

CLEAR and I-CLEAR: A Report on New Information Technology  
in Chicago and Illinois

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## Introduction

This is the fourth evaluation report<sup>1</sup> on the status of new information technology enterprise systems under development by the Chicago Police Department and the Illinois State Police. Since 2001, the Chicago Police Department (CPD), along with Oracle Corporation, has been developing a state-of-the-art integrated criminal justice information system. The system – Citizen and Law Enforcement Analysis and Reporting (CLEAR) – is part of the CPD’s ongoing quest to “police smarter” and be “intelligence driven.” More than a decade ago, in its strategic plan for the future the department foresaw the expanding relevance of technology for policing. In the plan, the CPD committed itself to using new technology to support the broader goals of the city’s community policing program – “enhancing our crime-fighting capacity, improving the quality of neighborhood life and developing a strong partnership with the community.” Powered by the CPD’s data warehouse, CLEAR is designed to provide anytime, anyplace access to vast repositories of centralized relational data.

CLEAR’s value to civic leaders as well as the law enforcement community was quickly noticed. In early 2004, the governor of Illinois and mayor of Chicago announced their commitment to building a single criminal justice database for the state and all of its criminal justice agencies. The system, still under development, is called I-CLEAR, with the “I” designating that it will serve all of Illinois. I-CLEAR represents an unprecedented partnership between the Illinois State Police (ISP) and the Chicago Police Department, one that promises to position Illinois well in the regional data-sharing arena. A soon-to-be launched web-enabled case management system, known as I-Case, will be available to all law enforcement agencies in the state and will provide uniform reports for participating agencies. An electronic warehouse has been built to house statewide data. In a project such as this, governance should have been a high priority to ensure that the needs of users throughout the state are met and to provide a conflict-resolution body between agencies, but no actual governing body ever materialized.

This report is presented in two parts. The first looks at CLEAR application development and usage as well as its impact on officers using the various modules. It also provides a glimpse at CLEARpath, the CPD’s newest suite of applications aimed at strengthening the city’s police-community partnership. The difficulties of securing funding for this endeavor are also described. The second part of the report showcases I-CLEAR development and the ISP-CPD partnership that has guided the construction of the I-CLEAR case management system. Observations and recommendations complete the report. To gather the information presented in this report, we conducted personal interviews, administered officer surveys, analyzed system usage data; attended planning and status meetings, and training and testing sessions. This report covers progress and activities through the end of April 2007.

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<sup>1</sup>The first report can be found within the CAPS Years 8&9 report at [http://www.northwestern.edu/ipro/publications/policing\\_papers/years8&9.pdf](http://www.northwestern.edu/ipro/publications/policing_papers/years8&9.pdf); second year reports can be found at [http://www.northwestern.edu/ipro/publications/policing\\_papers/Policing\\_Smarter.CLEAR.pdf](http://www.northwestern.edu/ipro/publications/policing_papers/Policing_Smarter.CLEAR.pdf) and <http://www.cops.usdoj.gov/default.asp?Item=1331>; the third report is found at <http://www.icjia.state.il.us/public/pdf/ResearchReports/CLEAR2004.pdf>

## Information Technology and the CPD

CLEAR was launched as the information technology (IT) revolution touched the criminal justice world. Police departments were ripe for change, as they became increasingly reliant on timely information to guide daily operations, analyze the effectiveness of crime prevention tactics and enhance management accountability. The “CompStat” management system in New York City, as well as data-driven law enforcement programs such as the federal Strategic Approaches to Community Safety Initiative, have given police a taste of what is possible. “Hot spot” policing and other operational programs have a greater likelihood of success if managers have access to up-to-date data for planning and evaluation. Unfortunately, most police departments have yet to exploit the capabilities inherent in information technology. Agencies the size of the Chicago Police Department are awash with data. Each day, big cities receive thousands of 911 calls, complete thousands of crime reports and arrest hundreds of people. Although tens of thousands of data elements are entered into their databases each day, this information is of little value because it is not easily or quickly extracted in useable form.

Data-driven policing continues to dominate discussions in the law enforcement community, spurred in part by external demands on the police: that they be more accountable for cost-effectiveness, that they “right-size” their staff and that they make more strides in pursuing procedural regularity. In the private sector IT has improved internal business processes by lowering recordkeeping costs, encouraging flexibility and speed in decision-making, giving management better control over product quality and enabling businesses to have more individualized relations with their customers. Policing organizations hope to benefit as well. IT adoption in policing comes at a time when the required computer hardware and software is more accessible in terms of price and user-friendliness. Many police agencies want to get involved, and they showcase new mission statements, business and marketing plans, and training programs that rely on information technology. Too often, however, there has been more talk than progress in implementing integrated data systems, gathering data consistent with National Incident-Based Reporting System<sup>2</sup> (NIBRS) standards, sharing data in partnerships with researchers and conducting sophisticated crime analysis and forecasting.

The CPD’s effort to harness the power of information technology began in June 2001. With more than \$35 million in support from Oracle Corporation and other funding sources, the CPD began an intense program of software development and testing to streamline its business processes. Oracle, a major business software designer, wanted to demonstrate that advances in information systems could be tailored to help foster greater accountability, efficiency and effectiveness in the public sector. Oracle assigned more than 20 software developers to work on the project. The CPD’s superintendent and deputies made CLEAR a top organizational priority.

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<sup>2</sup>The National Incident Based Reporting System (NIBRS) expands on the UCR system, which simply collects summary information about crimes reported to the police. Under NIBRS, data collection elements include the expansion of the number of offense categories, detail on individual crime incidents, the linkage between arrests and clearances to specific incidents or offenses, inclusion of all offenses in an incident, the ability to distinguish between attempted and completed crimes, and the linkages between offense, offender, victim, property and arrestee variables that permit examination of interrelationships.

With this level of commitment and expertise from the participants, CPD management increasingly observed that it would have a substantial impact on the department and the community it serves.

Oracle had been working with the CPD since the mid-1990s on development of its Criminal History Record Information System (CHRIS), so when the department decided to overhaul its information technology systems, it approached Oracle to present the concepts behind what eventually became known as CLEAR. At a 2001 Oracle/CPD meeting, the department described CLEAR's potential market value and reasons why Oracle would be the CPD's best partner for developing an enterprise system for law enforcement. Both Chicago's police superintendent and the chief of Washington, DC's Metropolitan Police Department were involved, showing that there was "multi-city interest" in such a project.

The CPD and Oracle were quickly engaged in continuing dialog about CLEAR development. To underscore Oracle's enthusiasm for the project, it offered a substantial number of hours of development assistance free of charge. Concurrently, a CPD deputy superintendent contacted the Police Executive Research Forum (PERF) to gauge its interest in partnering with the CPD to compile best practices in the IT field and to educate other law enforcement agencies about CLEAR and potential IT applications. PERF showed immediate interest in the CLEAR project's concepts and its proposed role.

Oracle eventually provided 90,500 consulting hours for CLEAR project development. The CPD reciprocated with an offer of \$9 million from the Office of Community Oriented Policing Services (COPS) funding that had been allocated for technology. As the project approached the \$40 million mark, a law firm was hired to handle the contract negotiation process. With City Hall's help in the contract process, the agreement was completed in just one week.

About a year before the Oracle negotiations, the CPD built its own data warehouse, which has the ability to sort through large amounts of data. There are, for example, nearly 5.8 million arrest records stored in the system – in a matter of seconds. The data held in the warehouse can be manipulated quickly with the aid of "easy-to-use" features, making it very popular with Chicago detectives and users from outside agencies. CLEAR applications, which are powered by the data warehouse, impact three major functional aspects within the CPD: police management, criminal justice integration and community/business partnership:

**Police management:** CLEAR promotes effective resource allocation; officer management and accountability; risk management and early warning; tactical and strategic planning; and fiscal accountability. The department-wide management accountability process makes use of CLEAR systems to address crime and disorder problems; react to emerging crime; optimize community involvement; and manage available human and material resources.

**Criminal justice integration:** The system enables unified strategies to reduce crime; eliminate criminal justice bottlenecks; increase accountability between criminal justice agencies; and provide a comprehensive picture of offender activity. Beginning in 2002, the CPD data

warehouse was marketed to criminal justice agencies in Cook County. As its first endeavor in criminal justice information sharing, the CPD offered access to the data warehouse system, free of charge, along with training and an easy login procedure. Adoption and usage spread quickly in Cook County,<sup>3</sup> and access was soon being offered in the border counties and to federal agencies. Interest has since spread beyond the Illinois borders to Wisconsin, Indiana and Minnesota. Making the data warehouse accessible to outside law enforcement agencies, prosecutors, the court system and the corrections system laid the groundwork for I-CLEAR while enhancing partnerships with surrounding suburbs and cities.

**Community/business partnership:** The department anticipates that CLEARpath, the department's developing suite of applications, will strengthen problem-solving capacity; facilitate community-needs assessment; and allow for easy and convenient information sharing and intelligence gathering from the community. Currently the CPD partners with citizens through monthly beat community meetings and through District Advisory Committees in the city's police districts. There will be increased effort to reach people currently not participating in these activities as well as an increased focus on meaningful problem solving, citizen involvement at beat community meetings, and community-based performance assessment. CLEARpath currently has an e-mail notification system that provides citizens with easy access to safety alerts, news releases, crime information and other useful resources via the Internet. In addition, those registered with the CPD's e-mail notification system enables residents to receive up-to-date information on community alerts, beat meetings and other matters.

## **CLEAR Development, Use and Impact**

**Overview.** This evaluation period, just over two years in duration, was one of slow but steady progress for CLEAR. Continuing changes in management hindered progress as new managers became familiar with their new roles. Since our last report, the relatively new deputy superintendent overseeing IT development was joined by several new top aides: an assistant deputy superintendent, commander of Information Services, deputy director of Information Services and a director of system development. With several CLEAR projects already underway, the I-CLEAR partnership and I-Case development limping along, and pet projects of the mayor and superintendent emerging on a regular basis, there was a time of apparent water-treading as these new managers attempted to stay afloat. And just when they seemed to catch their stride, the deputy superintendent retired. As could be expected of any new administration, the team also set out on a new course to develop a system that was its own – CLEARpath, which is discussed later in this report. Several other impediments have had an ongoing stymying effect. For example, unlike the early period of CLEAR development, there was no one individual to pursue and track grants, and funds have dwindled.

CLEAR is an enterprise system, meaning that it has the power to impact everyone in the organization – from the way officers perform their jobs daily, to the administration and

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<sup>3</sup>More information about data warehouse adoption and use can be found in W. G. Skogan and S. M. Hartnett, "The Diffusion of Information Technology in Policing," *Police Practice and Research: An International Journal*, 6, no.5, (2005): 401-417.

management of the agency as a whole. One of the CPD's goals for CLEAR is to harness its vast stores of information to optimize resource allocation, increase accountability and enable officers to perform at a high level. The department has implemented a significant number of applications of varying size and scope, that collect and analyze data to produce reports in a useful and timely fashion. This report focuses on three components of the CLEAR system that not only impact the CPD's core functions, but also that are used by a large number of officers and have the most profound impact on their performance.

## **Tightening Up on Management**

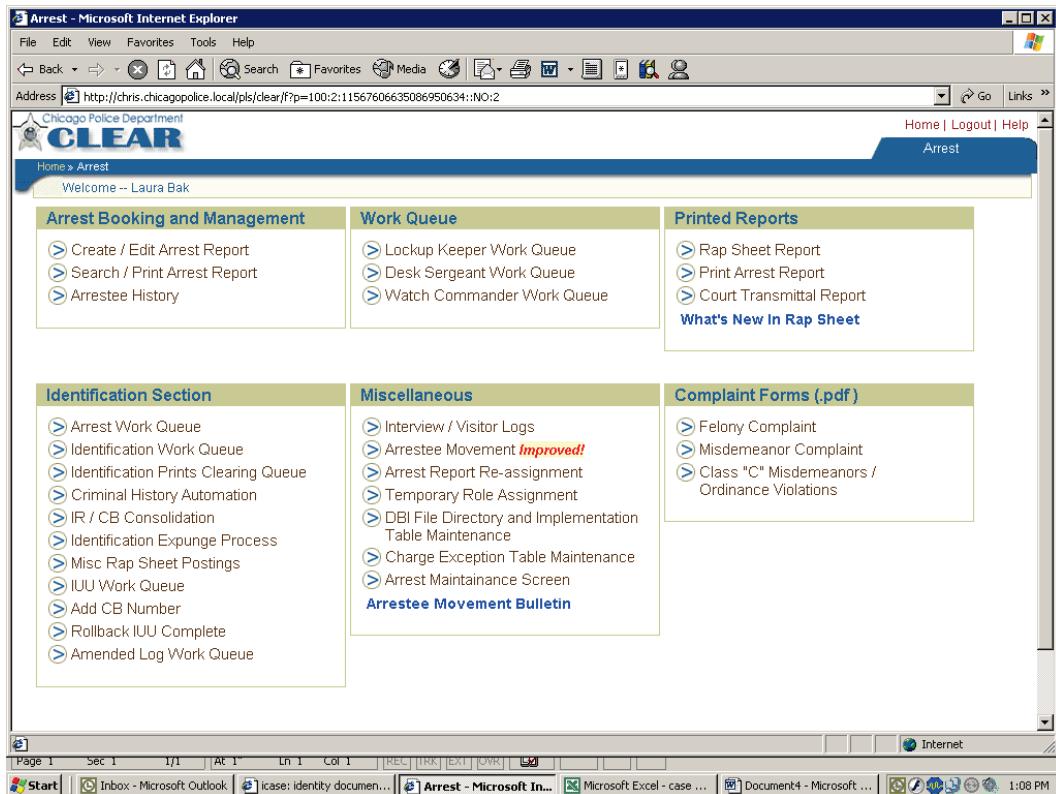
### **Paperless Arrests**

Automated arrest processing offers an array of benefits to police agencies. It should reduce the amount of time it takes officers to process prisoners and return to their street duties. It also allows for the collection and later accessibility of innumerable data elements and precludes the need to enter the same information in subsequent applications. Likewise, electronic evidence processing and inventorying offers increased recordkeeping accuracy and accountability. Two CLEAR applications accommodate automated arrest processing – Automated Arrest and eTrack.

**Automated Arrest System.** The CPD's automated arrest system was launched in 1998 as a client-server application used by lockup personnel to enter prisoner information during intake. The current system shifts this function to arresting officers, allowing them to process the arrest in station house interview rooms via bolted-down, ruggedized laptop computers. Data entered by arresting officers links to information about previous arrest and then interfaces with the department's digital mugshot application and automated fingerprint identification system (AFIS). This allows lockup keepers to photograph arrestees as soon as they enter the lockup, resulting in integrated real-time records. In addition, after lockup keepers post their bookings, desk sergeants and watch commanders can approve the bookings or subsequent releases online. Arresting officers can collect as many as 182 distinct data elements as they book a suspect. The automated arrest system produces a two-part arrest report: the first contains the data entered by the arresting officer, while the second compiles information inputted by the lockup keeper, desk sergeant and watch commander as arrest processing progresses. Information relating to the arrestee's positive identification is also added to this part of the report. These two reports constitute a complete arrest processing package.

The automated arrest application provides a variety of management functions, as illustrated by the menu shown in Figure 1. Command staff can track arrestees electronically and access a variety of reports on a per-request basis. For example, watch commanders can look at real-time listings of arrestees in custody. History reports can be generated by any number of search criteria, including date ranges; officers requesting detainments; and number of detainees by detention facility for a given time period, to name a few. Numerous customized reports are obtainable using available data captured through this process as well.

Figure 1  
Automated Arrest Menu



Development of this application took place over many years, based on information gleaned from sessions with internal and potential outside users. Input was also provided by prosecutors and members of the department's Legal Affairs Unit. Policy-making sessions were also held regularly to deal with issues affecting general orders and procedures that emerged as testing progressed. In summer 2003, pilot testing of the web-enabled Automated Arrest application began in one Chicago police district. A considerable amount of preparation was required at the pilot site. A facilities assessment was carried out to ensure that all infrastructure upgrades would be completed by the deployment date. New furniture and computer equipment was ordered to accommodate the special security needs of that particular environment. All equipment – furniture and computer hardware – added to these rooms had to be bolted down for the safety of interview room users. Complications in coordinating all of the facilities work postponed the pilot implementation date several times, but when the first paperless arrest was processed, the Automated Arrest application worked remarkably smoothly. Members of the training team were at the station 24 hours a day from the moment the application was implemented, and they remained there for several weeks. Lessons learned from the various “operator errors” that emerged in the first few weeks became training points for district personnel in future classes. Technical problems often required action from vendors if the problem was equipment-related, and they sometimes necessitated convening policy decision-makers to

determine the best way to circumvent the difficulty. Ongoing user-feedback meetings identified highly desired enhancements that resulted in an upgraded version of the application, launched in late 2003, that provided new functionality and ease of use. A new server was also brought in to speed up printing of lengthy arrest reports, which were sometimes taking more than a half hour to produce. Two months after the Automated Arrest pilot launch, the application was deemed to be functioning sufficiently well for it to be introduced in a nearby district; however, procurement delays and complications routinely postponed the launch date.

After its deployment in the pilot district, several enhancements were made to the Automated Arrest application, two of which notably provide the department with increased efficiency. The first enhancement, referred to as “the paper queue,” enables the district desk personnel to view paper arrest report information and obtain electronic identification clearances for these paper arrests. Before this feature was developed, Identification Section personnel faxed the forms to the district station, often creating a wait-time of many hours. The paper queue feature also allows paper arrest reports to appear on electronically generated court transmittal sheets. This feature eliminates the need for desk personnel to handwrite paper transmittal sheets when transferring arrestees to court. With the creation of the paper queue and district desk personnel’s ability to view clearances on-line and generate electronic transmittal sheets, officers are able to return to the street faster. It also allows for a more timely release of eligible arrestees from the lockup facility.

The second enhancement was the automated generation of gang information cards. Prior to this modification, officers processing the arrests self-described gang members were required to complete a separate form that gathered information about arrestees’ gang affiliation. This Automated Arrest enhancement electronically populates the fields of the gang information card with information entered into the arrest report. Eliminating the need to enter data twice results in a time and materials savings for the department.

**Citywide rollout.** The Automated Arrest story is as much about deployment logistics as it is about the technical development of the application itself. Since its introduction in the pilot district, it has been a very stable system. There have been several new releases, mostly to accommodate enhanced features, and each has performed reliably. In fact, by March 2004, information managers at the CPD declared that the program could be introduced throughout the city. However, the facilities upgrades described above had to be performed at each facility where the application would eventually be used, equipment needed to be procured for each, and training the 10,000-plus officers to use it still lay ahead. Any of these factors alone was sufficiently comprehensive to determine – if not derail – the deployment pace. And each did.

The facilities assessment to determine site needs focused on things as mundane as the number of electrical outlets available, and as specialized as data-transmission capacity of the wiring in a station house. While the assessments were executed by the CPD’s Information Services Division employees, the actual prep work was generally the responsibility of city departments like the Bureau of Electricity and other units that balance the needs of the police department with those of all other city agencies. Therefore, the department’s deployment timetable did not always factor into the various city bureaus’ work-completion dates. Procurement was another area in which

labyrinthine municipal processes subverted timetables. Competitive bidding and fine-tuning legal verbiage are realities that impacted the chronology of this project. But, arguably, the factor that slowed the citywide spread of Automated Arrest most was the magnitude of training – the one thing over which the CPD did have control.

When first introduced, Automated Arrest training was delivered over a two-day period for supervisors and as a one-day class for patrol officers. The department planned to first launch the application at each area headquarters and the district stationhouse sharing the facility. This strategy made the application available first to the potentially heavy users – gang and tactical officers. Including the district station and its personnel capitalized on infrastructure upgrades already taking place in the facility. It also enabled members of the second highest user group – patrol officers – to begin processing arrests electronically. When all of the area headquarters and adjoining districts had use of the application, the superintendent declared citywide deployment of the Automated Arrest application a top priority and authorized stepped-up training. The goal was to familiarize every sworn department member – everyone who could conceivably make an arrest – with the new electronic procedures as quickly as possible. Thus, supervisors' instruction was cut back to a one-day curriculum, and the staff began training groups from two districts or units daily. At that pace, it took approximately five weeks to train all officers in the two units.

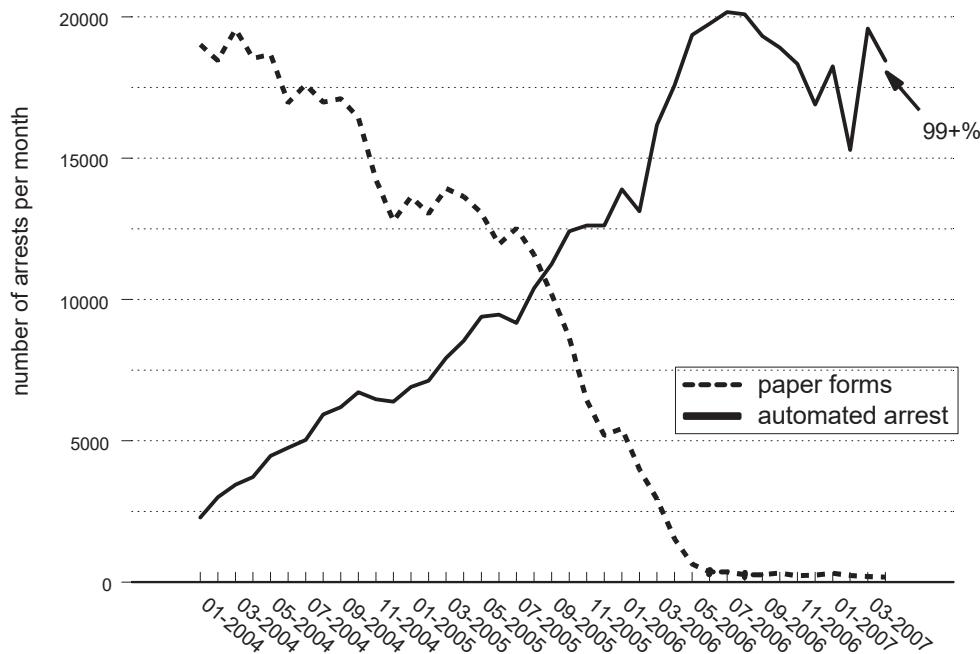
The CPD used creative thinking to circumvent facilities issues that also bogged down systematic Automated Arrest deployment. Because wiring in a number of district stations scheduled for future demolition was too outdated to upgrade, the decision was made to close the lock-ups in those buildings. A new directive had officers from those districts – after training – processing their arrests at a designated nearby facility. Several lessons were learned from this change – not the least of which was that the nearby facility would need more equipment to accommodate the increased activity. Nonetheless, this innovative solution to a temporary infrastructure problem showed that the CPD was committed to fully automating the arrest process. By summer 2006, however, the training momentum had been lost, just as the specialized units were set to be trained. Special deployments for summer events and increased street presence decimated the training teams.

When this report was written, academy staff had completed training of all but approximately 1,000 officers in the city. Figure 2 shows the steady upward usage of the Automated Arrest application and the corresponding decline in use of the paper report.

### eTrack

The Chicago Police Department automated evidence and recovered property inventory and tracking, one of its core activities, with the multi-phased deployment of eTrack. The first phase, launched in summer 2002, provided electronic data capture. The second phase, implemented in June 2003, replaced the aging Criminal Evidence Recovered Tracking System (CERTS), the department's legacy inventory application. eTrack's third phase, deployed in early 2004, incorporated functions for numerous key activities of the Forensics Services Section and integrated upgrades to existing features. Recent development activities resulted in an automated crime-scene report and digitized crime scene photos.

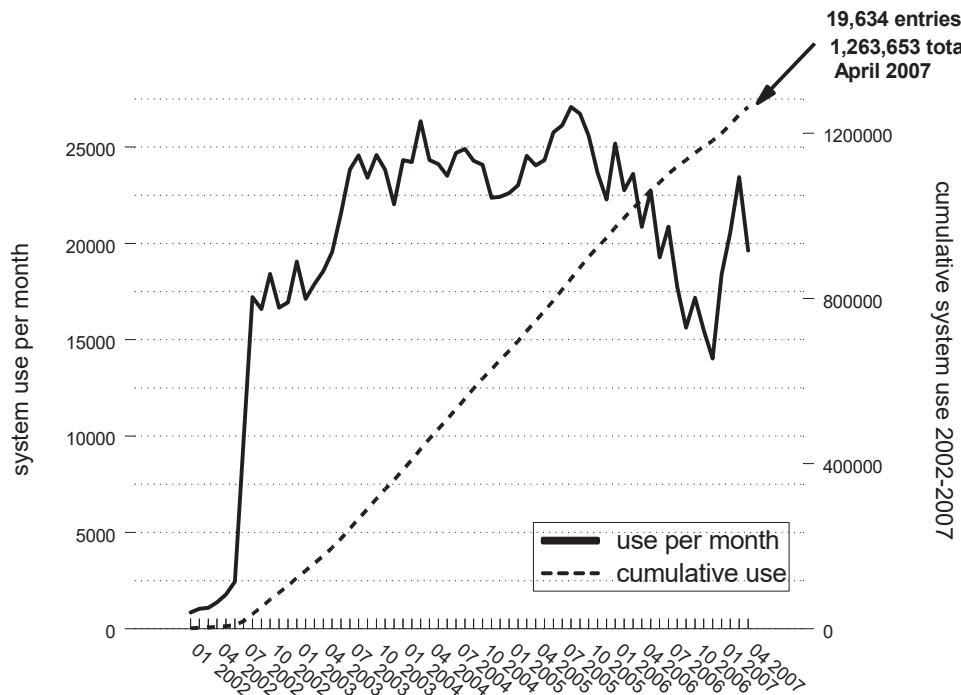
Figure 2  
Volume of Automated Arrest Cases



**Phase I.** Phase I enabled officers and evidence technicians to record new inventories and specify their destination. The application is available via any computer with access to the CPD intranet. After logging on, officers input the same information on evidence or property that was captured on the previously used five-part handwritten form. Supervisors approve the inventory electronically after the officer submits it electronically, and a bar-coded label is printed and attached to the package. eTrack also enables electronic manifesting, with couriers scanning the bar-coded label of each package to be transported. In addition to creating a manifest document, this process provides a cross-check that ensures that all evidence or property approved for transport is picked up. When evidence or property arrives at the Forensics Services Section (crime lab) or the Evidence and Recovered Property Section (the evidence room), the receiving officer rescans the package to acknowledge its arrival. Thus, with the completion of phase I, all handwriting has been eliminated from the inventorying process. In addition, inventories can be queried by any number of variables.

The impact of eTrack's first phase is substantial on many dimensions. From a sheer breadth standpoint, eTrack impacts every individual who might need to inventory evidence – essentially every sworn member of the department. In addition, electronic inventorying offers improvements in officer time-management, legibility and integrity of data, accuracy of disposition and courier accountability. As officers have become familiar with eTrack, they are able to quickly input inventories in less time than it took to fill out the old written form, and the volume of automated entries has climbed steadily, as shown in Figure 3.

Figure 3  
Volume of eTrack Entries



Additionally, prior to eTrack's launch, each "intake unit" had only one inventory collection book. Therefore, officers needing to record a piece of evidence or recovered property would spend a considerable amount of time in the station either tracking down the inventory book or waiting until other officers completed their work and supervisors approved it. The inventory book could also be lost, and along with it, the only record of inventoried property. Correcting and recording inventories electronically is likewise more efficient. Rather than having to use correction fluid to make changes on a five-part written form, officers need only log on to an edit page, and the correction is quickly and neatly accomplished. Consequently, officers are able to return to their street assignments more quickly than in the past. Legibility issues no longer exist. The advent of electronic evidence-data input enhances accuracy, because all data fields must be filled before the report is submitted to a supervisor; incident numbers are validated against 911 calls; and addresses correspond to the city's geocode file. The disposition of evidence and recovered property is accurately recorded and traceable with eTrack, because all inventories require that an "action" field be filled. Officers must specify what will be done with the property and how it will be transported to the appropriate destination (crime lab, Evidence and Recovered Property Section). The location of the property or evidence can be determined at any time by querying the system.

**Phase II.** As mentioned earlier, eTrack Phase II was launched in June 2003. Phase II is completely invisible to all of the CPD except those who work in the Evidence and Recovered Property Section (ERPS) or Forensics Services. eTrack II enables ERPS and Forensics personnel to easily locate property within the facility, track its movement from one individual to another,

and provide an accurate and complete snapshot of evidence in custody at any time. In addition to replacing the CERTS system, Phase II provides a data feed to the Illinois State Police Forensics Lab, where all evidence is eventually sent. Data from eTrack resides within the CLEAR database.

**Phase III.** The third eTrack release automated some key functions of the Forensics Services Section, such as crime scene processing and digital crime scene photo capture. DUI kits are also being processed automatically now, and detailed information about seized guns is captured within the database. With this launch, quantities of confiscated narcotics are documented electronically, and Forensics personnel are able to automatically generate associated statistical reports. Tasks related to the submission of evidence to the Illinois State Police lab and retrieval of test results are handled through eTrack now. Forensics has also expanded document scanning capabilities, which enables users to attach and store ancillary documents and pictures, consolidating evidence file components.

The latest addition to the eTrack system automates crime scene reports for the department's Forensic Services Division. As evidence – blood, bullets, photos and fingerprints, for example – is collected, it is recorded by technicians via drop-down menus. As the evidence type is registered, labels are printed out and they are affixed to the evidence. This module's integration with eTrack and the Illinois State Forensic system makes Chicago's Police Evidence System fully functional, and there are no plans for additional phases. As with any system, the need for enhancements emerges over time, and any such upgrades will be systematically incorporated as funding permits. A data feed has been created from eTrack to the new statewide data warehouse (see I-CLEAR section).

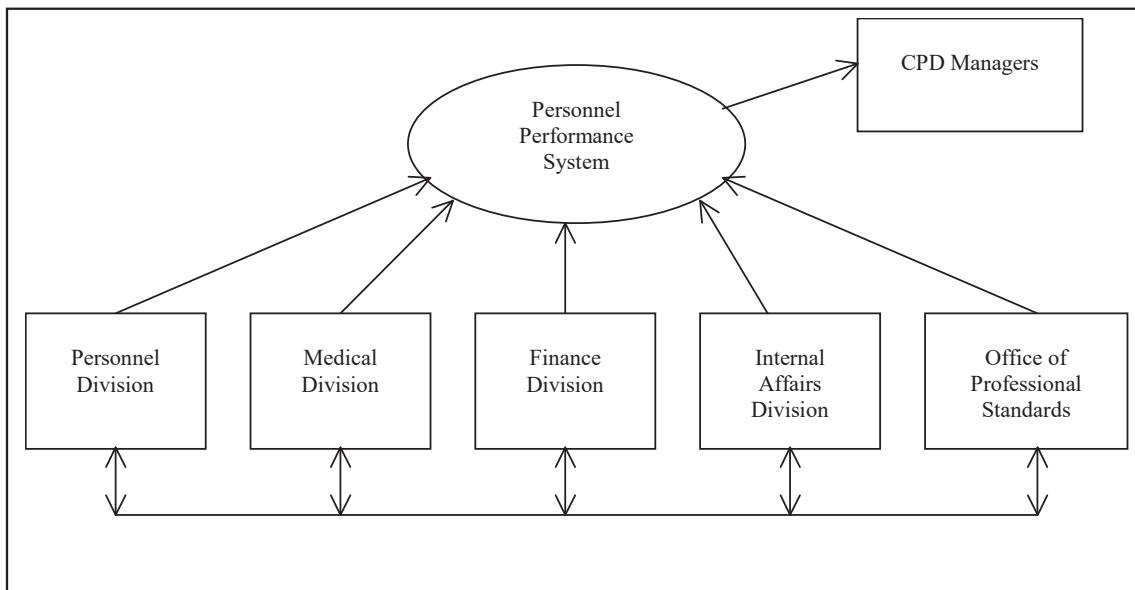
## Personnel Suite

The Chicago Police Department is automating human resource functions in five of the Department's units: Finance, Internal Affairs (IAD), Office of Professional Standards (OPS), Medical and Personnel. The collection of these various applications is known as the Personnel Suite. There are three main goals for the Personnel Suite:

- to maintain comprehensive personnel files while eliminating redundant data entry
- to enable employees to initiate and complete many of their own personnel-related tasks – requesting days off and furlough, initiating tuition reimbursement process and the like
- to provide managers with rich personnel-related data to help them review performance and monitor behavior

The Department is also institutionalizing accountability by developing a module known as the Personnel Performance System (PPS), which will identify problem behavior before it results in an unfavorable outcome. Data pertaining to behavior monitoring and performance will be collected in the Personnel Performance System, as shown in Figure 4.

Figure 4  
Personnel Suite Overview



The availability of this type of real-time performance-related data can facilitate meaningful and effective personnel management at the CPD at a time when the mayor, politicians and Chicago residents are calling for accountability in the wake of several public examples of police misconduct. When PPS is fully operational, the department will begin systematically acknowledging high achievers and provide early intervention to help problem employees improve their job performance whenever possible, or begin progressive discipline when it is not. Implementing such a system, which could result in termination, would represent a major cultural shift in the Department's approach to problem employees. And, in keeping with the current thinking in police administration, PPS will be an early intervention system (EIS) designed to help problem officers rather than simply warn their supervisors about them. Because the Personnel Performance System will be an EIS, a broad array of intervention options will be developed to help officers address underlying causes of the questionable behaviors.

Because the Personnel Suite consists of a variety of applications, development has proceeded one step at a time, with the order being determined by a range of factors. Development of some modules has been impelled by unit need, others by availability of personnel and funding, and still others by the realization that information from an as-yet-unbuilt application is essential for another module to function optimally. While Personnel Suite applications are developed individually, each will be integral parts of the Personnel Performance System.

**Development and Implementation.** Personnel Suite development has progressed in three phases. The first phase automated the Medical Services Section's functions and a few less-complicated modules, such as the Emergency Notification system, which stores information on contact names for CPD employees in case of emergency. Phase II, still underway, has concentrated mainly on the automation of IAD and OPS duties, and has included work on a number of smaller

applications that produce information needed for the IAD /OPS systems. Completion of the IAD/OPS applications will mark the onset of the third phase, during which the functions of the Personnel and Finance Divisions will be computerized.

**Phase I.** Medical Services Section applications were the first Personnel Suite modules to be developed because automating paper-based processes (as all Medical Services Section procedures had been) is less complicated than replacing legacy systems. Two such systems were launched in July 2003. The first was Medical Absence Reporting. This system handles tasks performed by district personnel at all levels; access to the various tasks is determined by user roles. General users, such as those working at the district front desk, can create a medical absence report (shown in Figure 5) for co-workers calling in to report an illness-related day off, while lieutenants have approval and return-to-duty information access. In addition, through this system lieutenants and watch commanders can view officers' work status, create furlough requests and view information about officers' medical absence history. Also automated is the supervisors' request for another supervisor to make a home visit to verify that an officer is there when unable to work due to illness.

Figure 5  
Create Medical Absence Report

Medical Absence Report - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address: http://167.165.43.101:7777/pls/DEV/www\_flow.accept

Training & Development

Home | Print | Logout | Help

Medical Absence Report

ID: 208 Name: STEPHENS, JENNIFER L Emp No.: 304774 Category: Sickness Status: N First Day on Medical Roll: 27-MAR-2003

1. Create Medical Absence Report 2. Nature of Sickness/Injury 3. Review & Save Medical Absence Report

Steps 1. Create Medical Absence Report Go Cancel Next >

Category	Employee Information			
<input checked="" type="radio"/> Sickness	Name	STEPHENS, JENNIFER L	Assigned Unit	145
<input type="radio"/> Injured	Watch	2	Detailed Unit	153
<input type="radio"/> Injured On Duty	Address	45435 S ASHLAND AVE #405	Day Off Group	6
<input type="radio"/> Recurrence Of I.O.D.		CHICAGO IL 60624	Furlough Period	N/A
	Phone No.	(312) 555-2345		
	* Last Day of Assigned Duty	26-MAR-2003	[Calendar icon]	
	* First Day on Medical Roll	27-MAR-2003	[Calendar icon]	
	* Received Date and Time	27-MAR-2003 08:53	[Calendar icon]	
	Received by	BURKHART, JANET	Star No	N/A
<p><b>TIP</b> The dates must be entered in the format DD-MON-YYYY.</p>				
<p><b>TIP</b> * = Required field</p>				

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Internet

Another facet of the application is used by Medical Services Section staff to schedule appointments, record progress notes (shown in Figure 6) and capture all information needed for medical records. Some data inputted by Medical Services staff, such as information about when an officer is able to return to duty, is available to unit supervisors. Sworn users at all levels also use the Medical Services application to acknowledge a status change (for example, returning to duty or going from medical leave to light duty) before they leave the Medical Services unit. Non-medical-condition-related information that is gathered via these systems can be tracked for managers by the Personnel Performance System. In addition, visits to the homes of officers on medical leave are requested and tracked online through this system. Future enhancement to this system will include an appointment scheduling function.

Figure 6  
Medical Progress Notes

**Phase II.** During this evaluation period, Personnel Suite development mainly focused on systems that will be used by the Internal Affairs Division and the Office of Professional Standards. IAD investigates complaints of alleged misconduct by department members and OPS, a civilian unit, investigates allegations incidents of excessive force and domestic violence involving department members. With funding earmarked for the project depleted and few new

sources identified, decision-makers opted to remove Oracle from the Personnel Suite project and turn development over to CPD employees. The far-reaching management changes discussed in the introduction of this report had a profound impact on Personnel Suite development. In fact, when the CPD's Personnel Suite project manager moved to another city government position along with the former CLEAR chief administrator, the project left the CPD along with them. As a result, development was stalled for several months as the business of the new department took precedence. When the new deputy superintendent regained control of the project, progress was fleeting for some time. Key personnel on every level of this project – from assistant bureau chief to division managers to dedicated police officers with responsibility for vital aspects of Personnel Suite development and deployment – changed during this evaluation period, leaving the project with virtually no institutional memory or expertise. The reasons for the departures ran the gamut of career events, such as retirement, promotion, lateral moves with greater potential for opportunity and the “brain drain” that resulted from the CLEAR architect’s transitions to other governmental posts.

Hoping that sufficient groundwork had been laid, several Personnel Suite modules were handed over to internal software developers. A sergeant with some database-development experience was brought in to oversee the Personnel Suite project. When the new project manager took over, several applications were in the final stages of development and, because they were considered to be among the simpler Personnel Suite components, launching them seemed to be a good early move. With these applications deployed, developers and programmers would be able to concentrate on the IAD and OPS portions of the Personnel Suite. Equally important, information produced by these applications would be accessible by the IAD and OPS modules as well as many other Personnel Suite projects. As a result, these applications went through an abbreviated testing period, and some fundamental flaws were discovered after the modules were launched.

As management positions with responsibility for Personnel Suite were filled, and as these key individuals become more familiar with the complexities of the Personnel Suite (and the extent of the task before them), the decision was made to bring back the Oracle consultant who had previously led development. In doing so, a systematic development approach was reinstated, the hastily launched applications were taken out of production and reworked, and work began anew on the IAD and OPS modules.

An over-arching organizational reality that also impacted Personnel Suite development was contract deliberations between the CPD and the union. Work on various modules was halted because of their inclusion in the negotiation process. In a similar vein, the department had not had a performance evaluation process for over two years. It was caught up in contractual discussions between two city agencies, and the contract to the vendor that was supposed to create the performance evaluation remained in limbo. Since a performance evaluation measure is a critical piece of any personnel system, nothing could be finalized. A new performance evaluation system that will be incorporated into PPS was recently completed. A general order formalizing the system’s procedures has been written and is in the approval process. Likewise, the performance evaluation system will soon be submitted to the union for their approval.

Since our last report, four Personnel Suite modules were launched. The Awards application automates the process of nominating officers for honorable mentions and awards, and generates notifications to winners. This module is an example of an application whose development was put on the fast track because information from it will optimize the IAD/OPS applications: officers' awards histories are taken into consideration when consequences are meted out for infractions. This application should also assist CPD management in its desire to recognize officers more frequently for exceptional performance on the job. Another deployment is the Star Management application, which manages and tracks the department's inventory of stars, badges and shields, and keeps a historical record of star/badge/shield assignments. While the inventory management and tracking features of this application are used only by a few individuals, all sworn personnel will be able to see the availability of star numbers, as members of multi-generation police families often like to have the number that was assigned to their now-retired relative. The Star Management system also ensures accuracy in recordkeeping, because whenever a star number is entered into a field in a CLEAR application, the name of the officer automatically appears, or vice versa.

Also deployed were Watch Assignment and Unit of Detail. These two modules replace Office Automation, an internally developed application that was essentially created and launched within the Patrol Division, outside of the CLEAR umbrella. Watch Assignment provides real-time information on every sworn department members' current post as well as their beat assignment, locker number, day-off group and the like. It also provides information on where an officer was working on any given day. Unit of Detail will provide a snapshot of how many people are on long-term temporary assignments and where they are. Eventually a history of these assignments (known as "being detailed out") throughout their career will be accessible.

At this report's writing, the Phase 1 portion (complaint intake, assign and investigate) of the IAD and OPS modules are in use, and Phase 2 joint development sessions are taking place. These units' applications are being developed and built in tandem, as many of their processes share a number of similarities. Two related applications that were developed and launched are the automated Tactical Response Report (TRR) and the automated Summary Punishment Action Request (SPAR) report. TRR reports document incidents in which force is used or resistance encountered; SPAR reports document disciplinary procedures for transgressions that do not require formal investigations and management responses. While these reports are not part of the OPS/IAD portion of the Personnel Suite, they were developed in conjunction with it because data relating to use-of-force events and conduct resulting in a SPAR report will be available in the Personnel Performance Suite.

Regularly scheduled user-group meetings have been held to get feedback on the modules as they are developed to make sure that as many as possible of each unit's functions are included and to ensure that security requirements are met. Before they are launched, each unit's application will be tested in a computer lab setting by employees of IAD and OPS.

**Phase III.** Work has begun on the third developmental segment, which will automate Personnel functions such as tuition reimbursement. As mentioned above, tracking of time and

attendance, which had been maintained manually by unit are already completed. Prior to its automation, the department was unable to obtain real-time information about manpower strength. In the present climate of ongoing terrorism threats, real-time information that is immediately accessible is considered absolutely necessary to ensure effective deployment in the event of an incident. In addition, the system will eventually automate basic timekeeping tasks, such as transmitting time slips electronically. Managers will benefit by having data available to help them approve vacation and time-off requests based on anticipated manpower levels, and officers will be able to track their vacation, furlough, sick time and overtime allotments.

An important byproduct of the Personnel Suite is the previously mentioned Personnel Performance System (PPS), which tracks a range of job performance numbers – sick days, citizen complaints, arrest figures – and notifies supervisors if an emerging pattern indicates that an officer may need counseling or additional training. The system also track positive trends, allowing the department to recognize and reward high achievers. Because of the widespread impact of Personnel Performance System and the sensitivity of the information it manages, the Police Executive Research Forum (PERF) provided some early assistance to the CPD in identifying best personnel practices and policies from the public and private sectors nationwide in the human resources areas the suite will encompass.

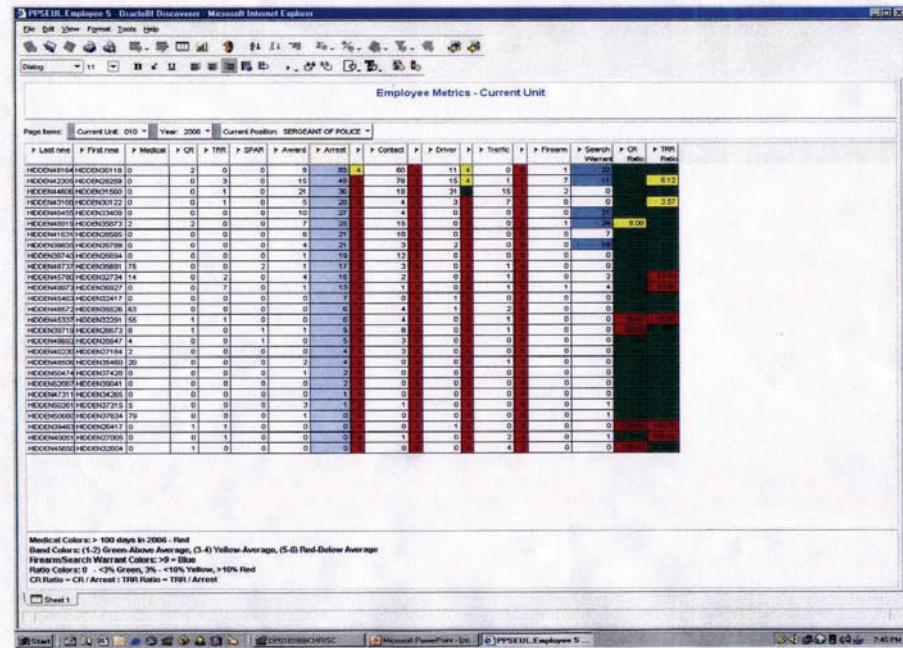
During this evaluation period PPS became a reality. It was known from the start that PPS would be built later in the development cycle, mainly because other applications from which essential personnel data are extracted were not yet completed. But progress on PPS development was delayed by the disbanding of the CPD oversight committee, which fell victim to the management changes mentioned earlier in this section. A newly reconstituted group began meeting about a year ago; the committee is larger than the original and now has representatives from the various police unions among its membership. PPS oversight committee members have visited police agencies across the nation to cull best practices from their experiences in instituting similar performance systems, and earlier this year a pilot system was launched.

**PPS Pilot.** Six unit commanders comprising two groups are currently piloting PPS. The first group of three commanders volunteered to become involved. About three months after the pilot launch, the other three commanders were selected to begin using the application based on a variety of factors pertaining to their units, such as size, location and level of activity.

The application evaluates personnel metrics such as medical use, complaints registered (CR), summary punishment action requests (SPAR) and various measures of officer activity, such as arrests made, contact cards written, search warrants executed and firearms recovered. The system evaluates officers in relation to peers rather than personnel assigned to other districts or units, to notify commanders of officers who may need early intervention and guidance. Figure 7 shows activity-related data for sergeants within one district.

Figure 7  
Sergeants' Activity Metrics

PPS - Sorted by Arrest Activity (Sergeant Only)



Access to information is role-based, meaning that supervisors or managers are restricted from seeing data that is not pertinent to their particular role. In addition, information is easily sorted by various categories, as shown in Figures 8 and 9.

Feedback from those participating in the pilot has been positive, with virtually no complaints coming from the small user group. The system is quite user-friendly, and commanders were offered a two-hour orientation session. Commanders who had been using computers on a more limited basis found that they needed a bit more help, and they received a second training session in their offices, carried out by Help Desk personnel. Users have been encouraged to make suggestions that will ensure that PPS meets their needs. Several enhancements have been added based on user requests. All of the information available on PPS is available in different forms, and has been for some time. But with PPS, it can be displayed by various dimensions, and commanders can get detail on the various numbers.

Figure 8  
Arrest Activity - Medium-Low Sort

PPS - Sorted by Arrest Activity (Medium-Low Band)

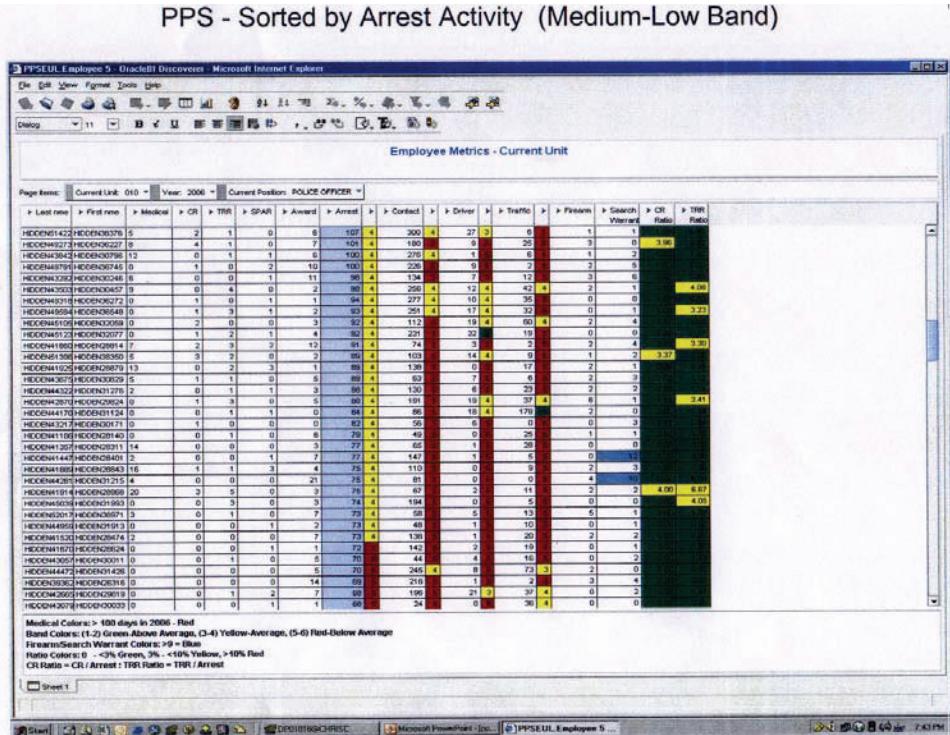
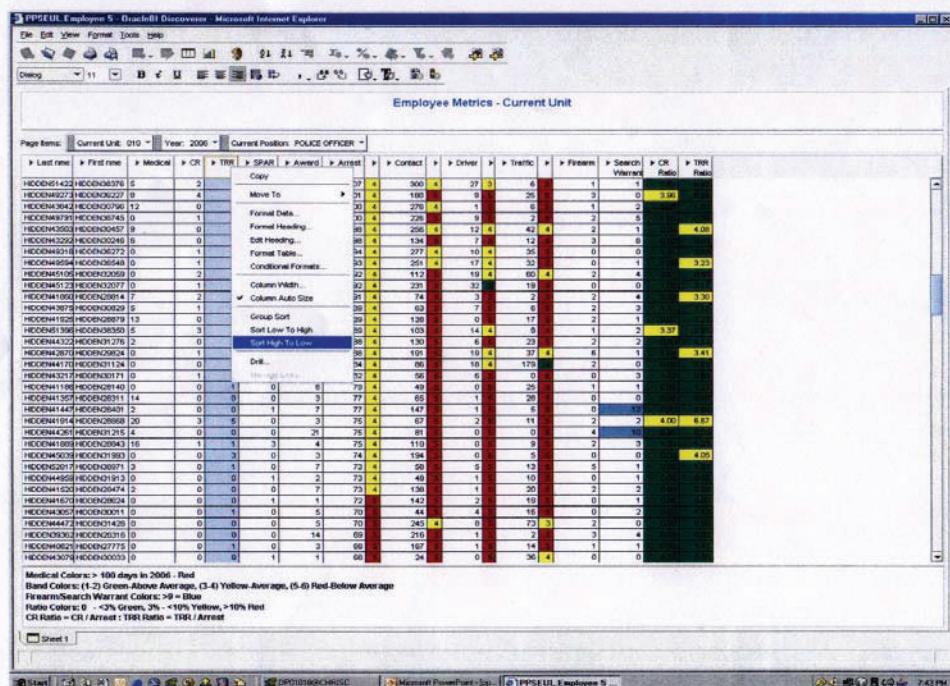


Figure 9  
Column Sorting

Oracle Discoverer Tool Feature – Dynamic User Column Sorting



The PPS system is complete and could be rolled out to all unit commanders – it only needs to be “fine tuned.” What prevents the CPD from rolling it out immediately is training, which will focus on use of the system as well as on appropriate interventions.

There is still a considerable amount of useful data that is not available on PPS; anything that is not automated cannot be part of PPS. For example, civil actions and on-duty traffic crashes are not automated and, therefore, data about them are not easily accessed. As more systems are added to the CLEAR system, PPS will become increasingly robust.

### **Empowering the Community**

The Chicago Police Department is currently developing the community component of its automation project – giving meaning for the first time to the first initial of the CLEAR (Citizen and Law Enforcement Analysis and Reporting) acronym. The community’s suite of web applications, called CLEARpath, is described by the department as the third phase of its information-technology endeavor. The first phase gave birth to CLEAR, which shares problem-solving information with CPD users through a private internal network, while the second phase provided data to members of external governmental agencies through a secure external network. CLEARpath will interface with residents through the Internet. CLEARpath is expected to augment the CAPS problem-solving model and further enable community members to work with their local officers to make Chicago a safer place.

Presently there are a number of features available for community access:

- News Releases and Alerts Archive - a collection of past news and alerts issued by the Chicago Police Department.
- CLEAR Map - a tool to assist residents in engaging in problem-solving to combat crime and disorder in their neighborhoods. It is an offshoot of the CLEAR mapping system developed by the CPD for police officer use. The application enables the community to search the department’s database of reported crime, yielding maps, graphs, and tables of reported crime. The database contains 90 days of information which users can access in blocks of up to 14 days. Though the data are refreshed daily, the most recent information available is from seven days prior to the inquiry.
- Wanted - an archive of photos of individuals wanted for investigations.
- Prostitution Patron Arrests - a somewhat controversial posting of pictures of arrestees for solicitation of prostitutes, in an effort intended to discourage prostitution by means of humiliating its customers.
- Sex Offender Search - a searchable database of sex offenders residing in the City of Chicago who are required by federal law to register and keep their addresses current.
- Tow/Steal Search - a website that helps community members locate towed vehicles as well as those recovered after being stolen. Information is updated every 20 minutes, 24 hours a day.

- Crime Stoppers - a gallery of persons currently wanted that promotes citizen involvement and joins the community, law enforcement, businesses and the media to fight crime. The gallery keeps everyone informed of persons being sought; those who provide information leading to an arrest can be eligible for a reward.
- Chicago Police Blog – a mechanism for commending officers for noteworthy on-the-job performance as well as providing a forum for community input.
- Cold Case Investigations – details unsolved Chicago homicides. This site enables community members to provide information about the crime to assist in its resolution. Users can submit information via e-mail or by phone. Anonymous submissions can also be posted on the site. In addition, community members can sign up for e-mail notification of community safety alerts and beat meetings. These functions offer the community increased information, and each has its own utility. They represent a fraction of what is proposed to be built and, in fact, are those that could be launched prior to the CPD having identified a funding source for the development of the problem-solving modules of CLEARpath.

According to its earliest blueprints, the community component of the CPD's enterprise data system was supposed to (1) strengthen problem-solving capacity; (2) improve community-needs assessment; (3) make information sharing easier and more convenient; and (4) increase the amount of intelligence gathered from the community. In its latest version, CLEARpath will have two major components: a problem management/CAPS component and a crime analysis component.

The CAPS five-step problem-solving process, considered to be a foundation of Chicago's community policing strategy, consists of the following:

- identifying/prioritizing problems
- analyzing data
- developing strategies
- implementing strategies
- evaluating success to solve problems

The information that drives the problem-solving model is largely found on paper reports – beat plans, beat community meeting logs and strategic operational plans. Few civilian CAPS stakeholders formally engage in this process currently, and the department expects to reinvigorate problem-solving activities when these discrete paper documents are automated in CLEARpath. To augment the process, beat officers will be able to share real-time data at community meetings via laptop computers as well as enter new information that emerges at the gatherings.

In addition, a knowledge base, accessible only by police officers, that accrues information about problems – for example, what indicators are associated with certain problems and which strategies work to solve them – will be created and put to use in problem-solving forums. The knowledge base will mine the ever-growing data warehouse to make associations among data elements from a variety of sources. For example, a search for an individual will indicate all of his contacts with the police as well as known contacts with others via a shared gang affiliation, or a

field interview when they were stopped together. As information is entered into any CLEAR application – or the 311 and 911 systems – it will be assessed in real time. CLEARpath is to then construct and contact a network of stakeholders to assist in problem-solving. Beat officers also will interact with CLEARpath via the portable data terminal in their squad cars; residents, businesses and community organizations will be able to receive alerts via home or office web access, cell phones and other mobile data devices.

**Start-up.** As with any technology undertaking, securing funding was an early hurdle. Governmental resources are less available than they were when the CPD began CLEAR development, and funding priorities have changed as well. Facing these constraints, the department decided to pursue a previously uncharted course by a policing agency – seeking funding from a private foundation. Because CLEARpath is intended to strengthen the community’s partnership with the police and, in the process, enhance community safety, the CPD turned to a major private grant-making foundation based in Chicago that provides awards for community-safety initiatives.

The foundation was likewise entering new territory when considering funding the CPD’s CLEARpath proposal. It had never before underwritten a law enforcement agency initiative and, though the community was the stated recipient of CLEARpath benefits, the foundation had to be convinced that the welfare of the community was at the forefront of the CPD’s efforts. Complicating the matter was the fact that at least one already-launched CLEARpath component – Prostitution Patron Arrests – was considered by the funding agency to compromise the rights of some individuals in pursuit of the “greater good” of the community.

The process of deciding whether to provide a grant for CLEARpath became an exercise that brought together the Chicago Police Department, the academic community and one of the foundation’s partner agencies that has already invested heavily to strengthen Chicago communities. A panel of members from these groups was convened to carve out values and guiding principles that were to be followed as a condition of a grant award. The resultant creed aims to “promote and protect key values and principles, achieve multiple ownership of the project, and keep focused on and cognizant of outcomes and purposes.” The panel further specified that any technological systems created by the department must not only promote safe neighborhoods but also:

- involve information that is useful
- sustain accountability for all stakeholders
- be a positive force that promotes equality and engages in proactive efforts
- be used responsibly and reflect ethical norms
- be inclusive of all constituencies and communities
- be mindful of operational issues and limitations
- include an evaluation component

**The future of CLEARPath.** Development of the CLEARpath public portal is being funded by an \$850,000 grant from the private foundation, and the pilot phase is currently underway. The program participants and structure are shown in Figure 10.

Figure 10  
CLEARpath Pilot Project Structure



Residents from seven pilot areas are collaborating with the CPD by providing input with the assistance of a local consulting firm that specializes in empowering and mobilizing community stakeholders. The consulting firm will also be funded by the foundation. The above-mentioned partner agency is organizing capital and other resources that can stimulate the development of the neighborhoods. A local university is overseeing documentation and carrying out interviews to track lessons learned and provide feedback. In addition, the university recently launched a survey to learn more about residents' views in each police beat so that the CPD can be more responsive to community concerns. Technical development of the various CLEARpath modules will be the responsibility of Oracle Corporation, based on input from participants in the pilot areas.

### Regional Data Sharing

The Chicago Police Department opened its data warehouse to law enforcement agencies beyond the city's borders in 2002. Such data sharing has the potential to help eliminate bottlenecks in the criminal justice system by facilitating the flow of information and by enhancing

agency partnerships through the creation and use of that information. Access to and use of the data increases the ability of criminal justice agencies to prevent and solve crime, and prosecute criminals. The advantages of such data sharing are also incalculable in the post-9/11 environment. Chicago's decision to open its system to outside agencies reflects the understanding that "crime has no borders" and represents forward thinking and agility that supersedes that of most other agencies, even on a national scale.

Chicago's data warehouse is an information repository that can produce a variety of relational reports using modern, flexible database-query software. It features an intuitive, web-like appearance that allows users to quickly search the CPD's deep databases using "fill-in-the-blanks" fields on the screen. The data warehouse can be accessed via high-speed Internet connections used by most justice agencies in Illinois. The warehouse includes an expanding list of data elements. Currently available to outside agencies are data on the criminal history of arrestees, outstanding arrest warrants, traffic violations, investigative alerts, suspect searches, property checks, mugshots and digitized fingerprints. Users within the CPD can also access incident reports, victim reports, repeat offender information and search contact cards. Participating agencies can tap into CPD directives, digital streaming training videos, and email addresses and directories. The CPD's offer of access to the data warehouse includes training for participating agencies in how to use the system as well as follow-up technical assistance. Behind the scenes, Chicago created mechanisms to track usage of the system by outsiders and established safeguards to ensure that the data is used responsibly. This section of the report provides an overview of the spread of data warehouse use throughout the state of Illinois as well as to bordering states and a variety of other agencies<sup>4</sup>.

## Who Uses the Data Warehouse?

Information on intra-agency use of the data warehouse is extracted from the database itself. The system is configured to log the ID of each agency performing a query. As of April 2007, a total of 411 agencies have online access to the CPD's data warehouse. Of these, 333 agencies in Illinois are participating, as are 28 in Indiana, and four in Wisconsin. Two jurisdictions in Minnesota have also recently signed on. Active non-Chicago Police Department users total more than 17,000, meaning that outside users outnumber internal CPD staffers.

Table 1 classifies data warehouse users by type of agency and lists their average system use per month. Municipal police departments make up the bulk (73 percent) of data warehouse users. This was especially true in the early months of the project, but over time the diversity of the user base has grown. By April 2006, 28 county sheriffs agencies were using the system. Most are located in Northeast Illinois, as can be seen in Figure 11, but sheriffs using the system ranged as far away as Jasper, Coles and Sangamon Counties, each approximately 200 miles from Chicago. Among the 19 federal agencies using the warehouse were the Drug Enforcement Administration

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<sup>4</sup>Additional information on early data warehouse participation can be found at [www.northwestern.edu/ipro/publications/policing\\_papers/caps28.pdf](http://www.northwestern.edu/ipro/publications/policing_papers/caps28.pdf) in a paper discussing our Fall 2003 survey of users and potential users of the data warehouse.

Table 1  
Average Monthly Warehouse Use by Type of Agency

type of agency	number of agencies	queries per month
municipal police	260	223
specialized police	22	341
county sheriffs	27	1,519
federal agencies	27	233
prosecutors, probation and parole	14	630
state police	2	3,132
other	13	32

(DEA), the US Marshal's office, the FBI, the Department of Homeland Security, the Internal Revenue Service and the Secret Service. A regional U.S. Attorney's office, the Illinois Attorney General and eight state's attorneys offices were using the system, along with six county probation offices, five regional 911 communication centers, a multi-jurisdictional task force and the Illinois State Police.

Figures 12 and 13 track the expansion of data warehouse use by these agencies. Figure 12 illustrates how many agencies of all types began to use the system by April 2007. Monthly sign-on figures and the cumulative total number of agencies involved are presented. A total of 28 agencies had been trained and were using the system within three months of the start-up date. At the time, they were concentrated in Cook County. Within six months, 64 agencies were involved, and data warehouse use began to diffuse more widely. Between autumn of 2002 and April 2007, new users signed on nearly every month, with a peak of 21 new agencies subscribing in June 2003. As late as the third quarter of 2004, an average of 10 new users were participating each month. Currently, the number of log-on IDs is nearly 17,008, which means that more law enforcement officers outside of Chicago had been issued IDs than there are members of the Chicago Police Department.

As is evident in Figure 12 the number of agencies newly signing on has dwindled to just a few per quarter. There are a number of reasons for this, most significant of which is that a new statewide data warehouse containing information from each of the 102 counties in Illinois is soon to be launched. With this knowledge, minimal active marketing of the CPD's data warehouse has taken place in the last 18 months. (The statewide data warehouse is discussed fully in an upcoming report section.) When outside agencies contact the CPD about data warehouse access, the project manager does meet with them and provide presentations. To date, briefings on and demonstrations of the CPD data warehouse have been presented to 545 criminal justice agencies.

Figure 11  
Agency Partners

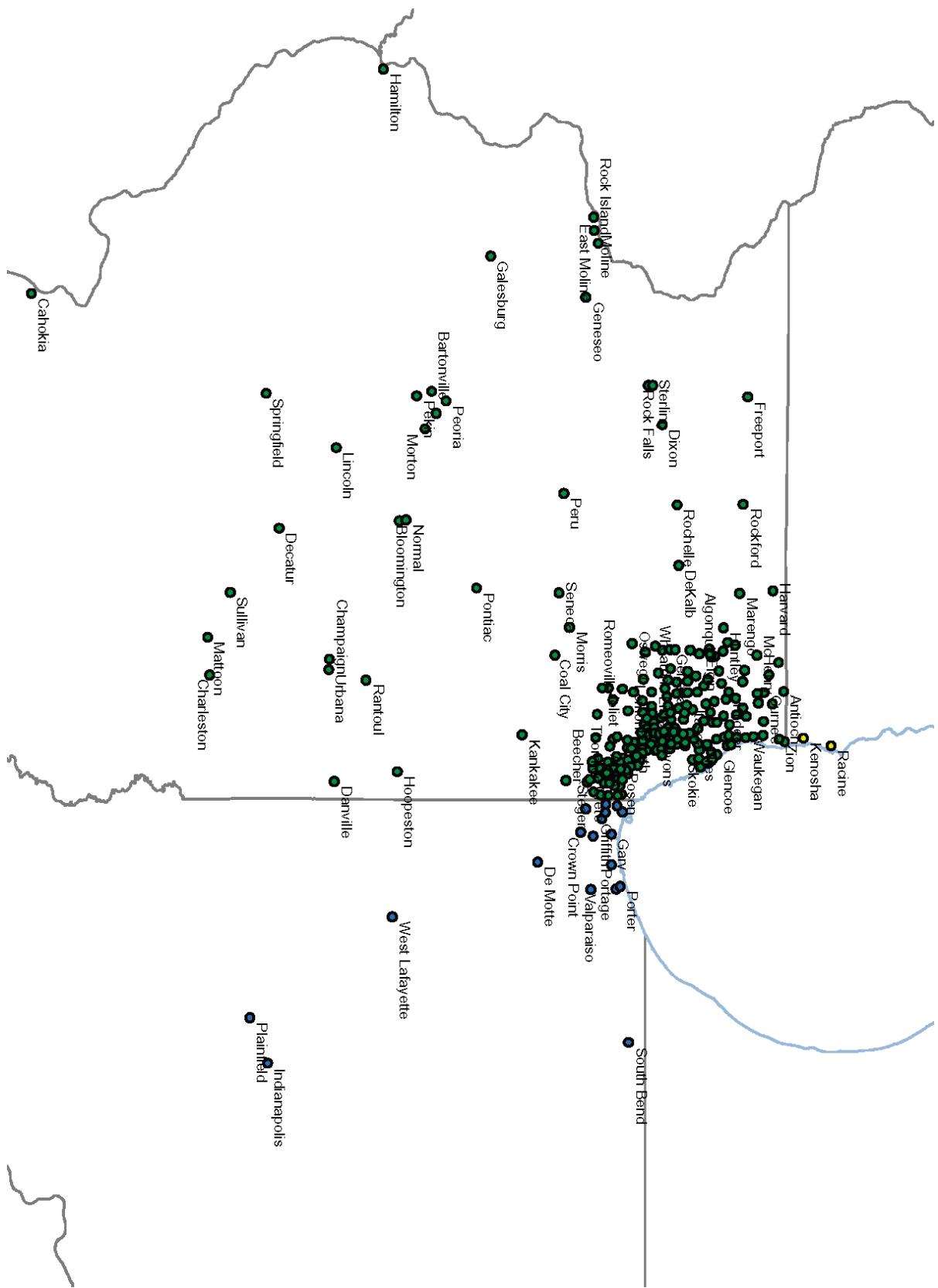


Figure 12  
Trends in the Number of Participating Agencies

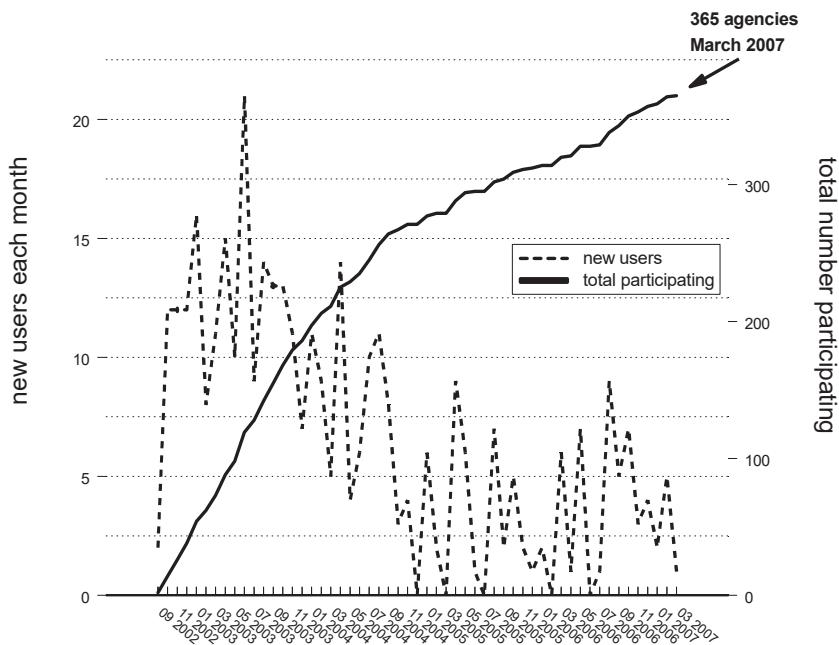
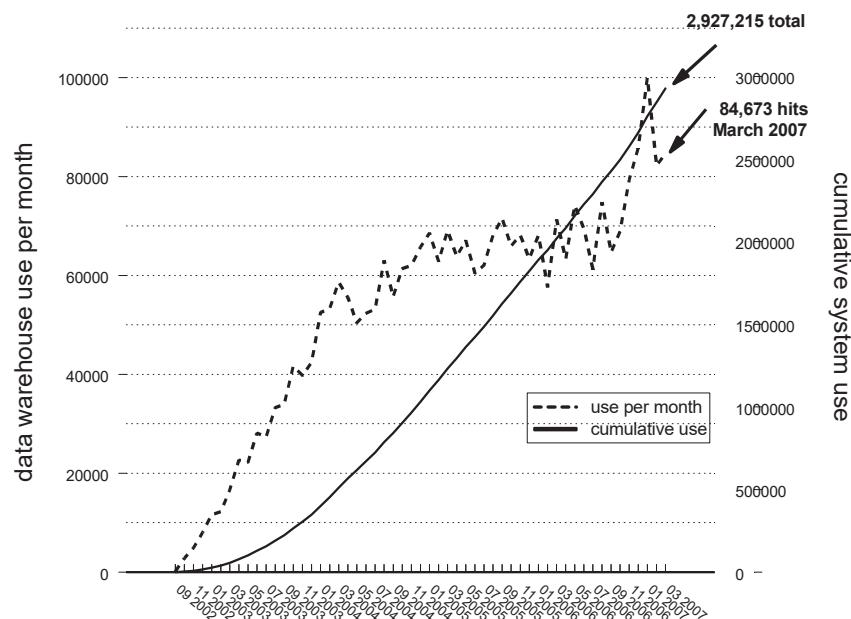


Figure 13  
Trends in the Volume of System Use



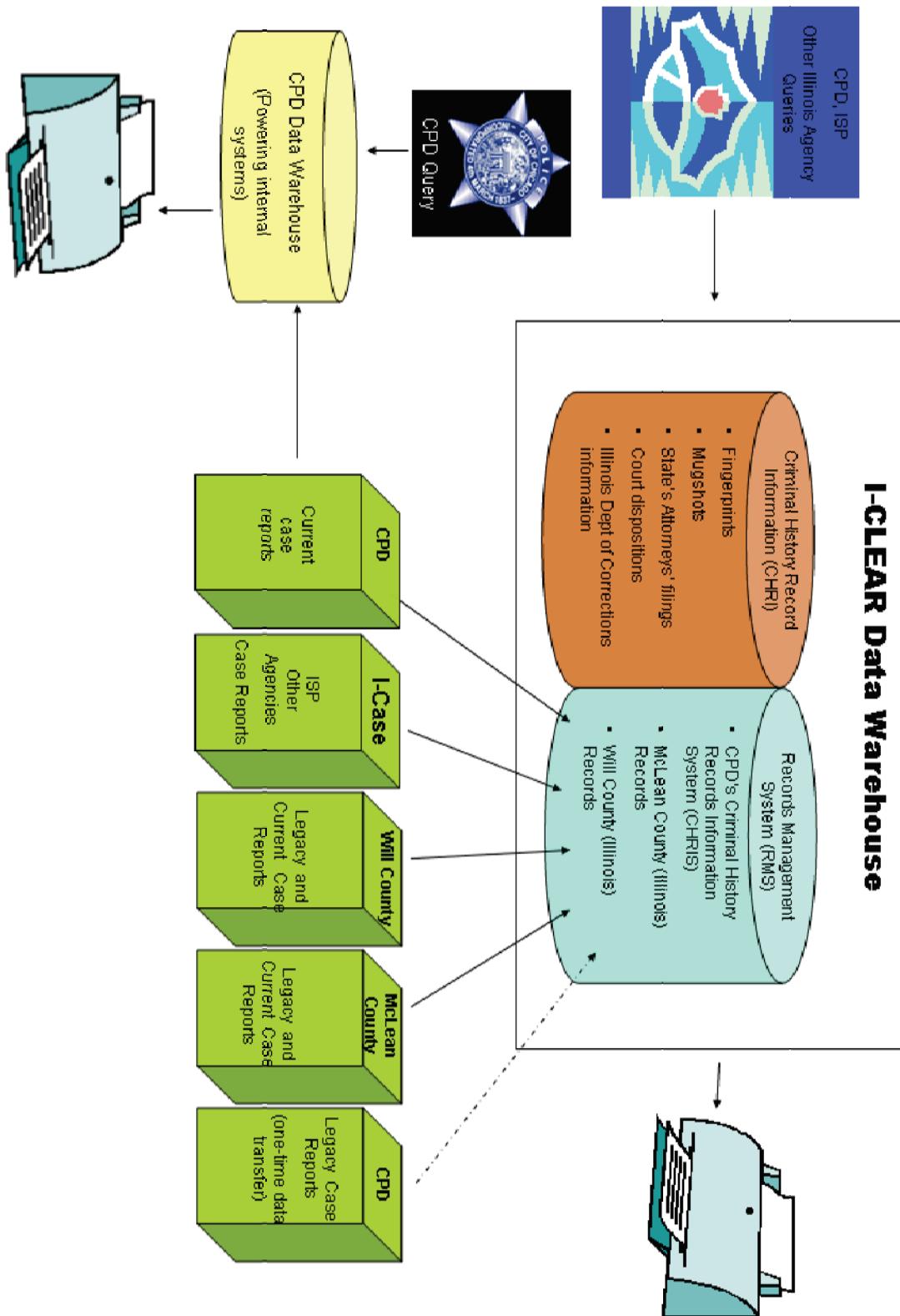
Each agency with access to the data warehouse has sent representatives to the CPD for a half-day training session for new users. These classes have been conducted since October 2002. Held at Chicago Police headquarters in a room equipped with computers, the sessions take about three hours to complete. A total of 55 training sessions have been conducted to provide newly registered agencies with the know-how to use various I-CLEAR applications. The average police department sends two people to be trained – usually detectives or patrol officers. Agencies are encouraged to take responsibility for training other users in their own departments; hence, the data warehouse instruction follows a “train the trainers” model. When surveyed in late 2003, 92 percent of police departments in Cook County (the study sample) indicated that they had provided training to others within their agency, and the steadily increasing usage data shown in Figure 13 indicate that this mode of instruction has continued.

Figure 13 tracks trends in data warehouse participation by the volume of system use, which is measured by the monthly number of database queries made by participating agencies. For example, users might start an investigation by typing in the nickname of a possible suspect. They could follow up on the response by requesting a mugshot, which can be accomplished by simply clicking on the name of any of the individuals identified by the nickname search. This would be counted as two queries by the system. Figure 13 tracks both monthly system use and the cumulative volume use of the system by partner agencies of all kinds. In the first three months a relatively small number of new users had “hit” the system almost 8,000 times, in contrast to more than 100,000 hits by 87 agencies at the nine-month mark – more than a 10-fold increase. The peak month of use was January 2007, when more than 100,000 queries were issued by partner agencies. The greatest hike in system usage by outside agencies occurred in 2004, when yearly inquiries grew from 331,620 in 2003 to 686,600 – a 107 percent increase. By the end of March 2007, the total volume of system use had accrued to 2,927,216 queries.

### **The Future of the CPD’s Data Warehouse**

As mentioned earlier, a new statewide data warehouse has been created to house data collected by I-Case, the State of Illinois uniform incident reporting system. The CPD will supply its incident data to the statewide warehouse, but it will continue to operate its data warehouse as well. The data flow is shown in Figure 14. All legacy data has been converted to the state warehouse’s data model and will be accessible by users of the state data warehouse, ensuring that it will have the robust data necessary for optimal usefulness from the time of its deployment. Cook County agencies will continue to have access to the CPD data warehouse through their participation in the county’s Criminal Apprehension and Booking System (CABS), in addition to being able to tap into the statewide repository.

Figure 14  
CPD-Statewide Data Warehouse Data Flow



## The Paperless Squad Car

When the Chicago Police set out to become intelligence driven, the intention was to make available as many of the CLEAR applications as practicable to field officers, essentially equipping crime-fighters on the street with a paperless squad car. In doing so, electronic case reporting, arrest processing and the vast array of data elements accessible through the warehouse would be available to the officers who form the backbone of the department. These advances would not only arm the majority of the city's troops with tools to enhance their crime-fighting and proactive efforts, but so-equipping the department's auto fleet would provide the officers with mobile administrative offices. Challenges to attaining this technological goal abound, with different pitfalls impacting the three main CLEAR modules made available in the squad car.

### Electronic Case Reporting

One of the CPD's earliest efforts in its quest to automate focused on electronic case reporting. Computer-aided call dispatch was well-established by the mid 1990s, and investigative follow-up and crime record storage and retrieval was handled by the department's extant CHRIS system. The missing segment was automated incident reporting. The module developed to accomplish this is known as AIRA (Automated Incident Reporting Application). AIRA enables Patrol Division officers to complete case reports via portable data terminals – laptop computers known as PDTs – or networked computer stations in any CPD facility. The department's vision entailed officers having the ability to input information at incident or crime sites as well as in their squad cars. AIRA's development dates back several years, and its story is illustrative of the challenge of deploying a well-conceived, vital system in a large city known for its labyrinthine bureaucracies. It also sheds light on the vagaries of developing a computerized system over an extended period of time.

The CPD's goals for its automated case reporting system have been constant. AIRA is to:

- simplify the reporting process
- improve reporting accuracy, quality and completeness
- free supervisory personnel from reviewing repetitive report elements
- provide follow-up investigators with complete and timely information to improve case solvability
- reduce the number of hours tied to report processing
- collect NIBRS data and, ultimately,
- interface with the Department's other key information applications and systems

Because AIRA is the first-line information collection system, it is the only application that must successfully interface with the city's portable computer-aided dispatch system (PCAD). In addition, it must also feed data into subsequent branches of the CPD's case reporting system (digital mugshots, automated arrest and investigative follow-up), and transmit information to the data warehouse. AIRA was intended to work in a wireless mobile environment – creating a “paperless squad car” – as well as on networked PCs within CPD

facilities for use when residents visit the station to report an incident. The timing was right for this mobile endeavor, because the city's aging PDTs needed to be replaced, and rugged laptop computers that could withstand the department's situational and environmental demands were recently available on the market.

**History.** The CPD's efforts to create an automated incident reporting system predates CLEAR development. Work on AIRA began in early 2000 as an in-house project headed up by a lieutenant in the Department's Research and Development (R&D) unit. The goal for the six-person team was to develop over a five-month period the business logic for a user-friendly data entry system to be used by patrol officers to complete incident reports. Their work would then be handed over to a vendor for actual development of the application. A few months into the effort, various manpower shifts virtually dismantled the team, leaving only one sergeant to develop the application's logic single-handedly. The project remained a low priority until an administrator was brought in to see the development of CLEAR to fruition.

The project was resurrected in summer 2001, but despite the fact that Oracle developers were already beginning to work on several CLEAR modules, AIRA remained an in-house project, very much isolated from the other applications comprising the CPD's "enterprise system." Several police officers with programming experience joined the project manager, and the application began to take shape. Another officer was brought on to create flow charts to ensure that screens were developed for every type of incident – screens that captured the rich data needed for crime analysis. The team continued to grow with the addition of street officers who provided insight and input based on their field experience. Because AIRA was not being developed by Oracle, standardized development processes were not always followed, but focus groups representing all types of users regularly provided feedback. A development team member carried out a systematic review of general orders affected by AIRA and worked with R&D personnel responsible for rewriting them.

Generally, reaching this point in the development of a CLEAR application would mean that after a period of programming, pilot testing and training, the application would be ready to launch. However, such was not the case for AIRA, because of a constellation of factors. Perhaps the most conspicuous of these were equipment and infrastructure constraints. The department's portable data terminals (PDTs) were dated and not adaptable to the wireless technology needed to transmit the large packets of data that comprise completed reports. In addition, upgraded PDTs would have to be retrofitted with radio frequency equipment – necessary for the transmission of 911 calls to patrol cars – which proved very problematic. Changes to the city's automated dispatch system were required, and while accomplishing them was anticipated to be a lengthy process, disagreements over contract details between the vendor and the city's legal department delayed the needed changes to the dispatch system for many months. Furthermore, the complexity of the changes caused the vendor to revise its timeline numerous times. These obstacles were compounded by territorial issues within the city's bureaucracy: the 911 center, known as the Office of Emergency Management and Communication (OEMC), is not governed by the police department, and dispatch-related decisions made at OEMC presented some hardware challenges for the paperless squad car.

All of this resulted in ongoing delays, a time during which technological advancement forged on. Operating systems and platforms were born and retired during the AIRA development lifecycle. Facets of the application or its hardware were often retooled in an attempt to stay current, but the net effect of the above-mentioned impediments prevented a full scale deployment of the mobile version of the automated reporting system. This virtually split development of the automated incident reporting application into two distinct projects – LAN-based AIRA, which slowly was being launched inside district station houses on the department's network, and mobile AIRA, which was languishing. Nonetheless, the years of fits and starts on the CPD's paperless incident reporting system laid the conceptual groundwork for what would eventually become a mobile reporting system for policing agencies in the State of Illinois. (This venture will be discussed fully in the next section of this report.)

**LAN-based AIRA.** As mentioned above, the original intention was to launch AIRA as a single application that would be used for mobile and onsite incident reporting. However, when the program was finally web-enabled and performing reliably – and a completion date for PCAD upgrades was nowhere in sight – AIRA was implemented at a pilot district's front desk, capturing data provided by people who came to the station to report an incident.

LAN-based AIRA became operational on one watch only in summer 2003. Training team members were onsite during that watch throughout the first two weeks as a resource for already-trained users as well as to observe circumstances during glitches. Front desk personnel attended a two-day, hands-on training session at the academy before they were given log-in access. While several needed fixes or enhancements were identified in the first weeks of the pilot, no significant difficulties arose. By November 2003, LAN-based AIRA was being used around the clock in the pilot district stationhouse. Training was held for desk and relief personnel, again at the academy, and district gang and tactical team officers, who routinely complete incident reports in the station, later received training and joined the district's users group. By the end of 2003, all officers assigned to the pilot district had been trained and were able to use the application. In addition, civilian Help Desk employees received instruction on the system.

By spring 2004, LAN-based AIRA was being used in four district stations spanning two policing areas, and the number of incident reports being submitted electronically was increasing steadily. In early 2005, it was introduced incrementally in the city's Alternate Response Section (ARS) facility, where non-emergency incident reports are created. Pilot testing showed that a small modification would be needed to accommodate this unit's report approval process, and the modification was carried out soon thereafter. At present, all ARS officers complete and submit incident reports electronically – an average of 500 reports per day. Users are reportedly pleased with the application itself, but they often encounter slow processing times. When this happens, they resort to creating reports in the detectives' follow-up-investigation report system (formerly known as CHRIS), essentially allowing them to compose a report in a later stage of the electronic case reporting system. Supervisors especially enjoy using AIRA when it is working smoothly, as it allows them to approve many reports in a greatly reduced amount of time.

In addition to its use in the Alternate Response Section, currently, the LAN-based application is operational in four districts, and one area headquarters, though not all officers have been trained to use it, for reasons that are discussed in the upcoming subsection on the future of AIRA.

**Mobile AIRA.** As mentioned earlier, mobile AIRA is unique among CLEAR applications, because it is the only one that cannot be routinely launched after programming and testing. Its deployment is dependent on a range of additional factors, technical and otherwise, that must be in alignment before full implementation. In previous reports, we noted that the implementation of automated incident reporting in Chicago still faced several significant challenges – bandwidth capacity, facilities limitations and the magnitude of training – but none of these had a direct impact on the Department’s inability to get the mobile pilot test started before late November 2003. Instead, the major impediment to mobile AIRA’s launch had to do with completion of PCAD programming changes. These changes were handled by the vendor of the city’s automated dispatch system, and in spite of steady work on the project, the vendor continued to miss self-imposed deadlines, mainly because of programming complications. Also impacting the wireless AIRA application was the fact that development halted for a few months when responsibility for the project followed the CLEAR architect to his next post.

The dispatch system changes were eventually completed in January 2004, and incident reports can now be completed and transmitted via PDT. The updated PCAD software not only interfaces with AIRA, but it provides enhanced screens and functionality. This version is much more user-friendly, and its Windows-like screens are easier to view than the outdated black and green no-frills version previously used. The new PCAD application prevents work-in-progress from disappearing from the screen when call-related event updates appear, correcting a long-standing problem. Another enhancement allows officers to move back and forth between applications via a tool bar that remains visible at all times. Other new features include touch-screen access to functions that formerly required the typing of lengthy command lines; storage capacity for up to 100 sent and received messages; automatic 90-day event histories for dispatched addresses; and e-mail and enhanced car-to-car messaging.

Mobile AIRA was introduced in the pilot district via a “soft rollout,” meaning that the application was first introduced on one watch only. By April 2004 all three shifts had use of mobile AIRA; however, because of a number of problems – most of which resulted in very slow performance – no directive required that officers complete incident reports electronically. To avoid potentially alienating users, the AIRA project manager did not want to force officers to use the application when it was not working optimally.

A persistent and overriding challenge plaguing AIRA implementation had to do with the inability of the CPD’s current radio-frequency dispatching system to accommodate a large-scale wireless communication system such as AIRA – one that must transmit large packets of data. The narrow-band public safety system has a transmission speed of only 9K, one-sixth as fast as a dial-up modem, causing the development team to devote much attention to holding to a minimum the amount of data transmitted at any given time. Officers found ways to circumvent the snail’s pace at which reports were sent. Many officers completed and saved their work on the PDTs and then went into the station to submit them to their supervisors for approval.

A solution to the bandwidth limitations appeared to be at hand by mid-2004. The City’s Office of Emergency Management and Communications contracted with a major broadband carrier to provide a wireless network capable of transmitting incident-report-size packets of

information. Testing of the system yielded promising results, and the wireless network was in use in the pilot district by early 2005. At the same time, new PDTs with wireless modems, larger screens and more powerful batteries were put to use, mitigating several performance issues related to this equipment.

However, because the decision-makers at OEMC do not consider cellular technology to be as secure as the public safety radio band, they have not agreed to switch the entire system to cell technology. Consequently calls continue to be dispatched from the 911 center to the department's squad cars on the radio IP. This decision had a ripple effect on the mobile portion AIRA because the new ruggedized PDTs would have to be retrofitted with a radio frequency modem; there are no wireless computers on the market that are equipped with both radio and cellular modems. After much research and deliberation, the decision was made to have a radio modem installed inside the new portable terminals. (The realization of this represented an unprecedented alliance between competing industry-leading companies.) The physical feat of installing an additional piece – the radio modem – inside the portable computer was realized; however, in everyday use, the modem would overheat and expand, causing other components within the unit to malfunction. Eventually, the retrofitted internal radio modem was replaced by a free-standing radio modem that was hardwired to the squad cars, quashing any possibility that information entry could occur outside of a squad car or CPD facility.

The beleaguered wireless project faced an additional impediment. When the CLEAR visionary moved to his next government post, the majority of the AIRA team relocated with him, as did the AIRA project itself. Pressing priorities slowed development of the wireless AIRA module as multi-tasking team members attended to their many new assignments. The CPD regained responsibility of the AIRA project several months later, but little had been done on the project and momentum had been lost.

## **Automated Arrest**

With the department's automated arrest application working smoothly in district stationhouses throughout the city, and after the cellular network was efficiently transferring packets of information to and from the upgraded PDTs, the decision was made to test the automated arrest application in the mobile environment. In early 2005, it was made available to officers in the pilot district for a special pilot use. At that time, the department ran a trial program in which individuals caught for possessing small amounts of marijuana were ticketed rather than arrested. Because the confiscated marijuana would need to be inventoried, an arrest report would need to be completed to feed the automated inventory application. Hence, a test lab for the automated arrest program was created. While the automated arrest application worked smoothly, officers complained about having to re-enter arrestees' basic information that moments before had been entered into AIRA. Based on this feedback, programmers endeavored to add a few arrest-related screens to AIRA and devise an interface that would transfer information and populate fields in the arrest program. This, combined with a growing realization that incident and arrest reports are not discrete entities, had developers incorporating facets of automated arrest into AIRA soon thereafter. Programming was completed by October 2005, but changing priorities and a fast approaching completion date for I-Case caused programmers and testers to

be reassigned. A police officer with programming experience was tasked with adding a portion of the Automated Arrest application to the mobile AIRA system, but when development of I-Case (the incident reporting application discussed later in this report) began to take shape, the project was shelved.

## **Enhanced Mobile AIRA**

Though generally hailed as a well-conceived and efficient application, AIRA was to be retired when I-Case was fully implemented in the Chicago Police Department. However, in recent months, the CPD has indicated that it might reinstate AIRA for use by the CPD until I-Case is fully operational. (For further detail on events leading to this decision, see the upcoming section, The CPD and ISP Partnership: The Development of I-CASE.) The original AIRA project manager has begun work anew on incorporating the arrest application into AIRA. Currently there are some bugs that must be resolved, but currently the AIRA programmers are temporarily working on another project. In addition, there is an insufficient number of trainers to handle an effort such as this. At the time this report was written, the upgraded AIRA release remained untested and unused.

## **Data Warehouse**

The benefit of affording the power of the CPD’s data warehouse to officers in the field is a “no-brainer,” but doing so could not become a reality until numerous technical factors were in alignment. First, only upgraded PDTs are capable of handling the data warehouse, so its introduction was limited to districts using the new models. The reality that the radio modems needed to be hard-wired into the squad cars also dictated the pace at which data warehouse access could be offered in the mobile environment: only a few cars per district could be adapted at a time to ensure that a sufficient number of automobiles were serviceable to meet manpower needs. Because all officers have been trained to use the data warehouse, the instructional constraints that restrict deployment of other CLEAR applications do not impact this effort, but the spread of its mobile use is incremental nonetheless. At this time, field officers in four districts as well as those assigned to an area headquarters are able to use the data warehouse in their squad cars.

The data warehouse historically has been the favorite computer system among Chicago police officers, and their positive attitudes apply to its wireless availability as well. Informal polling revealed that of all CLEAR systems, officers are most satisfied with data warehouse access in the squad cars, because it allows them to know the criminal background of whomever they are dealing with – which can be particularly advantageous if that individual is in the squad car with them.

## **Use and Impact of CLEAR**

This section presents selected findings from 8,291 officer surveys administered between June 2004 and April 2007 at Automated Arrest training. Officers were asked to complete a 10-

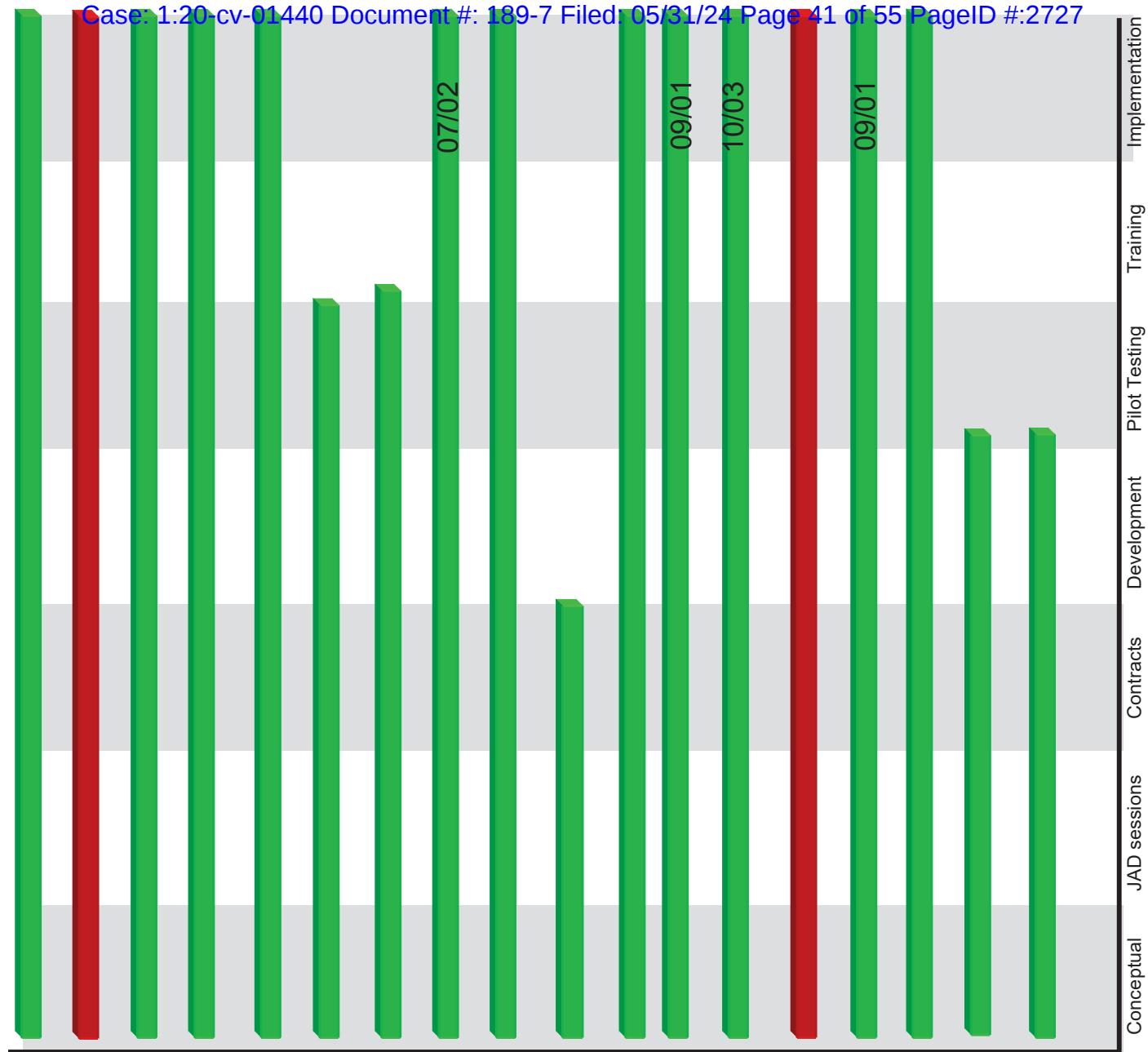
minute survey at the beginning of the training session. They are assured that the survey is strictly confidential; that the findings will only be presented in aggregate form by the evaluation team from Northwestern University; and that their participation is voluntary. The surveys probed the frequency with which officers use the various automated systems available to them, their purposes for using each system and attitudes about ways in which computers have impacted policing. It also collected demographic information such as rank, age, work location and assignment.

**CLEAR Use.** In our last report we used the data described above to discuss officers' self-reported utilization of the numerous applications available to them. However, as the months tick by and CLEAR system use becomes the modus operandi of the department, these data become less noteworthy, because using the various applications is no longer optional. For example, if officers have evidence or property that must be inventoried, the only means for accomplishing this is by using eTrack. By 2007, more than 66 percent of officers surveyed reported using eTrack at least once or twice weekly, with another 21 percent stating that they use it, but very rarely. This likely indicates that the remaining 13 percent of surveyed officers – those claiming to never use it – have no occasion to inventory evidence or property. The same would hold true for use of the department's mug shot system, portable data terminals, LEADS (the Law Enforcement Data System, used for warrant and vehicle checks) and the detectives' follow-up report system (formerly known as CHRIS). Paper-based options for performing the tasks related to these systems no longer exist. Figure 15 shows the level of implementation of several CLEAR modules that were in the department's original automation blueprint.

That being said, one CLEAR system for which this would not hold true is the data warehouse, which is reportedly used by 92 percent of the more than 8,000 Chicago police officers surveyed. Data warehouse inquiries, by and large, are discretionary. No particular duty of the police officer is dependent on accessing information from the data warehouse. Information provided by the CPD's repository rounds out the basic tasks of police officers – assisting in positive identification of suspects and helping in recognizing patterns, and so forth. Of the 92 percent reporting they use the warehouse, 47 percent answered that they query the data warehouse every day, and 33 percent indicated that they use it at least once or twice weekly. Another 12 percent report using it rarely. So with only 8 percent of surveyed officers reporting that they never use the data warehouse, there is clear evidence that officers recognize the utility of robust information at their fingertips and that they are willing to make the effort to access it.

**Attitudes about automation.** Successfully changing the way a police department does business is a process that depends on winning the hearts and minds of the rank and file. To gauge whether the CPD's transition to data-driven policing has been woven into the agency's cultural fabric, we queried patrol officers – the “foot soldiers” of the organization – on their attitudes

Figure 15  
CLEAR Module Timeline



Probation/Parole Information Integration  
Automated Pawn Shop  
Automated Arrest  
Records Div Traffic Crash/Routing System  
Enhanced Hot Desk  
Personnel Performance System  
AIRA  
ICAM Mapping  
ETrack  
Community/Business Partnership (CLEARpath)  
Gangs System  
Data Warehouse  
Youth System  
Traffic System  
Organized Crime System  
Mug Shot System  
HTML Conversion  
NIBRS Compliance

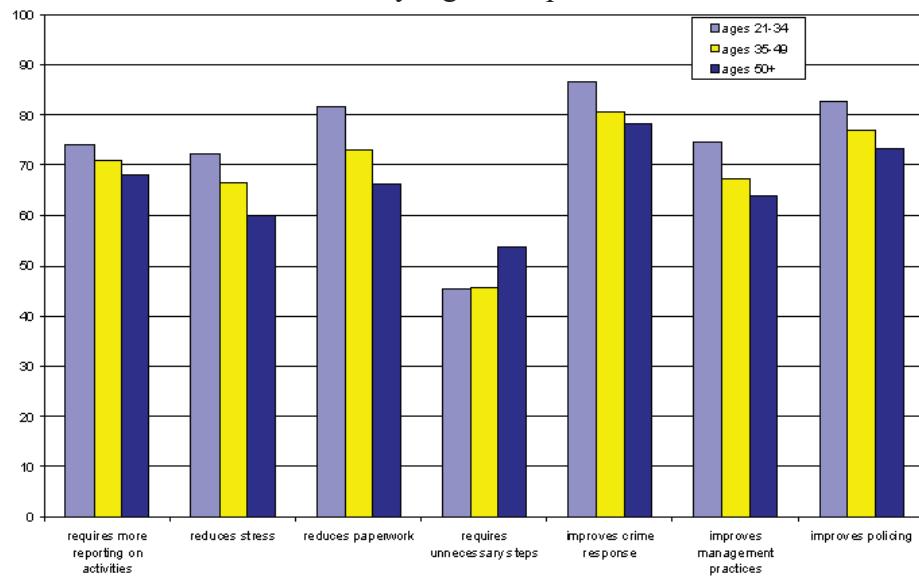
Indicates that work has yet to begin

about automation. Because more positive attitudes might be predicted among younger officers – who generally come to the job with more computer competence than their older counterparts – we analyzed opinions by age group as well as in the aggregate. Respondents were divided into three categories: 21 to 34 years old, 35 to 49 years old, and 50 years old and older.

It is notable that patrol officers' responses – regardless of age – showed unquestionable acceptance of the CPD's adoption of new technology, as well as automation's effect on policing in general. Ninety-two percent of surveyed officers reported that automated systems allowed them to work more effectively; made their work easier; improved information quality; and increased computer literacy among police. Another positive sign is that more than 84 percent of respondents – again across all age groups – believe that computer technology has led to improved information sharing among members of the CPD; has increased their effectiveness on the job; has improved police response to crime; and has improved police service to the public. The largest concern – among 47 percent of those surveyed – is that the systems they are using require them to follow unnecessary steps to get things done. This attitude has held steady since we first polled officers about it in 2004. However, as automated incident reporting – the first step in data entry – becomes available to the whole of the department, and as all CLEAR applications become integrated, this situation could be mitigated.

There were a few dimensions on which there was a statistical spread of more than 5 percentage points in opinions between the oldest and youngest groups of officers, as shown in Figure 16. Many of the topics on which their judgments varied were predictable: younger officers were more convinced that automation reduced job-related stress and paperwork than were older officers. Similarly, fewer older officers opined that computerization improved crime

Figure 16  
Attitudinal Differences about Automation  
by Age Group



response, management practices or policing in general than did the younger groups. Another subject on which older and younger officers' opinions differed was whether computers required them to follow unnecessary steps to get things done: 54 percent of senior officers report that more work was involved versus 45 percent of the youngest group of officers. The most surprising finding was that the officers in the oldest group were less convinced that using CLEAR applications required them to report more frequently on their activities than were their younger coworkers.

However, on a much larger range of dimensions, officers across all age groups held similar views about the ways in which computerization has impacted their jobs and policing in general, as shown in Table 2. In every category, patrol officers across the board are remarkably positive about the addition of information technology to their job.

Table 2  
Views of Automation's Impact

Computers have:	Ages 21-34	Ages 35-49	Ages 50+
improved information quality	97	95	95
allowed me to work more effectively	96	93	90
made my work easier	93	89	85
increased computer literacy among police officers	91	89	87
increased district personnel's effectiveness	90	85	85
improved police response to crime	87	80	78
improved police service to the public	83	83	83
improved police accountability	83	83	81
enhanced professional status of police	82	79	76
improved information-sharing among district personnel	89	85	85
made my work more interesting	78	77	76
allowed district personnel to work more cooperatively	77	72	72
improved communication among district personnel	76	72	72
made me more accountable for my actions	72	71	75
created a more positive work atmosphere	77	71	72
limits the discretion I have	51	53	55
caused conflict among district personnel	27	23	29

It is no surprise that throughout the study the youngest tier of police officers with beat assignments has been most confident about its ability to use CLEAR systems: 96 percent of this group characterized itself as somewhat or very competent. However, older officers are notably self-assured as well. Ninety-one percent of officers between the ages of 35 and 49 reported feeling somewhat competent or very competent in using computer systems for work, as did 82 percent of those aged 50 and older. This compares quite favorably with the general adult population (18 years and older), only 64 percent of which even used computers in 2003.<sup>5</sup>

### **The CPD and ISP Partnership: The Development of I-CASE**

The benefits of information-sharing among law enforcement agencies cannot be overstated. Information-sharing is often cited as the chief U.S. intelligence failure prior to the September 11th attacks. Knowing that Illinois could benefit from the groundbreaking information-sharing advances already underway at the CPD, in January 2004 officials announced a shared vision whereby the state would become the first to establish a single criminal justice database for its local agencies – a full four months before the U.S. Attorney General unveiled the nation’s plan “to strengthen the nation’s security through better intelligence analysis and sharing.”<sup>6</sup> In announcing the statewide system, the governor of Illinois and the mayor of Chicago described the planned system – Illinois Citizen and Law Enforcement Analysis and Reporting (I-CLEAR) – as “one of the most important weapons in the battle against crime and terrorism.” I-CLEAR seeks to leverage the existing financial, technological and human resources of the Chicago Police Department and the Illinois State Police to develop a system for the collection, maintenance and dissemination of criminal justice data in Illinois. The flagship I-CLEAR application is a uniform incident/case report called I-Case. Until recently, the intention has been for I-Case pilot testing to begin at the ISP, with the CPD starting trial use a few months later among a small user group. The long-term goal is to make I-Case available to all criminal justice agencies in Illinois thereafter.

The story of how the two largest policing agencies in Illinois set out to make I-CLEAR a reality is several case studies rolled into one. It is a story about logistics, project management, communication, resource management, human dynamics and maneuvering within bureaucracies. The two agencies differ dramatically in their physical, organizational and business structures. And the task they undertook is complex, protracted and highly specialized – though the end product has to be generic enough to benefit agencies of varying size and focus. Realizing an effort of this magnitude requires a strong a strong belief in the partnership and equally strong leadership within both organizations. This information-sharing venture is strengthened by the

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<sup>5</sup>U.S. Census Bureau, “Computer and Internet Use in the United States: 2003;” issued October 2001, <http://www.census.gov/prod/2005pubs/p23-208.pdf>.

<sup>6</sup>“FACT SHEET: NATIONAL CRIMINAL INTELLIGENCE SHARING PLAN” Press Release. Department of Justice Official Home Page. 2004. <http://www.fbi.gov/dojpressrel/pressrel04/factsheet051404.htm>.

fortitude of a working group tasked with developing I-Case, which meets regularly and works long days, despite the geographic distance between these two organizations. This report section provides a brief history of data-sharing efforts among Illinois law enforcement agencies, as well as an overview of I-CLEAR development and the governance activities guiding the project.

**Statewide data sharing.** Law enforcement data sharing in Illinois began in 1969, when the Illinois State Police introduced the LEADS network, which connects state, county and local police throughout Illinois. A few years later, the Illinois Criminal Justice Information Authority (ICJIA) developed the Police Information Management System (PIMS), an automated police records and information package that comprises several modules, including arrest, incident and crime analysis. PIMS provides network-sharing among subscribing agencies, as well as training and 24-hour support. Participating agencies were also given a voice in the ongoing evolution of the system. Subsequently ICJIA developed its Area-wide Law Enforcement Radio Terminal System (ALERTS), which is a fee-based, in-car data communications system for police. ICJIA developed, operated and maintained the central computer hardware and telecommunications system equipment for ALERTS until 2006 when the operations were privatized. It also provides funding to support new information technology initiatives and applications in Illinois, including the CLEAR and I-CLEAR systems. In addition, in 1997 the ISP, with cooperation from ICJIA, sought solutions for a statewide mobile network infrastructure, resulting in the Illinois Wireless Information Network (I-WIN), which became fully operational three years later. I-WIN provides fast, secure wireless connectivity to various state and local public safety agencies, enabling them to access a number of mission-critical database applications from virtually anywhere in Illinois. Since I-WIN provides users with access to LEADS, particular emphasis is placed on restrictions regarding dissemination of LEADS information. Also, because LEADS is accessible through mobile data computers, emphasis is placed on security to eliminate unauthorized use.

In 1999 the Cook County Sheriff's office launched a high-tech system to quickly and accurately identify criminal suspects. Known as the Criminal Apprehension and Booking System (CABS), the system provides a uniform booking system and statewide digital mugshot database. A U.S. Department of Justice grant funded the creation of the system, and Cook County agencies were encouraged to participate. The initiative brought 108 Cook County jurisdictions into CABS. Arrest data from these agencies were merged with CPD arrest records, allowing for a robust database and easy access for those needing the arrest data. CABS became a model for data-sharing across jurisdictional borders without concern for data "ownership."

Beginning in 2002, the CPD made its CLEAR data warehouse accessible to an ever-increasing number of local jurisdictions, an undertaking described earlier in this report. This, combined with the apparent utility of the many applications powered by the data warehouse, seemed to be the element that unified the state's early data-sharing achievements and propelled the creation of a new statewide warehouse and a uniform incident reporting system – I-Case – that was to be used by both the Illinois State Police, the Chicago Police Department and, ultimately other Illinois jurisdictions.

**Governance.** The governor of Illinois signed an executive order to form the Illinois Integrated Justice Information System (IIJIS) board in summer 2003. The IIJIS board, chaired by

the Illinois Criminal Justice Information Authority's director, provides oversight of criminal justice integration efforts in Illinois and meets on a regular basis. However, the IIJIS board's relationship to the I-CLEAR enterprise system is unclear at this point. An I-CLEAR-specific governance body was also formed within the CPD and ISP, spearheaded by top members of both organizations. There were some initial meetings of this body, known as the Inter-Governmental Agreement (IGA) group, but substantial personnel changes caused it to disband. The IGA document was eventually signed, but both the ISP and CPD worked assiduously without it, having agreed to it in principle.

Governance is currently one of the top issues looming in the development of I-CLEAR, for such a body is critical for understanding and accommodating the needs and wishes of potential future users of the system. If I-CLEAR is to be responsive to the needs of all law enforcement agencies in Illinois, input and oversight from agencies other than the founding organizations will become increasingly important. A governing body also may have been useful in keeping the founding organizations united .

### **Uniform Case Reporting**

I-Case makes available a single automated case reporting system for the entire state, consolidating incident reports and detective follow-up reports. I-Case's usefulness goes beyond the creation of a single statewide automated case reporting system. For example, using I-Case will enable Illinois to join the handful of states that have become NIBRS-compliant. I-Case is also a critical tool that facilitates regional data integration by gathering and sharing information across borders – a tool that may be critical in addressing terrorism. Both the Chicago Police Department and the Illinois State Police have made a substantial commitment to the I-CLEAR project in terms of resources and personnel. I-CLEAR was originally to be an adaptation and expansion of the CPD's enterprise system; the ISP was to provide the funding, while the CPD was to provide the technical expertise. It was agreed that the two agencies would have equal decision-making roles, because each was making a comparably key contribution.

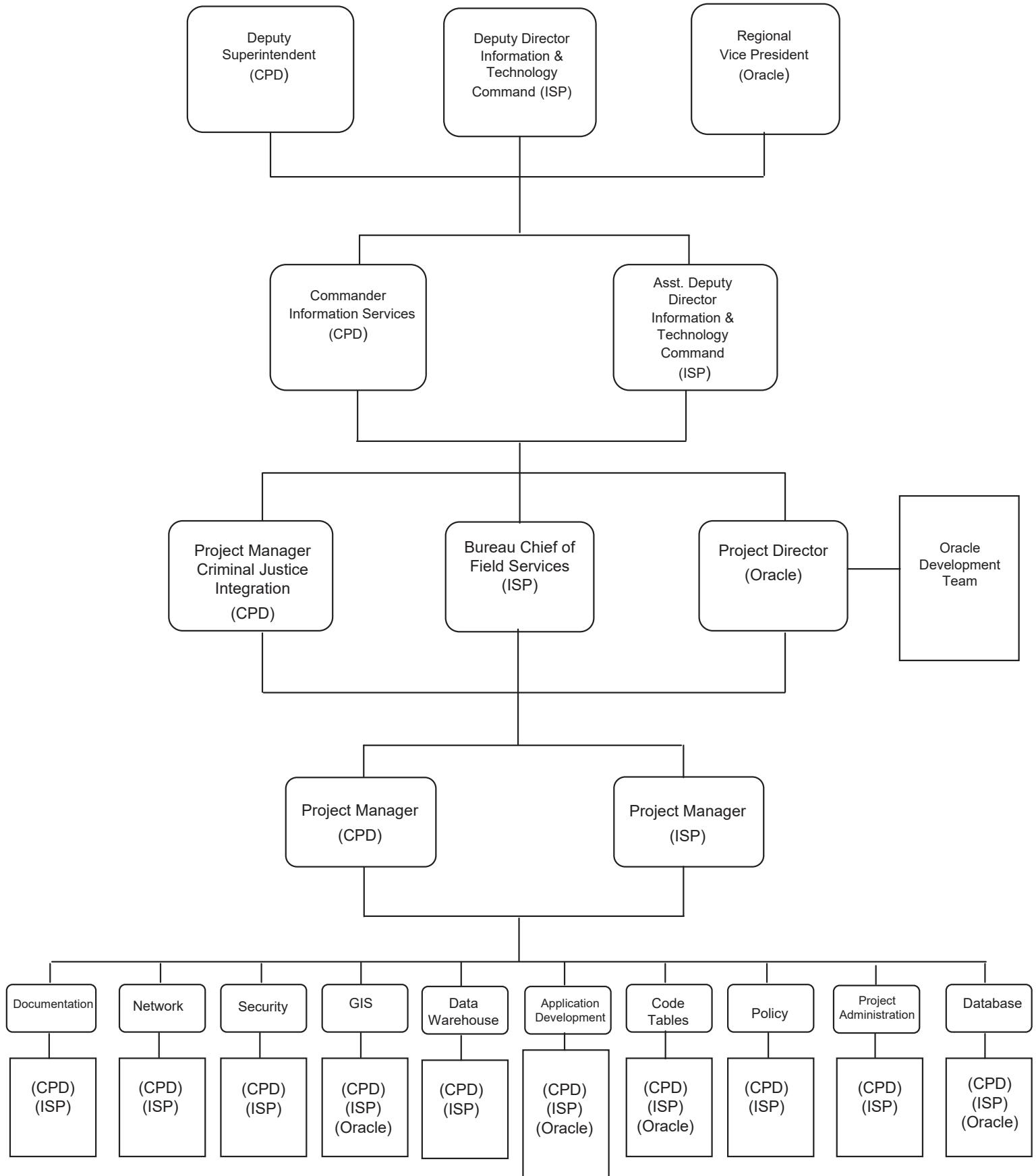
Funding for I-Case development through June 2007 has come from a variety of sources. Because one of the anticipated outcomes of I-Case is that it will facilitate NIBRS compliance in Illinois, the ISP received a federal grant to support development of the system. The ISP was able to begin I-Case development with \$639,000 from this pool of money. Another significant source was the result of a \$4 million contract between the ISP and Oracle Corporation. Under this agreement, Oracle provided consulting services and products to the ISP. In turn, the ISP made Oracle the sole source provider of such services. Another \$2 million was received from the Office of Community Oriented Policing Services (COPS) in Washington, D.C. Homeland Security funds were also made available through the Illinois Law Enforcement Alarm System (ILEAS), which allocates millions of dollars in Law Enforcement Terrorism Preparedness Program funds to local law enforcement agencies. Both the Chicago Police Department and the Illinois State Police have made a substantial commitment to the I-CLEAR project in terms of resources and personnel.

**Partnering.** When the statewide data-sharing project first got underway, the architect of the CPD's enterprise system was at the helm of the I-CLEAR project alongside an ISP deputy director. The two administrators were considered to be innovators with an ability to "make things happen." Soon after the announcement, a kick-off meeting was held at the CPD, at which members of both agencies were introduced to the I-Case "vision." ISP staffers were given demonstrations of the CPD's automated arrest system and the data warehouse. The Oracle team also gave a short presentation that outlined its role and provided an overview of the development process and expected I-Case capabilities. Eleven working groups, each made up of ISP and CPD personnel, were formed and tasked with devising a plan for their contribution in their areas of expertise. Group members were expected to meet and map out impacts and outcomes related to security, documentation and the agencies' networks, for example. The groups were encouraged to hold an inaugural meeting fairly quickly to determine how and when their participation would be needed. The resulting organizational structure is shown in Figure 17.

Most of the working groups established their schedules and planned their tasks over the ensuing months, but one group – the application development group – mobilized right away and began meeting at least three full days per week. The CPD assigned three people to the application development team, who paired up with ISP personnel dedicated to the project. While the CPD team members retained responsibility for other internal projects, several team members from the ISP worked strictly on I-Case development and, in fact, relocated to CPD headquarters to work side-by-side with CPD personnel as development got underway.

A considerable amount of preliminary work was required from the group before application development could even begin. Each agency needed to familiarize the other – and the Oracle developers as well – with its structure and operating procedures to ensure that I-Case would meet the needs of both organizations. The combined team also brought in experts and sought input from other agencies in the state so that I-Case would be an adoptable system for the hundreds of other potential users in Illinois, regardless of size or location. This exercise, drawn out over several months, did produce the key information needed to lay the groundwork for software development. However, the disclosure process seemed to emphasize the agencies' differences rather than foster a partnership. The individuals comprising the group appeared to get along on a personal level, but there was ongoing friction during the requirements discovery process. The meetings were described by a few participants as "painful." The group eventually became known as the "core group," and over the next year, team members relentlessly slogged through the numerous tasks inherent in aligning the various functions, processes and reports of each agency. One such exercise required team members to do a detailed analysis of every data element collected by both agencies. This undertaking identified shared data fields and gave the two departments the opportunity to cull unnecessary elements or add new ones that would enhance their law enforcement capabilities. It also facilitated NIBRS compliance. During this time, the Oracle team met regularly with other working teams on matters such as network connectivity, policy-making and security to compose business and technical requirements documents.

I-CLEAR/I-Case Organizational Structure



Predictably, various impasses emerged in the earliest development stages, and a conflict-resolution process was established. When the core group was unable to work through an issue, technical or field experts were brought in to provide input in the decision-making process. For matters that remained unresolved, a three-level graduated decision-making structure was established. First-level resolutions are made by the CPD's Information Services Division commander and the ISP's assistant deputy director of Information and Technology Command. If further escalation is needed, the issue goes to the project's executive director level – a CPD deputy superintendent and an ISP deputy director. If the issue remains unresolved after passing through these levels, it is referred to the top level, with the final decision made jointly by the CPD's superintendent and the ISP's director. Orderly processes such as those described above are the bedrock of project-management practice, which controls for the tangibles in a venture. But project management could not control the rich array of intangibles that had an impact on I-Case development during its first year. One such intangible is inherent in the business of law enforcement: the agencies conduct business 24/7, and at any moment, any crisis can – and does – reset priorities. New priorities caused by emergent conditions often pulled key members from the various working teams, toppling interim deadlines.

**Transitions.** More than anything else, the management changes described earlier in this report set off a chain of events that resulted in a complete redirection of the I-Case project. The CPD's ace moved on to a municipal post at the same time that the CPD's deputy superintendent overseeing IT development retired. This left a temporary leadership gap that took a toll on Chicago's I-Case team members. The new deputy superintendent – a rare outside appointment in an organization known for promoting from within – scrambled to get a foothold while replacing the many key middle managers who moved on with the former CLEAR architect. At about the same time, the remaining half of the dynamic executive team – the ISP deputy director – began to experience the frustrations of a project that appeared to be spinning its wheels. An ambitious launch date had been announced publicly, but the enormity of identifying I-Case requirements made that date unattainable.

The slow pace also gave the ISP executive team leader ample opportunity to step back and re-evaluate the direction of the project. I-Case originally was to “piggy-back” on the CPD's automated incident reporting application, which had been developed in-house, as explained in an earlier section of this report. In addition, I-Case was going to feed information into the CPD's already aging data warehouse. While each system continued to serve the CPD well, new technologies had emerged in the time since AIRA and the data repository were built, and the prudence of looking into building new systems rather than altering old ones was becoming evident.

By spring 2005 the ISP determined that I-Case would be built from scratch along with a new data warehouse. While the decision did push deadlines back even further, all that the application development team had accomplished to that point would still be usable in developing the new system. The ISP's deputy director also decided to move all I-Case development activities to the Illinois State Police facility in Joliet. CPD core-team members and the Oracle developers were given workspace there when the move was finally made – some six months later. Additional computer hardware was needed in Joliet for the Oracle developers to

accomplish their tasks, and the state's plodding procurement process prevented the relocation from taking place sooner. The majority of the data warehouse development activities were to take place in Springfield, at the state police headquarters. Accommodations were made for Oracle personnel there as well, and the acquisition of new equipment for its development and operation was also subject to procurement red tape.

At about the same time the decision was made to start fresh with I-Case, a new Oracle manager assumed responsibility for all projects at the CPD as well as at the ISP. The new administrator took the lead at a time of great frustration for both the ISP and the CPD. The very nature of their partnership had changed, as had the direction and scope of the project. When the partnership began, the contributions of each organization were clear-cut. The ISP was to provide the funding to build onto the CPD's existing systems. The CPD was to furnish its automated case reporting system and data warehouse along with the intellectual property acquired through developing and operating them. But more than a year later, the ISP found itself bankrolling a project that was becoming increasingly amorphous. The decision to build anew was well-advised, but after 14 months of work, there was little visible evidence that the project was heading anywhere. The ISP had also not expected to house the new statewide information-sharing systems nor had it anticipated acquiring the servers and other hardware and software associated with developing and operating them. Furthermore, despite working with Oracle for more than a year, the ISP did not appear to have developed a comfort level with the company, and an entirely new project was about to begin with an entirely new Oracle project lead. And in the background was the apparent feeling on the part of the state police that the CPD had far less to lose if the I-Case project failed.

The CPD's discomfort sprang from a number of sources both internal and external, and on the surface, it seemed to be borne mostly at the core team level. Because CPD personnel to whom the core team members reported were new to their positions, and because their jobs entail much more than I-Case or I-CLEAR, it was a challenge for them to devote the same amount of attention to the project as did their counterparts at the ISP. Further, when the application development work moved out of CPD headquarters, it became even harder for them to keep sight of project issues. There was no longer a visible presence to remind them daily of the I-CLEAR partnership, and the opportunity disappeared for impromptu meetings from which important decisions, large and small, often emerged. CPD core team members were learning to work for their new managers while having to continually remind themselves that the decision to construct a totally new case reporting system and data warehouse did not reflect on the integrity of the applications they had created. In addition, the CPD core team members were going to have to relocate for at least a portion of their work week to Joliet, making their continuing CPD responsibilities harder to control. Another difficult thing for the core team to watch was the Oracle team's gradual shift in allegiance to the ISP – who was now paying the bills – after years of working side-by-side with Oracle on CPD projects. But perhaps the biggest worry for the Chicago Police Department, from the core team on up, was that all of the information in the data warehouse would need to be converted and downloaded into the new statewide repository. This would require funding, the source of which was still unidentified.

It did not take the new Oracle leader very long to assess the status of the project he inherited. He quickly realized that in addition to having to define and achieve targets, considerable attention would need to be paid to partnership strengthening – not only between the two agencies, but also between his organization and the clients. And perhaps his most crucial task was selling his law enforcement clients on the vital role of timely decision-making in successful project execution. To that end, the Oracle lead convened a steering committee of decision-makers from both agencies that began meeting on a regular basis to stimulate timely resolution of outstanding issues. He also arranged for Oracle to present a week-long project management training for project managers of each agency. Participants learned about the importance in software development of following an “iterative” approach, which involves a sequence of incremental steps, rather than a “waterfall” approach, which dictates that strictly ordered phases be completed before the next begins. Weekly status reports were enhanced to include information about all aspects of the project from team-member vacation schedules to budget, scope adherence and issue management.

Hence, in the spring of 2006 it appeared to the evaluators that the I-Case project had found its footings. Weekly status meetings were becoming efficiently briefer and less contentious. The CPD had appointed a project manager dedicated to I-CLEAR, and this seemed to confirm the CPD’s commitment in the ISP’s eyes. The new appointment also seemed to improve to CPD management’s ability to keep abreast of the project. Milestones and deadlines were met on Phase 1 of the project, while preliminary Phase 2 work began according to the latest version of the schedule. Construction of the I-Case application was expected to be completed on time, and testing seemed destined to begin according to the schedule laid out when the project was reforged.

But then a new round of management changes evolved. The ISP’s deputy director – the remaining half of the team behind the project’s inception – retired, as did the CPD’s deputy superintendent overseeing the project. As if those changes were not enough, the Oracle manager overseeing I-Case development project eventually was reassigned. Each change had its own repercussions, none overtly benefitting I-Case development.

A very able program manager replaced the Oracle project manager, and I-Case development progressed admirably. The program manager had considerable technical expertise as well as a fine working knowledge of both CPD and ISP operations. Challenges were overcome; milestones and deadlines were met. From a software development viewpoint, all was going well, and the project was within its proposed budget. ISP network problems continued to crop up, but the agency confronted them head on, though resolutions were not always easily reached. (This troubling situation continued through the end of the evaluation.) A significant obstacle involving data conversion emerged – one that tested the strength of the working group’s partnership – in time a solution was reached, and again the project was on track. Pilot user training of the I-Case application began in Spring 2007 as planned, but it was toppled by the ISP’s network insufficiency.

Members of the combined core team were frustrated by the ongoing network problems, and though CPD team members were understanding about the configuration complexities faced by the ISP, they were disheartened by the fact that their co-workers had been relocated to the ISP facility prematurely. But they were still optimistic about I-Case and proud of the product that they had produced with their ISP partners. In an attempt to overcome the network deficiencies, the ISP contracted with Oracle's support division. But on hearing that network difficulties persisted, CPD management decided to reconsider its participation in the I-Case project.

Until March 2007, the intention was for both the CPD and ISP to utilize I-Case on the ISP's network. Based upon a series of internal CPD discussions that reached to the highest levels of the organization, a determination was made that CPD could not be dependent upon an external network beyond its control, for its incident reporting operations. CPD has invested considerable resources in the development and maintenance of its network infrastructure, and has a high confidence in its ability to ensure its continuous operation. Based upon these discussions, in the interest of risk minimization, a decision was made to obtain a version of I-Case, based directly on the state I-Case model, and run this version on CPD's own infrastructure. This decision was made based upon input from a variety of high-level sources in municipal government.

As a parallel effort, CPD also made a strategic decision to continue the development of its AIRA (Automated Incident Reporting Application) system, designed to capture incident data on both mobile and desktop computers. Initially, AIRA only captured incident information, with no arrest data capture. With some modification, which was completed during the summer of 2007, AIRA was modified to capture both incident and preliminary arrest information. The decision to continue AIRA development was made to allow for a fall-back position in the event a strategy for running I-Case on CPD's 2,500 mobile computers cannot be determined. AIRA is designed to run in the mobile environment and does not have any additional associated licensing costs. CPD's database staff has expressed some concern that running I-Case directly on mobile computers may require an Oracle database to be installed and maintained on each client, adding significant potential management and cost issues to the deployment.

While the aforementioned are compelling considerations, the decision was handled poorly. At the close of our fieldwork, top project leaders from the two agencies had still not spoken to one another about the matter – more than two months after the decision was announced to the CPD core team members. The decision may benefit both departments, but until there is a healthy dialog that weighs all of the options, both the ISP and the CPD appear to be fundamentally confounded by “information-sharing.”

In spite of this, both agencies maintain that they are committed to the vision of a statewide case reporting system, data-sharing and a statewide data warehouse and the I-CLEAR partnership. And, regardless of whether the Chicago Police Department proceeds with its thought of either abandoning use of I-Case or using I-Case on its own network, the basic goal of information-sharing in Illinois will be met, because of the data feed from the CPD's data warehouse to the new state data warehouse. But it will have missed its opportunity to be, along with the Illinois State Police, an innovator in criminal justice information integration.

## I-CLEAR Data Warehouse

The ISP and Oracle began work on a new data warehouse in autumn 2005. The project launched with some very ambitious deadlines. Like I-Case, development of the I-CLEAR data warehouse is following an iterative approach, which involves sequences of incremental steps rather than a more linear process. Approximately 15 agencies from around the state participated in joint application development sessions. These meetings were held in both Joliet and Springfield to encourage participation from jurisdictions throughout the state. Heading up the statewide data warehouse project is the ISP's assistant bureau chief for field services. Working with the assistant bureau chief is an Oracle consultant with several years' experience on CLEAR-related projects for the CPD. The creator of the CPD's data warehouse and its present manager also have worked with Oracle and the ISP on an as-needed basis.

The pilot deployment of the new data warehouse in late 2006 involved data already stored in the ISP's Criminal History Records Information (CHRI) repository. Officers using the new statewide data warehouse were able to query CHRI information by a vast number of variables – nicknames, tattoos and gang affiliations, for example – which will enhance greatly the crime-solving capabilities of agencies throughout Illinois. A subsequent phase incorporated CPD data already housed in its warehouse, followed by information from a mid-state county and then a Chicago collar county. These counties were chosen to contribute during the development stages because they already collect and share data from the various jurisdictions within their county. Agencies in the mid-state county are using a uniform case report, data from which are being processed and stored on an Oracle platform. As mentioned previously, the I-CLEAR data warehouse has been plagued by network infrastructure challenges which were not fully resolved at the time of this report's writing.

The I-CLEAR data warehouse is Global Justice XML Data Model (GJXDM) compatible. GJXDM is a data reference model designed specifically for criminal justice information exchanges. It enables law enforcement, public safety agencies, prosecutors, public defenders and the judicial branch to effectively share data and information in a timely manner. GJXDM relieves local agencies of the responsibility to independently create exchange standards. Because PIMS is already GJXDM compliant, agencies that want to share their data via that network will be able to do so.

## Final Observations

In the nearly six years we have been evaluating CLEAR, technology development at the CPD has taken many circuitous and sometimes choppy routes. That being said, the CPD has made commendable progress in its quest to become an information-driven organization. However, the department has missed several apparent opportunities to enhance, nurture or fully exploit existing systems. Personnel changes, new divisions of responsibility, budget realities and the exigency of finding new ways of reducing crime have had variable effects on development of the enterprise system.

When this evaluation period began in late spring 2005, development of the CLEAR enterprise system appeared to be stagnating, and the system it spawned, I-CLEAR, was in upheaval. At the CPD, a series of management changes and funding constraints, combined with the agency's need to respond to ever-changing situations and priorities, left the department with key projects that were very much in limbo. Even equipment problems impeded progress: the launch of the long-awaited wireless incident reporting application, AIRA, ran aground when its cellular modem failed in field use. Applications that comprise the Personnel Suite languished when responsibility for development was handed over to CPD employees in a cost-saving move. And despite these many projects stalling, a whole new range of applications, to be known as CLEARpath, was being planned.

When CLEAR was announced in 2001, it was to consist of a number of applications that never came to fruition, and over the period of six years, many undoubtedly were found to be of less import as time ticked by. Likewise, many new applications or systems have been launched that did not originally fall under the CLEAR umbrella. Importantly, as planned, much has been done to advance the CPD's core functions technologically – a goodly number of the department's incident reports are electronically processed; all arrests and incarcerations are logged by computer and many personnel processes are handled by automation. All of the data from each of the above-mentioned transactions are stored and are retrievable for analysis. In fact, the development of the Chicago Police Department's data warehouse and its availability to outside agencies at no charge is among the greatest contributions to law enforcement made by a local jurisdiction. The CPD also is to be lauded for developing a suite of applications that are available to the community. The department garners attention regularly for its recent innovations, many of which are showcased in its Crime Prevention and Information Center. And while there is no question that these systems will benefit the department and the city's residents and business owners, the CPD missed a wonderful opportunity to prove its intention to create a culture of integrity by completing the Personnel Performance System – before the recent public events that underscored the need for it.

Though the CPD sometimes looked as though it was easily distracted by newer, glitzier systems, it has shown areas of maturation. In particular, the agency exhibited an adroitness uncharacteristic of large police departments when it changed its training design to quickly enable a greater number of officers to process arrests electronically. This necessitated procedural changes, facilities realignments and manpower shifts that showed an agility that is usually reserved for responses to crime trends or political pressures. The department also recognized the importance of professional expertise and reversed its decision to take over internal development of a complex and vital suite of applications that stand to enhance its management capabilities as well as the ongoing development of its workforce. As a result, construction resumed on several modules that make up the Personnel Suite. Related to this, an oversight committee has reconvened to carefully guide the creation of a personnel performance system that will draw data from the Personnel Suite. And though it seemed premature a year ago, the CPD forged ahead with a plan to create a suite of applications aimed at strengthening the city's police-community partnership. With traditional funding options limited, administrators sought creative new paths to get the project underway.

The CPD's innovation in criminal justice information-sharing resulted in the development of I-CLEAR and its flagship application, the I-Case reporting system. The Illinois State Police made a bold decision to change the course of a project with over-ambitious deadlines. With the project very much in the public eye, the temptation was undoubtedly great to move on with its initial plan. Because the earliest development tasks were so time-consuming and protracted, the agency took the opportunity to reassess whether building on to an existing case reporting application and data warehouse would create the optimal system for uniform crime reporting, data-sharing and data analysis. The decision to "piggy-back" onto the CPD's pioneering CLEAR systems was well-advised when I-CLEAR was conceived and announced; however, advancements in technology dictated that an entirely new data warehouse and case reporting system be built. The decision to build anew resulted in further delays and a total relocation of the project. It also changed the dynamic of the partnership and sent shock waves through the CPD core team at a time when its direct management was in transition. Though it may have been easier to simply stay the course, the impending first release of a modern, customized I-Case application is an endorsement of the decision-making process and the project's management. But after more than three years of arduous work by the core development team from both agencies, just when it seemed that this landmark effort stood to benefit all of law enforcement in Illinois, the CPD upended the partnership without saying a single word. And, equally inexplicably, the ISP did not reach out to its partner to try to find out what could be done to right the sinking ship.

There are two fundamental areas that we believe could use some attention to ensure continued progress. Neither of these recommendations is new but, in our opinion, their importance remains paramount. First, an impartial governance body would not only enhance the conflict resolution process on this project, but it would also represent and accommodate the needs and wishes of potential future users of the system. It would benefit the project and the reputations of each agency to move forward in establishing an oversight structure. The second recommendation is in the area of succession planning. While only a soothsayer could have predicted the breadth of the personnel changes that affected IT endeavors at the CPD, we have been amazed throughout our 14 years of evaluating efforts at the agency at the discontinuity caused by promotions, lateral moves and retirements. Precious time is wasted when new appointees must learn every aspect of their jobs independently; the time lost was acutely obvious during the early part of this evaluation period and again after the retirement of a CPD deputy superintendent. Also, new appointees understandably prefer to introduce their own innovations rather than focus on their predecessors' unfinished "pet projects," and the highest command echelon has rarely mandated any of these initiatives a priority. Doing so would have lent much needed continuity and yielded a greater return on the department's substantial investments.

As a final note, it is quite disappointing to the evaluators that after six years of evaluation, there has been no opportunity to study the impact of CLEAR or I-CLEAR. In each of our proposals we clearly stated our intention to do an impact evaluation as well as a process evaluation. That there is no way to evaluate the technology's impact is perhaps our most telling finding.