perhaps they could serve as consultants to other departments in implementing CAD technology. In essence they could become a "pool of resources" in special areas of concentration to aid in the diffusion process. However, they must maintain their independence from vendors or others who have a vested interest in the technology transfer process.

Finally, it is essential to remember that one of the most critical elements of success is that the desire for change must come from within, not without. Better evaluation and standards of performance can help educate police departments as to the advantages and limitations of technology, and "pools of resources" from within and without the law enforcement community might establish a two-way communication to facilitate diffusion. Still, the final desire for change and the specific design and implementation of alternatives must come from the police department involved.

There is a human tendency to seek direct solutions and to try to classify actions as either failures or successes. In the area of implementation, though, there seems to be no one absolute, single answer. Rather, the correct prescription must come from a confluence of factors. Even then, some

implementation efforts will succeed, some will fail, and others will fall somewhere in between. Hopefully, we can learn from all three situations. Evaluation is necessary to weed out unjustified innovations, but it should be remembered that the field of computer technology is still in its infancy. The first commercially sold stored program computer, the Universal Automatic Computer, or Univac 1, was built only 26 years ago in 1951. The third generation of computers has been commercially available only since the late 1960s. Perfection should not be expected instantly in an area so young and rapidly changing. On the other hand, a certain mystique as well as commercial force surrounding the application of computers has led to high hopes and to major oversell. In reality, the state of the art is often far less than the general impression one gets from the literature. As time goes forward, expectations should become more realistic and our ability to perform will improve.

E. Conclusion

Even if computer technology can be implemented successfully, important questions remain about the final impact of this technology and the benefits and costs. The Crime Commission's report in 1967 stressed the use of technology in law enforcement, it was optimistic about the potential for such innovation. Since then we have learned a great deal. Quick solutions should not be expected, and costs accompany any benefits that are achieved. In a narrow sense, this report has found that there are technical and service impacts stemming from the routine use of computer technology, and in the area of nonroutine use, indications of technical and service improvements have been documented. However, we have also learned to expect

little impact from computer technology on crime and the basic law enforcement issues. Crime is rooted in an infinite mix of factors; technology can do little to alter these conditions. Earlier, we stated that no one should expect the computer to change the direction of law enforcement dramatically. The findings of the report confirm this conclusion. The best that can be expected are marginal improvements. Still, it is relevant to ask: "What power impacts will technology have and what changes, if any, can be expected in the personnel, tasks and structure of the police?"

Determining such power impacts poses a more difficult research problem than probing technical or process oriented service impacts. No major shifts have been identified, but subtle changes may be forthcoming. The emphasis in Kansas City on conducting computer searches versus other types of law enforcement activities is one indication and the conflict between team policing and the LEMRAS/ADAM system in Los Angeles is another. To the extent that computer technology places greater emphasis on quantitative approaches to the law enforcement problem, shifts may occur.

Clearly, personnel in the law enforcement community have had more impact on technology than the reverse, but again, subtle shifts may occur in the future. Our survey results have shown that people with more quantitative backgrounds seem to be gaining in terms of their importance in police departments and those who have a greater ability to utilize computer technology may increase in importance in police departments.

Finally, there is some evidence that computer technology may lead to a greater centralization of police structure and power. However, based on closer examination it seems that computers themselves do not cause centralization or decentralization. Rather, they are tools that can be used to move in either direction. Centralization may be the most common result, but

not necessarily. In fact, in telephone interviews with police chiefs, several indicated that, with the computer, decision making was becoming more decentralized. Because more information is available to field staff and district commanders, they should be able to make wiser decisions.

Students of technology and society have largely abandoned the view that computers and other technologies will impinge directly on institutions and organizations, causing dramatic collisions and changes of direction. Computer technology does not create social forces or trends; rather, the application and the use of new technologies are strongly influenced by political forces and social values. This is especially true in the law enforcement area. During the last decade, for example, a number of scholars have debated the nature and causes of the crime problem, only to realize how difficult it is to trace the relationships between alternative "solutions" and the crime rate. Nevertheless, technology may well support or enhance established trends or directions of change. They may make powerful people more powerful, and established practices more set.

There is a range of views about the use of computers and technology in our society. At one extreme are those who see the increasing movement towards a technological society as dangerous, a movement that will take us away from the "good life." Scientific rationality and technological progress may have questionable results and set up a chain reaction that we may not be able to reverse.[16] At the other extreme are the technologists, the champions of the rational, scientific approach, and the vendors who sell their products

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16. For an interesting presentation of this argument see Abbe Mowshowitz The Conquest of Will: Information Processing in Human Affairs, (Reading, Massachusetts: Addison-Wesley, 1976).

They argue that the benefits of technology outweigh its costs and tend to oversell their products and to promise more than they can deliver. This report concludes that the truth lies somewhere between. On the one hand, computer technology has become a part of law enforcement activity. Rather than trying to unrealistically halt this reality, the most useful orientation is to evaluate current needs and progress and to promote change where it is appropriate. On the other hand, we must admit that many of our efforts at technological innovation have failed. Promises have been overextended, expectations have not been met, and resources have been wasted. The answer to our problems does not lie in hardware; it lies in basic value judgments and in people. In talking about a computer application in his police department, one police sergeant astutely remarked:

> "The computer terminal in the car is an effort by the police department to professionalize from a hardware approach. This is O.K., but the more we concentrate on hardware, the farther we move from the basic people issues. The real police problems don't have technical solutions. Instead, it's the people who are screwed up, and we need more people-to-people-type efforts in police departments, such as improvements in communication, increased motivation, productivity modifications, better interpersonal relations, etc. In short, instead of hardward solutions, we need policy resolutions of the basic issues of the police force. The result of the computer may be to take our minds off what are the more important issues."[17]

In summary, most arguments against the computer are made on the grounds that too much money is currently being spent on law enforcement technology, particularly when it is not clear that the benefits of such technology justify the costs. This study has found such arguments to be valid in a number of cases, but in others, it appears that as long as benefits are defined in narrow, process-oriented terms, they sometimes do justify

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17. Interview between Kent W. Colton and a police sergeant in Oakland, California, 1974.

the costs, particularly with routine applications. (Naturally, success regarding use varies from department to department.) Further, this efficiency may continue to develop with time as computer technology becomes more sophisticated, and particularly as police departments get better at handling the organizational and behavioral problems which often accompany the introduction of technology and the implementation of change. Certainly at this stage oversell and unmet expectations exist in many departments. Still, computer technology is in its comparative infancy, and time may bring some alterations in the operations of law enforcement work as a consequence of the computer.

However, there are other issues surrounding the use of the computer that are even more important than those of costs and benefits. The use of computer technology by the police must be placed in perspective. The most pressing law enforcement questions at this time are to define the basic task of the police, to identify how the patrolman's time is really being spent, to determine the correct allocation of resources and to determine if current recruiting and training practices complement the basic needs and priorities of the police. The computer (along with proper analysis) may help in a small way to resolve these issues, but until this is done, the implementation of the computer may also serve to reinforce the status quo, to lock in and substantiate our present approach, and to indirectly countermand major innovation, if required. This can cause anxiety about the negative effects of computer technology on the grounds of the changes that it won't bring instead of those that it will. The computer would be a fantastic tool if it could help solve socio-economic problems of our society such as racism, inequality and poverty; or even at a less comprehensive level if it could answer some

of the basic issues which the law enforcement community faces today such as defining the basic task of the police, structuring police departments and selecting candidates for police service. The computer has a role to play in police departments, but it is only a machine and as such, its use should always be considered in the overall law enforcement context.

The greatest strengths of computer techology seem closely related to its greatest weaknesses. Computers have the potential to aid in criminal justice activities through rapid communication, better information and perhaps a more rational approach to decision-making. We must realize that there are limits to the benefits of this technology, though, and not overestimate its potential. However, these very benefits, if not properly controlled or planned, may result in misuse, unintended consequences, wasted resources, and frustrations. Expanded computer use by the police is at a crucial point and now is the time to point to a new direction, one slanting toward attention to evaluation and implementation, stressing performance standards and transfer, and realizing that police play a broader role in society than simply fighting crime. Such a new direction requires careful consideration so that the strengths of technology can be judiciously marshalled and the weaknesses and potential risks prudently forestalled.

APPENDIX

RECOMMENDATIONS TO THE LAW ENFORCEMENT ASSISTANCE ADMINISTRATION

By now it should be apparent that there is no one common solution concerning the application of computer technology by the police. Two extremes have been identified. At one extreme are the technologists, those who argue for the increasing use of the computer. Their vested interest is greatest in the sale and success of increasing computer use. At the other extreme are those who argue that neither the technology nor the expense has yielded much benefit to law enforcement. They feel the use of technology by the police should be discontinued.

Our conclusion is that the truth is somewhere between. On the one hand, there are no quick or easy solutions. Computer technology will have little impact on crime. It is a major mistake to oversell the potential. On the other hand, a number of technical and service benefits have been achieved through the effective use of computer technology. The key is to develop a series of policies that will pursue a modified course through the middle ground with emphasis on implementation and evaluation. With this in mind, five overlapping recommendations can be made to the Law Enforcement Assistance Administration.

First, standards of performance for technological innovations should be established. One reason for many of the past technological failures was police departments' uncertainty about what to expect and require from vendors who oversold their product. We now have enough experience with a number of applications of computer technology to establish performance standards that could be used by police departments throughout the country.

CAD is an appropriate illustration. Based on the San Diego, New York City, and other experiences, a standard set of specifications for CAD which would probably vary, according to city size and communication workload, could be developed as a guideline for interested departments (and vendors). By beginning to set "truth in technology" standards the LEAA could make an important contribution to computer technology.

Further evaluation is a pre-requisite to establishing such standards. This report only scratches the surface. Many of the early technology efforts that were implemented and funded by the LEAA failed to include evaluation steps and little good data are available to ascertain their success or failure. In recent years LEAA has placed greater emphasis on evaluation, and the National Institute for Law Enforcement and Criminal Justice has spent millions of dollars for evaluation. Still, evaluation efforts should be linked more closely with decisions for future funding. When projects are implemented, an evaluation program should be part of the design so that comparative data can be collected on the technical, operational, and attitudinal impacts.

When failure occurs it must be recognized. For example, within the next several years important conclusions may be reached concerning the impact of various technological innovations on response time and the utility of response-time improvements. If the Phase II AVM experiment in St. Louis indicates that the goals and objectives have not been met, it will be important to widely publicize these results. Finally, as evaluation proceeds, we should not expect significant impacts on crime. Rather, we must carefully define our objectives and look to other measures of police performance related not only to crime fighting but to service and order maintenance

activities. Continued attention by the LEAA to devise measures of success and failure is essential in any evaluation effort.

Second, federal resources tend to be devoted to funding "new" and "innovative" ideas; although innovation is important and experimentation essential, the results of this study indicate that greater attention should be devoted to following through on ideas that have proved successful. To the extent that federal resources are only appropriated for new ideas, innovations can only occur in selected departments. It may be more appropriate for the police and the LEAA to identify areas where computer technology has achieved success so far and to assist other departments to experience similar benefits.

Third, based on evaluation and performance standards, clearer priorities should be outlined dealing with computer technology. In talking to police departments around the country, a number of people characterized the LEAA system of funding as haphazard and undirected. The block grant system, which tries to avoid excessive federal direction, naturally contributes to this perception. Although I am skeptical about the possibility of developing a grand master plan for the application of technology, greater efforts could be made by the LEAA to assemble and channel the information that has been gained to date when setting funding priorities. Future funding should be based on a better understanding of what has worked and what has failed in the past.

Fourth, police departments need greater flexibility in working with vendors. Funding is often the key. In providing money, the LEAA must set up constraints and time dimensions. However, one of the reasons for the success of the CAD system in San Diego was their ability to withhold funds until the promised product was delivered. In several cases included in

Technical assistance to cities from disinterested third parties

this report involving LEAA funds, payments had to be made to vendors by a particular time. The process of extending the grant was complex, and the flexibility in working with vendors was therefore limited.

Fifth and finally, greater attention should be paid to the implementation and transfer of computer technology. It has become fashionable in recent years to talk about technology transfer. Let us be the first to admit that there is no master scheme for the effective implementation of technology or for the magic transfer of an innovative system from one department to another. However, the LEAA can help to promote sensitivity to the behavioral and institutional dimensions of innovation. Although we may not know exactly what to do in every case, we do have a good idea as to what not to do. For example, failure to devote ample attention to the education and training of dispatchers when implementing a CAD or AVM system is a guarantor of trouble.

Recent LEAA legislation has emphasized technical assistance. The problem now, though, is that there is often little tie between technical assistance and an ongoing long-term committment to implementation. In fact, those providing technical assistance are usually available on a short-term basis only, are unfamiliar with the background and environment in the police department, and may even have special interests or informal contacts among vendors. Further, systems specialists have been assigned to all ten LEAA regions. However, they have little link with technical assistance, are overburdened with responsibilities within the bureaucracy, and often have expertise in only limited technical (let alone behavioral and organizational) areas.

An alternative system for technical assistance is worth considering, although this report will not attempt to outline such a program in detail.

First, if priority areas for implementation and transfer of routine and nonroutine computer applications are selected based on evaluation, "pools of resources" in each of these priority areas can be identified. Such "pools" would rely on people from government, from law enforcement and from the academic community. They could provide a resource of talent to aid in the transfer process. Second, performance standards could be developed in each of these areas and educational material could be made available outlining both the advantages and disadvantages of new technology. Third, if a police department is interested in innovation (and it is essential that the identification of need be from within) then people from these "pools of resources" could be made available to such departments to assist in the transfer process. The Office of Technology Transfer in the National Institute of Law Enforcement and Criminal Justice already provides funding for police departments to travel to other cities to investigate innovation. The communication must be two-way, though. Not only should interested parties visit other areas, those who have achieved success might be given the opportunity to travel to an area interested in implementing change and to provide them with ongoing advice on what steps to follow. When Salt Lake City began to consider CAD, they sought help from the police captain in San Diego who had been instrumental in the implementation effort in that city. Such assistance now only occurs on a limited basis, though.

Naturally, those who have achieved success will have only limited time to offer, and instant transfer will not occur. However, a small portion of the millions spent on providing police departments with computer technology could appropriately be set aside to provide impartial advice concerning its implementation, and to relate transfer and technical

assistance to a more realistic perspective of how local change really occurs in the law enforcement community.

APPENDIX B: RESUME OF EVALUATOR

William R. Partridge has 25 years of professional experience involving management systems, operations research, data processing, personnel development, and general management. He currently is an independent consultant after serving for four years as director of The University of New Mexico Criminal Justice Program. His prior criminal justice experience includes six years as a consultant engaged in a wide range of evaluation projects and system design and implementation programs.

Partridge holds a B.A. degree from Pomona College based on engineering and liberal arts studies. After completing an M.P.A. program at the Maxwell Graduate School, Syracuse University, Partridge obtained an M.B.A. with a concentration in operations research from the Graduate School of Business, U.C.L.A. He is completing Ph.D. requirements at The University of New Mexico.

Partridge is the subject of notice in Who's Who In The West and The Dictionary of International Biography.