

588

**TESTIMONY BEFORE
HOUSE JUDICIARY COMMITTEE
10-31-90**

PRESENTED BY

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On behalf of the Police Commissioner of Philadelphia, Willie L. Williams, I would ask that the House Judiciary Committee and all members of the House of Representatives support the CHRIA amendments and ensure that this critical piece of law enforcement legislation is passed and made into law during this legislative session. Like the law enforcement agencies who have already testified before you, the Philadelphia Police Department is in line with them in support of these amendments and in its commitment to having these necessary changes in the law made.

The amendments to section 9106 of the CHRIA are responsible changes which more than adequately protect the rights of the citizens of Pennsylvania while giving the law enforcement community the technological hardware to face the criminal challenges of today. Section 9106 is out of step with the advancement of modern day computer equipment and out of line with laws throughout the rest of the country. Even with these amendments, Pennsylvania will remain the strictest state in the nation regarding computerization of Intelligence and Investigative information.

Law enforcement managers need computerization of these types of information to establish effective and efficient record management systems. The net result of the changes to the CHRIA from a management perspective will be improved services to the field officers and investigators as well as to the public from enhanced and sophisticated computer record systems. In Philadelphia, reallocation of manpower and the discarding of archaic and cumbersome manual file systems would be possible with these amendments.

Law enforcement field officers and investigators also will be able to have information and facts analyzed and evaluated in a more productive fashion. Computer aided analyses should reduce investigative time, thereby increasing the efficiency and quality of investigations while field officers will benefit from the information that can be disseminated regarding crime patterns and facts about those individuals committing crime.

In short, Police Departments and similar agencies will be able to use modern day technology to combat crime involving drugs and violent crime in a more appropriate, useful and beneficial manner.

Lt. Carre and myself have been urging legislators to support these amendments for several months. During our discussions with legislators and their staff, we have heard that there is opposition on the grounds of "philosophical differences" with the basic focus of these amendments and the improvements that law enforcement would acquire by them. While this position may have merit, as with any bill that provides governmental entities certain abilities should be examined for the potential for abuse, the bottom line focus and reality, however, should not be skewed or lost. With respect to the CHRIA amendments, this bottom line is:

1. Law enforcement can streamline basic record systems and this should create budgetary savings, particularly for large departments such as Philadelphia.
2. Criminal investigations and the ability to analyze criminal data will be enhanced significantly.

3. The safeguards and regulations, which are part of these amendments, control how and when computerization of data can be used and disseminated and acts as a sufficient check and balance to prevent governmental abuse.

(Please note that law enforcement currently possesses the ability to collect and store intelligence information and most departments have responsible policies in this area where there is no statutory regulation. Thus, to receive the benefit of a change in technology, law enforcement will actually be subject to de facto regulation of intelligence and investigative information.

Therefore, these important factors must be considered by the House when the merits of "the philosophical opposition" to these amendments are made, and when they are made, I would ask that the following be considered:

- A philosophical point of view does not solve serial homicides or crimes such as multiple rape and robbery cases which Philadelphia encountered in the Center City Stalker case. Computers would.
- A philosophical position does not breakdown a pornographic ring of pedophiles that use computerized menu boards which communicate through coded language to spread their unique brand of filth. Computers would.
- A philosophical stance will not establish cases against drug and other organized crime networks by assembling, analyzing and evaluating intelligence and investigative data to form the basis for successful criminal prosecution. Computers would.

In closing, these realities call for the passage of these amendments in order to facilitate the job of law enforcement by giving it the equipment to work together and to wage a competitive war against all crime as we approach the twenty-first century.

Thank you for your consideration and any support that you can give for the CHRIA amendment.

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EXHIBIT A

**COST SAVINGS THROUGH AUTOMATED SYSTEMS
IN THE PHILADELPHIA POLICE DEPARTMENT**

COST SAVINGS THROUGH AUTOMATED INFORMATION SYSTEMS IN THE PHILADELPHIA POLICE DEPARTMENT

Background

In March, 1987, the Philadelphia Police Study Task Force noted that "much of the success in managing a police department and solving crime is dependent on how well the organization manages the flow of information." They then went on to recommend that "A strategic plan for Department management information systems must be created and implemented on a prioritized basis."

Following this recommendation, Mayor W. Wilson Goode provided the Department with \$70,000 to develop a formalized plan.

How the Study Was Conducted

To meet this objective, the Police Commissioner established a committee of experts to oversee the development of the plan. This committee consisted of the Executive Vice Presidents for Information Systems of the SmithKline Beckman and Pennwalt Corporations, the Managing Partner of the Philadelphia office of the Arthur Young Company, the Chief of Staff of the Office of the Managing Director, a director of the Philadelphia Computing Center and several Police Department officials, including the Deputy Police Commissioner for Administration. The consulting firm of Arthur Andersen Company was chosen by the committee to work with members of the Department to devise the plan.

The committee met frequently and at length to review the work. Non-police members of the committee, especially the corporate vice-presidents, spent considerable time conducting on-site interviews with Police Department personnel. The corporations also generously contributed the use of facilities, technical assistance, training and some funding toward the project.

Conceptually, the primary question asked in researching the plan was, "What information systems are needed to achieve the Department's mission, improve planning and control, increase cost-effectiveness and improve service to the public?"

The Report's Conclusions

Based on this question, several systems were found to be needed. Perhaps most critical to the Department were systems for recording, tracking, and analyzing the activity of police officers responding to over 1.5 million calls for assistance annually and supporting systems to manage investigations, prepare cases for presentation in court, and also scheduling officers for appearance in court.

Incident System

The committee found that there are 154 police officers and 13 civilian department employees whose only function is to process the paper documents generated by the 1.5 million calls. An automated system, known as an Incident System, properly designed and implemented could free these personnel from this purely clerical role. The annual cost, as measured solely in terms of the salary and fringe benefits of these employees is \$8.5 million.

In addition to these direct labor savings, additional savings can be achieved through better planning, supervision and deployment of officers and investigators. Further savings could also be achieved by reducing the amount of time a patrol officer takes to complete a particular task.

Investigation, Case Management and Court Notice Systems

The next largest potential-savings found by the planning team was in the area of notifying and preparing officers for appearance in court. A large degree of inefficiency was found in gathering the many documents required for both the defense and the prosecution, and in the scheduling and notification of officers for court appearance.

The team noted that 34 police officers and between 12 to 35 civilian employee positions are devoted to gathering documents and notifying other officers to appear in court and could be replaced with appropriate automated systems. The labor costs associated with these processes are between \$2.1 million and \$2.8 million annually.

In addition, it was estimated that overtime payments to police officers called unnecessarily to court could be reduced by a factor of between 5% and 15%. For FY 1990, court overtime costs were \$10,082,553. The estimated savings could then be between \$.5 million and \$1.5 million.

The total savings to the Police Department from automating these manual clerical positions may then be between \$11.1 million and \$12.8 million, annually.

Other Agencies

In addition to these direct savings to the Police Department, other agencies would be in a position to achieve collateral savings. Although no attempt was made by the study to document these savings, the Philadelphia County Court of Common Pleas might achieve noticeable savings by disposing of cases more efficiently by reducing the number of continuances caused by inefficient paper-work systems.

Similar savings may also be realized by the prisons, District Attorney's and Sheriff's Offices.

Cost and the Impact of CHRIA

The estimated cost to purchase all systems recommended by Arthur Andersen is approximately \$11 million. In addition, there would be recurring costs of approximately \$1 million. Mayor Goode has allocated \$3.5 million to the Department towards the development of an Incident Reporting System.

As an industry standard, computer systems are generally planned to depreciate over a five-year period. Over a five-year period, savings would be between \$39.5 million and \$48 million.

It is important to note that the final cost of developing the systems can vary. Impediments such as CHRIA can increase development cost, while at the same time, reduce the opportunity to achieve maximum savings.

One reason for this is the availability of software. There are several less-expensive "off-the-shelf" law-enforcement computer systems currently on the market. These systems were developed and intended to be sold throughout the United States and have several features which may be prohibited by the unique constraints of Pennsylvania law.

In a report prepared by Arthur Andersen consultants on April 27, 1989, they noted that:

"Pennsylvania law may not permit the storage of all investigative (i.e. text) information on a computer-based system. If this law is strictly interpreted and the Incident Reporting System design cannot store this information, many of the expected benefits of the system may not be achievable."

APPENDIX

COST SAVINGS THROUGH AUTOMATED INFORMATION SYSTEMS
IN THE PHILADELPHIA POLICE DEPARTMENT

Police Officer

Salary per Current Contract	\$34,298.00
Fringe Benefits	
Pension Contribution	\$9,767.62
Employee Disability	1,920.00
Legal Services Plan	240.00
Life Insurance	96.84
Health Insurance	6,257.28
Total Fringe Benefits	\$18,281.74
Total Salary & Fringe Benefits per Police Officer	\$52,579.74
Salary and Fringe Benefit Cost of 188 Police Officers	<u>\$9,884,991.12</u>

Civilian Employee (Clerk Typist II)

Salary per Current Contract	\$20,135.00
Fringe Benefits	
Pension Contribution	\$3,221.60
Employee Disability	297.36
Legal Services Plan	144.00
Life Insurance	103.92
Health Insurance	4,020.00
Total Fringe Benefits	\$9,327.21
Total Salary & Fringe Benefits per Civilian Employee	\$29,462.21
Salary and Fringe Benefit Cost	
Between	
25 Civilian Employees	<u>\$736,555.25</u>
and	
48 Civilian Employees	<u>\$1,414,186.08</u>

Total Employee Cost

Salary & Fringe Benefits 188 Police Officers	\$9,884,991.12
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AND

Between

25 Civilian Employees	\$736,555.25
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and

48 Civilian Employees	\$1,414,186.08
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TOTAL LABOR SAVINGS

Between

188 Police & 25 Civilians	<u>\$10,621,546.37</u>
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and

188 Police & 48 Civilians	<u>\$11,299,177.20</u>
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TOTAL COURT OVERTIME SAVINGS

<i>Between</i> 5% of \$10 million	<u>\$500,000</u>
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<i>and</i> 15% of \$10 million	<u>\$1,500,000</u>
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TOTAL SAVINGS

<i>Between</i>	\$10,621,546.37	Reduced Labor
	500,000.00	Reduced Overtime
	<u>\$11,121,546.37</u>	<u>TOTAL</u>

and

	\$11,299,177.20	Reduced Labor
	1,500,000.00	Reduced Overtime
	<u>\$12,799,177.20</u>	<u>TOTAL</u>

3 pgs

EXHIBIT B

**QUESTIONS AND ANSWERS ON WHY
INTELLIGENCE INFORMATION SHOULD BE COMPUTERIZED**

CHRIA - COMPUTERIZATION OF INTELLIGENCE INFORMATION

1. Why should intelligence information be computerized?

The CHRIA amendments would benefit law enforcement intelligence processes in three (3) different areas - analysis, information management and security and privacy.

2. Is intelligence information really considered important in law enforcement?

Intelligence information is essential to law enforcement. It provides data necessary to link criminal organizations and place members of such organizations "at the scene of a crime". The importance of intelligence information has been highlighted at the national level in the drug area by two (2) recent reports. Synopsis of both are attached for your review and consideration. These reports are:

1. Toward a Drug Free America: A Nationwide Blueprint For State and Local Drug Control Strategies, National Association of Attorneys General, National District Attorneys Association
December, 1988 pps. 22 - 24

2. National Drug Control Strategy

William Bennett, Office of National Drug Control Policy
September, 1989 pps. 88 - 90

3. How would computerization aid analysis of intelligence information?

Computerization improves the intelligence field's ability to ascertain reliable information and chart organizations. For example, a computer program can immensely aid reliability factors which are necessary to establish a successful intelligence file by analyzing the source and content of the information and ensuring that only timely, accurate information is acceptable. Thus, it would help compliance with this proposed law by refusing to accept data not up to prescribed standards.

The charting of criminal organization groups by computer would produce manpower savings as reliable intelligence information can be sorted out from raw data to make accurate pictures of an enterprise.

4. What about information management of intelligence information by computers?

As with investigative information, computerization of intelligence files would increase productivity and reduce reliance on manpower to staff manual file systems. It would reduce human error in the filing and processing of reports as well as improve storage capabilities. Computerized entry of these reports would be controlled thereby helping to maintain what goes into an intelligence file.

Computerization also would create added audit control files to check, review and evaluate who has requested or been given information from a particular file. It also could aid law enforcement by quickly identifying agencies concurrently investigating the same group or individual.

Finally, electronic purge controls would ensure that this mechanism is conducted and handled in a timely manner.

5. How is adequate security and privacy maintained by computerized intelligence files?

Now, manual files are only as secure as the facility that maintains them. Computer files with access codes can help prevent unauthorized entry and can be easily changed to maintain an upgraded security system against hackers. Backup computer disks reduce damage which could occur in manual systems through water or fire.

Law enforcement recognizes the privacy rights of individuals. The CHRIA amendments form a system of checks and balances that will protect citizens rights on one hand while allowing law enforcement to use the modern technological tools to combat crime on the other. This balancing strikes an acceptable circumstance whereby the needs of government are compatible with and protective of individual rights.

6 pgs

TOWARD A DRUG-FREE AMERICA:

A Nationwide Blueprint for State and Local Drug Control Strategies

**THE EXECUTIVE WORKING GROUP FOR FEDERAL-STATE-LOCAL
PROSECUTORIAL RELATIONS**

NATIONAL ASSOCIATION OF ATTORNEYS GENERAL

NATIONAL DISTRICT ATTORNEYS ASSOCIATION

in association with

- **International Association of Chiefs of Police**
- **International Narcotic Enforcement Officers Association**
- **National Criminal Justice Association**
- **National Sheriffs Association**

December 1988

distribution network. The failure or ineffectiveness of law enforcement at any level impacts and restricts the effectiveness of investigations and prosecutions at all levels. For this reason, each state must

develop a truly *integrated* drug enforcement strategy—one in which all of the constituent strategies work in harmony.

State and Local Contributions to the National Drug Intelligence Strategy

No comprehensive drug enforcement program can succeed without access to accurate and timely information. A comprehensive intelligence and drug information management strategy supports all other drug enforcement strategies. Information is needed not only to support tactical operations and investigations, but also to assist law enforcement officials in developing plans of action and in allocating limited resources.

The nation's law enforcement community must take advantage of the wealth of information already available to state and local law enforcement departments. In 1986, state and local law enforcement officers were responsible for more than 600,000 arrests, each of which was a potential source of information. Furthermore, local police officers routinely come into direct contact with members of the community and have a tremendous opportunity to develop confidential sources of information—not only from criminal informants, but from concerned private citizens as well.

First Objective: Expand the Sources of Drug Information

- *Targeted patrols.* Each state should take full advantage of the information gathered by routine and targeted patrol officers. This is not limited to the patrol of highways, but should also encompass routine patrols of neighborhoods and high drug crime areas.

. . . Intelligence and historical information must be used to support investigations and prosecutions . . .

- *Patrol drug response teams.* Each state should develop patrol drug response teams whereby experienced narcotics detectives can be summoned to begin an immediate, on-the-scene investigation where a patrol officer discovers a cache of drugs.
- *Data collection protocols and training programs.* Each state should develop standard reporting procedures and training programs to make certain that all police officers know how to collect information which may be useful in supporting drug investigations.
- *Forensic laboratory reports.* Each state should develop standard forensic laboratory reports and a procedure to collect and analyze this information to help assess the nature and scope of the drug problem.
- *Prescription drug tracking system.* Each state should take advantage of information provided by the Drug Enforcement Administration concerning prescription drugs. Each state should monitor the dispensing of prescription drugs.
- *Precursor tracking system.* Each state should track the purchase and transport of precursor chemicals used in the manufacture of controlled dangerous substances.
- *Cooperative informants.* Each state should build a core of reliable informants and should encourage, in appropriate cases, participants in illegal trafficking activities to cooperate with law enforcement. Each state should establish an information sharing system to enable prosecutors to determine the need for and value of information which might be supplied by a given defendant.

• *Immunity program.* Each state should allow a prosecutor to obtain "use and fruits" immunity to compel a defendant to provide information about his or her superiors in the drug trafficking network. [See also Prosecution Strategy.]

• *Citizen "tip" lines and watch groups.* Each state should develop a program to encourage private citizens to provide information about suspected drug trafficking. [See also Community Involvement and Interaction Strategy.]

Second Objective: Improve the Flow, Management and Dissemination of Drug Information

- *Inventory of existing systems.* Each state should inventory all existing information management and sharing systems.
- *Standardized and upgraded data collection.* Each state should standardize procedures for collecting and collating historical information from arrest and incident reports and judgments of conviction. Each state should also consider updating the Uniform Crime Reporting system and establishing an incident-based reporting system.
- *Information management officers.* Every law enforcement and prosecuting agency should have an information management officer who knows how to gain access to existing information systems.
- *Information management units.* Each state should create information management units in appropriate law enforcement and prosecuting agencies to provide tactical, operational and statistical information to all other units within the agency.

The nation's law enforcement community must keep pace with the increasingly sophisticated practices and technologies used by organized criminal enterprises. A computer-aided information system can enable law enforcement professionals to assess the scope and nature of the drug problem, develop

. . . Law enforcement must keep pace with organized criminal enterprises . . .

local and statewide strategies to target the most dangerous offenders, and make the best use of investigative and prosecutorial resources. A computer system not only allows investigators to pursue leads more quickly, but can also provide ready access to sources of information which would otherwise be unavailable. A computer system, for example, can detect linkages and common modes of operation which might otherwise go unnoticed.

The use of sophisticated technology is not new to the nation's law enforcement community. States must recognize, however, that the most sophisticated and expensive computer systems are not always needed. Given budgetary restraints, states should be cautious when developing new computer systems. Any electronic information storage and retrieval system will be meaningless unless a state also enhances the core of trained professionals at all levels of government who actively develop information sources and follow up on investigative leads.

The key to a cost-effective information sharing system is communication among agencies at all levels of government. No agency has a vested "proprietary" right in any category of information. Information must travel in all directions within the law enforcement community. Federal and state-level agencies must provide information to local law enforcement agencies, just as local agencies must provide information to their federal and state counterparts.

- *Enhanced computerization and networking.* Each state should develop a computerized capacity to store, collate and retrieve intelligence and historical information concerning drug offenders. Before initiating new computer projects, each state should take advantage of existing computerized information exchange and pointer systems, such as the Regional Information Sharing System (RISS) and Operation Pipeline. Each state should actively participate in multi-state, regional and national information networking projects.

Third Objective: Enhance Analytical Capabilities

Information on narcotics trafficking abounds, but few state and local resources are devoted to collating and analyzing this information. Intelligence and historical information must not be collected for its own sake, but must be used to support investigations and prosecutions. Each state must develop an analytical capacity to identify common linkages and patterns of criminal activity, and must also devote investigative resources to confirm the reliability of potentially useful information and to follow up on investigative leads.

- *Enhanced analytical capacity.* Each state's Intelligence and Information strategy should provide for the development or enhancement of the capacity to

analyze data and feed it to the appropriate law enforcement units. Each strategy should provide a mechanism by which information can be corroborated through alternative investigative means and each state should develop a system to pursue investigative leads based on computer-assisted analysis.

- *Trend analysis.* Each state, taking advantage of existing multi-state or regional information sharing projects, should create or enhance the capacity to analyze drug use and distribution trends and offender and vehicle characteristics. Each state should use computer-assisted analyses to pinpoint specific areas, roadways or types of locations which require enhanced patrol and interdiction activities.

State and Local Contributions to the National Drug Interdiction Strategy

Interdiction encompasses any law enforcement activity which restricts or interrupts the stream of illicit drug commerce. Such programs need not be limited to eradicating the cultivation, production or processing of illicit drugs at their source; nor should interdiction be restricted to law enforcement operations at borders or major points of entry. In fact, a large volume of controlled dangerous substances are produced domestically, and in some states, marijuana has become a major cash crop. Interdiction must also include highway and neighborhood patrols and surveillance activities conducted by uniformed and plainclothes officers in motor vehicles, as well as on foot.

Enhanced and targeted patrol is the logical state and local counterpart to federal interdiction programs. This does not mean that state and local agencies should not also assist federal efforts to monitor activities at major points of entry. It does suggest, however, that state and local law enforcement agencies must assume the role of *lead* agency for routine highway and neighborhood patrols. Such patrols can serve a number of public safety functions. Highway interdiction often results in the seizure of drugs in transport, removing these drugs

from the stream of illicit commerce. Patrol activities can also provide invaluable intelligence information concerning new drug use trends and courier characteristics. Enhanced patrols will also provide an expanded core of informants and valuable sources of confidential information needed to apprehend drug kingpins.

Most importantly, aggressive patrol programs directly promote the general deterrence of drug offenders by maintaining a highly visible police "presence." Such patrols can be especially effective in deterring and displacing open and notorious drug transactions and use, and this, in turn, directly promotes the goal of convincing citizens, and especially young people, that drug offenses will not be tolerated. For these reasons, local interdiction efforts may have a greater impact than efforts designed exclusively to eradicate drug cultivation and drug production or to stop the flow of drugs at national borders. The latter type of interdiction tactics are not as "visible" to the public, and unless such supply-oriented programs succeed in disrupting a significant portion of the flow of drugs, their impact will not be felt by the average citizen, or even the average drug user.



NATIONAL DRUG CONTROL STRATEGY

September 1989

On September 5, 1989, President Bush sent to Congress and released to the nation the National Drug Control Strategy required by the Anti-Drug Abuse Act of 1988. The 154-page report was prepared by William J. Bennett, Director of the Office of National Drug Control Policy created by the Act.

After an Introduction by Director Bennett, the report sets forth national priorities in seven chapters:

- * The Criminal Justice System
- * Drug Treatment
- * Education, Community Action, and the Workplace
- * International Initiatives
- * Interdiction Efforts
- * A Research Agenda
- * An Intelligence Agenda

The report also includes several appendices:

- * Quantified Two- and Ten-Year Objectives
- * Federal Implementation and Resource Requirements
- * Recommended State Legislation
- * High Intensity Drug Trafficking Areas
- * Information Management

Director Bennett's strategy treats drug abuse as a truly national problem, with responsibility for addressing it falling on both the federal and state governments and on every citizen. However, his report also recognizes the need for increased federal financial support to state and local governments. It calls for more than a doubling of federal assistance to state and local criminal justice programs, from \$150 million allocated for 1989 to an authorization of \$350 million for 1990. The overall strategy calls for federal budget authority in 1990 of \$7.9 billion, an increase of \$2.2 billion or 39 percent over the current fiscal year.

The National Drug Control Strategy has received intensive examination in the press and NCTAP News will not undertake to duplicate that coverage. Instead we have excerpted passages from the strategy that we believe are of particularly salient inter-

est to our readership. The excerpts that follow, while direct quotations from the strategy, are not necessarily in the same order in which they appear in the report.

Thinking About Drugs and Public Policy

[pp. 5-9]

Last fall, an important and valuable piece of omnibus Federal drug legislation was enacted, "The Anti-Drug Abuse Act of 1988." Among its several hundred provisions was a declaration that it would be the policy of the United States Government to "create a Drug-Free America by 1995." That is an admirable goal. It is already a reality for the vast majority of Americans who have never taken an illegal drug. And government has a solemn obligation to keep those Americans—and their children after them—safe and secure from the poison of drug trafficking and drug use.

But the government also has an obligation to tell the truth and act accordingly. There is no quick fix or magic bullet for individual dissipation, and policymakers should not pretend that we are on the verge of discovering one for drugs. The continued search for a single "answer" to our troubles with drugs—in law enforcement, in education and treatment, in border interdiction, or somewhere else—is a bad idea. We have bounced back and forth in emphasis this way for too long. It has not worked well. And it will hold us back in the near- and long-term future, by diverting our attention from new and serious work that can and must be done *right now*.

The United States has a broad array of tools at its disposal, in government and out, each of which—in proper combination with the others—can and does have a significant effect on the shape and size of our drug problem. We must use them all. We must have what we have never had before: a comprehensive, fully integrated national drug control strategy. It must proceed from a proper understanding of all that we do and do not know about drugs. It must take calm and intelligent measure of the strengths and limitations of specific available drug control initiatives. And it must then begin to intensify and calibrate them so that the number of

and international participation in drug-related technology development.

Collection, Analysis, and Dissemination of Intelligence

[pp. 88-90]

The law enforcement community generally does a successful job of evaluating raw information with implications for current investigations or interdiction actions. "Actionable" reporting frequently results in successful arrests or seizures. But greater effort is required in the coordination of foreign and domestic collection and the production of intelligence targeted against trafficking organizations and their allied enterprises. Only if we have a reasonably complete and accurate picture of an entire drug enterprise, and the ability to disseminate this information, can we be confident that we are striking at the heart of drug trafficking rather than at its periphery.

The application of high quality computer technology is essential to this task. Technology makes it possible to store and sort vast volumes of data, and to assist the analyst in understanding his target, all in a very rapid manner. The computer is a powerful tool that must be brought fully to bear in the fight against drugs. Comprehensive drug intelligence analysis cannot be done without modern data processing capabilities—upgraded facilities, hardware, and personnel. * * *

The Office of National Drug Control Policy will chair a working group of Federal supply reduction agencies to plan a center that, by linking information resources with analytic skills, will provide necessary strategic analytic intelligence to various Federal (and appropriate State and local) agencies.

The National Drug Control Strategy to be submitted on February 1, 1990, will contain a specific proposal and recommendation for funding of such a center.

Recommended State Legislation

[pp. 125-127]

States and localities are already doing many good things in the fight against drugs. They provide the lion's share of resources and many of the best ideas. New Mexico, for example, recently enacted a provision which enables law enforcement officers to issue citations requiring drug offenders to pay fines to the State revenue office. Such provisions, used properly, can provide an additional tool for law enforcement in the fight against drugs.

The Anti-Drug Abuse Act of 1988 contained numerous Federal provisions that might profitably be adapted to State

and local purposes. Several such provisions—and other recommended State legislation—are briefly discussed below.

Minimum mandatory sentences for serious drug crime. Criminal sentences should distinguish between serious and non-serious offenses: limited prison space should be reserved for the most serious offenders. Serious crimes deserving stiff, minimum sentences include: drug trafficking, possession of large amounts of drugs, selling drugs to children, and using children to sell drugs.

Alternative sentencing statutes. For first-time, nonviolent offenders, States should expand their use of efficient and effective alternatives to prison, including: boot camps, environmental work crews, community service, house arrest, and other such penalties.

Asset forfeiture laws. Real estate and other property derived from illegal drug transactions, or used to facilitate such transactions, should be subject to confiscation by law enforcement officials. Asset forfeiture laws should sanction both casual users and drug traffickers. They should be used to direct forfeiture proceeds to law enforcement purposes. Laws that permit forfeiture proceeds to revert to general or non-law-enforcement funding accounts are counterproductive. Asset forfeiture laws should also facilitate "tracing"; they should include a legal presumption that assets are derived from a drug enterprise if authorities can show that there is no other likely source of income for their purchase. All asset forfeiture laws should be written to permit the substitution of non-drug related assets for drug-related assets in cases where drug-related assets are beyond the reach of our judicial process.

Schoolyard laws. Modeled after the Federal "schoolyard law," these laws afford special protection for children by creating "drug-free" zones around locations frequented by minors. They establish stiff minimum and mandatory sentences for anyone caught distributing drugs (or possessing drugs with an intent to distribute) within 1000 feet of a school, playground, pool, youth center, or video arcade. Schoolyard laws should also apply to minors selling drugs inside these zones so as to prevent dealers from utilizing underage drug "runners" to circumvent the law.

User accountability laws. States should enact a range of penalties for persons caught using or possessing even small amounts of drugs, among them:

- * Suspension of drivers' licenses for 1-5 years.
- * Suspension of State benefits (such as student loans, grants, and contracts) for 1-5 years. Exceptions could be made for certain welfare-related benefits, and provision could be made for restoration of all benefits upon completion of a drug rehabilitation program.
- * Criminalization of offers, attempts, and solicitations to sell or buy drugs. (Such statutes permit law enforce-

Philadelphia Police Department



Testimony Before the House Judiciary Committee

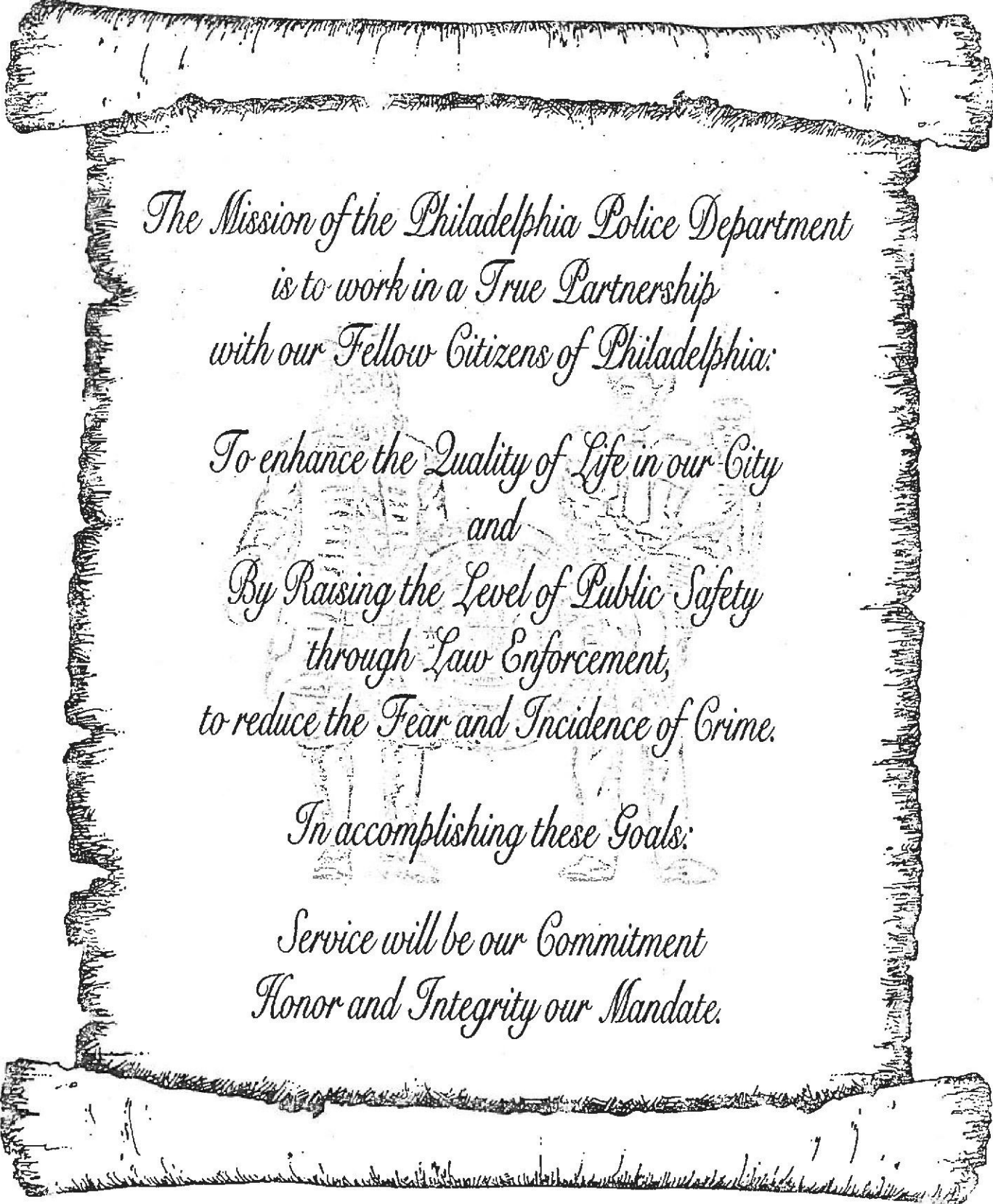
October 31, 1990

Presented by:

*Augustine E. Carre
Lieutenant*

and

*David J. Domzalski
Assistant City Solicitor
Police Counsel*



*The Mission of the Philadelphia Police Department
is to work in a True Partnership
with our Fellow Citizens of Philadelphia:*

*To enhance the Quality of Life in our City
and
By Raising the Level of Public Safety
through Law Enforcement,
to reduce the Fear and Incidence of Crime.*

In accomplishing these Goals:

*Service will be our Commitment
Honor and Integrity our Mandate.*

PHILADELPHIA POLICE DEPARTMENT STATEMENT OF ETHICAL PRINCIPLES



In one of its definitions, the word "ethics" encompasses the standard of conduct governing all members of a profession. Police exist to preserve law and order. The Greek philosopher Plato wrote that good government is wise, brave, temperate and just. This statement of ethics for police officers establishes broad standards to help police accomplish their mission in a manner which comports with good and wise government.

Citizens who earn their police badges voluntarily bear the public trust. They are faithfully charged to protect the safety and the rights of fellow members of society.

To provide these special protections, police officers carry special powers. They have the authority to investigate other people, to abridge their normal liberties, and to use force when necessary.

Two basic constraints limit use of this authority. First, it is wrong for police to use their office for personal profit or gain, wrong for them to accept any favor which places their own advantage above the welfare of the public. Second, it is wrong for officers to violate the Constitution or laws in performance of their work.

Officers must also bring to their work personal qualities which can spring only from within their personal fabric. They must appreciate and care for the needs of the people they serve. They must exercise common sense in a manner that conveys common decency. They should never render themselves needlessly to danger; they should maintain their physical fitness and their skillfulness in using the tools of their work.

Fulfilling this public trust is demanding work. It brings disappointment, weariness and stress. But these are the facts of life in this profession each officer has chosen. But it also provides officers the opportunity to contribute in an immeasurable way to the common good.

The Philadelphia Police Department is obligated to provide the best training and support for its officers throughout their careers. The Department will strive to the utmost to provide clear policies and adequate resources for every officer to accomplish the work we have accepted together.

INTEGRITY

The public demands that the integrity of its law enforcement officers be above reproach. The dishonesty of just one officer may impair public confidence and cast suspicion upon the Department as a whole. Succumbing to even minor temptations can generate a malignancy which will ultimately destroy an individual's effectiveness and which may well contribute to the corruption of fellow officers. Officers must scrupulously avoid any conduct which might compromise their integrity or the integrity of those with whom they work. No officer should seek or accept any special consideration or privilege, nor anything of value for which others are expected to pay, solely because they are police officers, or for performing their duty in some manner inconsistent with the highest regard for integrity.

RESPECT FOR RIGHTS

A broad range of rights and privileges are afforded each individual by law and nature. Liberty is maintained for the most part by our constant attention toward preservation of a consistent exercise of these rights and privileges and through mutual respect for every person's exercise of his or her rights and privileges. However, the police officer must contend with a persistent flow of personal conflicts, both legal and illegal. To resolve these differences, the police enforce a body of laws within the Constitution's assurance that all of us -- regardless of economic status, sex, race or creed -- receive equal and fair treatment. In so doing, officers often face ambiguous situations, particularly in trying to protect the rights of a victim and an accused.

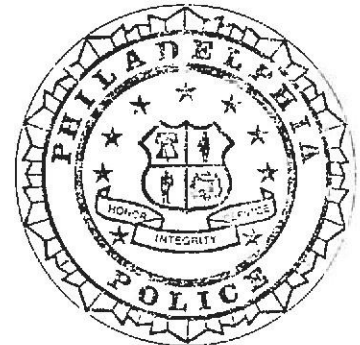
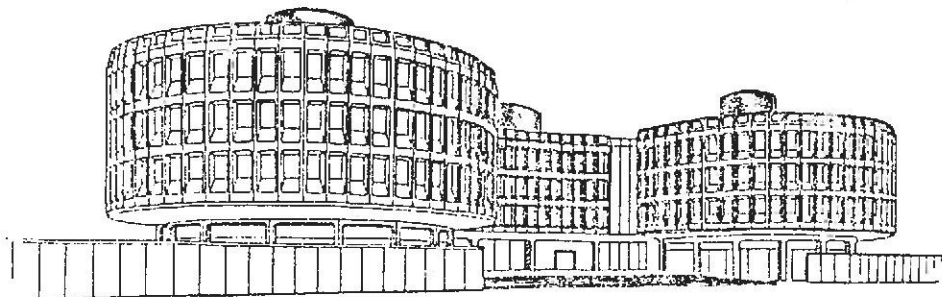
To carry out this mission, police officers have the power to search and arrest, to use force, and to investigate and incarcerate. As police, we must use these tools properly with no abuse of our authority. Decency, security and liberty all demand that government officials observe strict limits to their awesome powers. A government of laws cannot exist when its servants fail to observe the law's own boundaries. Any government official who disobeys the rigorous demands of law in turn disturbs the public order which all of us are sworn to uphold.

USE OF FORCE

In a complex urban society, officers daily confront situations where control must be exercised to effect arrests and to protect public safety. Control is achieved through advice, warning and persuasion, or by the use of physical force. Force may not be used unless other reasonable alternatives have been exhausted or would be clearly ineffective under the particular circumstances. When the use of physical force is necessary, using baton, blackjack, firearms or other means, it must be exercised only when, and in the manner, authorized in the Department's policies. Decisions as to when and how to use force must be consistently made and exercised throughout every neighborhood of this City.

COURTESY

Effective law enforcement depends on a working partnership and a community of interest between the Department, its officers and the public they serve. The practice of courtesy in all public contacts encourages understanding and appreciation. Discourtesy breeds contempt and resistance. Most of the public are law-abiding citizens most of the time; they rightfully expect fair and courteous treatment by Department employees. While the urgency of a situation might preclude the ordinary social amenities, discourtesy under any circumstances is indefensible. The practice of courtesy by an officer is entirely consistent with the firmness and impartiality that characterizes a professional police officer.



In 1979 this Legislature acted with due respect for the rights of the citizens of Pennsylvania in passing Section 9106 of the Crimes Code. Confronting the danger of potential abuse from unwarranted government intrusion by computer, this law attempted to place strict limits on the power of criminal justice agencies to automate information not related to a criminal incident or an allegation of criminal wrongdoing.

By passing this law in 1979, Pennsylvania took the leadership role in light of this powerful technology to balance the rights of individuals with the need for effective law enforcement.

In agreement with this goal, the Statement of Ethical Principles of the Philadelphia Police Department reminds us that "Decency, security and liberty all demand that government officials observe strict limits to their awesome powers."¹

Because of our concern to achieve this proper balance between our duty to provide the public with the most effective law enforcement possible in return for their tax money, and our duty to protect the rights of all individuals, whether crime victim or suspect, we actively support the proposed changes to Section 9106.²

Because of many unforeseen changes in technology since 1979, the current law is now obsolete. Individual liberty is no longer adequately protected and the ability of police departments and other criminal justice agencies to economically provide services and enforce the laws of this Commonwealth is hampered.

To help illustrate this point, the first IBM personal computer, which has spawned much of the change in technology, was not released until August, 1981.³ Practical word-processing systems, which are now common-place in any office, were still at least a year or two into the future in 1979. This Legislature could not anticipate the possible impact of wordprocessing to speed the preparation of investigative reports for arraignment, discovery and trial which could benefit the courts, defense and prosecution alike. Thus the current law only permits the automation of "names, words, phrases, or other similar index keys to serve as indices to investigative reports."

Ironically, one of the most important changes in computer technology since 1979 has been the development of relational data-base management systems (RDBMS) which provide immense power through the sophisticated use of the indexed information permissible under the current law. It is now possible to index virtually any kind of information and cross-index it, or link it, to any other information. These systems were first introduced by IBM for their large main-frame computers in 1981 and are now common-place for the personal-computer user.⁴

Relational data-bases, coupled with so-called 4th Generation Languages, developed in the mid 1980's, enable even the casual computer user to compile and search through an "infinite variety of seemingly unrelated facts."⁵

Finally, since the current law was enacted, there has been vast progress in telecommunications capabilities that enable persons to remotely access information stored on computers.

It is important to realize that, because of the technological limitations in 1979, the use of computers, and the data they contained, were managed and controlled in a centralized manner by data-processing professionals. Thus, the current law does not demand standards for data entry, tracking of disseminated information, removal of useless information, security, training and supervision. In many ways that are essential to the proper safeguarding of individual rights, we are essentially unregulated.

The present bill before the Committee does provide these and other protections. In fact, an automated system regulated by the provisions of this bill provides far greater protection against abuse than does a legally-permissible manual paper-based system. This is especially apparent in the area of intelligence information.

To demonstrate this point, the proposed bill permits placing intelligence information in an automated system only if there is reasonable suspicion of felony or misdemeanor level criminal activity; it prohibits the collection or maintenance of information on non-criminal organizations; and it restricts the access to, and dissemination of the information.⁶ This is a far more stringent standard than is applied to manual record systems.

COMPARISON OF PROTECTION: BETWEEN:

AUTOMATED SYSTEMS UNDER CURRENT LAW (SEC. 9106);
 MANUAL PAPER-BASED RECORD KEEPING SYSTEMS; AND,
 AUTOMATED SYSTEMS UNDER PROPOSED CHANGE TO SECTION 9106.

PROTECTION	Current Law Sec. 9106	Manual System	Proposed Bill
Reasonable suspicion standard for gathering information	NO	NO	YES
Access to information restricted to certain persons	NO	NO	YES
Misdemeanor or felony level information only	NO	NO	YES
Information must be verified prior to disseminating	NO	NO	YES
Access to information restricted to certain agencies	NO	NO	YES
Reasonable certainty as to identity of subject-person	NO	NO	YES
Mandatory quality control standards for:			
Data entry.	NO	NO	YES
Maintenance	NO	NO	YES
Security	NO	NO	YES
Categorization	NO	NO	YES
Dissemination	NO	NO	YES
Removal of misleading information	NO	NO	YES
Removal of "state" information	NO	NO	YES
"Need to know" standard before disseminating information	NO	NO	YES
Tracking of information disseminated	NO	NO	YES
Information must be protected from theft, sabotage, etc.	NO	NO	YES
Personnel must be supervised and trained before having access	NO	NO	YES

In addition, the standard of the proposed bill on the collection of intelligence information is more restrictive than the standard for collecting investigative information under the current Section 9106. Under the current law, investigative information may be automated if it is "assembled as a result of any inquiry, formal or informal, into a criminal incident or an allegation of criminal wrongdoing ..." The regulation to automate intelligence information under the proposed bill, however, requires that there is reasonable suspicion, and further, that the criminal offense be at least a misdemeanor.

Passing this bill will be an important milestone in protecting the individual. It is also important in providing quality and economical police service to our citizens.

In March, 1987, the Philadelphia Police Study Task Force noted that "much of the success in managing a police department and solving crime is dependent on how well the organization manages the flow of information." They then went on to recommend that "A strategic plan for Department management information systems must be created and implemented on a prioritized basis."

Acting on this recommendation, the Department commissioned a study of its information needs which are essential to achieving the Department's mission, improve planning and control, increase cost-effectiveness and improve service to the public.

Several systems were found to be needed. Perhaps most critical to the Department were systems for recording, tracking and analyzing the activity of police officers responding to over 1.5 million calls for assistance annually and supporting systems to manage investigations.

In addition, a large degree of inefficiency was found in gathering the many documents required for both the defense and prosecution for use in court, and in the scheduling and notification of officers for court appearances.

The direct labor savings to the Philadelphia Police Department achieved by implementing these systems are approximately \$12 million annually.

In addition to these direct savings, additional efficiencies can be achieved through better planning, supervision and deployment of officers and investigators. Further savings could also be achieved by reducing the amount of time a patrol officer takes to complete a particular task.

It should be noted that other agencies would be in a better position to achieve collateral savings. Although no attempt was made to document these savings, the Philadelphia County Court of Common Pleas might achieve noticeable savings by disposing of cases more efficiently by reducing the number of continuances caused by inefficient paper-work systems. Similar savings may also be realized by the prisons, District Attorney's and Sheriff's Offices.

Although these systems are very cost effective, they are still expensive. The present law can increase their cost, while at the same time reduce the opportunity to achieve maximum savings.

One reason for this is the availability of software. There are several less expensive "off-the-shelf" law-enforcement computer systems currently on the market. These systems were developed and intended to be sold throughout the United States and have several features which may be prohibited by the unique constraints of the current Pennsylvania law.

In a report prepared by our consultants, they noted that: "Pennsylvania law may not permit the storage of all investigative (i.e. text) information on a computer based system. If this law is strictly interpreted and the Incident Reporting System design cannot store this information, many of the expected benefits of the system may not be achievable."

Most importantly, without the benefits that these systems provide to manage its information, the Department can not achieve its greatest potential to manage itself. No one, whether crime victim, suspect, or tax-payer can benefit from a weakness of their police department.

NOTES:

- 1,2 Philadelphia Police Department Statement of Ethical Principles - Copy attached.
- 3 DOS Programmer's Reference 2nd Edition, T. Dettman, p10-13; QUE Corporation, 1989. - Copy attached.
- 4 This information obtained from Mr. James Foley, Sales Representative, Philadelphia Office, IBM.
- 5 "Fourth-Generation Languages: The New Law Enforcement 'Combat Masterpiece'; The Police Chief, June 1989. Copy attached.
- 6 Proposed amendment to Title 18, Section 9106, subsection 2 through 6.
- 7 Philadelphia Police Department Mission Statement - Copy attached.

Fourth-Generation Languages: The New Law Enforcement "Combat Masterpiece"

By JAY JULIAN, Ph.D., Customer Relations Manager, Unisys Public Sector Systems Division, Blue Bell, Pennsylvania

Computers have proven to be a valuable tool in the law enforcement arsenal to combat crime. But all too often, law enforcement application development, or modification, is held hostage by the lack of flexibility and the severe shortage of computer programmers available.

The solution lies in the use of fourth-generation languages—productivity tools that allow end users to produce highly flexible application programs without the use of professional programmers. Now, the administrative sergeant or detective who needs a computer application to search and match information to help solve a crime, or a chief administrator who needs a computer application modified to reflect procedural changes, can program a computer without having to learn mnemonics, formats, sequences or complex constructs. Fourth-generation language application development tools, also known as 4GLs, all but write the application themselves.

History of Computer Languages

4GLs are best understood if we compare them with earlier computer languages. The first generation of computer languages, which emerged in the 1940s, consisted of "ones" and "zeros" that indicated if a physical location in the machine was "on" or "off." This method, prone to errors, was later improved upon with the use of mnemonic codes to represent operations. But even with this improvement, program development remained an arduous task.

By the mid-1950s, the second generation of computer languages emerged, using symbolic addresses rather than physical machine addresses. These second-generation languages, commonly known as "assembly" language programs, were considered a real time-saver for programmers. When the physical location of instructions had to be changed, which was almost continuously, the programmer did not have to reenter the new physical address. Second-generation languages included EASYCODER, AUTOCODER and Symbolic Assembly Program.

Fourth-generation languages represent the most important breakthrough in computer languages because they allow non-programmers to quickly develop their own applications.

These once-popular programs fell by the wayside during the 1960s with the dawn of third-generation languages that used English language-type instructions: COBOL, FORTRAN, ADA, etc. These high-level languages dramatically reduced the amount of work previously required to write programs. Programmers were able to write system applications without having any knowledge of the machine's hardware. Such hardware independence permitted programs to run on different machines.

However, third-generation languages were still not oriented to the end user. Data processing professionals were required to write vast numbers of lines of code and spend endless hours debugging and modifying complex systems, and they were unable to respond quickly to the needs of the user.

The result was frustration. Minor variations of a management report or crime information could take six months or more because the modifications invariably required a special programming effort and a lot of overtime.

Fourth-Generation Languages: A Breakthrough for End Users

These application programming problems have been solved through the speed and flexibility of fourth-generation language technology. 4GLs represent the most important breakthrough in computer languages because they allow non-programmers to develop

their own applications in a minimal amount of time and with a minimal amount of computer expertise.

It is important to note that all 4GLs are not the same. They vary widely in power and capability: some are query languages that allow non-programmers to generate reports from an established data base. Others, such as the Unisys LINC and MAPPER® 4GLs, can develop complete applications.

Conceptually, all 4GLs employ sequential statements like third-generation languages and use a variety of other mechanisms such as filling in forms, screen interaction and computer-aided graphics. Validity and security checks are often built in, so the user does not need to worry about them. The idea behind 4GLs is to put computer power into everyone's hands.

The use of 4GLs is proliferating throughout the law enforcement community. Police agencies, with the assistance of computer companies, have begun to utilize 4GLs to develop new applications to use the extensive information collected by police officers—information that goes beyond computer-aided dispatch and investigative case management, such as crime scene analysis, property identification and criminal history records.

Recently, the Houston Police Department implemented a sophisticated crime analysis system utilizing the Unisys MAPPER® 4GL system. In a six-week period, Houston's first city-wide crime analysis program, the Citywide Robbery Analysis System (CRAS), was developed and implemented. Presently, information from various data bases such as robbery, burglary, sexual assault, auto theft, wanted persons and parolees are analyzed, with the results available to each separate command. The system is producing dramatic results: Police were able to link a suspect to fast-food restaurant robberies in 30 cases; an inmate recently paroled was identified as a murder suspect; 13 auto theft suspects were arrested through directed patrol; and 38 wanted and charged suspects were apprehended in

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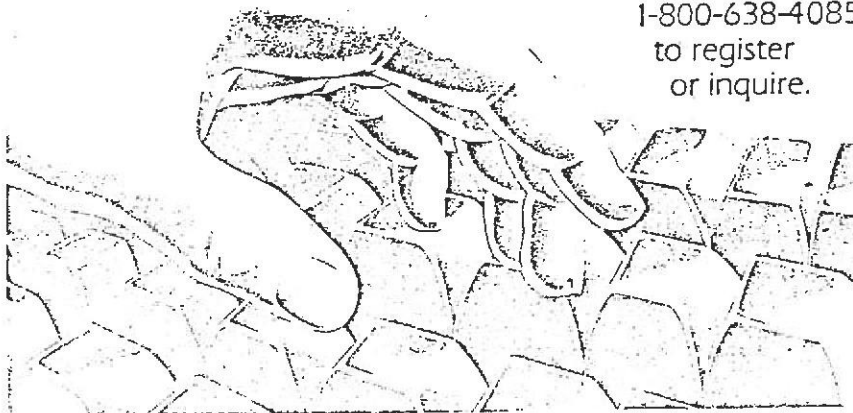
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The Uniform Crime Report (UCR) is currently undergoing the most dramatic changes since its inception in the 1930s. Over the next 10 years, the UCR will move from an aggregate-based system to an incident-based system. Local departments are currently faced with a massive information-gathering task. They must capture massive amounts of information on all reported incidents. They must define and record additional information on victim/offender relationships, physical injuries, suspects, etc. They must link criminal history records and crime records. And they must do all this while complying with the unique reporting standards and requirements of both the Federal Bureau of Investigation and the state.

For departments using third-generation languages, the task is overwhelming. Source codes must be rewritten for all the different applications at each level. But 4GLs do not require this kind of investment in application development time. They offer the most logical, efficient and cost-effective solution to the complexities of federal and state requirements for UCR report generation and standardization.

4GLs also offer infinite flexibility and functionality in the area of combating crime. For the police officer on the street, being armed with up-to-the-minute information prior to conducting a vehicle stop or responding to a family disturbance may mean the difference between life and death. For the detective, being able to search criminal history records, analyze methods of operations, patterns, trends and relationships between victims and known offenders may mean solving a host of previously unresolved open cases.

The police officer and the detective now have a tool to search and match an infinite variety of seemingly unrelated facts that could produce prima facie evidence or probable cause for arrest.

Finally, a 4GL can be utilized by a police administrator as a planning tool to make informed strategic and tactical decisions. More accurate and timely reporting could provide the ammunition necessary to obtain additional personnel and equipment. Through extensive tracking capabilities, a 4GL can streamline all administrative tasks associated with police personnel, from recruitment to retirement.

Fourth-generation language applications are limited only by the imagination and the amount of dollars invested. Law enforcement professionals can use 4GLs not only to help solve today's problems, but also to plan more accurately for the future. ★

BIOS programs: Two programs implement DOS; one, the ROM BIOS, is an interface module loaded from disk that augments the ROM BIOS functions and usually contains a set of standard device drivers; other, the disk operating system itself (DOS), is the high-level interface for all programs that run on the computer, whether or not they make use of the disk.

command processor: Most people think of this module as DOS, the command processor, the normal interface to DOS services for programs working with the system, generates the command prompt (C>), interprets commands, and executes programs requested by users of the system.

These modules are covered in detail in Chapter 2, "Structure of a DOS system," and Chapter 3, "The Dynamics of DOS." Some basic explanations are in order at this point.

DOS provides a series of functions that programmers can use to perform operations without having to concern themselves with the details of underlying hardware. Throughout this book BIOS functions are used to illustrate necessary operations in programming examples. Part V of this book, "BIOS," contains a function-by-function reference to the capabilities of the BIOS.

Although it is powerful, BIOS is far from comprehensive. DOS, built on top of the BIOS, provides many services that are necessary for programming. In the early days of computers, before general-purpose operating systems (such as DOS) became available, programmers had to include the functional equivalent of DOS. This made the process of debugging applications terribly complex.

DOS functions already programmed by Microsoft (and other authors) of DOS became our partners in program development. We should not assume that *everything* in DOS works without error, but we can be sure that (unless proven otherwise) DOS is solid. Part V of this book contains a function-by-function breakdown of the DOS functions.

Why of DOS

Over the years, DOS has emerged as the primary operating system for IBM PCs. DOS, without a doubt, has more users today than any other operating system. It has become a sophisticated environment with tools and techniques to meet a wide spectrum of needs.

DOS's foreseeable growth involves expansion to handle more sophisticated microprocessors such as the 80386 and 80486. Future releases of DOS may even handle multitasking and multiuser operations (some may question this statement, in light of the emergence of OS/2).

DOS was first marketed by Seattle Computer Products as 86-DOS for that company's line of computers. The original DOS was written by Tim Paterson starting in April 1980, and first shipments were made in August of that year. At that time, Digital Research's CP/M was the most widely used microcomputer operating system. 86-DOS was specifically designed to make porting applications from CP/M easy: it kept the same structure for file control blocks and functions so that a mechanical translator could convert a program directly to 86-DOS.

Because 86-DOS worked only with 8086/8088 CPU chips, which were just coming into the marketplace in 1980, few people even knew that it existed. Those who did use the 8086 CPU on their S-100 systems as an upgrade from the 8-bit 8080/Z80 standard and CP/M found 86-DOS useful, and Seattle Computer Products established a base of several dozen customers including at least one other hardware manufacturer. Then Microsoft approached SCP about writing a customized version for an anonymous customer. Through at the time no one knew it, IBM was looking for an operating system. By January 1981, Paterson knew who the customer was, and Microsoft had taken out a license to distribute 86-DOS under its own name. In April of that year, Paterson left Seattle Computer Products and joined Microsoft, where he spent the next several months tailoring the system to IBM's needs.

In July 1981, Microsoft bought from Seattle Computer Products all rights to 86-DOS. When IBM released the PC on August 10, 1981, Microsoft was ready with MS-DOS 1.0 (Personal Computer DOS, *not* PC DOS, for IBM machines; IBM never accepted the popular term *PC DOS* in reference to the system, and the latest IBM versions are identified simply as *DO5*).

Paterson's direct involvement with DOS ended during 1982, but he remains active on the PC scene, most recently as a consultant to Phoenix Technologies Inc., the clone BIOS experts.

After the PC's original release, DOS still was not prominently displayed in some stores. IBM had selected CPM-86 and Softech's P-system as alternative PC operating systems. But vendors were slow to deliver both products, and few languages were available for development under those operating systems. Microsoft already had earned a reputation for programming languages. IBM released its own software using DOS, and developers rapidly

picked up the ball, which has never stopped rolling. CP/M-86 and the P-system never "got off the ground" as serious contenders in the PC marketplace.

DOS has been changed officially many times (and several versions exist that were not available for general use). Although improvements and bug fixes both have figured in this evolution, each release usually has involved a response to some hardware change—particularly, a change in disk-drive format or capability.

Table 1.1 lists each major official DOS release (to date) and the primary change involved. (Some minor releases have been omitted from this list.)

Table 1.1. DOS Versions

Version	Date	Hardware Change
86-DOS	August 1980	Seattle Computer Products' version (began in April 1980, by Tim Paterson)
1.0	August 1981	Original PC, single-sided disk
1.1	March 1982	Double-sided disk, date-time stamping
1.25	March 1982	First OEM version (ZDOS), VERIFY added
2.0	March 1985	PC XT, including hard disk
2.1	October 1985	IBM PCjr and Portable PC
3.0	August 1984	Personal Computer XT, including high-capacity disk
3.1	March 1985	Networking
3.2	December 1985	Enhanced support for new media
3.3	April 1987	Support for PS/2
4.0	June 1988	Support for disk drives larger than 52M, integration of EMS memory capability

As you look at this list, consider the trade-off between memory and features that each new version of DOS has required. DOS 1.0 was capable of existing in 16K of memory, and the original IBM PC was available with

only 64K. Version 2 needed at least 255 of memory (more, if it were installed). Any special programming required a minimum memory. As of V3, DOS needed 36K of memory (and could use more for file-sharing and installed device drivers). Machines with 512K were almost impractical. And with V4, 512K became a requirement and more than 640K (expanded) and extended a Chapter 2) definitely desirable. As DOS continues to expand, it needs megabytes of memory to do practical work.

Let's look at each version of DOS in a row, but was involved in. Throughout this book, we say V1 when we refer to a generic of V1, and V1.1 when we mean a specific sub-version #.

Version 1.0

DOS 1.0 was the original support on the PC system. It was basic single-sided, eight-sector disk format and provided all the services. Changes from CP/M included a much-improved directory structure that managed file attributes and exact file size. Version 1.1 to the original 86-DOS improved disk allocation and managed operating-system services, and an AT-TREXEC batch file for start-up. IBM was the only vendor to ship this version. Interestingly, of DOS did not include the date-time stamping of files that known as one of the major distinguishing features of DOS.

Version 1.1

The date-time stamping and support for double-sided disk drive in this version (the last IBM-only release) as were some bugs released in March 1982.

Version 1.25

This was the first version to be distributed by original equipment makers (OEMs) other than IBM. (The jump in version number 1.25 reflects the difference between IBM system count and 1 percent revision control system, in which IBM V1.1 was known. The VERIFY capability was added in this version, as was the directory flag byte, which did not appear in IBM versions in