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RESULTS AND EVALUATION OF THE PATRIC OPERATIONAL TEST-BED

Sergeant R. L. Kenney
Los Angeles Police Department and
Mr. J. K. Boyer
System Development Corporation
Santa Monica, Ca.

INTRODUCTION

The *Pat*tern *R*ecognition and *I*nformation *C*orrelation (PATRIC) Project, an automated approach to tactical information correlation and retrieval, addresses the problem of dealing with the tremendous amount of crime and crime-related reports processed by the Los Angeles Police Department. Each day, the LAPD is inundated with approximately 650 Part I Crime reports. In only a few months, the quantity becomes staggering and prohibits the effective utilization of the data for other than purely statistical purposes. For example, it is virtually impossible for an investigator to survey crime reports outside his particular division of assignment for similar elements of *modus operandi* (MO), suspects, or vehicle description. Thus, potential information leading to case clearance may be lost. In patrol divisions, radio cars are deployed on crime patterns ascertained by a laborious manual search and tally of recent crime occurrences.

As a result of analyzing the problem of unmanageable data, it became increasingly obvious that an automated system of storage and access should be developed. The PATRIC Project was thus conceived to meet the following goals:

1. Provide efficient and effective use of tactical and investigative police MO, suspect, vehicle, and stolen/pawn information files.
2. Provide users with timely, correlated, and condensed data.
3. Maintain a dynamic system capable of being readily modified as tactical MO considerations change to reflect contemporary conditions.

In order to meet the expected goals, a three-step developmental effort was undertaken. Step I, from January 1, 1971, through February 28, 1972, provided for the definition of the data base, incorporating elements of crime reports, Field Interviews, Investigators' Final Reports on felonies, Registered Sex Offender registrations, and pawned/stolen property information; and the establishment of an on-line test-bed operation to research and validate the PATRIC concept. City-wide information was made available to investigators and patrol supervisors. Step II, March 1, 1972, through August 31, 1972, encompassed the completion of the research objectives, definition of system requirements, and presentation of several development and design alternatives. Step II-A, September 1, 1972, through April 30, 1973, will produce partial programming and purchase specifications for the final system. Programming will be completed and the necessary software and hardware purchased and installed during Step III, May 1, 1973, through December 31, 1973. Implementation of the final system is scheduled for January 1, 1974.

The development of PATRIC through Step II will be discussed in the subsequent sections of this paper, including a description of the test environment, results of the test-bed operation, and a comparison of alternative development and design approaches to achieving an operational system. Appendices I and II will enumerate specific system requirements and costs for development and annual operation.

THE TEST ENVIRONMENT

Realizing that theoretical designs do not always meet the needs of the real world, it was decided to implement a prototype on-line PATRIC System in a limited test environment. Not only would the feasibility of the PATRIC concept be explored, but also a degree of operational support for police functions could be provided. Thus, on July 6, 1971, the PATRIC Project implemented on-line access to its preestablished data base.

Hardware and software support was provided by the System Development Corporation, Santa Monica, California. The initial software system, the Commercial Data Management System (CDMS), was used until May 22, 1972, when a change was made to the prototype DS/3 data management system. This change resulted in significantly reduced response times and more easily understood output.

The test-bed operation included eight interactive terminals operating in six adjacent geographic police divisions of the City of Los Angeles. The six test divisions involved were Central, Rampart, Southwest, Hollywood, Seventy-Seventh Street, and Wilshire, which cover a total area of 92.9 square miles, and contain a combined population of over one million people. These divisions encom-

pass highly concentrated commercial-industrial districts, lower economic inner-city neighborhoods, high-rise apartment areas, and middle-income residential areas. The selection of these divisions represented a cross-section of most socio-economic groups found in Los Angeles.

THE PATRIC DATA BASE

The data base established by PATRIC for the test was composed of eight files, grouping like crimes together and permitting the storage of six months' worth of data on each disc pack before a given file would require purging. The file name, number of entries, and crime type included as of August 31, 1972, the end of Step II, are listed below. Approximately eight months of data are currently included due to the increased storage capacity of the prototype system.

File Name	*Number of Entries*	*Crime Type*
Crime	15,520	Aggravated Assault Child Annoyance Child Molest Homicide Indecent Exposure Kidnap and Attempts Miscellaneous Sex Crimes Prowl Rape and Attempts
Robbery	41,891	Bunco Drunk Roll Grand Theft Auto and Attempts Pickpocket Purse Snatch Robbery and Attempts Theft from Person and Attempts
Burglary	43,182	Burglary and Attempts
BTV	26,345	Burglary from Vehicle and Attempts Grand Theft from Vehicle Theft from Vehicle and Attempts
Field Interview (FI)	80,939	Auto Field Interviews
Suspect	7,357	Sex Registrants Investigator's Final Report
Pawn	6,602	Pawn transaction in following categories: Guns and equipment Business Machines Cameras and equipment Watches Jewelry Radio and TV equipment Power tools
Property	Discontinued April 1972	

THE PATRIC RESEARCH ANALYST

Located in each of the test divisions was a Research Analyst (RA), who served as the link between Department personnel and the testbed PATRIC operation. The Research Analyst operated the computer terminal and performed the *modus operandi* analytical activities on an operational basis for Department personnel while operating on a research basis for PATRIC Project personnel. This dual responsibility made it difficult at times to carry out both functions satisfactorily.

Basic job requirements established for the Research Analyst position included a bachelor's degree, a minimum of six months' experience with the Los Angeles Police Department, and analytical experience or ability. The six months' experience allowed for opportunity to become familiar with crime reports, concepts of MO and general police jargon. The analytical ability was essential for determining patterns of crimes, both for case clearance and repressive patrol. Adaptability also proved to be a key factor to success because of such factors as new MOs appearing, unexpected results being obtained through the correlation process, and several different software systems being employed. The Civil Service classification chosen for the Research Analyst position was Administrative Assistant.

Working in the test divisions the Research Analysts encountered different needs between patrol and detective processing. Even within the two major segments of patrol and detective, there were differing approaches developed early in response to the nature of the requests received.

The Research Analyst in a detective division familiarized himself with the various methods of investigation. Basically, he found that the detective could utilize PATRIC information in two ways. The first method began with an unsolved case. A search was made for similar cases by matching MO, suspect description, or vehicle description, or some combination of the elements. Three files were usually searched: the appropriate crime file, the Field Interview file, and the Suspect file. The searches produced matching crimes which often provided better physical descriptions, additional elements of MO, additional victims for future identification of possible suspects, or even named suspects from already cleared cases, F.I. cards on involved vehicles, and data on suspects known to have committed similar crimes.

The second approach to PATRIC was to link crimes to a suspect already in custody. Reports

obtained from this type of search helped build a case against a suspect, decreased paper work by clearing many crimes simultaneously, and assisted detectives in other divisions who may not have known the suspect had been arrested.

Between the correlation attempt at the terminal and the presentation of information to the investigator, there was an intermediate step of gathering related data and screening it to determine its utility. Correlated hardcopy crime reports were pulled and read to insure that the information was kaypunched correctly. Other data, such as copies of Field Interview cards, mug shots, criminal history records, and vehicle registrations were collected in order to prepare a complete package of PATRIC-obtained data for the investigators. It was observed that detectives were more willing to use PATRIC information if the entire package was prepared for them. Therefore, Research Analysts provided this service.

Before attempting a correlation, it was essential that the analyst have an opportunity to question the concerned investigator regarding MO and solicit as complete a picture of the known facts of the case as possible. This was often the only way to obtain MO information known only to the investigator.

The analysts had to be familiar with everyday police jargon so that they might communicate in terms familiar to police personnel. This had a distinct, positive effect on user confidence. Having interacted with the investigator, experience showed, the analyst could proceed to query the system effectively without having the investigator present.

System output also had to be returned to the investigator by the analyst and reviewed in detail to insure that pertinent information was called to the detective's attention. User interest diminished when printouts were forwarded without personal interaction, often resulting in no further requests for PATRIC processing.

Some Detective Bureau-wide procedure to insure adequate coordination between divisions was found necessary to avoid duplicative information processing and, much more important, to allow for interdivisional teaming of investigators or some other method of conserving investigative resources in such cases.

The goal of the Research Analyst in a patrol division was somewhat different from that of his counterpart in a detective division. Rather than being concerned with individual suspects and case clearances, he directed his attention to developing crime patterns within a certain area and deploying patrol units as a repressive measure to decrease the frequency of crimes. Several suspects and vehicles were identified as being active within the area, so that patrol cars had specific things to look for, in addition to just being a visible deterrent to crime.

There were two primary methods by which the Research Analyst approached the task of supporting patrol deployment. In the first method, the geographic division was surveyed to identify the crime problem of greatest concern, i.e., the area of greatest increased activity. A profile of the problem area was then composed, identifying crime types, time of day, day of week, method of operation, suspects/vehicles involved, and so forth. A particularly useful feature of the software system called 'grid' allowed the plotting of two elements such as time of day and day of week, for a given crime type within a specified geographic area. Later in the project a third approach examined the concept of 'adjacencies', a term used to denote a reporting district and all its surrounding (adjacent) reporting districts. An historical seasonal norm of crime occurrences for each adjacency set was established. Thus, when subsequent statistical reports of crime occurrence by adjacency groups were generated by the PATRIC System, they could be compared to the norm to measure the decrease/increase of crime in the area. A significant increase in an area triggered the procedure necessary to produce a current, useful area profile.

With the above described resources of test divisions, hardware/software configurations, and Research Analysts, the PATRIC Project was able to conduct a productive fourteen months' on-line test.

RESULTS OF THE TEST-BED OPERATION

The test-bed operation was subject to both statistical and subjective evaluation. Whenever possible, evaluative measures were introduced to gauge the effect of a given activity. The research results can be categorized by the following areas of activity: investigative support, automatic correlation strategies, patrol deployment support, direct data input, stolen property/pawn connect-up, and identification of multiple occurrences of selected data elements.

CORRELATION RESULTS

In pursuit of a statistically valid sample for investigative processing, a goal of 2400 correlation attempts was established. The goal was first divided

proportionately according to frequency of occurrence among ten major crime types· burglary, robbery, homicide, grand theft auto, theft from person, rape, bunco, child molest, indecent exposure, and kidnap. Subsequently, a revision was made to reflect the additional factor of demonstrated amenability to computer processing. Each correlation attempt, upon completion, was classified as "successful" or "unsuccessful" by the Research Analyst according to the information retrieved. If information was retrieved which matched on a minimum number of descriptive elements stipulated by the investigator, the correlation was deemed an apparent success. Where the information retrieved included a name, vehicle license number, or booking number, the correlation was further designated a "primary" success; all other successful correlations were designated "secondary".

During the period July, 1971, through June, 1972, a total of 3262 correlations were attempted, and of these correlation attempts, 1112 or 34% met the success criteria set by the investigators. For the final results of Step I and II, it was decided that the required minimum of 2400 correlations would not include the results of the first two months of test-bed experience, due to difficulties experienced in attaining adequate data for the various files. Therefore, the correlation total from September, 1971, through June, 1972, is 2,473 by previously specified crime type, and 312 "Other" crimes for an overall total of 2,785 attempts. Successful correlations accounted for 1,044 attempts, or a success rate of 37 percent. This percentage may be translated into a more meaningful statement: in approximately two out of every five cases, PATRIC was able to supply the investigator with additional information.

The monthly success rate fluctuated from a low of 24 percent in September to a high of 48 percent in January. Figure 1, found at the end of this report, illustrates the percentage of successful attempts on a monthly basis for the nine-month period previously considered. The steady increase in percentage of successful correlations from September through January resulted from a number of factors. First was the improvement of the quality and quantity of the data in the PATRIC data base. Second was the increased interaction between the analysts and the investigators, and third was the increased ability of the Research Analyst to use the PATRIC System effectively. The decrease in successes after February may have been due to discontinuity in the Analyst's activities between Steps I and II, and the failure to maintain the files during the 17 day hiatus.

While the statistical results were impressive, they should be considered in light of the "effective" results, i.e., the extent to which the information actually assisted in case investigation. To this end, interviews were scheduled with detectives who used the PATRIC System during Step I to determine the benefits derived from successful correlations. Over 50 interviews were conducted; however, the quantity of data derived from the interviews was disappointingly low. Several major problems were encountered: 1) a detective's work load often precluded his devoting a sufficient amount of time to preparation for the interview; thus, the PATRIC case was not fresh in his mind and, while he could give a general opinion of the value of PATRIC information, he could not give quantitative data about the results; 2) when interviews were scheduled shortly after the PATRIC information was given to the investigator, he had frequently not had enough time to make use of the information, and PATRIC work load requirements prohibited expending time on follow-up interviews; and 3) the interviews were necessarily brief so as not to impose a burden on the already overworked detective; however, it was found that the amount of time allotted was often consumed by general discussions of the system's capabilities rather than reporting specific results on any given correlation attempt.

PATRIC, even when unsuccessful in correlating reports or identifying suspects, provided a valuable tool for the detective by eliminating various avenues of investigation. Other comments from the interviews centered around suggestions for improving the system, most of which are reflected in the requirements delineated in Appendix I (a subsequent section) of this paper.

In summary, the interviews showed that "effective" results of Step I were favorable, but that a new approach was needed to capture quantitative data about such results.

At the beginning of Step II, a program was implemented to provide routinely for feedback on numbers of arrests, crimes cleared and investigative hours saved as a result of PATRIC assistance. The resultant "PATRIC Correlation Evaluation" form was sent to detectives with the information retrieved on each correlation attempt.

As of July, 1972, 270 evaluation forms had been received by the project. These represented 9 arrests made as a result of PATRIC information, 122 cases cleared, and 1,209.5 investigative hours saved. One

hundred twenty-five of the forms indicated that the investigation had not been completed. The comments made by detectives corroborated the benefits derived from the system. These ranged from a succinct "Great! Good connect-up!" to a report that information from PATRIC was instrumental in assisting the investigator in conducting a more useful interrogation of a suspect who later became cooperative and assisted in identifying the remaining suspects on a case; PATRIC was also able to arm the detective with information on other cases of the same type which provided a tool to induce the suspect to admit to the crimes. Even on cases where the investigation had not been completed, several of the comments indicated that the PATRIC information was proving useful to the investigator.

PATROL DEPLOYMENT RESULTS

Evaluation of the effect of PATRIC assistance in strategic patrol deployment was difficult to accomplish. The Patrol Bulletin by which crime pattern information was transmitted to patrol officers included a section for recording arrests and field interviews which resulted from the directed deployment. Table 1 shows the number and results of PATRIC Patrol Bulletins between July, 1971 and June, 1972. PATRIC results also incorporate results obtained by the Metropolitan Division task force operating for a short period in several test divisions. They were deployed only partially on PATRIC information, but it was impossible to separate the statistical results.

During the course of patrol processing, a number of problems were identified. The currentness of the data on which bulletins were based was never less than 9-12 days old, due to the number of steps currently involved in the data processing stream. Patrol users lost confidence in the system because of the inability to improve the currentness of data.

During April and May, 1972, the feasibility of remote data input from a geographic division to achieve 24-hour data currentness was tested at Southwest Division. The test proved that remote data input was possible and that the improved currentness of data had a significant bearing on the effectiveness of deployment plans. The test was suspended when the change to the second software system was effected. The concept of direct data input will be further explored in Step II-A.

Another problem encountered in the patrol divisions was the lack of available patrol time by regularly deployed radio cars. Although the divisions were chosen because of their high crime rate, it soon became apparent that the radio units also had a greater amount of calls for service and less available time for special, repressive patrol. Two other divisions with more available time – Venice and Newton – were supplied information sporadically to test the utility of PATRIC-generated patrol bulletins.

The most effective use of PATRIC data was made by the divisional special operations squads, where they existed. The eight to twelve-man team was available to work any time period in any area on any problem, free from the constraints of radio calls. They also had the option of working in uniform or plain clothes as the situation warranted. The research analyst was able to deploy effectively this squad on problems which he discerned, or on information compiled at the request of the squad supervisor.

In addition to the problems of data currentness and unavailability of patrol time, it became obvious that many of the crime patterns discovered by Research Analysts were of marginal utility. Frequently, patterns identified by PATRIC turned out to be historic patterns dictated by demography, such as street robberies in the city's skid row section or residential burglaries in the housing projects. These historic patterns were well known by patrol personnel; hence, PATRIC did not add anything new in such cases.

Consequently, as a part of the conversion from CDMS to DS/3 for patrol processing during May, 1972, a reassessment of the types and formats of deployment information was undertaken. The concept which gained prominence was to establish historic crime occurrence norms by geographic area, which could then be monitored automatically by the system. When the crime rate fluctuated beyond a predefined tolerance in a given geographic area, the system would trigger a report calling this to the attention of analytical personnel.

The establishment of crime occurrence norms for individual reporting districts proved to be impractical. The number of crimes occurring in a single reporting district during a fixed time interval (one day a week) was too small to permit establishment of a meaningful norm. In many reporting districts there were only one or two repressible crimes per week. Therefore, it was decided to use a larger geographic area, or "Adjacency Group". The Adjacency Group was defined as a reporting district and all those reporting districts which physically touch it.

The Adjacency Report was produced in two versions, a Summary Report, shown in Figure 2,

and a Detailed Report, shown in Figure 3. Both were in two-dimensional array or matrix format. The Summary Report presented a count of crimes by crime type and by day of the week for each Adjacency Group. An Adjacency Group was indicated by the central Reporting District and included all the Reporting Districts that were contiguous. In effect, the summary represented a crime index by Adjacency Groups which pinpointed the geographic center of the highest concentration of crime. The detailed report provided a matrix where the vertical axis represented the individual reporting districts that comprised an Adjacency Group and the horizontal axis represented the days of the week. The total line for each Adjacency Group Detailed Report formed a line in the Summary Report.

The greatest benefit of this type of automatically triggered report was that random searching by Research Analysts for a deployable crime pattern was eliminated. This represented a substantial saving in man-hours and machine time spent on unproductive random searching for crime patterns.

Although the Adjacency Report concept for PATRIC patrol deployment processing was introduced too late in the research phase to show operational results from its use, evaluation of patrol supervisors indicated that it was more meaningful than the prior PATRIC bulletin information. Standard question sets to enable generation of Adjacency Reports in a batch mode were developed and will be utilized again in Step II-A.

AUTOMATIC CORRELATION STRATEGIES

Imbedded within the general categories of investigative and patrol processing were several other tasks of sufficient importance and magnitude of effort as to be considered "mini-projects". The first of these several tasks was the determination of automatic correlation strategies.

It has been assumed that among the approximately 250,000 Part I Crimes in the City of Los Angeles each year an as yet undetermined number contain sufficient information to be processed in a batch mode, employing automatic (program-controlled) correlation strategies in an operational system. Working towards that end, an analysis was conducted to identify the elements of information used by the Research Analyst in attempted crime correlations. The project staff collected, recorded, and analyzed 206 successful and unsuccessful correlations. Several crime types were examined in this manner to see if the approach to correlation attempts was greatly influenced by the type of crime.

The analysis was conducted with the expectation that MO correlation strategies could be developed from the PATRIC correlation results. However, the results indicated that MO correlation strategies, *per se,* were used infrequently. In the majority of correlation attempts, the Analyst included a combination of vehicle and suspect description information; he very seldom used MO information exclusively.

Because standard approaches to classes of crimes could not be derived from the results of the on-line strategies, the PATRIC staff developed crime correlation strategies that could retrieve crime reports containing similar MO, suspect, and vehicle descriptions. The approach was to develop strategies using premise, trademarks, and other MO information from the crime report. Vehicle and suspect information (other than descent) was not included in the strategy. Further analysis and refinement will be accomplished by running the current strategies in a batch-processing mode during subsequent phases of the project.

Although MO strategies were not developed from the above analysis, the research into the derivation of automatic correlation strategies indicated that when a vehicle license plate number, or a suspect's name, or the description of a suspect's vehicle is contained in the crime report, that piece of information should be correlated against information in the existing files.

Additionally, an iterative process involving three major steps was used to arrive at potential correlation strategies for each crime type. Briefly, the following steps were involved:

1. Initial correlation strategies concepts were based on crime reports, data base contents, and LAPD experience. Only certain elements of information were found to be helpful in retrieving similar crime reports, e.g., location of crime, type of crime, suspect's descent, trademark category (boldface headers on crime report) and trademark name (individual descriptors).
2. Strategies were coded for computer processing, run in a batch-processing mode, and the resultant printouts analyzed to identify potential correlations.
3. Strategies were evaluated, modified, processed through the computer again, and modified until they began to produce a higher number of correlations.

The resultant correlations were then sorted by descent and geographic location. In this manner correlation strategies were developed for indecent exposure, kidnap, child annoying, child molesting, rape, robbery, burglary, theft from person, purse snatch, and bunco. The recommended strategies have been documented in PATRIC Design Requirements Volume II: Research Results, TM-L-4953/002/00, published jointly by LAPD and System Development Corporation.

MULTIPLE OCCURRENCE DETECTION

Another mini-project to which effort was directed was the detection of multiple occurrences of data elements. The importance of detecting multiple occurrences is based on the assumption that at a certain level recurring elements form a pattern that could be of appreciable tactical and investigative value. In order to validate this concept the Field Interview (FI) file was searched for multiple occurrences of whole names and license numbers. Between July, 1971, and April, 1972, eight separate analyses were made, each time selecting from the FI file those names and license numbers that occurred five, six, seven, eight, and nine times. The number of occurrences was called the screening level.

The printout resulting from the file search was examined to determine valid multiple entries. The corrected data were then compiled into standardized reports using the report preparation capability of the PATRIC System under CDMS. Two reports were produced, separating multiple occurrences determined by license numbers and those determined by whole name.

The final multiple occurrence report was distributed to various detectives throughout the City upon request, and to the Watch Commander of the Burglary/Auto Theft Division (BAD). Although only a small amount of feedback from these users has been received, it has been quite favorable. Several detectives used the printout as an effective interrogation tool, pinpointing the suspect's associates and locations he frequented. Other detectives appreciated the opportunity to keep abreast of unusually large numbers of FI stops within their particular areas. Several multi-FI subjects were arrested and now appear in the suspect file (felony arrestees), lending credence to the assumption that their movements should be brought to the investigators' attention.

Two major problems were encountered with the FI multi-occurrence reports, specifically in the areas of preparation and evaluation. A great deal of time was expended in the preparation of the report. Data conversion programs united in a single FI entry only those FIs that were identical in the first 24 characters.[1] If the time recorded by the field officers varied by even five minutes or if the reporting district was miskeyed, the entry appeared as a unique transaction, distorting the number of actual multiple occurrences. Approximately half of the values were eliminated or reduced each time through visual screening as described above. This process needs to be automated, linking entries within a given range of times or reporting districts if other elements appear to be identical. Many times additional occurrences are also overlooked owing to a slightly different spelling of a name or to the transposition of characters in a license number. These occurrences are usually discovered accidentally; currently there is no specific method for finding the values with slight variations.

Part of the problem of preparation was alleviated by raising the screening level from five to six, which reduced the qualifying entries to a workable number. Screening could then be accomplished in a shorter period of time, and the resulting report was smaller and more apt to be used. Tests were conducted on a file containing only about six months' worth of data. It is foreseeable that the screening level would be raised even higher if a longer period of time were included, although a screening level of six and a time period of six months seems quite satisfactory. Producing the report on a monthly basis rather than bimonthly would also decrease preparation time. An example of a "Multiple Occurrences of License Numbers" report appears in Figure 4.

STOLEN PROPERTY PROCESSING

The last mini-project of significance was the processing of stolen property. The first approach to the file was an analysis of the distribution of stolen property item categories to determine if there was operational utility in such information, either by itself or when compared to a similar analysis of the typology of pawned items. Knowledge of any radical change in classes of items that are the object of attack might be predictive to some extent and might be usefully included in citizen-education campaigns. Initial file profiles were established, but were not maintained long enough to discern significant changes by category.

In the general correlation strategy, only minimal usage was made of the Property file. The file was not a usual part of the correlation attempt, which sought for crimes with similar MO suspects, or vehicles.

Also, inaccurate data, caused by serious errors in reporting, coding, and keying procedures inherent in the variability of the data and lack of standard procedures, discouraged use of the file. Few positive results were ever obtained in the property file.

In a sample of four weeks' correlation attempts, 633 queries were made of the files, coupled with 313 search requests. Of the queries, only 20 were made of the Property file; 12 searches were conducted of the Property file. The Property file was

used only 3.4 percent of the time, counting both queries and searches.

The pawn file, containing all pawn transactions from seven major categories, was to have been an important link in the recovery of stolen property and the apprehension of criminals. This was to have been accomplished by linking items from the Property file with pawn transactions and thereby identifying a potential suspect. However, as a result of the difficulties encountered in data input for the essential crime files, the Pawn file received little attention until late 1971. By that time, many of the problems with the Property file had been realized, and successful stolen property/pawn linkages could not be made.

As of April 12, 1972, updating of the Property file was suspended indefinitely. Infrequent use of the file, coupled with retrieval difficulties, could not justify the cost involved in data conversion and file maintenance.

DEVELOPMENT AND DESIGN APPROACHES

The culmination of PATRIC research and the final link in requirements for the operational system was the document published at the conclusion of Step II, describing several design alternatives for the final system. The three alternatives considered include:

1. Custom software development
2. Procurement of an off-the-shelf software package
3. Procurement of an off-the-shelf software package with modifications

In reviewing the alternatives, it was discovered that the first alternative must be rejected on the basis of an estimated two-year development schedule, an estimated cost of over $1,000,000, and other uncertainties involved. The second alternative, off-the-shelf software, was seen as a way of attaining a reliable data processing capability at a minimum cost and short lead time. However, a review of 164 known software packages revealed that only a few systems can be considered as candidates. In fact, no available system could meet all PATRIC software design requirements without modifications.

Therefore, the third alternative of procurement of a package with modifications was adopted as the most feasible method of satisfying PATRIC requirements at the least cost, least risk, and within the available time period.

Four data management systems were selected for comparison: System Development Corporations's DS/3; TRW's Generalized Information Management (GIM); IBM's Generalized Information System/Version 2 (GIS/2); and MRI's System 2000. A comparative evaluation was conducted utilizing various system requirements weighted according to importance. The four systems were very close in overall evaluation, and a definitive choice would have been hard to make. However, the true purpose of the evaluation was to illustrate some specific guidelines for package evaluation, rather than the selection of a specific software system.

Based on the system requirements and the suggested approach of procuring a software system to be modified as needed, bidding specifications can be prepared and requests for proposals distributed. At the present time, the projected schedule plans for opening of bids at the end of April, 1973, and the awarding of the contract by August 1, 1973. The system should be tested and fully operational by the implementation target date of January 1, 1974.

CONCLUSION

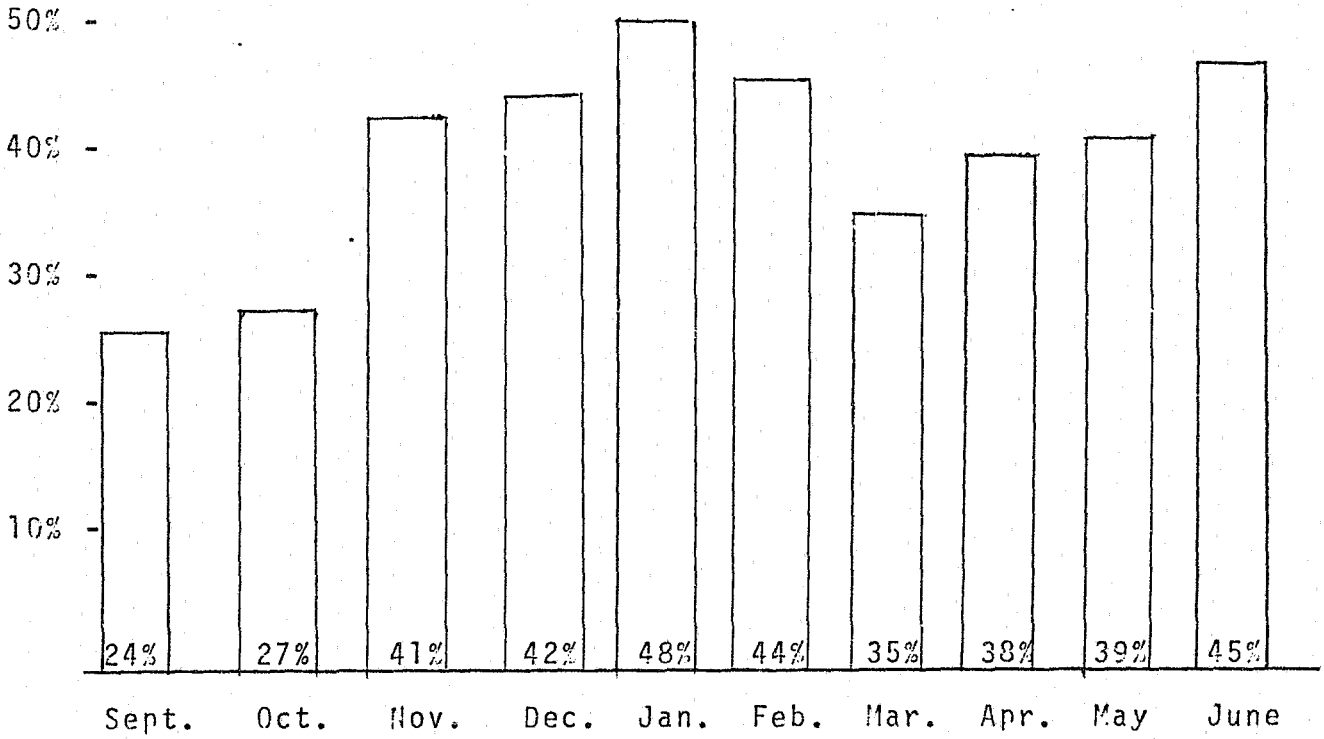
Having completed its basic research and defined requirements for an operational system, the PATRIC Project is preparing to write the system specifications. Operational support will continue to be provided by a limited on-line system. Extensive training will be conducted to educate present and potential users. Regional applications will be investigated, and other systems will be surveyed to determine the best method and timing for implementation of the final system. The PATRIC Project is well on its way to becoming an objective reality and an integral part of the operation of the Los Angeles Police Department.

FOOTNOTE

[1]The first 24 characters contain: date of report, time, reporting district, license, and state.

Figure 1

Percentages of Successful PATRIC Correlation Attempts by Month from September, 1971, through June, 1972.



06/19/72 ADJ GROUPS FOR A BURG AND BURG PAGE 1

ADJ	CNT MON	CNT TUE	CNT WED	CNT THU	CNT FRI	CNT SAT	CNT SUN	CNT TOTAL
0365	18	8	22	16	20	22	10	116
0367	20	10	18	6	16	20	10	100
0368	16	8	10	2	12	18	16	82
0371	18	16	18	16	10	12	14	104
0373	30	18	18	30	26	18	14	154
0375	18	6	14	10	16	12	6	82
0377	20	16	16	16	22	16	18	124
0378	22	10	10	2	12	10	20	86
0381	2	2	10	0	4	2	0	20
0382	8	12	10	4	12	8	6	60
0383	8	22	10	6	24	14	12	96
0384	26	26	14	26	36	14	20	162
0385	22	14	16	20	18	8	16	114
0386	14	22	28	16	24	10	10	124
0387	22	28	24	18	28	10	10	140
0388	24	28	30	26	36	4	12	160
0389	24	28	26	16	26	4	10	134
0391	16	14	10	16	12	14	10	92
0393	24	22	10	28	26	14	14	138
0395	28	26	20	26	28	16	20	164
0397	16	16	14	18	18	12	18	112
0398	22	12	12	6	12	12	18	94

Figure 2 Summary Report of Burglaries by Adjacency Group

CRIMES BY ADJACENCY GROUP

05/05/72 322,777,778,323,333,332,331,321,776 PAGE 1

RD	CNT MON	CNT TUE	CNT WED	CNT THU	CNT FRI	CNT SAT	CNT SUN	CNT TOTAL
0321	0	0	1	0	0	0	0	1
0322	2	2	0	2	1	3	0	10
0323	1	2	1	0	3	2	1	10
0331	1	1	0	3	1	2	0	8
0332	1	1	2	0	2	0	0	6
0333	0	0	1	0	0	3	0	4
0776	0	1	0	0	0	0	0	1
FINAL TOTALS	5	7	5	5	7	10	1	40

40 ENTRIES (9% OF DB) QUALIFY

Figure 3 Detailed Report of Crimes by Reporting Districts Comprising an Adjacency Group

Figure 4 Sample Multiple Occurrences of License Numbers in the FI File.

LICENSE*	DATE STOPPED	TIME	RD	MAKE	DOB	NAME*
	04/04/71	0830	1405	CHEV	04/18/57	
					08/27/54	
	06/04/71	2345	0125	CHEV	07/04/52	
	10/05/71	0130	1162	CHEV	05/01/49	
	10/20/71	0015	0412	CHEV	05/01/49	
	10/21/71	1040	1162	CHEV	05/01/49	
	05/12/71	1715	1405	FORD	08/03/46	
	09/05/71	1610	1417	FORD	08/03/46	
					10/31/44	
					08/03/46	
	09/20/71	1605	1413	FORD	08/03/46	
	09/23/71	1100	1419	FORD	08/03/46	
	10/10/71	0615	1435	FORD	10/12/50	
	08/28/71	0245	1047	CHEV	02/25/55	
					09/18/52	
	02/31/71	2325	0925	CHEV	09/18/52	
	09/08/71	0110	1069	CHEV	09/18/52	
	09/17/71	2215	1069	CHEV	09/18/52	
					01/31/55	
	10/12/71	2120	1059	CHEV	08/11/52	
		2130	1059	CHEV	09/18/52	
	10/25/71	1200	1559	CHEV	02/25/55	
	10/28/71	2025	0976	CHEV	11/04/56	
		2030	0976	CHEV	04/09/57	
					09/18/52	
	08/18/71	0530	0246	DODG	05/19/43	
		0535	0246	DODG	06/27/39	
	08/27/71	0515	0226	DODG	06/27/39	
		0520	0226	DODG	08/30/41	
	09/21/71	1130	0228	DODG	06/27/39	
			0228	DODG	09/07/47	
	10/02/71	0915	0226	DODG	06/22/41	
	10/18/71	1815	0239	DODG	02/23/38	
					09/07/47	
	05/12/71	1045	1137	CHEV	09/14/53	
					04/08/53	
	07/29/71	1030	1341	CHEV	01/15/45	
	08/28/71	0215	1161	CHEV	10/05/53	
		0230	1161	CHEV	02/16/56	
	10/17/71	1300	1143	CHEV	10/26/53	
			1143	CHEV	10/26/53	
	10/18/71	0430	1134	CHEV	05/27/52	
		0930	1134	CHEV	08/10/57	

*Deleted to insure privacy.

TABLE 1

NUMBER AND RESULTS OF PATRIC PATROL BULLETINS
(July 1971—June 16, 1972)

Division	No. of Burglary Bulletins	No. of Robbery Bulletins	No. of Other Bulletins	Total Bulletins	No. of Arr.	No. of FIs	Total A + FI
Central	19	9	7	35	19	59	78
Venice	6	0	3	9	2	7	9
Newton	10	1	6	17	2	73	75
Wilshire	4	1	0	4	0	0	0
Southwest	56	23	3	82	603	812	1415
77th Street	21	27	5	53	405	141	556
TOTALS	115	61	24	200	1031	1092	2123

The arrest and FI figures for Southwest and 77th Street Divisions include those that were logged in by the Department's Crime Task Force while deployed on composite 77th Street and Southwest Divisional crime patterns identified by PATRIC.

APPENDIX I

As a result of the test-bed research conducted in Steps I and II, requirements have been defined for the final PATRIC operational system. Many of the requirements have been inferred in the section on results of the test-bed operation. The definitive document for system design is *PATRIC Design Requirements Volume I: System Requirements,* TM-L-4953/001/00, published jointly by LAPD and System Development Corporation. Briefly, grouped according to function, the major requirements are as follows:

DETECTIVE SUPPORT REQUIREMENTS

- PATRIC should provide detectives, when possible, with a suspect's name or the license number of a suspect's vehicle, or if this is not possible, it should provide a physical description of the suspect or of the suspect's vehicle. It should also provide reference to other crimes that may have been committed by the same suspect.
- PATRIC processing support should be provided and terminals should be located at the detectives' normal work locations; the system should be on-line for eight hours each workday.
- PATRIC operators should have ready access to several data files of different crime types.
- File groupings should be separated into files of crime reports, identified persons, and pawned property descriptions.
- Certain correlation processing should be accomplished on-line, interactively, to support detectives' immediate needs.
- Certain prespecified correlations and analyses should be processed automatically in a noninteractive mode.
- The PATRIC data base should be updated with new crime reports and follow-up reports within 24 hours.
- On-line PATRIC files should consist of reports reflecting at least the most recent 26 weeks, with the exception that files containing felony suspect descriptions and pawn transactions should be purged selectively and not on a periodic basis.
- PATRIC computer printouts should use no codes and should be readable without special training.
- The Field Interview and Pawn files should be processed periodically to identify the multiple occurrence of specific values.
- When querying a file by suspect name and description, a ranked list of similar names that might qualify as the suspect should be provided.

PATROL DEPLOYMENT REQUIREMENTS

- PATRIC should provide patrol divisions with crime pattern identification that includes geographic areas, time ranges, available vehicle and suspect information, and unique crime characteristics.
- Analysis of crime problems for patrol deployment processing should be performed on divisional, adjacency group, and interdivisional bases using the reporting district as the unit of analysis.
- The system should be capable of displaying data elements in a two-dimensional grid and in sorted, formatted reports.
- Patrol deployment data should be retrieved on-line and interactively.
- Standard question sets related to crime patterns should be processed automatically in a noninteractive mode.
- The Repressible Crime file should be updated with new crime reports within 24 hours.
- The Repressible Crime file should remain on-line for 28 days.
- All repressible crimes should be grouped into one file structure with the capability to subset the file by specific crime type.

FELONY VEHICLE PROCESSING REQUIREMENTS

- A capability should exist to identify and report on all vehicles associated with felonies found in the PATRIC data base.

MANAGEMENT REPORTING REQUIREMENT

- The PATRIC System should prepare periodic reports to management reflecting the general and overall performance of the system.

INTERFACE REQUIREMENTS

SYSTEM	PATRIC Interface Required		TYPE OF INTERFACE
	Obtain Info From	Provide Into To	
AWWS	X		PATRIC terminal should access AWWS through the Front-End Communication System.
LEMRAS		X	Manual distribution of PATRIC Patrol Bulletins to Supplement LEMRAS reports.
STATS	X	X	Common data collection, quality control, and data conversion; preparation of special reports.
Auto FI			None—function should be incorporated into PATRIC.
ARMS	X		PATRIC terminal should access ARMS through the Front-End Communication System.
RJIS	X		PATRIC Analyst verbal request to RJIS terminal located in LAPD.
PSIS	X	X	Detective verbal request for reports of crime correlations.

SYSTEM CONSTRAINTS

- The PATRIC System should operate within the environment of the Los Angeles City Data Service Bureau computer facility.
- PATRIC should interface with the DSB Front-End Communication System (FECS).
- PATRIC should be compatible with the DSB teleprocessing monitor.

SYSTEM RESPONSE REQUIREMENTS

- The PATRIC System should provide three-minute maximum response to interactive queries.
- PATRIC noninteractive (batch) requests should receive overnight turnaround service.

DATA COLLECTION REQUIREMENT

- Data should be collected, using the PATRIC crime reports as source documents, and preprocessed for computer usage.

DATA INPUT REQUIREMENTS

- A noninteractive data input and data base generation capability should be provided.
- A noninteractive capability should exist for adding entries to current files.
- A noninteractive capability should exist to update data values and to delete entries from current files.

DATA SUBSET REQUIREMENT

- An interactive and noninteractive user of PATRIC should have the capability to create and retain smaller files containing entries selected from larger existing files.

DATA BASE DESIGN REQUIREMENTS

- The PATRIC data base should contain the data elements and values recorded in the LAPD crime report forms.
- PATRIC should have the capacity for storing 360,000 records comprising 60 to 70 million bytes of data, not including the data management system overhead.
- Data base elements and element relationships should be variable, and a method should exist that permits user definition of the data relationships and contents.
- The user should have the capability to specify data element names.
- The user should have the capability to specify element type designators, element value delimiters, and mandatory value elements.
- A capability should exist for defining embedded elements or subelements.
- The PATRIC data base should allow linking of data describing suspects with the separately maintained description of each suspect, and it should allow recording of multiple values for a single data element in a single logical entry.
- An option should exist for defining a fixed field input record format, the byte locations within the record from which each element's values are to be extracted, and a value translation array for each element.

DATA RETRIEVAL AND DISPLAY REQUIREMENTS

- PATRIC should provide multiple, remote user, on-line, interactive data retrieval capability.
- PATRIC should allow processing of retrieval requests in a noninteractive batch mode.
- Interactive inputs and all PATRIC outputs should use English-language forms.
- The user should be able to qualify specific entries from his file and to display the total entry or specific element values within the entry.
- The user should be able to display data definitions, values, and counts of values in an easy-to-read format.
- The user should be able to repeat execution of retrieval statements.
- The user should be able to cancel an output sequence while it is in process.
- The output format for interactive retrieval should be controlled by the user.

REPORT GENERATION REQUIREMENTS

- A user-oriented report generation capability should be included in the PATRIC System.
- The report generation capability should include user control of report format and content.

GENERAL SOFTWARE REQUIREMENTS

- The Remote Job Entry (RJE) facility of the IBM operating system, or its equivalent, should be available to PATRIC.
- A complete set of support and utility programs should be available.

SECURITY REQUIREMENT

- Access to the PATRIC System should be controlled by both hardware and software techniques to ensure the security of the PATRIC files.

EQUIPMENT REQUIREMENTS

- PATRIC files should be stored on high-speed random access devices.
- The PATRIC operating programs and data base should be stored on magnetic tape for back-up purposes.
- Interactive terminal devices should be provided.
- PATRIC batch-processing output should be directed to a high-speed lineprinter at a central LAPD location.
- A Remote Job Entry card reader should be provided to accompany the lineprinter.
- A data transmission control unit should be provided.
- Communication lines and data sets should be provided to link the terminals located in each geographic division with the central computer located in the DSB facility.
- A communication line should be provided to link the remote data transmission control unit, for the printer and card reader-punch at Parker Center, to the computer located at the DSB facility.

IMPLEMENTATION REQUIREMENT

- Steps II-A and III should be pursued, as described, in order to achieve an operating PATRIC System.

ECONOMIC REQUIREMENT

- Funding should be authorized, in the necessary amounts, in order to achieve an operating PATRIC System.

PATRIC TRAINING REQUIREMENT

- A training program should be developed and presented to division commanders, detective and patrol personnel, and PATRIC Analysts.

PATRIC ANALYST REQUIREMENTS

- The PATRIC Analyst should complete a special PATRIC training program; he should have experience with a computer terminal or teletypewriter; he should have the ability to organize and analyze crime data; and he should be able to interact positively with police personnel.

ORGANIZATIONAL REQUIREMENTS

- A PATRIC System Project Office should be authorized and created.
- Responsibility for data input should be centralized.
- System interaction should be decentralized.

APPENDIX II

The estimated cost for development of the PATRIC System for Steps II-A and III (September 1, 1972 to January 1, 1974) and the estimated annual operating cost of the system are presented in the following tables:

Estimated Development Cost of the PATRIC System

(September 1, 1972 to January 1, 1974)

A. DEVELOPMENT COSTS (Step II-A)

Task	*Man-Months*	*Cost*
System Specifications	25	$ 44,000
Special Purpose Specifications	6	10,000
FECS Specifications	1	1,500
Purchase Specifications	15	27,000
Vendor Selection	4	7,000
		$ 89,500

B. DEVELOPMENT COSTS (Step III)

System Software Package		$ 100,000
Software Modifications:		
Grid Display	24	100,000
Data Definition	12	50,000
Retrieval by Number of Occurrences	6	25,000
Data List	6	25,000
Weighted Name Search	24	100,000
Group Subset	12	50,000
		$ 450,000
Off-line Programs:		
Adjacency Group Report		
Felony Vehicle Report		
Basic Car Area Summary		
License Plate Report		
Vehicle Description Report		
FI and Pawn Multiple Occurrence		
Automatic Correlation Processing		
Utility Programs		
	72	$ 120,000

C. COMPUTER TIME	*Hours*	*Cost*
On-Line System Test	252 (@$375)	$ 94,500
Off-Line Program Test	216 (@$200)	$ 43,200
		$ 137,700

D. EQUIPMENT (nonrecurring) COST

Install 21 Telephone Lines	$ 294
50 Magnetic Tapes	1,000
Extended Core Memory (512K bytes)	277,000
1 Disk Storage Unit	174,000
4 Disk Packs	4,000
20 CRT Terminals (including hardcopy device and data set)	93,153
1 Printer/Reader/Card Punch (including adaptor unit)	35,000
	$ 584,447

SUMMARY OF DEVELOPMENT COSTS

A. Specifications and Vendor Selection		89,500
B. On-Line Software and Modifications		450,000
Off-Line Programs		120,000
C. Computer Time		137,700
D. Equipment Cost		584,447
	TOTAL	$1,381,647

Estimated Annual Operating Cost of the PATRIC System

	Gross	*Displaced*[1]	*Net*
A. Computer Time 300K @ $17,500/mo.	$210,000		$210,000
B. Data Preparation Cost @ $28,931/mo-MSD $ 5,961/mo-DSB	$418,704	$418,704	$ 0
C. Telephone Line Charges:			
1. Twenty-one Low-Speed Lines @ $776/mo.	$ 9,312		$ 9,312
D. Personnel:[2]			
1. DSB System Maintenance, Operation, and System Improvements	$ 60,693	$ 18,937	$ 41,756
2. Operating Divisions			
17 Analytical Ofcrs. (AA - $14,428/yr.)	$313,225	$313,225	$ 0
18 Sr. Clerk Typists ($9,312/yr.)	$214,038		$214,038
SUBTOTAL	$527,263	$313,225	$214,038
3. System Project Office			
1 Supervisor (Sgt. II - $18,333/yr.)	$ 23,943		$ 23,943
2 Sr. Admin. Asst. — ($17,017/yr.)	$ 43,462		$ 43,462
2 Admin. Asst. — ($14,428/yr.)	$ 36,850		$ 36,850
1 Clerk Typist — ($7,705/yr.)	$ 9,839		$ 9,839
SUBTOTAL	$114,094		$114,094
SUBTOTAL PERSONNEL CHARGES	$701,357	$333,225	$368,132
TOTAL ANNUAL OPERATING COST	$1,340,066	$750,866	$589,200

1 Displaced cost represents cost currently being expended that could be applied directly to PATRIC.
2 Personnel at full time, full benefits and top step. Employee benefits: 27.7% civilian, 30.6% sworn.

SUMMARY OF NET OPERATING COSTS

A. On-Line Computer Time	$210,000
B. Data Preparation	0
C. Telephone Line Charges	9,312
D. DSB Personnel	41,756
LAPD Analyst Personnel	214,038
SPO Personnel (LAPD)	114,094
	$589,200

END