# Information Technology in the Practice of Law Enforcement

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## EXECUTIVE SUMMARY

*In February 2001, the Charlotte-Mecklenburg Police Department began the rollout of a "mobile" information system that will eventually enable all information relating to incident reports, arrests, and investigations to be collected, distributed, and managed in a paperless, wireless environment. The system, dubbed Knowledge-Based Community Oriented Policing System (KBCOPS), began as a "grass roots" project within the police department to reduce paperwork, increase data accuracy, share knowledge and information, and promote a problem solving analytical framework. The system has been under development for seven years, from concept to implementation. The strategies and approaches used to develop this system, the technologies employed, and, most importantly, the challenges faced in merging wireless, wired, database, and applications technologies while satisfying the user requirements of the police department are detailed in this report.*

*Keywords:* *database; database management; emerging information technologies; end-user computing; end-users; law enforcement IS; strategic alignment; system acceptance; system implementation; systems development life cycle; systems development process; user satisfaction; wireless technologies*

## ORGANIZATIONAL BACKGROUND

The Charlotte-Mecklenburg Police Department (CMPD) is the principal local law enforcement entity for the city of Charlotte, NC, and surrounding Mecklenburg County. CMPD serves a population of nearly 700,000 citizens in an area covering more than 550 square miles, and employs nearly 2,000 people, including sworn police officers and civilian support staff. Civilian personnel are assigned to a variety of clerical and administrative support functions related to but not directly involved in the practice of law enforcement activities. CMPD is headquartered in a state-of-the-art building in the downtown area of the city. This facility was designed and constructed to support the computing and data communications needs of CMPD.

CMPD is commanded by the Chief of Police with the aid of the Deputy Chief of Administrative Services, Deputy Chief of Support Services, Deputy Chief of Field Ser-

vices and Deputy Chief of Investigative Services. There are many units in CMPD. Figure 2 in Appendix A contains a full organizational chart for CMPD. Technology Services, a division of Administrative Services, manages existing information systems and is responsible for the design and implementation of new IT applications. In addition, they manage strategic planning and crime analysis and provide training for all police department personnel.

The operating budget for CMPD in FY2005 is approximately $146 million. Administrative Services, which includes but is not limited to Technology Services, accounted for approximately 20% of the overall budget. CMPD's operating budget over the 3 most recent fiscal years is shown in Table 1.

CMPD prides itself on being a community-oriented law enforcement agency whose mission is "to build problem-solving partnerships with our citizens to prevent the next crime" (FY2004 & FY2005 Strategic Plan, p. 57). As stated in the 2004-2005 strategic plan, "the Police Department's problem solving efforts are predicated on the availability of accurate and timely information for use by employees and citizens" (FY2004 & FY2005 Strategic Plan, p. 57). Since 1995, CMPD has recognized that IT will be one of the most important crime fighting tools of the 21st century and has emphasized the commitment to making information one of its most important problem-solving tools. The strategic plan recognizes that IT will play an integral role in achieving the strategic goal of "making Charlotte the safest large city in America" (FY2004 & FY2005 Strategic Plan, p. 31).

## SETTING THE STAGE

CMPD was established in 1994 when the city and county police departments of the Charlotte-Mecklenburg area merged. At about that same time, CMPD hired a new Chief of Police, who recognized the potential of information technology as a problem-solving tool in the practice of law enforcement — particularly in the areas of crime analysis and computerized mapping. To further this cause CMPD commissioned a nearby university to conduct an in-depth needs analysis in 1995. CMPD also hired a planning director to lead the effort of updating or replacing antiquated systems, and more importantly, to identify new systems that would improve the quality of policing. As a result of the needs analysis, an information systems master plan was created in 1996. The master plan called for the establishment of an infrastructure, followed by the development of

*Table 1: CMPD Budget Summary*

| | FY2003 | FY2004 | FY2005 |
|---|---|---|---|
| Field Operations | $71,695,470 | $72,321,646 | $75,522,528 |
| Investigative Services | $14,963,920 | $14,388,016 | $14,915,761 |
| Special Services | $26,353,258 | $25,119,778 | $25,827,326 |
| Administrative Services | $27,513,572 | $28,886,714 | $29,827,691 |
| **Total Police Services** | **$140,526,220** | **$140,716,154** | **$146,093,306** |

mission-critical databases. Top priorities included the creation of a wireless network, an improved dispatching system, and a new report management system.

The information system requirements of CMPD are many and varied. Major systems include those that support (1) administrative and personnel functions; (2) dispatching and 911 emergency services; and (3) incident reporting, case management, arrest, investigative, and crime analysis activities. The system that supports the information requirements encountered in the daily activities of law enforcement is of primary interest in this case. This mission-critical system includes, but is not limited to, incident reporting, case management, arrests, investigation, and crime analysis. The Knowledge-Based Community Oriented Policing System (KBCOPS) was designed and developed to support these activities.

Prior to the roll out of KBCOPS, daily law enforcement activities were carried out in a paper-laden environment. The processes of reporting and investigating incidents were not linked. When an incident was reported, a patrol officer was dispatched to perform a preliminary investigation. During this investigation, the officer took notes on a small paper notebook. When the officer returned to headquarters, often several hours later, he would file a paper report detailing the incident based on his notes and memory of the details of the case. The paper report was given to the appropriate supervisor for approval. The reports were sometimes returned to officers for revision before approval. Reasons for returned reports included spelling errors, grammatical errors and lack of sufficient information about the incident. Patrol officers quickly became aware of which supervisors were more likely to accept their reports without revision. In addition, reports were often resubmitted to a different supervisor due to shift changes. One problem arising from resubmission to a different supervisor was that the new supervisor was not aware of the initial rejection of the report and the reasons for the rejection. Once the report was approved it was sent to the Records Department. The Records Department was responsible for entering some of the information from the report into a database, archiving the report and routing a copy to the proper investigative unit. The supervisor for the investigative unit then assigned the case to a detective. The time frame from reporting an incident to assignment to a detective was four to five days.

In the pre-KBCOPS environment, systems across CMPD did not effectively link to each other. As a result, when a detective discovered a pertinent piece of information upon investigation of the case, the patrol officer who originally investigated the case was not usually notified and there was no mechanism for the notification to take place. If an officer wanted to look at crimes with similar characteristics, the paper reports for those crimes would have to be pulled from the archives by the Records Department and the cases would be analyzed manually by the detective. Information needed for crime analysis, which identifies patterns that might lead to the prevention of the next crime, was not readily accessible across units.

Although information technology supported the collection of data needed in daily law enforcement activities prior to the rollout of KBCOPS, it did not meet the needs of the department with respect to sharing, assimilating, and reviewing these data. It also fell short of fulfilling the Chief's vision of IT-enhanced law enforcement. Efforts to create KBCOPS began in 1996. The development and implementation of this new system is the subject of the case described in the following section.

# CASE DESCRIPTION

When a police officer responds to an incident in the field an incident report is filed. The first portion of KBCOPS implemented at CMPD — the Incident Reporting Subsystem — supports the electronic capture, storage, and retrieval of these reports. Functionality has since been added to support case management activities, arrests, investigative activities, and crime analysis. The following sections describe the features of the system in more detail as well as the required infrastructure, the process used to develop the application, and user perceptions of the system.

## The KBCOPS Application

The Incident Reporting subsystem rolled out in February 2001 and consists of modules for creating and approving incident reports. The Incident Reporting subsystem captures all information needed to file an initial police report. This includes data pertaining to suspects, vehicles, victims, witnesses, relationships between suspects and victims, the role a person plays in a crime (victim, suspect or witness) and prior offenses. Accurate, complete, and timely information is critical to subsequent arrest and investigative activities.

KBCOPS runs in a client/server environment. The client runs on laptops issued to police officers in the field, in what is essentially a browser window. Officers use the client software to create police reports *while they are in the police car* rather than waiting until they return to their division office or police headquarters to complete their reports. The ability to capture the data at or near the source, as opposed to hours afterwards, is a significant benefit of KBCOPS because it pushes better investigation at the scene and improves the quality of the information contained within the incident report. Confidence in the merits of this system is so strong that upon initial roll-out of the Incident Reporting sub-system officers graduating from the police academy were issued three items: a flak jacket, a weapon, and a laptop.

To complete an incident report an officer fills out a series of forms that are generated as Web pages. Figures 3 through 5 in Appendix B provide examples of forms used in an incident report. Each form is submitted via a wireless link to a server at headquarters (HQ). Context-sensitive field-level and form-level intelligence and workflow routing capabilities are built into this application. Context-sensitive field-level intelligence means that given a specific piece of information the system automatically knows which remaining pieces of information are needed and, in many cases, what the range of acceptable values for those fields can be. Forms are also context driven — which means the next form generated is dependent on the entries on the previous form. This kind of built-in intelligence enables the system to check for errors, omissions, and inconsistencies. Officers must correct these errors before the report can be submitted. The length of time needed to complete an incident report depends upon the nature of the crime but typically ranges from thirty minutes to two hours.

The information submitted by officers in the field is immediately available to other authorized users of KBCOPS. Once a report is filed its contents cannot be modified.

Each time changes or additions to an existing report are needed a copy of the report is generated. Changes are appended to the copy and it is saved as a new report. Each previous version remains intact, ensuring that CMPD never loses a version of the incident report — an important consideration for data integrity.

Once an incident report has been submitted, it must be reviewed by a supervisor. If the report is rejected the supervisor provides comments as to why. Reports are often rejected due to spelling and grammatical errors. The supervisor's comments and submission history of the report are recorded, which prevents officers from submitting the same report to another supervisor for approval without first making the corrections suggested in the previous supervisor's comments. Figure 6 in Appendix B shows the screen the officers view to determine the status of their reports. After the report has been approved, a rule-based feature routes the report to the proper investigative unit. These rules are quite complex — requiring knowledge of statutes, policies and specifics of the crime, offender(s) and victim(s). Prior to the development of the system routing a report to the appropriate investigative unit could take days or weeks. Now, the report is routed in a matter of hours.

The Case Management subsystem, which went live in August 2001, extended these capabilities to allow tracking of a case from initial incident all the way through the arrest and investigation procedures. The officer in charge of the investigative unit responsible for the case can view the case summary, assign investigators to the case, or re-route a case to another unit. The Case Management subsystem allows supplements to be added to a case. A case supplement provides an officer with a copy of the original report to change as needed. Both the copy and the original are kept to track the progression of the investigation. When a supplement is added to a case all officers involved are automatically alerted to the new information. Supervisors can make a supplement required, in which case officers are notified when a supplement is past due. Figure 7 in Appendix B illustrates the screen officers view to manage their cases.

The Incident Reporting and Case Management subsystems facilitated the process of completing and tracking police reports. However, users remained unable to retrieve information from the database in any way other than report format. The KBCOPS database contains a wealth of information that can be used to identify and apprehend perpetrators and to identify patterns and trends in criminal behavior. In August 2002 search capabilities were added. Officers, detectives, and other users can now use a large number of search options to retrieve information from the database. Searches can be based on the type of crime, date ranges, patrol division(s), method of operation (M.O.), physical characteristics of the suspect, weapon(s) used, or any combination of a wide range of variables. Figures 8 and 9 in Appendix B show examples of typical searches.

In addition to search capabilities, several other new features have recently been implemented. For example, the data captured in KBCOPS can be rolled up into the format required for the National Incident-Based Reporting System (NIBRS). NIBRS (NIBRS Implementation Program, 2002) is a nationwide tracking system used to solve crimes that occur across individual police department jurisdictions and across state lines. Although many local police departments have records management systems to capture data about crime incidents, they are unable to use those systems to report to NIBRS because the data are in an incompatible format, not coded in a NIBRS-compliant man-

ner or not all of the mandatory NIBRS elements are captured. A feature that will provide a direct interface to NIBRS is currently underway.

Additional enhancements are being planned. One of these will integrate KBCOPS directly with other local, state, and federal law enforcement systems, as well as hospitals, pawnshops, utility companies, and other entities that possess potentially vital information. Additionally, GIS and global positioning system components will be integrated into KBCOPS to provide street file overlays on the officer's laptop. Finally, a Juvenile Arrest subsystem will be added in the near future. Handling crimes involving juveniles is complex because statutes and policies for dealing with juvenile offenders and victims differ significantly from those that do not. For example, fingerprints are not taken from juveniles for positive ID, making it nearly impossible to link crimes involving the same juvenile offender. The Juvenile Arrest module is scheduled for rollout in March 2004. Table 2 summarizes the currently implemented and planned components of KBCOPS.

*Table 2: Components of KBCOPS*

| **Incident Reporting System** | |
|---|---|
| **Key Functionality** | **Key Features** |
| Create Incident Reports | Context-sensitive intelligence |
| Approve Incident Reports | Checks for errors/inconsistencies |
| Assign Case to Investigative Unit | Rule-based assignment algorithms |
| View/Track Status | Status screens |
| Add Supplement | Automated version control |
| **Case Management System** | |
| **Key Functionality** | **Key Features** |
| View Case Summary | Complete history of all versions |
| Assign Investigator(s) to Case | Automated alerts for new data |
| Re-Route Case to Another Unit | Supplements can be required |
| Add Supplement | Notification of past due supplements |
| **Search Capabilities** | |
| **Key Functionality** | **Key Features** |
| Search by Type/Date of Crime | |
| Search by Patrol Division | |
| Search by Method of Operations | |
| Search by Suspect/Multiple Suspects | |
| Search by Weapon/Vehicle | |
| **NIBRS Reporting** | |
| **Key Functionality** | **Key Features** |
| Roll-up crime data for federal reporting | Collects/edits information for NIBRS |
| | Produces error reports |
| | Formats monthly data for submission |
| **Juvenile Arrest System*** | |
| **Key Functionality** | **Key Features** |
| View Case Summary | Complete history of all versions |
| Assign Investigator(s) to Case | Automated alerts for new data |
| Re-Route Case to Another Unit | Supplements can be required |
| Add Supplement | Notification of past due supplements |
| **Planned Enhancements** | |
| Interfaces with other law enforcement entities | |
| Interfaces with hospitals, utility companies, pawnshops, and so forth | |
| Interface with GIS components to provide street overlays | |

** Scheduled to roll out in March 2004*

## The KBCOPS Infrastructure

KBCOPS supports nearly 2,000 users. Category 5 (CAT5) cable is used within HQ for local area network (LAN) connectivity. CAT5 provides data transmission speeds of up to 100 million bits per second (Mbps) over normal telephone wire. Fiber extends to district offices up to 18 miles from HQ via a synchronous optimal network (SONET). SONET (Tomsho et al., 2003) is a wide area network technology that is used to allow dissimilar long-distance networks to transmit voice, data and video at speeds in multiples of 51.84 Mbps using fiber-optic media. Within the headquarters building and at district offices, CAT5 cable drops are available every 10 feet each with quad jacks supporting two data connections and two voice connections. This wiring infrastructure provides maximum data connectivity and work area layout flexibility.

The KBCOPS infrastructure initially included 1,500 laptops in the field (one issued to each patrol officer), more than 100 laptops at police headquarters for staff and support personnel, and some 500 desktop computers. Laptops are now issued to vehicles rather than to officers. Currently, over 700 police vehicles are equipped with trunk-mounted modems that support wireless data communication to and from headquarters. Servers and data switches were installed to support the implementation along with the required conventional wired connectivity. CMPD worked with a local wireless data provider to achieve a 99.9% coverage rate in the community. Approximately 53 towers are used to enable communication via TCP-based cellular digital packet data (CDPD). TCP (Tomsho et al., 2003) is an acronym for transmission control protocol, the primary protocol for transport of data packets over the Internet. CDPD (Tomsho et al., 2003) is a mobile computing technology used for wireless Internet and e-mail access. CDPD "sends packets of digital data over unused cellular voice channels at a rate of 19.2 Kbps" (Tomsho et al., 2003, p. 599). Although these towers are shared with cellular phone service providers, the frequencies over which CMPD transmits data do not compete with those used by cellular phone customers.

## The Development & Implementation Process

The development process for KBCOPS has been lengthy and costly-running five years from concept to rollout of the Incident Reporting subsystem at a cost of nearly $4 million. Although a majority of this cost has been offset by grant funding, the remainder has been supplied through departmental funds.

The development of KBCOPS was based upon the systems development life cycle (SDLC). The SDLC is a process for understanding how an information system can support the needs of a business, then designing, building, and implementing the system (Dennis & Wixom, 2002). As shown in Table 3, the SDLC consists of five fundamental phases: planning, analysis, design, implementation, and support.

Planning for KBCOPS began in 1996 with the creation of the information systems master plan. Shortly thereafter, efforts to understand the business needs began with one year spent determining the system requirements. System developers and consultants worked with a functional area expert from within CMPD to map the required processes to design specifications.

*Table 3: Systems Development Life Cycle Phases*

| SDLC Phase | Purpose |
|---|---|
| Planning | Assess project feasibility; establish budget, schedule, and project team |
| Analysis | Study the business needs; determine system requirements; develop system models |
| Design | Create a detailed system specification (interface, database, program and network designs) |
| Implementation | Build the system, test the system, and place it into operation |
| Support | Maintain and enhance the system through its useful life |

The development team consisted of nine people — including applications developers, database administrators, systems administrators, project managers, consultants, and network/mobile communications experts. Coding for the Incident Reporting subsystem was finished in April 2000, and system validation testing was conducted in July and August of that year. As a result of these tests new functionality was added and a long test/fix cycle ensued.

Despite early success in the requirements analysis and process mapping phases of development, the project soon suffered a variety of problems. These problems were primarily attributed to the creation of inadequate design specifications, failure to control project scope, and lack of a strong technical project leader. In addition, a number of organizational changes were taking place, including the retirement, in 1999, of the Chief of Police. Both the retiring Chief as well as his replacement supported the development of KBCOPS.

As development of the system progressed the project experienced "scope creep". Scope creep — the identification of new requirements after the project was initially defined — is one of the most common reasons for schedule slippage and cost overruns (Dennis & Wixom, 2002). In 1998 a new Director of Information Technology was hired, and the project was "re-scoped" with clearly identified project phases. An experienced technical project manager was brought on board to work with and oversee the development team. A formal development plan was established with a heavy emphasis on system validation testing. The design specifications were revised and new requirements defined. A great deal of progress on the KBCOPS application soon followed.

Design specifications were developed using Oracle Designer/Developer — a computer-aided software engineering (CASE) tool that supports the tasks associated with the system development process. The use of CASE tools has been shown to reduce development time (and costs) and improve software quality (Dennis & Wixom, 2002). The Incident Reporting subsystem is comprised of more than 1,000 modules (screens, reports, PL/SQL code segments, etc.) and 240 tables. JavaScript and HTML were used for the majority of the client application on the laptops, with PL/SQL running on the Oracle server.

At the time the KBCOPS application was developed the limited bandwidth (19.2 Kbps) available for the wireless transmission of data caused lengthy delays for officers filling in forms using the wireless connection from the field. Changes in the system architecture, including moving to JavaScript on the client side and redesigning transac-

tion confirmation screens (referred to as "Success" screens) were required to address these delays. The use of JavaScript allows some validation of information entered into the forms (such as ensuring required fields are not blank) to be handled on the client machine, instead of sending the form over the wireless connection to the server for all validation (Gosselin, 2000).

The rollout of the Incident Reporting subsystem — the first subsystem to go live - was conducted over a 6-week period. Two of the 12 patrol divisions went live each week. During this time period new incident reports were entered both in KBCOPS and in the old system to provide backup in the event of a major latent bug in the system. No major problems were found and duplicate data entry was soon discontinued.

CMPD used a proactive support strategy to assist officers during the implementation of the Incident Reporting subsystem. Officers and other users received 16 hours of initial training to learn how to use the system. A technical team of 12 full-time and six split-time people supported officers in the field. If an officer had questions or problems that could not be handled remotely, support personnel would go to the officer in the field to assist. Some support personnel were stationed at HQ, some at district offices, and others were mobile and thus able to respond quickly to an officer's questions at the incident site.

Today, support is handled by a team of four people at HQ. There is no longer a need to assist officers in the field as the system has become more familiar. KBCOPS has become an integral part of training on "report writing" within the police academy. Approximately 16 hours of the two weeks spent on report writing is dedicated to KBCOPS. Officers identified by their peers as "power users" help fellow officers when questions arise. The rollout of new features and subsystems now utilizes the "big bang" approach rather than a phased approach going division by division. Incremental changes are not viewed as significant enough to require a more conservative approach.

Development and implementation of new subsystems is ongoing. In September 2002 the Director of Information Technology was replaced. Despite this change in leadership support and enthusiasm for the application, it has continued.

A summary of how a case was processed before KBCOPS versus after KBCOPS is provided in Table 4. Due to the automatic storage of fields in the report to the database and the automatic routing of the approved report to the appropriate investigative unit by the system the time from reporting an incident to assigning an investigator has been reduced from four to five days to less than 24 hours.

A timeline of the major events that took place during the development and implementation of the KBCOPS application is provided in Table 5.

## User Perspectives of the KBCOPS Application

In November 2003 several users were interviewed to determine their perceptions of the KBCOPS application. The participants came from two groups, patrol officers and detectives. The interview questions were drawn from the technology acceptance model (Davis, 1989) and the information systems implementation literature (Burns, Turnipseed & Riggs, 1991). The interview protocol can be found in Appendix C. Example comments from each group are provided.

*Table 4: Before & After Comparison of Processing of a Typical Case*

| Event | Before KBCOPS | After KBCOPS |
|---|---|---|
| Incident reported | • Officer dispatched to scene | • Officer dispatched to scene |
| Preliminary investigation | • Officer interviews witnesses and records information in paper notebook | • Officer interviews witnesses and records information in paper notebook |
| Incident report | • Officer files a paper report after returning to headquarters | • Officer files a report on-line while in the patrol car |
| Approval of report by supervisor | • Officer submits paper copy of completed report to supervisor<br>• Report may be returned due to errors<br>• Report revised and submitted (possibly to different supervisor)<br>• Supervisor may not be aware of previous supervisor's comments | • Officer submits the report wirelessly<br>• The system alerts the supervisor of a new report<br>• Report may be rejected due to errors<br>• Each supervisor's comments are saved by the system as part of the report |
| Report to Records Department | • Paper report sent to Records Department to be entered into database and archived | • Report does not go to Records Department but is automatically stored in the database |
| Assign to investigative unit | • Records Dept. sends a paper copy of the report to investigative unit<br>• Supervisor of investigative unit assigns it to a detective<br>• Often takes 4-5 days from reporting of an incident to assignment of a detective | • System alerts investigative unit to the report<br>• Supervisor assigns a detective to the case electronically<br>• Often takes 24 hours or less from reporting of an incident to assignment of a detective |
| Investigation of case | • Detective updates paper case file<br>• Only those with access to paper file see updates<br>• Cases with similar characteristics pulled and analyzed manually | • Detective updates case electronically<br>• All versions maintained<br>• System alerts officers involved to updates<br>• Cases with similar characteristics analyzed using search capabilities |

## Detectives' Comments:

*"In the beginning, the time it took was huge. The compression utility has made a big difference. I am excited about it now. From an administrative point of view, it is great."*

*"Newer officers do not seem to have a problem with the system. Older officers still have some resistance."*

*"Investigation has improved. It used to take 4 or 5 days to assign a case to an investigator. Now it takes less than 24 hours. Also, being able to do searches is a big timesaver. We can identify patterns and trends. Our case clearance rate has improved greatly."*

*Table 5: Timeline for KBCOPS Application*

| Year | Event |
|---|---|
| 1994 | CMPD established after merger of city and county police departments |
| 1996 | CMPD created an IS master plan |
| 1996 | Efforts to create KBCOPS began |
| 1998 | New director of IT and experienced technical project manager hired |
| 1999 | Chief of Police who initiated project retired |
| 2000 (April) | Initial coding for incident reporting subsystem completed |
| 2000 (July) | System validation testing on incident reporting subsystem |
| 2001 (February) | Incident reporting subsystem goes live |
| 2001 (August) | Case management subsystem goes live |
| 2001 | Compression software installed |
| 2002 (August) | Search capabilities added to system |
| 2002 (September) | New director of IT hired |
| 2004 (March) | Juvenile arrest module projected to go live |

*"There is a big learning curve. Officers try to take shortcuts to get through the system. The reason the officers take so many shortcuts is there are so many screens to go through. Narratives aren't being done as well as they were before. Quality of data is still one of the biggest problems."*

### Patrol Officers' Comments:

*"The availability of information is a big plus. The ability to do searches transformed the system from one that seemed worthless to one you can use. Once you see how the information you enter is used, you understand why they need it. Seeing the big picture really makes a difference."*

*"We were trained on how to use the system, but we didn't understand why we had to use it or how it would alter the investigation process."*

*"The time it took to enter all that data seemed futile before. Now I use the search capabilities every day."*

*"Entering information one screen at a time is a big problem. You can't see the big picture. Some screens ask for information you did not know you had to collect."*

*"Spellchecking takes too long. You can't do intermediate saves in KBCOPS. If the system goes down while entering information, you lose the whole screen. I use Word so that I can undo, use the spellchecker and do intermediate saves."*

## CURRENT CHALLENGES/PROBLEMS FACING THE ORGANIZATION

Despite the success of the project, CMPD faces ongoing challenges with respect to the KBCOPS application. These challenges stem from technology, user, budgetary issues and aligning IT with community policing objectives.

## Technology Issues

At the time this case was written bandwidth in the wireless environment was limited to 19.2K, with an effective bandwidth of 10K. Compression software was installed to improve bandwidth, reducing delays by 60%. However, officers continue to experience delays in uploading and downloading forms.

The system manages approximately one million inbound mobile requests per month and supports 200-250 simultaneous users. The system has thus far proven to be highly reliable, experiencing fewer problems than the internal LAN within CMPD. However, reliability could become an issue in the future as new modules are added and the number of simultaneous users increases.

Although there have been no security breaches to date, security of the wireless implementation must continuously be evaluated. Initially, security issues required almost two years to resolve. The current solution includes user authentication with two levels of encryption. User authentication is the process of identifying authorized users (Newman, 2003). The most common method is through the use of user names and passwords. Encryption prevents a person with unauthorized access to data from reading them (Newman, 2003). Two independent vendors ensure an end-to-end secure connection. The commercial wireless provider encrypts data across its channels, and an additional layer of priority encryption and compression is performed by a leading software-based security system running on CMPD servers. Maintaining security across the network will be an ongoing challenge for CMPD as new encryption standards and better authentication techniques become available.

As with any IT application, the need to manage and integrate emerging technologies is an ongoing challenge. Although there has been relatively little need for maintenance or replacement of equipment, this will become a necessity in the future.

## User Issues

Restructuring CMPD's business processes forced changes in the daily activities of police officers. These changes continue to meet with some resistance. If not managed properly, user resistance can lead to attempts to undermine the system (Jiang, Muhanna & Klein, 2000). Thus, finding effective ways to deal with user resistance is vital to the continued success of the project.

Although many users are satisfied with the system, pockets of user resistance are visible. Some officers see the system as pushing extra work on them. KBCOPS requires them to spend a significant amount of time entering information that populates the incident database — a database that is subsequently used primarily by detectives. Although the implementation of search features has helped, some patrol officers still question the value added by the system.

Additionally, the software has some shortcomings that frustrate users. Specific issues include the delay time for submitting forms, the inability for the officers to save a form before it is submitted, and the lack of support for spellchecking. The last two issues are particularly problematic for forms that require narratives. As a temporary solution,

many officers enter their narratives in Word so that they can save their work intermittently and use the spelling and grammar features. They then copy the narrative to the required form. Although this workaround accomplishes the task, it takes extra time and leads to frustration.

Another challenge is created as officers become familiar with the system and take "shortcuts" to avoid filling in extra forms. Entering certain information in one form may generate many additional forms to fill in. Additionally, officers sometimes fill in the required fields in a form and leave non-required fields blank. Consequently, the information stored is sometimes incomplete and inaccurate, compromising the quality of the data and the resulting investigation. The shortcuts and incomplete forms also lead to problems between officers who enter the information and the detectives that depend on it.

Training is one of the most important parts of any change management initiative and is one of the most commonly overlooked (Dennis & Wixom, 2002). Training and a willingness to combine knowledge and skill sets across functional lines are critical success factors for implementation of large systems (Benji, Sharman & Godla, 1999; Gauvin, 1998). Research suggests that training improves the likelihood of user satisfaction, increases organizational effectiveness, and improves employee morale (Barney, 1991; Peters & Waterman, 1982; Rosenberg, 1990; Ulrich, 1991). Although CMPD trains officers on the use of KBCOPS, training focuses on how to use the system rather than why it should be used and how it fits into the bigger picture of crime investigation.

## Budgetary Issues

Continual feedback from users has led to a two-year backlog of requested enhancements. CMPD's ability to respond to these requests is threatened by the drying up of federal grants that to this point have largely underwritten the development of the system. Federal funds previously directed to local police initiatives are being eliminated or redirected to homeland security. Replacement of these funds will be a challenge (FY2004 & FY2005 Strategic Operating Plan).

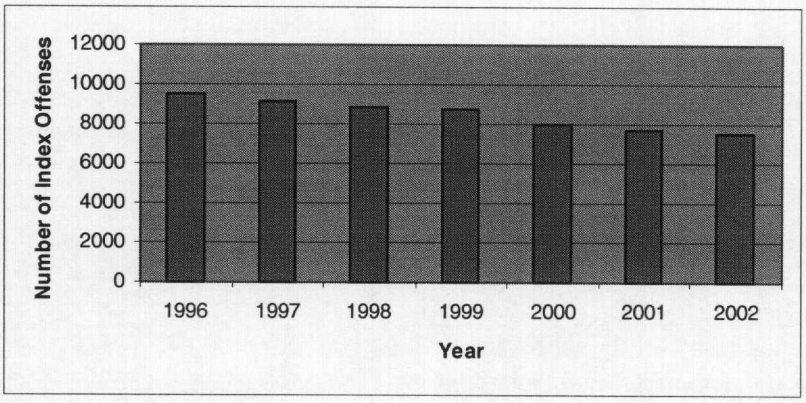
Further evidence of budgetary problems is reflected by unfunded CMPD budget requests of $1,409,074 in FY04 and $917,009 in FY05 (FY2004 & FY2005 Strategic Operating Plan). Unfunded requests directly affecting KBCOPS included installation of LAN switches and other networking equipment to enable direct access to the system.

At a more technical level, system enhancements present challenges in establishing effective ways to deal with configuration management, defect tracking, quality assurance, and test planning. Developers identified these as areas of concern. Lack of code/version control and inadequate testing are classic implementation mistakes (McConnell, 1996). Continued success of the project will require finding solutions to these problems.

## Aligning IT with Community Policing Objectives

Through the development and implementation of KBCOPS, CMPD has migrated from using IT in a reactive manner to employing IT in an active role for sharing knowledge, facilitating collaboration, and promoting a problem-solving analytical framework.

*Figure 1: Index of Crime Rates per 100,000 of Population*




The ultimate goal of KBCOPS is to improve the quality of policing. Although a causal relationship cannot be shown, crime rates decreased steadily between 1996 and 2002, as shown in Figure 1.

CMPD recognizes that it will be difficult to continue to reduce crime. Police will have to expand the number and scope of partnerships to solve new problems. CMPD must identify new ways in which KBCOPS and IT in general can support strategic initiatives and continue to improve the quality of policing.

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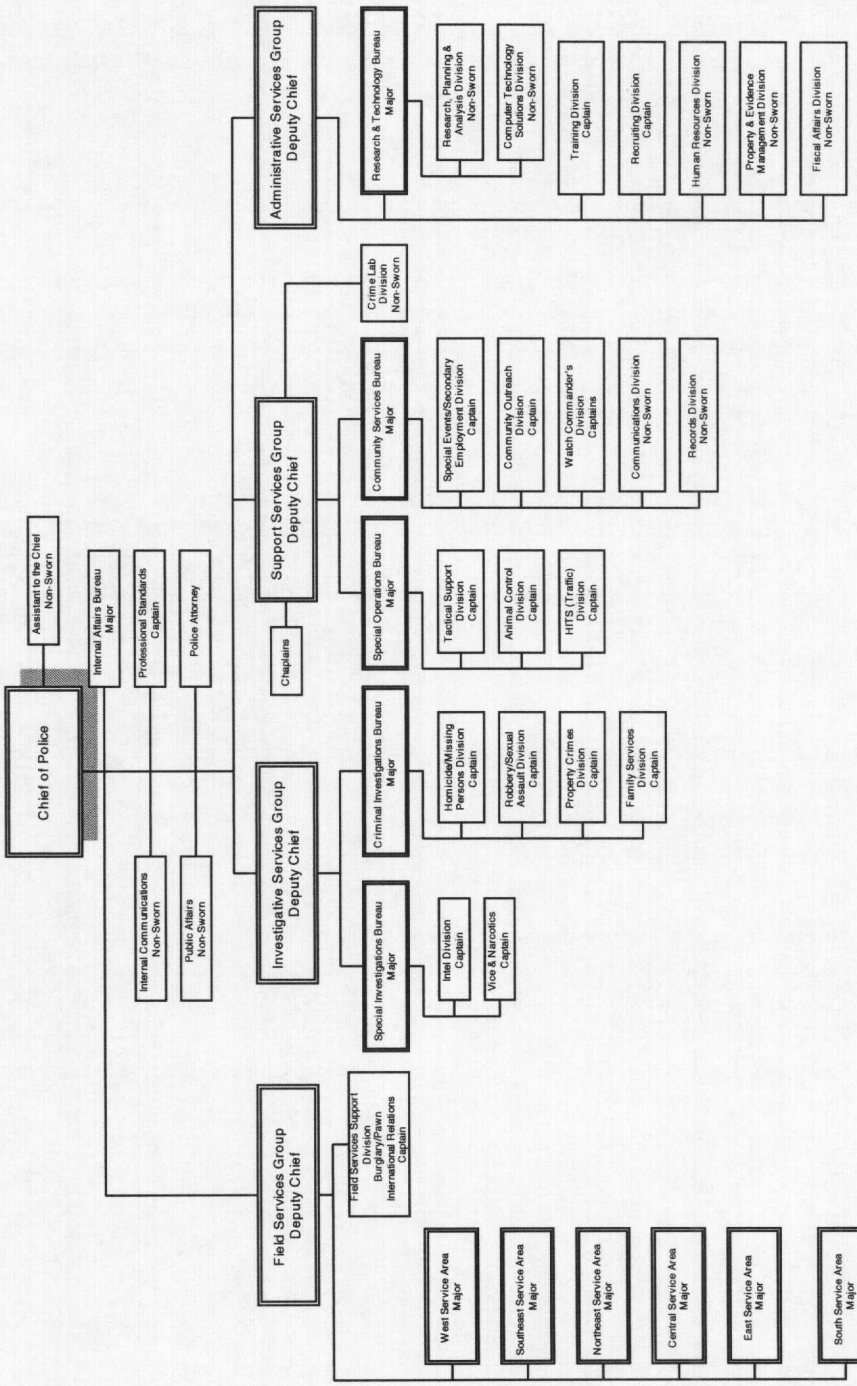
# APPENDIX A

*Figure 2: Organizational Chart*



# APPENDIX B

*Figure 3: Incidents Screen — Collects Information about the Date/Time & Location of the Incident*

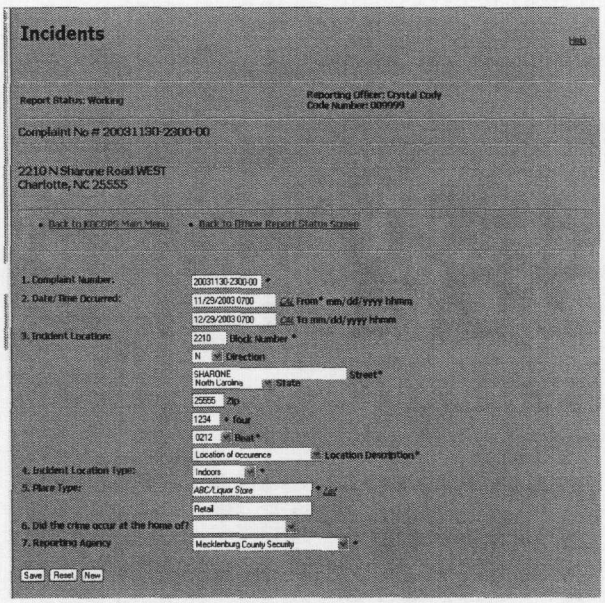



*Figure 4: Incident Demographics – Collects Other Details about the Incident Including the Clearance & Case Status*

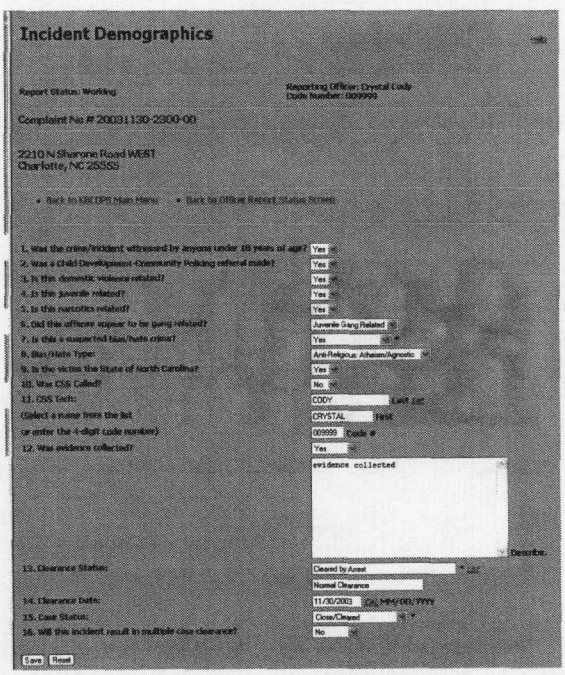


*Figure 5: Suspect Description — Collects Descriptive Information on the Suspect*

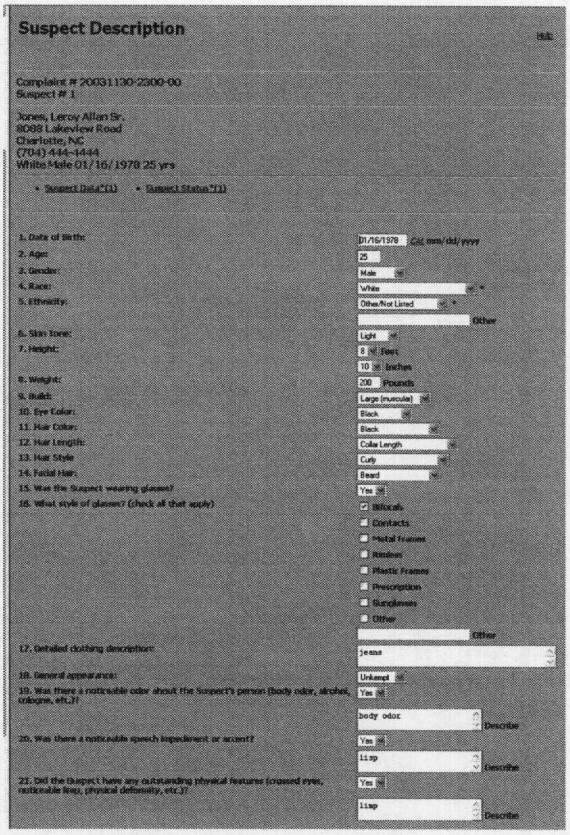



*Figure 6: Officer Report Status — Allows Officers to Manage Reports*

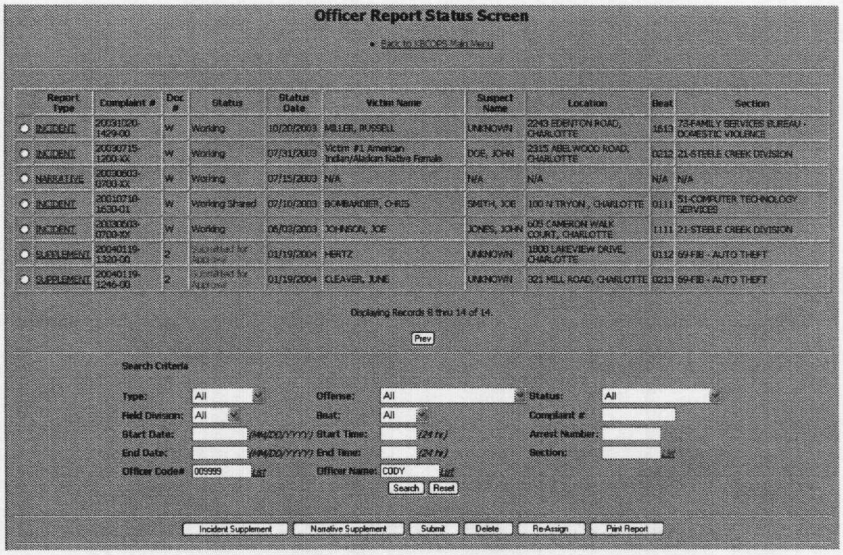


*Figure 7: Case Assignments – Enables Officers to Manage their Cases*

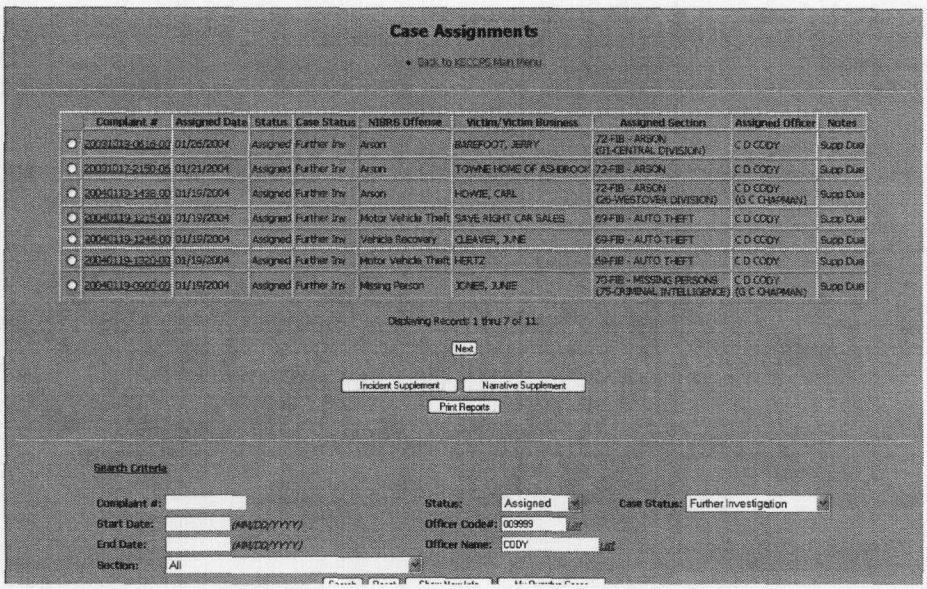



*Figure 8: Vehicle Search – Illustrates a Search for an Orange Cadillac*

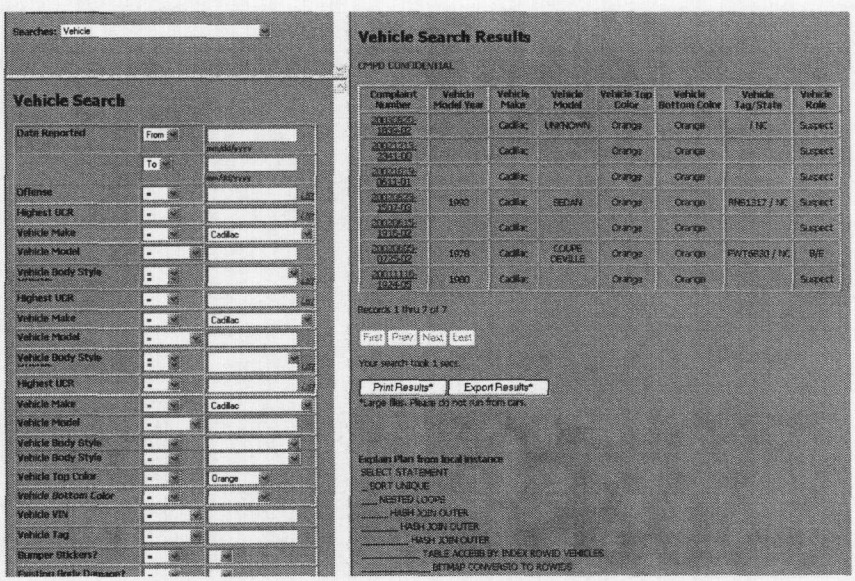
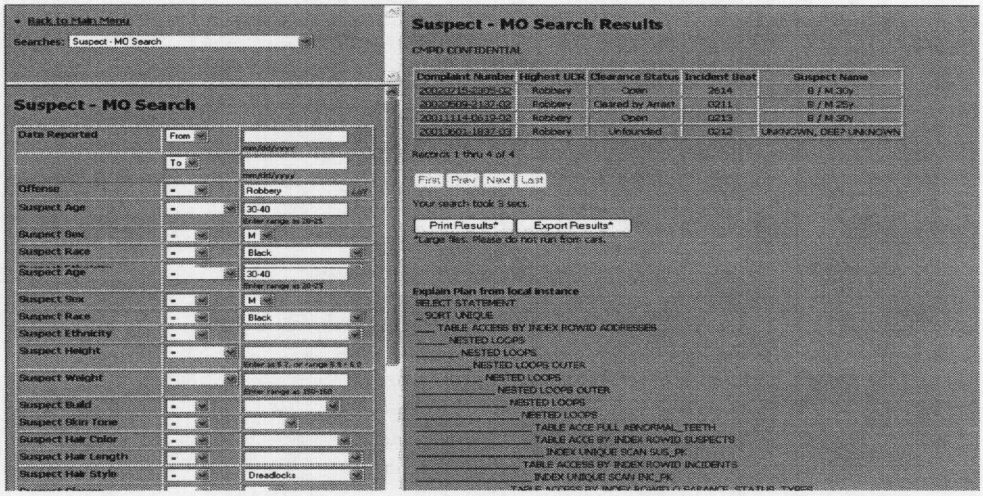


*Figure 9: Suspect MO Search – Illustrates a Search for a Black Male, age 30-40, with Dreadlocks & Gold Teeth who Committed a Robbery*




# APPENDIX C

Multiple visits were made to CMPD to interview project participants. The first round of interviews was conducted in February 2001 during initial system rollout. The second round was conducted in November 2003. Participants in each round were purposively chosen to span diverse areas of functional and technical expertise.

Questions in the first round were directed primarily to developers. Questions were based on the Varshney, Vetter and Kalakota (2000) mobile commerce framework and focused on identifying and understanding: (1) development methodologies, (2) infrastructure, (3) interface of mobile and land–based technologies, and (4) functionality of the application.

Questions in the second round focused on understanding implementation issues and user acceptance of the system. The following questions guided the second round of interviews:

1. At the time of our last visit, the Incident Reporting System was being rolled out. What other modules are now in place? What kind of roll out approach have you used?
2. What organizational difficulties have you encountered in implementing new modules?
3. In general, what is the level of acceptance of the system?
4. What are the "before" and "after" views of the users (police officers)?
5. To what extent have you integrated KBCOPS with external systems (hospitals, emergency services, federal and state law enforcement agencies, etc.)?
6. What technical difficulties have you encountered as the system has grown?

7. How do you train officers to use the system?
8. How do you support users in the field?
9. In what ways has the quality of policing improved since the implementation of KBCOPS?
10. Are other police departments following your lead and adopting similar systems?

To improve reliability, all interviews were conducted with two researchers present, each taking notes independently. These notes were later compared and synthesized to arrive at a clear and consistent interpretation of the verbal data.