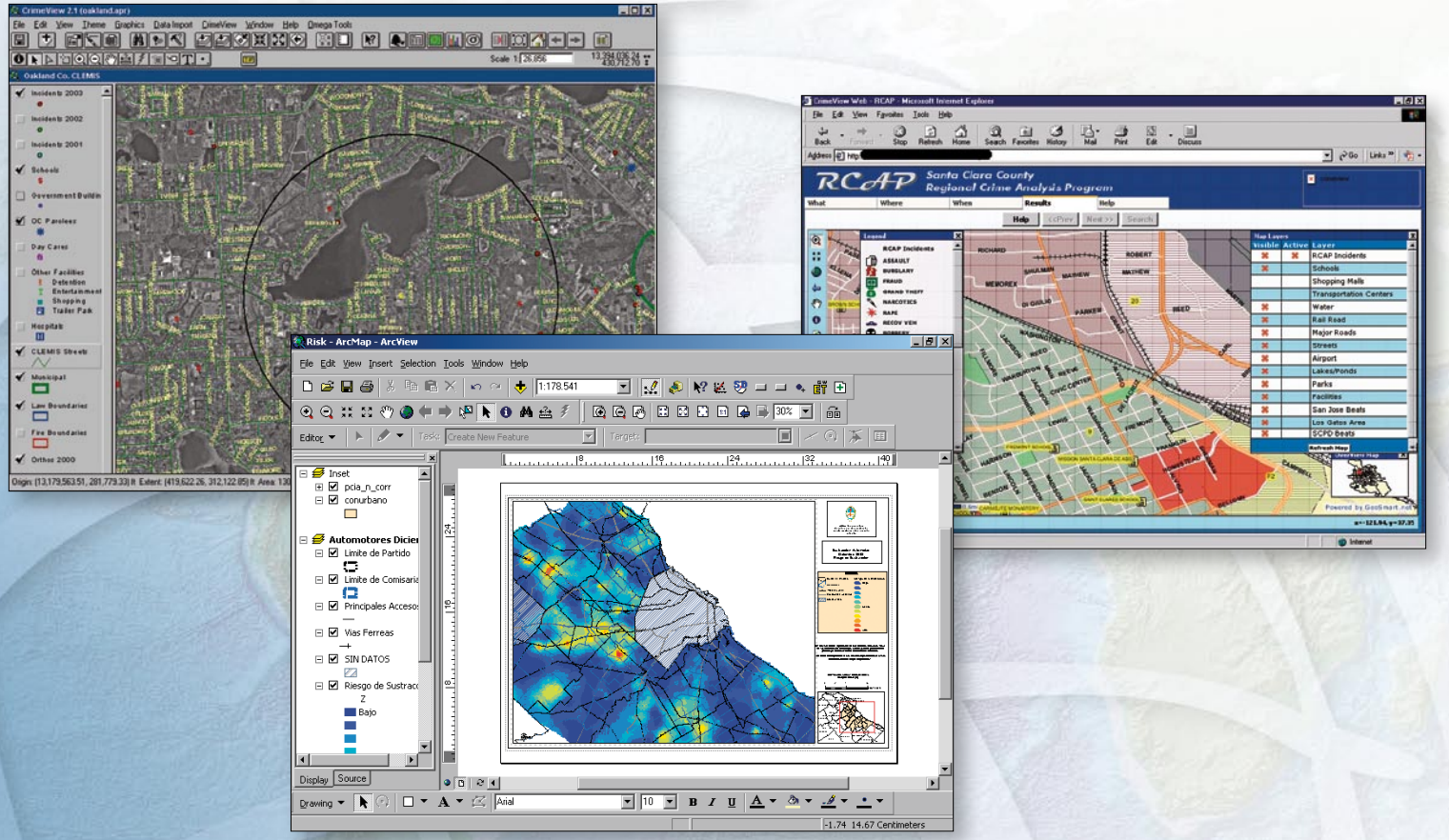
GIS Best Practices

Law Enforcement



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ESRI

Table of Contents

What Is GIS?

Making decisions based on geography is basic to human thinking. Where shall we go, what will it be like, and what shall we do when we get there are applied to the simple event of going to the store or providing security for a major sporting event or immediately following a natural disaster. By understanding geography and people's relationship to location, we can make informed decisions about the way we live on our planet. A geographic information system (GIS) is a technology tool for comprehending geography and making intelligent decisions.

GIS organizes geographic data so that a person reading a map can select data necessary for a specific project or task. A thematic map has a table of contents that allows the reader to add layers of information to a basemap of real-world locations. For example, a crime analyst might use a City basemap and select datasets from the records management system to add data layers to a map that identify crimes by type, date, time, and location. With an ability to combine a variety of datasets in an infinite number of ways, GIS is a useful tool for nearly every aspect and function of law enforcement.

A good GIS program is able to process geographic data from a variety of sources and integrate it into a map project. Many countries have an abundance of geographic data for analysis, and governments often make GIS datasets publicly available. Map file databases often come included with GIS packages; others can be obtained from both commercial vendors and government agencies. Some data is gathered in the field by global positioning units that attach a location coordinate (latitude and longitude) to a feature such as a pump station.

GIS maps are interactive. On the computer screen, map users can scan a GIS map in any direction, zoom in or out, and change the nature of the information contained in the map. They can choose whether to see the roads, how many roads to see, and how roads should be depicted. Then they can select what other items they wish to view alongside these roads such as storm drains, gas lines, rare plants, or hospitals. Some GIS programs are designed to perform sophisticated calculations for tracking storms or predicting erosion patterns. GIS applications can be embedded into common activities such as verifying an address.

From routinely performing work-related tasks to scientifically exploring the complexities of our world, GIS gives people the geographic advantage to become more productive, more aware, and more responsive citizens of planet Earth.

GIS for Law Enforcement

Law enforcement agencies face a multitude of tasks and challenges in their daily responsibility of protecting life and property while keeping the peace in their communities. Virtually every task and challenge has a geographic component. These tasks require both strategic and tactical planning in rapidly changing social, economic, and political environments. While law enforcement agencies collect vast amounts of data, only a very small part of this information can be absorbed from spreadsheets and database files. GIS provides a visual, spatial means of displaying data, allowing law enforcement agencies to integrate and leverage their data for more informed decision making.

GIS allows law enforcement and criminal justice personnel to effectively plan for emergency response, determine mitigation priorities, analyze historical events, and predict future events. GIS can also be used to get critical information to emergency responders upon dispatch or while en route to an incident to assist in tactical planning and response.

GIS is the next step in the evolution of information technology. It is a core information and analysis tool that helps manage not only geographic data but other datasets as well. GIS has been embraced by professionals in all areas of law enforcement for conducting day-to-day operations as well as for planning, analysis, and decision support.

The following articles, reprinted from *ArcNews* and *ArcUser* magazines and *Government Matters* newsletter, detail a few of the many applications of GIS technology for law enforcement.

Santa Clara County, California, Develops a Regional Crime Analysis Tool

Police agencies across the United States share a common challenge—identifying and connecting crimes and issues that cross local jurisdictional lines. In Santa Clara County, California, the District Attorney's Office is working with the Chiefs of Police Association, local law enforcement agencies, and numerous other agencies to reduce violent crime and ensure a safe community environment for county residents.

Santa Clara County, located at the southern end of San Francisco Bay, encompasses more than 1,300 square miles and has a population of more than 1.6 million people. More than 90 percent of the county's population lives in 15 cities: Campbell, Cupertino, Gilroy, Los Altos, Los Altos Hills, Los Gatos, Milpitas, Monte Sereno, Morgan Hill, Mountain View, Palo Alto, San Jose, Santa Clara, Saratoga, and Sunnyvale. Recently, these municipalities agreed that select service delivery enhancements for both internal and external customers could be realized through a consortium data sharing initiative.

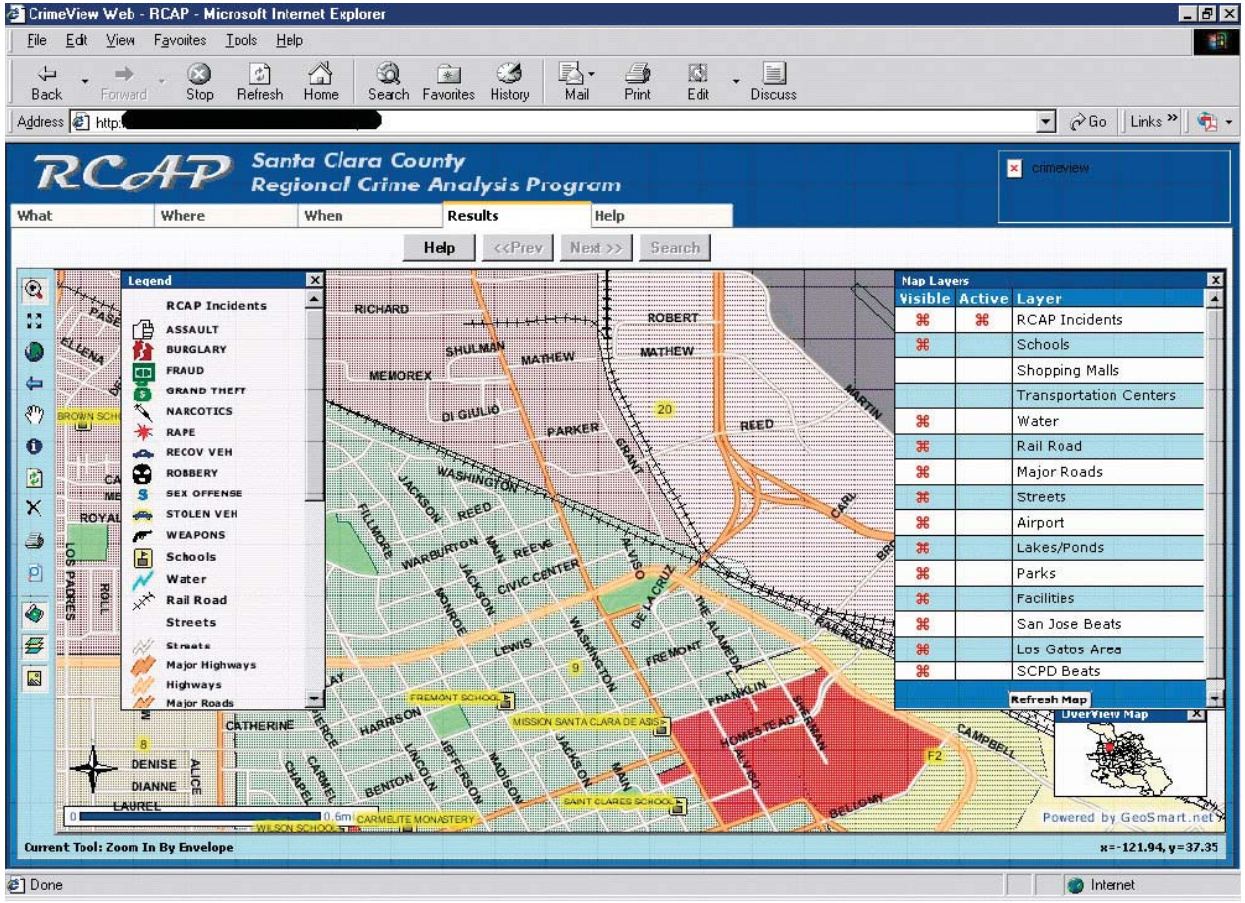
Historically, when crimes occur in different jurisdictions, investigators grapple with challenges and delays related to interagency information sharing. In Santa Clara County, however, law enforcement agencies are sharing information and making use of the Internet, a shared database, and GIS crime mapping technologies.

In August 2002, Santa Clara County awarded a contract to the team of ESRI and ESRI Business Partner The Omega Group to develop crime analysis capability countywide for a multijurisdictional collaboration known as the Regional Crime Analysis Program (RCAP). RCAP is an interagency partnership between local law enforcement agencies within Santa Clara County. The goal of this partnership is to standardize, access, and share specific crime data among all county law enforcement agencies to help identify and reduce serious and violent crime in the county.

Steven DiNoto, chief administrative officer of the San Jose Police Department, says, "The county's law enforcement agencies understand that expanded access to crime data by crime analysts at broader levels may bolster police service delivery at the local levels."

Creating a regional information sharing system for the county required the development of a standardized data set that would allow information to be analyzed across jurisdictional

boundaries. To this end, the goal of RCAP was clear: RCAP needed to rapidly and accurately share select crime data among its different law enforcement agencies.



The Regional Crime Analysis Program application, displayed using ArcIMS, gives crime analysts a specific regional map that identifies crimes by type and by date, time, and location.

As a result, the county worked with ESRI and The Omega Group to design a system that relies on a standardized coding scheme, is built on a centralized database that uses the Internet, and allows law enforcement officers to analyze crimes that occur across jurisdictional boundaries.

“The District Attorney’s Office witnessed a compelling data sharing need emerge,” adds Marc Buller, county assistant district attorney, “as well as a compelling regional GIS solution that promised to take best advantage of the local talents and experience of crime analysts, technologists, and investigators in support of targeted crime reduction goals countywide.”

RCAP uses ArcGIS, ArcSDE, and ArcIMS technologies for sharing data in a browser environment. ArcGIS ArcCatalog software-based data-loading tools within ArcInfo were used to load the data from each agency into a central Oracle/ArcSDE database. Once this data was stored in the geodatabase, ArcIMS extracted and published it to the secure RCAP Web site, displaying it with geographic layers such as street centerlines, schools, parks, law enforcement beats, and other geographic reference layers.

Once the county approved this final system design, the coding scheme was developed, and local agencies began transferring data nightly via a secure Internet connection.

Within RCAP, analysts can use three different views to query the attributes. In one view, analysts can define the parameters of the query to identify what crime incidents have occurred in an area by selecting individual or a combination of general crime codes. These codes contain top-level categories that include various incident types (e.g., assault, robbery, narcotics). In another view, analysts can select a combination of geographic attributes in a particular jurisdiction to identify where crime incidents have occurred in an area (e.g., to show the number of crimes within a given radius of a school or park). In yet another view, analysts can determine when crime incidents have occurred in an area by choosing specific date and time attributes.

The application is being rolled out in phases and is currently in use in the cities of San Jose, Los Gatos, and Santa Clara. In the next phase, the county will roll out the RCAP system to the remaining nine law enforcement agencies, thereby providing access to all local law enforcement agencies in the county.

(Reprinted from the Spring 2004 issue of *ArcNews* magazine)

Web Site Coordinates Undercover Activities

Editor's note: A Web mapping site developed by the Oregon Department of Justice (ODOJ) coordinates multiagency undercover operations, avoiding costly and possibly deadly miscommunication, without compromising the confidentiality of these operations.

Before leaving to serve an arrest warrant on a suspected drug dealer in Marion County, Oregon, a Regional Organized Crime Task Force police officer entered the suspect's address into the ODOJ Oregon State Intelligence Network's Web mapping site. The Web site geocoded the address, searched the database for other police activities in the vicinity, and immediately notified the officers that serving the search warrant might interfere, or "conflict," with a Marion County Gang and Narcotics Enforcement Team (MAGNET) case. The application also e-mailed and paged the MAGNET officer in charge of the case.

In the ODOJ Watch Center, an alarm sounded and staff responded by using a Web browser to click on the mapped event location and display detailed officer contact information. Officers were notified that they were conducting activities in close proximity to each other and were given each other's contact information. No other information was provided to the officers and they discussed their cases on the phone, thereby avoiding a potentially dangerous situation. By informing the officers that they were working in proximity to each other, the situation was "deconflicted."

Need for Deconfliction

ODOJ's federally funded High Intensity Drug Trafficking Area (HIDTA) program provides an Intelligence and Investigative Support Center that serves, in part, as a "one-stop shop" for criminal research, analytical case support, information exchange, and case coordination services often referred to as deconfliction. One of the goals of the Federal Office of National Drug Control Policy HIDTA program is to facilitate multiagency communication. Officers from federal, state, and local law enforcement agencies operate throughout Oregon.

Several geographic and operational issues make narcotics interdiction problematic: undercover operations are common; agencies have overlapping jurisdictions; in metropolitan areas, operations are often in close proximity to each other; investigations may take officers hundreds of miles from their offices; multiple agencies may be investigating the same suspect; and suspects may be under investigation for nondrug related crimes, such as burglary, by other departments in the same law enforcement agency. All of these factors combine to create

situations in which officers may interfere with each others' cases. Occasionally, undercover operations have deteriorated to the point that weapons are drawn and one officer harms, or even kills, another. True identities are often hard to ascertain in high-pressure undercover situations.

ODOJ managers knew that other law enforcement agencies had used desktop GIS to enter and search for potentially dangerous conflicts. These systems required officers to provide event addresses to a GIS analyst who geocoded and searched the vicinity for other officers operating in the area. If a potential conflict existed, officers were instructed to call one another and discuss their planned activities. This system achieved the goal of fostering interagency communication, but it was labor intensive and required officers to wait while event addresses were manually processed.

A Web Mapping Solution

ODOJ felt that the GIS used by other law enforcement agencies worked well; however, it was interested in developing a secure, automated, and Web-based method for deconflicting events. ESRI Business Partner Alsea Geospatial, Inc. (AGI), was contacted and a meeting was held to discuss the problem. Working with AGI, a list of system requirements was identified.

- Ability for officers to share the geography of their activities without compromising other case details
- 24/7 availability and direct officer entry of event information
- Automatic geocoding and search for other proximate events
- Automated event processing and the ability to preview and confirm events and the locations on a map
- Easy-to-use interface that required no understanding of databases or GIS
- Database security
- Secure availability through a browser interface

The system requirements were documented and reviewed with federal, state, and local law enforcement officers and managers, as were the layout of the Web page, mapping interface, Web forms, and data to be collected. The system architecture was identified and the hardware

and software purchased. Because of the mission critical nature of the application, an enterprise solution using a Microsoft SQL Server database, ArcIMS, and ArcSDE in a redundant, clustered six-server Windows 2000 environment was selected. To ensure that the site would continue to function during periods of electric power failure, a gas backup generator was installed.

The Web site has three frames that contain event registration, a map for confirming event locations, and conflict notification. After login, officers register their event and staging location by entering the address, type of operation (e.g., search warrant, buy, surveillance), search radius, event start and stop time and date, and contact information. This information is stored in the geodatabase, the address is geocoded, and the radius is searched for other events. If none is found, the event is simply stored for future potential deconfliction.

However, if one or more conflicts are detected, a screen pops up containing a contact list that shows the names, phone numbers, and e-mail addresses for the other officers. No geographic information regarding the other event is provided to the officer-its mapped location and address are not displayed. The instant the conflict is detected, an e-mail and page are sent to the officer owning the previously submitted event, and an alarm sounds in the Watch Center. This is the only point in the entire process that requires human action. Watch Center analysts click on the conflict to select and display it on the map and are provided detailed information about both events.

Watch Center staff make calls to ensure that both officers involved and any others on the contact list are aware of the conflict. To avoid disclosing sensitive case information, no information regarding either officer's case is provided by the Web site or the Watch Center. The officers decide what case information will be disclosed. However, the goal of facilitating interagency communication has been achieved.

Program Status

Subscribing to the notion that even the most useful Web site will go unused if it isn't advertised, more than 700 officers from federal, state, and local law enforcement agencies have been trained to use the Web site. At any given time, approximately 80 active events are registered and numerous potentially dangerous situations have been avoided. Conflicts between agencies and even between departments within the same agency have been detected and deconflicted. Many agencies now require officers to use the system.

A number of enhancements have also been identified; some have been implemented and others are being developed. New tools will select locations or enter GPS coordinates for events that do not have an address, such as parks and national forests; move incorrectly located event addresses; and help Watch Center analysts perform investigations and queries. Other enhancements include tactical planning pages and GIS layers from neighboring states because drug dealers do not respect political boundaries.

The automated nature of the Web site allows officers to self-register events, which limits ODOJ's staff responsibility for conflicted events and results in substantial time and labor savings. Officers are also able to enter events and search for conflicts at any time—they are not limited to Watch Center business hours.

Lessons Learned

It is essential to catch errors in data that is submitted to the database. Geocoding errors can be detected by verifying that an event address is within the state boundary. Data entry errors can be limited through the use of pull-down selection menus. During training, interaction with a live site is necessary. Skeptical officers are quickly won over when their pagers go off in response to conflicts detected from sample events registered during training. The Web site has been well-received, and ODOJ has had numerous requests for additional training and access to the site.

(Reprinted from the April–June 2005 issue of *ArcUser* magazine)

In the Province of Buenos Aires, Argentina, GIS Aids Crime Mapping

The population of Argentina is roughly 36 million, with the Province of Buenos Aires containing approximately 40 percent of the country's total population (almost 14 million inhabitants in 307,571 square kilometers). Surrounding Buenos Aires, the population density can be as high as 10,000 people per square kilometer whereas areas further out in the province can have less than one person per square kilometer.

The Conurbano is the name given to the Buenos Aires metropolitan area. This area includes approximately 30 counties, with 9.5 million inhabitants within a mere 5,600 square kilometers. To the Buenos Aires Province Police Department (BAPPD), which comprises more than 45,000 officers scattered in more than 130 counties within the province, the Conurbano is the most important zone with regard to crime levels.

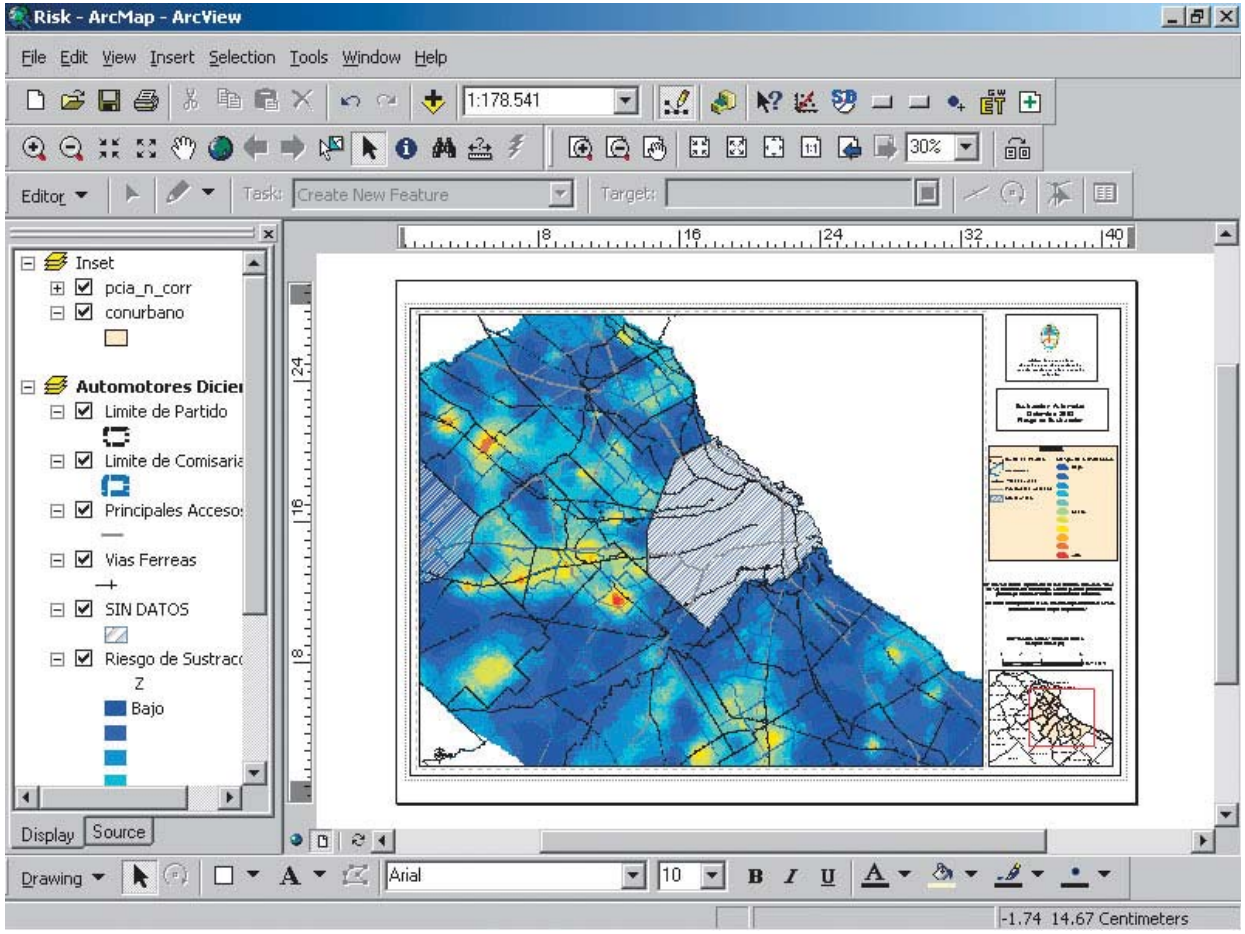
The goal of BAPPD was to develop a crime mapping and analysis capability. BAPPD began by developing a computerized system of locating crimes on digital maps to provide its police force with information regarding the distribution of crimes within its area of responsibility. The system later became more sophisticated by being capable of performing specialized spatial analysis and hot spot detection.

The Beginnings of Crime Mapping

In 1998, BAPPD obtained basemaps for the Conurbano area and some other significant urban zones, which were used to develop the system. Later, BAPPD expanded to cover the whole province. Also, based on the recommendations of the government agency that provided those basemaps, BAPPD ventured into GIS using ArcView, provided by Aeroterra S.A., ESRI's distributor of products in Argentina. As time went by, BAPPD gathered a group of talented professionals into a task force that developed a set of methodologies and procedures for producing state-of-the-art spatial analysis using innovative techniques and software products and, thus, provided a better service to the community.

As the BAPPD task force began, one of its first functions was to identify how to efficiently map the crime locations. It began by first manually locating each incident and to no surprise found it to be a laborious and time-consuming activity. Because of the particular Argentinean address style, the task force had problems geolocating incidents based on their address locations.

Eventually this process was improved when Aeroterra developed code to work with the ArcView geocoding engine that added a new style—named the “Argentine Address Style”—to the default addressing templates provided with the basic ArcView installation.



BAPPD had transformed more than 1,000,000 street records and was able to complete the basic modifications to the Crime Recording System to make it GIS friendly.

Once BAPPD overcame the addressing challenge, it came up against a second challenge. Although the task force now had a working addressing style, the department's street basemaps were not designed for use with the new style, nor was the crime database. Then began the transformation of street centerlines for more than 30 cities to make them compatible with the required fields of the Argentine Address Style. Following came the conversion of information about crime locations in the central crime database. Other challenges included developing a data dictionary, designing a proper way to write addresses and store them in the crime database to be readily usable by the GIS, error checks, and safeguarding procedures.

Within a short time, BAPPD had transformed more than 1,000,000 street records and was able to complete the basic modifications to the Crime Recording System to make it GIS friendly.

By 1999, BAPPD was able to start crime mapping. This began by first constructing many pin and choropleth maps, but BAPPD was eager to start some sort of aggregation analysis. It experimented with various additional spatial and crime analysis packages until its task force found CrimeStat software (www.icpsr.umich.edu/nacjd/crimestat.html), which was developed by Ned Levine & Associates, Houston, Texas, under grants from the U.S. National Institute of Justice. This package worked well with GIS software and provided the specific analysis BAPPD was looking for. By 2000, BAPPD was able to begin creating geographic profiles of crimes to provide to its crime analysts.

Creating Decentralized Crime Mapping Units

Until late 2000, the majority of the mapping project was supported by the central crime mapping unit, but the main focus of the project was always to create decentralized structures comprising relatively small areas (two counties at most) and allowing them to share common concepts, methodologies, and more.

During 2001, the Buenos Aires Province Ministry of Security adopted a new policy regarding crime mapping and promoted the creation of decentralized crime mapping units coordinated by a central crime mapping unit. In 2002 BAPPD launched a GIS-based crime analysis campaign, including press coverage, using ArcView 8.x along with cartography and geocoding style licenses provided by Aeroterra.

After almost four years, BAPPD now has detailed 1:5,000-scale maps of the Conurbano area and every urban center in the province with more than 2,000 inhabitants. At this scale BAPPD has been able to develop a geodatabase with basemaps that include street centerlines, city

blocks (parcels, etc.), census tracts, hydrographic information, and railroads. It has also enriched this database with locations including schools, hospitals, banks, and parks. Included in this data is the actual crime database, with valuable information about crimes recorded at the incident level as well as information recorded as aggregated counts at specific times and with aerial units.

(Reprinted from the Spring 2004 issue of *ArcNews* magazine)

The Search for Missing Children Aided With GIS

Technology and Data Help Recovery

By Geraldine Kochan, National Center for Missing and Exploited Children

A 2002 national study released by the U.S. Department of Justice's Office of Juvenile Justice and Delinquency Prevention (OJJDP) estimated approximately 204,000 family abductions took place in 1999. Forty-four percent of these involved the concealment of the child. In 76 percent, it was the intent of the abductor to prevent contact with the other parent; in 82 percent, the abductor intended to permanently alter custody. The study also estimated 1,682,900 episodes of runaway/thrownaway children took place that year. Fewer cases, but more ruthless and violent, involve those children taken by strangers who are sexually molested and killed and those children who go missing without a trace.

With the enactment of the Missing Children's Assistance Act (MCAA) in 1984, Congress directed the U.S. Department of Justice's OJJDP to establish a private organization to act as a national clearinghouse of information on missing and exploited children. The National Center for Missing & Exploited Children (NCMEC) (www.missingkids.com), a nonprofit organization, was established in April 1984.

Impressive Recovery Rate

Every day, 24 hours a day, NCMEC receives calls for assistance in searching for missing or abducted children from law enforcement and searching parents through its national, toll-free hot line (1-800-THE-LOST) in the United States, Canada, and Mexico. Since NCMEC was established, it has had an impressive recovery record. Through December 31, 2002, NCMEC has assisted with recoveries of more than 94 percent of the cases involving missing and exploited children and handled nearly 1.7 million telephone calls through the hot line. NCMEC now receives an average of 700 calls per day, of which more than one-third require the MCAA-mandated services.

When a child is reported missing to NCMEC, the child is assigned to one of four main missing case types—endangered runaway (ERU); family abduction (FA); lost, injured, or otherwise missing (LIM); and nonfamily abduction (NFA). Currently, ERUs represent approximately 72 percent of the children reported missing to NCMEC; FAs, 22 percent; LIMs, 4 percent; and NFAs, the remaining 3 percent.

To draw attention to the plight of missing children, a variety of tools disseminate the information about the child and/or abductor. After reports concerning missing children are “intaked” by the NCMEC hot line and its protocol requirements are met, a case manager in the Missing Children’s Division (MCD) is assigned and provides technical assistance to the searching parent(s) and to the law enforcement agency investigating the case.

Local law enforcement agencies, the Federal Bureau of Investigation, other nonprofit organizations, and parents might also receive leads. Staff analysts in the NCMEC Case Analysis and Support Division (CASD) work with the case managers to rank these leads for their investigative value. All leads received are disseminated to law enforcement.

Geography and Missing Kids

In 2000, hoping for support for the program, NCMEC contacted ESRI, which provided software to help find missing children. When a child is reported missing as either ERU or a victim of FA, the custodial parent(s) provides NCMEC with information about possible locations where the child might be. For ERUs this might be the location where friends reside or an area that the child discussed wanting to go. For FAs this might include the abducting parent’s present address, former address, or addresses of the abducting parent’s relatives and friends.

This information is entered into the NCMEC database and automatically geocoded with latitude and longitude. When leads of a sighting of a missing child are telephoned into the NCMEC hot line, the information is added to the case file, and as location information from the lead is input into the NCMEC database, it is automatically geocoded. Peg Flick, chief information officer, wrote a program in Java that runs as a background process on NCMEC’s database server that “wakes up” every 20 minutes and ranks any new leads. If the lead location is within a certain proximity of any of the addresses collected from the searching parent as possible locations, these leads are automatically given a high rank.

Case managers and their assistants use MapObjects software on their desktop computers to query each child’s case for the geographic distribution of the leads. All lead locations are mapped in conjunction with the “missing from location” of the child as well as any location to which the custodial parent believes the child may have gone. These leads are displayed against a variety of layers that include states, counties, roads, ZIP Code boundaries, train and bus stations, and telephone exchange boundaries. Additional layers, such as parks and campgrounds, are planned. The visual display of these leads is searched for patterns, and a

cluster of high-ranking leads in a given area could warrant a targeted poster distribution either by fax or mail to elicit additional leads.

NCMEC also uses ArcIMS with a system called LOCATER. The LOCATER program was developed to hasten the recovery of missing and abducted children by providing law enforcement agencies with technology to rapidly disseminate images and information about missing children. More than 3,300 law enforcement agencies have a LOCATER system. ArcIMS is used on the LOCATER server to enable law enforcement agencies with the system to instantly identify other LOCATER systems. The agency can e-mail a copy of the missing child's poster to the selected LOCATER sites.

Expanding the Work With GIS

Currently two staff members handle mapping for NCMEC. Flick and Geraldine Kochan, a research analyst in CASD, work together to either write the programs or map geographic information on missing children. A variety of maps is updated on a weekly or as-needed basis and made available on the NCMEC Internet and/or Intranet sites. Some of these maps include NCMEC's America's Missing: Broadcast Emergency Response (AMBER) plan, weekly maps of children of NFAs and LIMs missing over an 18-month period, residential location maps of America's Law Enforcement Retiree Team (ALERT) representatives, and deployment location maps of Team Adam, the on-site response and support system that provides human and technical assistance to local law enforcement consultants. Maps that show the regional divisions of some photo partners that post missing children's posters, including WalMart and ADVO, Inc., are also displayed.

Geographic mapping can also be used to assist in identifying missing or deceased child victims of serial child abductors and murderers. As serial child abductors/murderers become known, data layers of former residences and places of employment as well as the locations of known child victims can be compared with locations of LIMs and NFAs in the database. Using ESRI Business Partner Geographic Data Technology, Inc. (GDT), route data with ArcView Network Analyst, known routes that the serial abductor/murderer used during travel are also displayed. With this information, NCMEC is now able to buffer around a specific proximity of serial abductor sites and routes and compile a list of children who are missing. Each missing child's case can be examined individually for correlating dates and circumstances surrounding it and forwarded to the law enforcement agency handling the case.

NCMEC uses data from GDT in conjunction with ESRI's ArcView Network Analyst extension for two analytical mapping projects that are near completion and involve children missing as part of FA episodes and ERUs. Based on a sample of NCMEC's recovered children, distances between the child's missing location and the child's recovery location have been calculated and correlated with the length of time the child has been missing. This information may soon enable NCMEC staff to understand mobility patterns related to missing children and better assist law enforcement officials in recovering missing children. Because NCMEC also handles international missing children's cases, plans call for expansion of mapping beyond the national level.

Soon NCMEC plans to use ArcIMS mapping on the Intranet to give staff of the Missing Children's Division, the Case Analysis and Support Division, and others (approximately 25–30 people in all) the ability to query and map all location information regarding a missing child's case, make maps, and e-mail them to the law enforcement agency handling the case. NCMEC also would like Congressional staff members to be able to query information about missing children from their state through the ArcIMS interface.

The use of GIS at NCMEC to recover missing children is in the early stages. Challenges exist for working on social issues at national and international levels, but NCMEC foresees significant benefits to be gained and is exploring ways in which the ArcView Spatial Analyst and ArcView 3D Analyst extensions will be useful and will contribute to the search for missing children.

(Reprinted from the Fall 2003 issue of *ArcNews* magazine)

Regional Crime Analysis With CrimeView and Citrix

The spatial analysis of criminal activity provides information about crime patterns, hot spots, and trends that would otherwise be difficult to discern through nonspatial data. The ability to integrate crime data with other spatial datasets (such as land parcel data; demographics; and location of facilities such as schools, hospitals, and liquor shops) can help in better deployment of resources and proactive community policing. However, the real power of spatial analysis of crime data can be leveraged only by seeing patterns at various geographic scales—from neighborhood level to regional transportation corridors. This requires sharing and integration of crime data across jurisdictional boundaries among multiple public safety agencies.

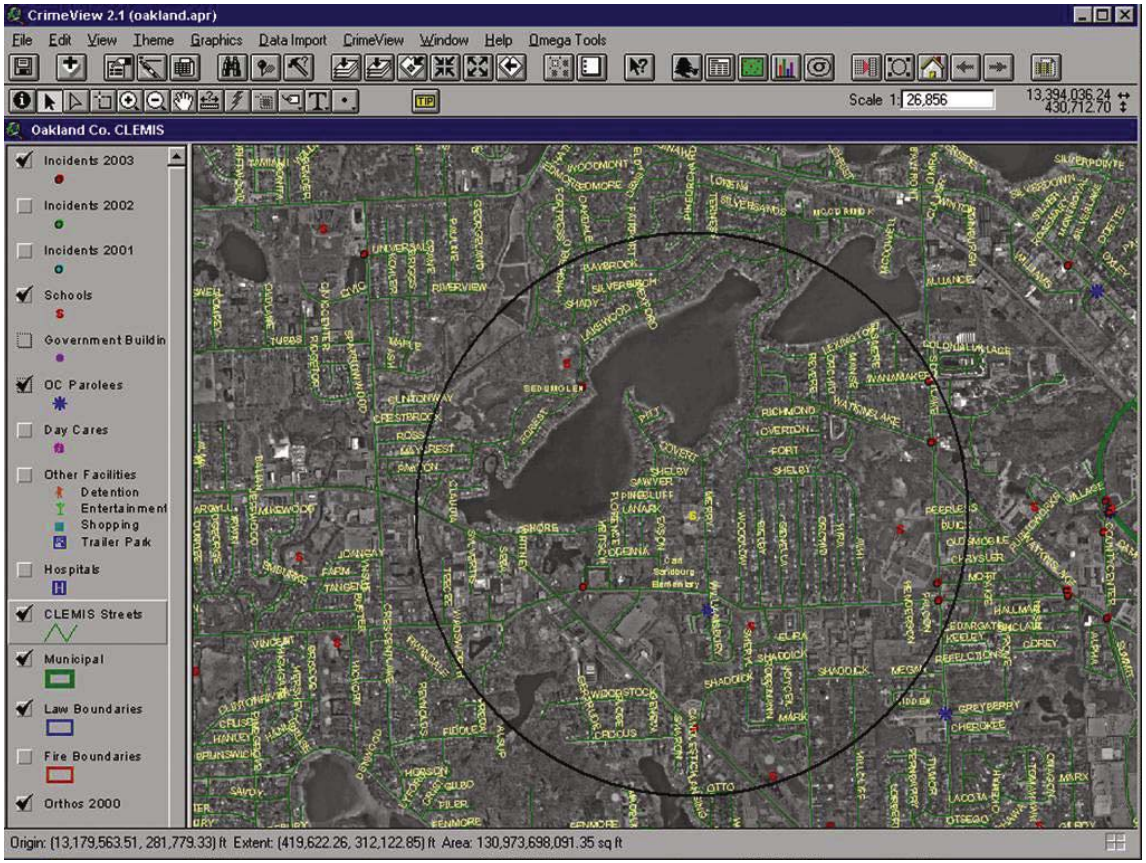
The sharing of cross jurisdictional crime data is not new in Oakland County, Michigan. A unique partnership that has been evolving since the 1970s has resulted in 134 public safety agencies, including local police departments in Oakland, Livingston, Wayne, and Macomb Counties, sharing data through an organization called CLEMIS. CLEMIS (i.e., Courts and Law Enforcement Management Information Systems) is a division of Oakland County's Department of Information Technology.

When the benefits of spatial crime analysis became obvious to the CLEMIS consortium, it contacted GIS Utility, Oakland County's Enterprise GIS agency, to find an appropriate solution. GIS Utility realized that the primary challenge was to provide a solution with regional data to the consortium members who had a range of computer hardware capabilities. CrimeView, a commercial off-the-shelf tool from ESRI business partner The Omega Group, was chosen in 2001. It was customized for deployment in a Citrix architecture.

Crime data for CLEMIS participants is extracted from the CLEMIS Records Management System every 24 hours. Incident addresses are mapped as points and stored in shapefiles. As incident data increases, Oakland County expects to harness the advances in ESRI technology by upgrading to CrimeView 2002 with ArcGIS and ArcSDE. Currently, crime data for the years 2001 to 2003 is available to CrimeView users. On average, 900,000 crime incidents are recorded each year for the CLEMIS region.

Other GIS data sets, such as the location of roads, schools, bars, shopping centers, and government buildings, are added to the map so that analysts can determine the spatial relationship of incidents. For example, the number of drug-related offenses that have occurred within a given distance of a school can be mapped, and charts showing when these incidents

occur by the time of day or day of the week can be created to incorporate the temporal element in crime occurrences.



CLEMIS incorporates other GIS datasets that show the location of roads, schools, bars, and other landmarks so that analysts can determine the spatial relationship of incidents. Specific incidents that have occurred within a given distance of a school can be mapped by year, month, day of the week, or time of day.

Oakland County's CrimeView deployment gained several benefits through its use of Citrix. The Citrix architecture allows client/server applications to emulate thin client architectures so that a significant amount of application processing occurs on the server. Consequently, the application performs well on the less powerful computers that are commonly found in law enforcement agencies.

The Citrix deployment also allows the use of concurrent software licenses, which eliminates the need for individual licenses installed on each computer. Any issues or changes in the application can be resolved once on centrally maintained software, rather than requiring site visits to geographically dispersed communities. Additional Citrix servers are deployed to support redundancy and supply load balancing as use increases. Finally, users have secure access to the application and data with the flexibility to store personalized projects and queries. This utility, though not originally planned, was added after requests were received from users.

As part of the CrimeView deployment, two days of training are offered to interested agencies. One day is devoted to basic GIS concepts and ArcView 3. The second day focuses on CrimeView and spatial analysis. Currently, 12 agencies have been trained, and a user group has been formed to share knowledge and identify future data and technology needs.

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Since 1969, ESRI has been giving customers around the world the power to think and plan geographically. The market leader in geographic information system (GIS) solutions, ESRI software is used in more than 300,000 organizations worldwide including each of the 200 largest cities in the United States, most national governments, more than two-thirds of Fortune 500 companies, and more than 5,000 colleges and universities. ESRI applications, running on more than one million desktops and thousands of Web and enterprise servers, provide the backbone for the world's mapping and spatial analysis. ESRI is the only vendor that provides complete technical solutions for desktop, mobile, server, and Internet platforms. Visit us at www.esri.com.

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