USING GEOGRAPHIC INFORMATION SYSTEMS IN LAW ENFORCEMENT BY THE YEAR 2002

TECHNICAL REPORT

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This Command College Independent Study Project is a FUTURES study of a particular emerging issue in law enforcement. Its purpose is NOT to predict the future, but rather to project a number of possible scenarios for strategic planning consideration.

Defining the future differs from analyzing the past because the future has not yet happened. In this project, useful alternatives have been formulated systematically so that the planner can respond to a range of possible future environments.

Managing the future means influencing the future--creating it, constraining it, adapting to it. A futures study points the way.

The views and conclusions expressed in the Command College project are those of the author and are not necessarily those of the Commission on Peace Officer Standards and Training (POST).

Using Geographic Information Systems in Law Enforcement by 2002.

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Abstract

The study examines the potential of advanced GIS to assist law enforcement personnel in resource allocation, planning and service delivery. Forecasting of relevant trends and events was completed by an expert panel from the law enforcement, GIS professionals to assist processing fields while interviews were conducted with GIS professionals to assist in issue identification. The study identified potential uses of GIS resource allocation and tracking such as crime trend forecasting, beat and patrol pattern modeling, hazardous material response and disaster mitigation and response. Service delivery could also be enhanced by tracking problem population groups (such as parolees, probationers, registrants and taggers) by mapping their residences and hang-outs and also through linking electronic "leashes" via geopositioning satellites (GPS) linked to GIS. Searches could enhanced through a linkage between GIS and photogrammetry with 911 responses improved through the transmission of complete GIS information to the officer in the field including local maps and floorplans. Included in the study are research data, forecasting results, graphics in text, research instruments in appendix, endnotes and bibliography.

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Chapter One

Introduction

Background

In the Fall of 1993, a large brush fire erupts in a densely populated hillside area in southern California. Valuable watershed, homes and wildlife are being destroyed by the fires along with utility poles and other equipment. Power is out, telephone service is interrupted and countless natural gas leaks exist from destroyed homes. Santa Ana winds drive the flames and create new fires. Arsonists add to the chaos by lighting additional fires throughout the wind-whipped coastal and foothill areas until numerous fires are burning out of control at one time. The resulting firestorm creates havoc in a number of communities simultaneously, stretching personnel and equipment resources to the limit. Entire neighborhoods cease to exist and thousands of people are homeless. While fire officials deal with massive fire control problems with the advancing flames, law enforcement is faced with the developing problems of traffic control, evacuation, emergency shelters and looter control in a number of areas in addition to handling other essential day-to-day law enforcement functions. Given the location of the fire, where are the best places for evacuation centers, traffic control positions and looter patrols? How do the police, fire and other governmental agencies establish a system which handles the dynamic, massive coordination required among multiple agencies to respond to this disaster effectively? How does an Incident Commander make the best use of resources in the least amount of time? Geographic information systems provide the answer for police, fire and other municipal entities for timely, effective and cost-efficient response to this emergency.

Data You Can See

The Clinton administration and many of the communications giants have been heralding the coming of "information superhighways" which will improve and speed up the ability of government, business, schools and individuals to access and

utilize the thousands of existing information databases available today. This vision of the future also creates a major difficulty for its users. How does anyone integrate all of this data into a meaningful medium so that it can be understood? The answer is in geographic information systems or GIS. According to the President of Ultimap Corporation, Bob Bro, "there are tax assessment systems and there are parks and recreation systems, and there are all kinds of accounting systems and police systems that have all kinds of attribute data from all over the United States. The real benefit of GIS will be the integration of all of the attribute data with the geographics."[1] GIS provides the opportunity to present virtually all data in a visual manner. If the laborious, one dimensional pin maps used by law enforcement in past years were valuable to plot crimes, imagine the ability to create this map in minutes (or seconds) with multi-dimensional information including type of crime, MO, type of location, owner/resident information, time, day, date, history, street lighting and proximity to known suspects. Imagine the ability to perform this task in real time. GIS provides the opportunity to make full use of the technology and data of the "information age" by presenting it in an easy to understand visual medium - a map.

What is GIS?

Geographic (or Geobase) Information System (GIS) is an overall term encompassing the entire field of computerized mapping as used today. GIS is like 5, 10 or 20 transparent maps representing different features of the same plot of land, overlaid on one another to represent the totality of that area. The user, however, is able to peel away a layer or layers to view the maps of interest and combine this with database information - all in a highly visual format.

The geographic information systems of today, however, are rooted in 18th century developments in cartography when the first accurate base maps were developed.[2] To some, GIS may seem like a new concept but, more than two centuries ago, George Washington's cartographers used map overlays in plotting his strategy for the battle of Yorktown in the Revolutionary War.[3] Various refinements in mapping and printing technologies, plus improvements in

statistical techniques and mathematics improved the field of cartography over the next 200 years but the development of computers in the mid-twentieth century marked the beginning of a revolution in mapping.

In the 1950's, thematic maps, those maps created to display a given theme such as land use or zoning, were first automated by researchers in a number of countries including the United States. During this time botanists, meteorologists, geophysicists and geologists began including computer-generated maps for a variety of purposes.[4] The evolution of GIS applications moved from limited meteorology, military, energy and transportation issues in the 1950's to almost every discipline in the late 1980's. Throughout this time, however, the primary customers of GIS firms were military and federal or state governmental entities. This pattern of usage had also influenced the design and marketing of products by GIS vendors.

The advent of computers allowed for the creation of a true GIS and, while it is not a requirement that GIS be computer-based, the reality is that in today's fast moving world, all useful GIS systems are computer-driven. Computers have allowed the GIS field to expand as it has enabled valuable linkages with other disciplines including computer-aided drafting, remote sensing, photogrametry, spatial analysis tools and a variety of databases. Software design has enabled GIS to be used on ever smaller computer platforms including PC's. It is also increasingly evident that the constant and rapid changes in computer hardware, such as increased speed, decreased size and reduced price, are helping smaller companies and organizations see the value of GIS.

GIS Today

The most critical issue in law enforcement today concerns the dramatic decrease in revenues in all areas of government which has severely affected safety services in California for the first time in recent memory. The deep, lingering recession and our huge national debt has caused the federal government to reduce aid to states and local communities. California has seen military bases close, aerospace jobs disappear, earthquakes, floods and riots contribute to its economic

problems. As local financial resources have decreased, the expectations of the police by the citizens have not. In a labor intensive operation such as a police department, the timely and most effective assignment/allocation of personnel resources in service delivery is of critical importance and it is in this area that geographic (or geobased) information systems (GIS) become invaluable.

The political and economic realities of the 1990's in the United States, however, are creating fundamental changes in GIS applications as the military (and, to some degree, its budget) continue to shrink and the California economy struggles to regain its momentum. According to John Antenucci, President of PlanGraphics Inc., state and local governments are experimenting with smaller, more focused GIS applications. "Focusing on a particular application is a whole lot more sensible than just surrounding yourself with technology and then looking for something to do with it."[5] GIS firms are placing an increasing emphasis on local government uses while looking for new markets and applications for their products. This "second wave" or revolution of GIS in government has caused the political entities and vendors to develop and build integrated GIS using improved technology, better organizational skills and new standards.[6]

So what is GIS today? According to Understanding GIS (Environmental Systems Research Institute (ESRI), Redlands, Calif.) there are 5 generic questions that a sophisticated GIS can answer.

1. *What is at...?* GIS can answer what exists at a specific location. For example, a location can be described using place name, ZIP code, latitude and longitude or many other type of location system.
2. *Where is it?* Find locations satisfying specified conditions. For example, an investigator may have some information from an anonymous party on a criminal suspect who is living in a small apartment building adjacent to some railroad tracks in a commercial area of a large city. GIS would be able to narrow the search to speed the elimination process. The more information, the narrower the search becomes.

3. *What has changed since...?* GIS can spot changes in an area over a certain period of time. For example, changes in the crime rate of a neighborhood since the creation and installation of a street lighting district.

4. *What spatial patterns exist?* GIS can find patterns. For example, GIS could develop a pattern analysis of burglaries in a given reporting district or beat in a few minutes to assist investigators.

5. *What if...?* GIS is extremely effective in modeling various scenarios. For example; or, what impact would the creation of a new police patrol system have on crime in a specific area?[7]

GIS can handle graphic data, but also has the ability to store nongraphic data and geographically referenced data and to link this information with the digital points on a map so that the users can perform any number of correlations, print the data, print a map or combine the features of both. The prime thrust of this technology is to provide geographic analysis and not just a display. In providing a variety of spatial analyses it can create any number of overlays for one project so that a researcher can "peel away" the demographic profile, the land use, the street lighting, the school districts or any number of other features.

Today, GIS is employed by government and business to conduct land-use studies, provide environmental assessments, evaluate and develop natural resources, determine the best place for residential or commercial developments, and to manage the infrastructure (roads, sewer, water, etc.) by both private industry and government. It is used to create highly accurate digitized mapping, to find the most efficient routes for school buses, analyze disease patterns and to define election districts. It is used in private industry to develop demographic and spatial analysis to develop markets and assist in locating retail or commercial facilities. Federal Express and other private parcel delivery services use the technology to manage the collection and delivery of packages. Its uses are virtually unlimited.

In law enforcement, GIS is used in hundreds of locations to enhance 911

services. This is one of the major growth areas expected for GIS in public safety in the future. "In the next 10 years, we can expect 911 emergency services to change drastically as competition increases in the industry, and large multi-location systems begin to provide increased levels of technical sophistication in the processing of emergency calls."[8] In Beaverton, Oregon, Des Moines, Iowa, Bradenton, Florida and numerous other locations, GIS is being used to improve emergency service deliveries. In cities like Jersey City, New Jersey GIS is being combined with CAD and call prioritization to improve response times and reduce errors. Recent software by Strategic Mapping and other vendors uses global positioning system (GPS) technology for vehicle tracking, displaying the vehicle's location directly to a base map and/or monitor.[9]

GIS is being used in crime analysis in Seattle and Tacoma, Washington, Minneapolis, Minnesota and San Bernardino County, California. Police officials have learned that graphically selecting, displaying and analyzing criminal activity allows officers to "see" crime via GIS and enables them to anticipate criminal activity, develop probable cause and focus scarce resources. The closer that this analysis approaches real-time, the more effective the analysis becomes.[10] In a related area, Melbourne, Australia is involved in a crime trend analysis study. The aim of this study is to use GIS to see whether resulting crime analysis reveals trends that could be used to improve police effectiveness and public safety.[11]

Products such as Find 911 (GTE) have been combined with StatusMap (ESRI/GTE) enabling linkage of nongraphic information to geographic locations. StatusMap type programs are designed to be fast, flexible display interfaces to enable not only the traditional tabular data (phone number, name, etc.) to be displayed, but would combine this with a map on the 911 display. Future enhancements will include last known vehicle location and routing information at this time.[12]

GIS is being used in disaster planning in Texas for flooding (Corpus Christi), earthquake response in California and hurricane response in Florida. In the aftermath of Hurricane Andrew, "GIS was used to locate the best sites for

kitchens, tent cities, disaster application centers, hazard mitigation locations and other types of location-dependent facilities".[13] In the relief efforts, GIS created 30 different types of maps each day for the multitude of involved agencies. One of the most important uses of GIS in the wake of Hurricane Andrew was in the removal and dumping of the hugh amounts of debris.

Clark County Nevada is engaged in an emergency management GIS project involving over a dozen agencies. This system is designed to assist in rapidly defining danger zones, critical facilities, shelters, power outages, hazardous material locations and spills, fires, road closures and other specified critical areas. They have conducted two successful simulations of the program at this writing.[14]

One of the most visible GIS stories in California law enforcement is SINS, which is shorthand for Statewide Integrated Narcotics System. SINS has been developed under the direction of the Western States Information Network (WSIN) and is a bureau of the California Attorney General's Department of Justice. This system operates two "war rooms" (Sacramento and Los Angeles) that will handle daily operations, provide real-time access to narcotics case information and coordinate investigations to avoid the potentially tragic situations where one agency's undercover officer is working a "suspect" who is actually an officer with another department working their case. SINS will eventually link numerous law enforcement databases to enhance safety, improve investigative quality and increase apprehensions.[15]

In Spain, the Guardia Civil instituted a full GIS to deal with all aspects of national security with inaugural use for the 1992 Olympic Games in Barcelona. This GIS provided national and local authorities with a real-time global view of multiple, evolving situations. This GIS included special event security and routing, vehicle control, real-time patrol allocation, digital terrain modeling, thematic cartography and report generation, monitoring itineraries and routes of VIP's, and location/attribute queries.[16]

Other current uses for GIS in law enforcement have been the creation of mutual aid response areas, beat and reporting district structures, patrol routes

and rudimentary flex beats (beats that change depending on need).

GIS technology is being pushed by several trends that will cause it to have an even greater role in local governmental decision-making, operations and reporting. First, governments have a better understanding and working knowledge of GIS and, because of this, are organizing information and structuring operations more effectively. Second, technology continues to rapidly expand providing GIS users greater variety and choice in both hardware and software plus rapidly decreasing cost. Third, a stronger pursuit of standards for GIS and data-sharing is making it easier for different entities to share systems and data. Last, GIS software is becoming more user friendly as vendors create improved, menu driven graphical interfaces to allow people without extensive backgrounds in computers to use their systems. All of these trends have combined with external issues (i.e. military cutbacks) to re-focus the GIS market on local government applications. The changes in market direction are already evident as one market research firm has concluded that over 37% of today's $2 billion GIS market is attributable to state and local government.[17] In fact, the Executive Vice President of Intergraph Corporation's Mapping Services Division believes that , "State and local government are probably the best customers for GIS technology. They have a mission that won't go away, and they have some of the most complicated problems that cut across jurisdictional, physical and political boundaries".[18]

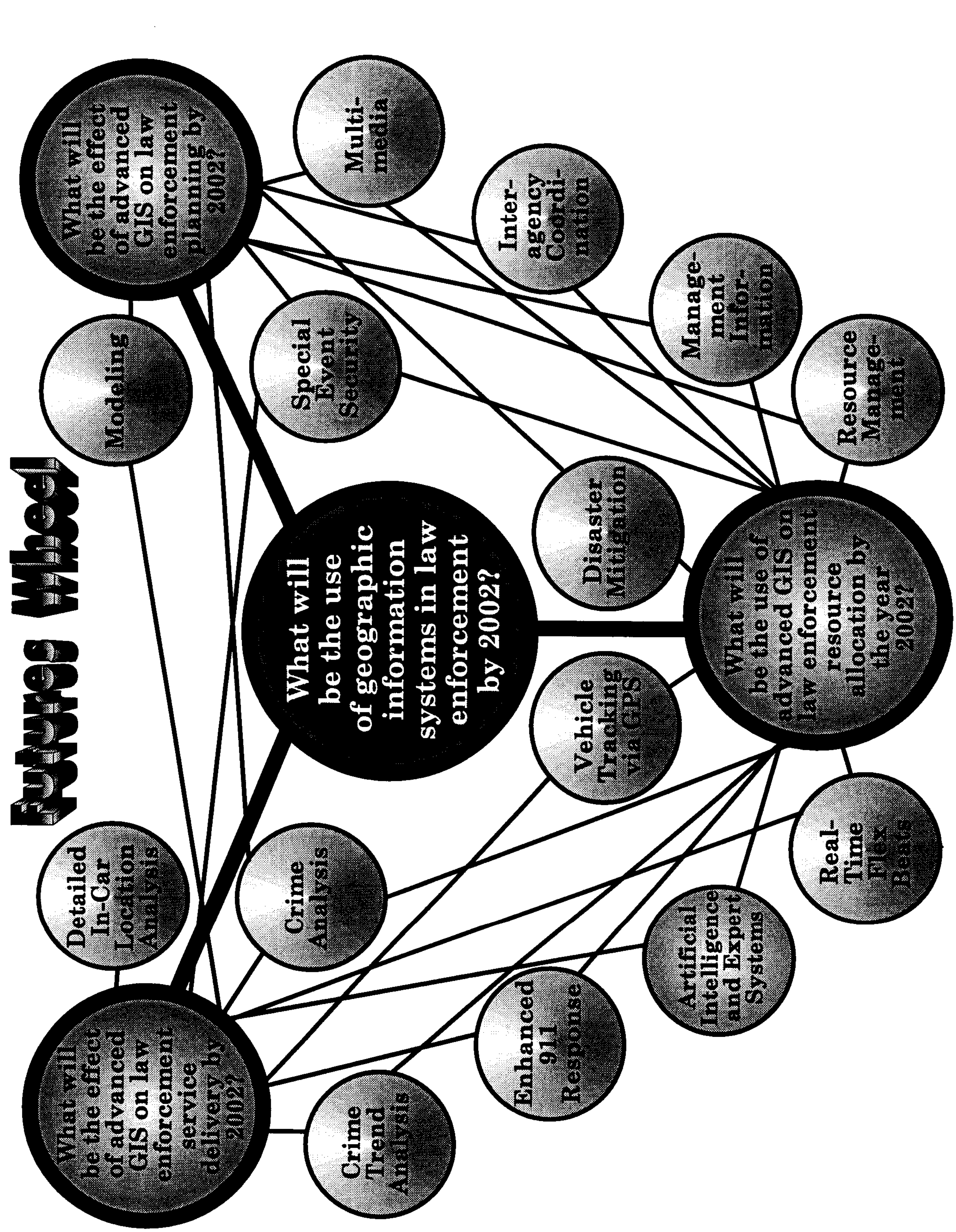


Figure 1 - Futures Wheel

Literature Scan

In order to get the most recent and valid information on the subject, eleven GIS vendors were contacted and asked for their assistance in providing an updated literature search. The library at Environmental Systems Research Institute was also contacted and made available to the researcher. A scan of the literature related to geographic information systems indicated a need for understanding a number of areas in order to successfully plan for, implement and realize maximum utility of GIS in the future. These areas are:

- GIS standards
- Database conversion
- Government data sharing policies
- Remote sensing
- Global positioning systems (GPS)
- Artificial intelligence
- Photogrammetry
- Computer-Aided Drafting and Design (CADD)
- Computer-Aided Dispatch (CAD)

The results of the literature scan indicated that GIS is a widely used and growing technology. The question that needs to be asked is what is the potential for GIS in the future and, particularly, its potential for the field of law enforcement.

Interviews

A variety of professionals in the GIS, law enforcement and data processing fields were interviewed to clarify both the results from the literature scan and to examine the issue and potential sub-issues. The cross-section was necessary to examine the GIS field from the design, application and utility perspectives. Many of these individuals were interviewed on several occasions. The persons interviewed in this part of the process were:

- Jon Harrison, Application Senior Consultant (Local Government

Applications), Environmental Systems Research Institute, Redlands, California, (909) 793-2853 (by telephone and in person)

- Rodney Hoops, Lieutenant, San Bernardino Sheriff's Department, San Bernardino, California, (909) 387-3700 (in person and by telephone)
- David Villegas, Data Processing Manager, City of Redlands, Redlands, California, (909) 798-7624 (in person)
- Fritz Maher, Manager, Applications Programming (Military Applications), Environmental Systems Research Institute, Redlands, California (909) 793-2853 (in person and by telephone)
- Milan Mueller, Principal/Director, The Omega Group, San Diego, California (619) 481-3119 (by telephone)

In the discussions of the findings from the literature scan the participants raised several other sub-issues within the issue. The GIS professionals believed that the strongest potential uses for law enforcement were in improving service delivery, assigning personnel appropriately and modelling or "what if" testing. In discussing this further with all of those interviewed the issue and sub- issues were narrowed as follows:

What will be the use of geographic information systems (GIS) by law enforcement by the year 2002?

- What will be the effect of advanced geographic information systems (GIS) on law enforcement resource allocation by 2002?
- What will be the effect of advanced geographic information systems (GIS) on law enforcement service delivery by 2002?
- What will be the effect of advanced geographic information systems (GIS) on law enforcement planning by 2002?

Definition of Related Knowledge Areas

A number of improvements in related fields have also advanced the cause of GIS during the past 30 years. Some of these fields were previously identified in the research but not defined. The following definitions should be useful to the

discussion of GIS.

Cartography

The technology of mapping or charting features of the Earth's topography. An important area of cartography is "thematic mapping", mapping a particular subject (such as burglaries in a given area) to present a visual representation of the subject.

Remote Sensing

Remote sensing, the recording of imagery or data from a distance (such as satellite infrared photography), can be coupled with aerial photography through the technology of photogrammetry to create accurate maps that can be incorporated into a GIS.

Photogrammetry

The technology of preparing maps from aerial photographs.

Computer-Aided Design and Drafting

Computer-aided design and drafting (CADD) is an automated drawing method that displays information spatially and which allows for the rapid development through GIS of various maps and fast, accurate printing thereof.

Global Positioning Devices

In addition, global positioning devices (GPS) can be linked with GIS to provide immediate locations of mobile units or to determine the geographic location of a particular place or area and image processing can be employed to insert digitized graphic information (such as photographs) into the GIS in reference to a particular location or purpose.

Computer Aided Dispatch (CAD)

Computerized assistance for dispatch that takes many forms including call prioritization, automated location information and available units. When used with emergency vehicles, CAD can be very sophisticated. On-line maps of a city can display emergency vehicles as moving dots on a map with their status (awaiting call, enroute, completed, etc.) displayed in color.

Artificial Intelligence

The part of computer science which studies how to use computers to simulate human mental processes.

Expert Systems

Computer programs that simulate the way experts solve problems and which improve performance in all areas.

Overview

This study is presented in five chapters - introduction, futures study, strategic management plan, transition management plan and conclusions and recommendations.

The introduction (Chapter One) is designed to stimulate interest in geographic information systems, present a background of the technology and to develop the issue and sub-issues.

The futures study (Chapter Two) will discuss the processes undertaken in forecasting trends and events relative to the issue and sub-issues. Scenarios will also be developed from forecasting data and one scenario will be selected for implementation.

The strategic management plan (Chapter Three) will examine the stakeholders in this issue and also evaluate the external environment and organizational capacity of Orangedale PD to address the issue.

The transition management plan (Chapter Four) presents a structure to maximize success and assist in implementing the strategic plan by examining the critical mass and developing steps to achieve the desired movement.

Conclusions and recommendations will be discussed in Chapter Five.

Chapter Two

Forecasting the Future

The Issue

What will be the use of geographic information systems (GIS) by law enforcement by the year 2002?

Sub-Issues

- What will be the effect of advanced geographic information systems (GIS) on law enforcement resource allocation by 2002?
- What will be the effect of advanced geographic information systems (GIS) on law enforcement service delivery by 2002?
- What will be the effect of advanced geographic information systems (GIS) on law enforcement planning by 2002?

Nominal Group Technique

One of the most difficult parts of this process was putting together a nominal group that would be representative of the law enforcement, GIS, data processing, planning and crime analysis functions. The group met to examine the aforementioned issue and sub-issues.

The nominal group was composed of twelve individuals in addition to the facilitator (author) and a recorder:

- Lieutenant Cletus F. Hyman, Patrol Watch Commander and Computer Services, Redlands Police Department
- Sergeant Bill Cranfill, Administrative Services and Emergency Services Manager, Redlands Police Department
- Corporal Mark A. Bush, Traffic Corporal and Traffic Records, Redlands Police Department
- Phillip McCormick, Emergency Services and Planning Manager, City of Chino and Chino Police Department

- Anthony Mackesy, Computer Design Engineer, Planning Department, City of Redlands
- David Villegas, Data Processing Manager, City of Redlands
- Scott Howell, Senior Administrative Analyst, Fontana Police Department
- Bryan Lavender, Research Analyst, San Bernardino County Sheriff's Department
- Todd Stellhorn, Marketing Consultant, Environmental Systems Research Institute, Redlands
- Fritz Maher, Manager, Applications Programming (Military Applications), Environmental Systems Research Institute, Redlands
- Jon Harrison, Application Senior Consultant (Local Government Applications), Environmental Systems Research Institute, Redlands
- Lee Johnston, Regional Manager (California, Nevada & Hawaii), Environmental Systems Research Institute, Redlands

The facilitator and recorder for this NGT were:

Facilitator: Chief Lewis W. Nelson, Redlands Police Department

Recorder: Captain Frank Scialdone, Fontana Police Department

The nominal group process began at 8 a.m. and lasted until approximately 2 p.m. during which time the nominal group technique (NGT) was employed in order to identify potential trends and events that would affect the issue in relationship to its use in law enforcement. Each participant was provided a handout that discussed the definitions and differences between a trend and event (Appendix A) and a basic description of GIS (Appendix B). Both handouts were discussed at length so that all participants had an opportunity to have their questions answered regarding GIS as well as with the NGT process.

Event Identification From the NGT

In the initial part of the NGT the facilitator solicited potential events from

each of the panelists until such time as it appeared that they had exhausted their ideas. The ideas were recorded on an easel and posted in view of the panel. The list of the original thirty-three events as generated was:

1. High-tech business exodus from California results in 30% decrease in State revenues.
2. Police departments mandate basic computer skills for all entry level employees.
3. Satellite link-up costs reduced by 50% to provide affordable data for geobase information systems.
4. A new system is developed to provide fast, reliable transfer of large amounts of data with a high degree of security.
5. The United States Supreme Court hands down a decision which releases approximately 40% of the non-violent inmates in California due to prison over-crowding.
6. State mandates all crime reporting in geographic geobase information format.
7. Federal government makes military and intelligence satellite data available to local government.
8. Satellite monitoring system developed in 2000 for high density, high crime population areas due to an all-time level of civil unrest.
9. The United States Supreme Court rules that satellite surveillance of high density, high crime areas is unconstitutional absent probable cause and specific purpose.
10. All major items of property are capable of being tracked by electronic tracking devices.
11. The Department of Justice requires all police departments in cities with populations over 50,000 to implement community-based policing.
12. Police officers issued notebook computers with communications capability.
13. Expert systems are developed that link geographic information

systems (GIS) with computer-aided dispatch (CAD) and crime analysis.

14. Developments in geographic information systems create the capability for real-time, flex-beats for law enforcement.
15. Federal government mandates all levels of government to build geographic information databases as part of a national system.
16. All traffic enforcement in California will be handled by California Highway Patrol.
17. Orangedale Police Department becomes the first "paperless" police department in California.
18. IBM finds a total collapse of the main frame and minicomputer markets because of parallel processing.
19. All California law enforcement is regionalized by the year 2000.
20. 50% of all law enforcement field personnel are civilians in 1997.
21. Orangedale Police Department loses multi-million dollar suit over field errors caused by faulty data in geographic information system.
22. Geographic information systems are used for the first time in real-time response to a 7.8 earthquake.
23. Intel Corporation announces the release of a new chip as powerful as main frame computers of the late 1980's.
24. The Federal government announces grants to fund the implementation of geographic information systems for local government.
25. Police unions throughout the state reject the automatic vehicle locating (AVL) systems.
26. San Bernardino Metropolitan Police Union files suit against department administrators in late 1995 complaining of the excessive amount of electronic gear they are required to carry and utilize.
27. New trade restrictions for imports from Pacific Rim countries result in skyrocketing computer prices in the United States.

28. CalTech uses a geographic information system as part of a program that successfully predicts an earthquake for the first time.
29. The State of California goes broke.
30. Geographic information pattern analysis locates 10 tons of cocaine in San Bernardino County.
31. 1995 FBI crime statistics indicate an 80% increase in Part 1 crimes since 1992.
32. A regionalized geographic information system is implemented in San Bernardino County.
33. The United States Geological Survey completes a 1:24,000 digital survey of the United States.

After the thirty-three original events were posted, there was a discussion among the panelists of seven of the events for the purpose of clarification. After this discussion, each NGT panelist individually ranked the events so that the top ten could be determined. Each member then provided their scores which were recorded and scored to arrive at the top ten. The top 10 selected from the original list of thirty-three events were:

1. Expert systems are developed that link geographic information systems (GIS) with computer-aided dispatch (CAD) and crime analysis.
2. State mandates all crime reporting in geographic geobase information format.
3. Developments in geographic information systems create the capability for real-time, flex-beats for law enforcement.
4. 1995 FBI crime statistics indicate an 80% increase in Part 1 crimes since 1992.
5. Geographic information systems are used for the first time in real-time response to a 7.8 earthquake.
6. Federal government mandates all levels of government to build geographic information databases as part of a national system.

7. Federal government makes military and intelligence satellite data available to local government.
8. All California law enforcement is regionalized by the year 2000.
9. All major items of property are capable of being tracked by electronic tracking devices.
10. Police departments mandate basic computer skills for all entry level employees.

Selected Events for Forecasting

Finally, the top ten events were prioritized by the panel in rank order beginning with that event which the group felt was most important. This was accomplished by each NGT panelist individually ranking the ten events on a provided worksheet. The Recorder then scored the sheets to determine the final order. The final list of ten in order of ranking were:

1. Expert systems are developed that link geographic information systems (GIS) with computer-aided dispatch (CAD) and crime analysis.
2. State mandates all crime reporting in geographic geobase information format.
3. Developments in geographic information systems create the capability for real-time, flex-beats for law enforcement.
4. 1995 FBI crime statistics indicate an 80% increase in Part 1 crimes since 1992.
5. Geographic information systems are used for the first time in real-time response to a 7.8 earthquake.
6. Federal government mandates all levels of government to build geographic information databases as part of a national system.
7. Federal government makes military and intelligence satellite data available to local government.
8. All California law enforcement is regionalized by the year 2000.

9. All major items of property are capable of being tracked by electronic tracking devices.
10. Police departments mandate basic computer skills for all entry level employees.

Event Forecasting

The group then engaged in another short discussion to insure that all members of the group understood each event. Following the discussion, the group engaged in the first round of event probability and impact evaluation using a form designed by the author (Appendix C). The median, as well as the upper and lower mean deviations from the median, were calculated and there was a discussion of possible reasons for scores that were excessively high or low for each event. A second round of scoring was undertaken to finalize the median and deviations.

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Event #1	0	0	0	0.28	0.55	0.62	0.69	0.76	0.83	0.9
Event #2	0	0	0	0	0.43	0.49	0.55	0.61	0.67	0.73
Event #3	0	0	0.25	0.49	0.73	0.77	0.81	0.85	0.89	0.93
Event #4	0	0	0	0	0.5	0.56	0.61	0.67	0.72	0.78
Event #5	0	0.15	0.29	0.44	0.58	0.62	0.66	0.7	0.74	0.78
Event #6	0	0	0	0	0	0	0	0.16	0.32	0.48
Event #7	0	0	0	0	0	0	0	0.17	0.34	0.5
Event #8	0	0	0	0	0	0	0	0	0.25	0.5
Event #9	0	0	0	0	0	0	0.13	0.27	0.4	0.53
Event #10	0	0	0	0.3	0.6	0.63	0.65	0.68	0.7	0.73

Figure 2 - Cumulative Event Probability

Events:

1. Expert systems are developed that link geographic information systems with computer-aided dispatch and crime analysis.
2. State mandates all crime reporting in geographic geobase information format.
3. Developments in geographic information systems create the capability for real-time, flex-beats for law enforcement.
4. 1995 FBI crime statistics indicate an 80% increase in Part I crimes since 1992.
5. Geographic information systems are used for the first time in real-time response to a 7.8 earthquake.
6. Federal government mandates all levels of government to build geographic information databases as part of a national system.
7. Federal government makes military and intelligence satellite data available to local government.
8. All California law enforcement is regionalized by the year 2000.
9. All major items of property are capable of being tracked by electronic tracking devices.
10. Police departments mandate basic computer skills for all entry level employees.

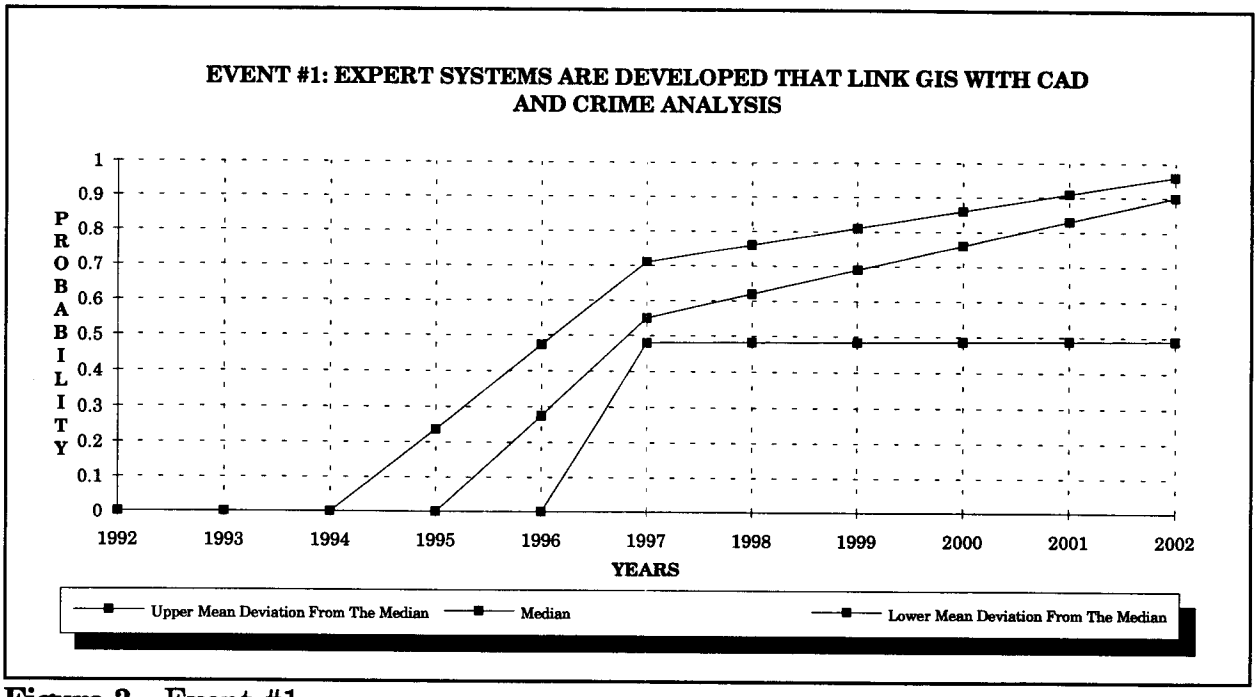


Figure 3 - Event #1

INTERPRETATION

During the NGT this was the 13th event listed during the round-robin recording of ideas. It was selected 1st in the initial selection of events and remained in that position after the events were prioritized in the last part of the NGT.

As the chart reflects, the second round of the delphi process identified the median for years until the probability passed zero as 3 with a mean deviation of 4/2. The median for probability for 5 years from now was .55 with a mean deviation of .71/.48. At 10 years, the median was .9 with a mean deviation of .96/.49. It should be noted there was a moderate narrowing (.24) of the mean deviation at 5 years from the first to the second round of the delphi but only a small decrease at 10 years (.11). The use of the upper and lower mean deviations from the median softens the possibility of a single individual or small group of individuals from skewing the data. This was used on all groups even if there may have been consensus on the issue.

extremely positive impact on the issue. During the discussions, many opinions were offered by law enforcement, GIS, and data processing personnel that a versatile, successful linking of GIS, CAD, and crime analysis would create a situation that would drive the increased use of geographic information systems. The graph indicates that the probability of this event occurring increases dramatically past 3 years. There were some divergent views of this event's probability of occurring after 5 years as noted by the wide spread between the lower deviation and the median but the median and upper deviation are extremely close at 10 years.

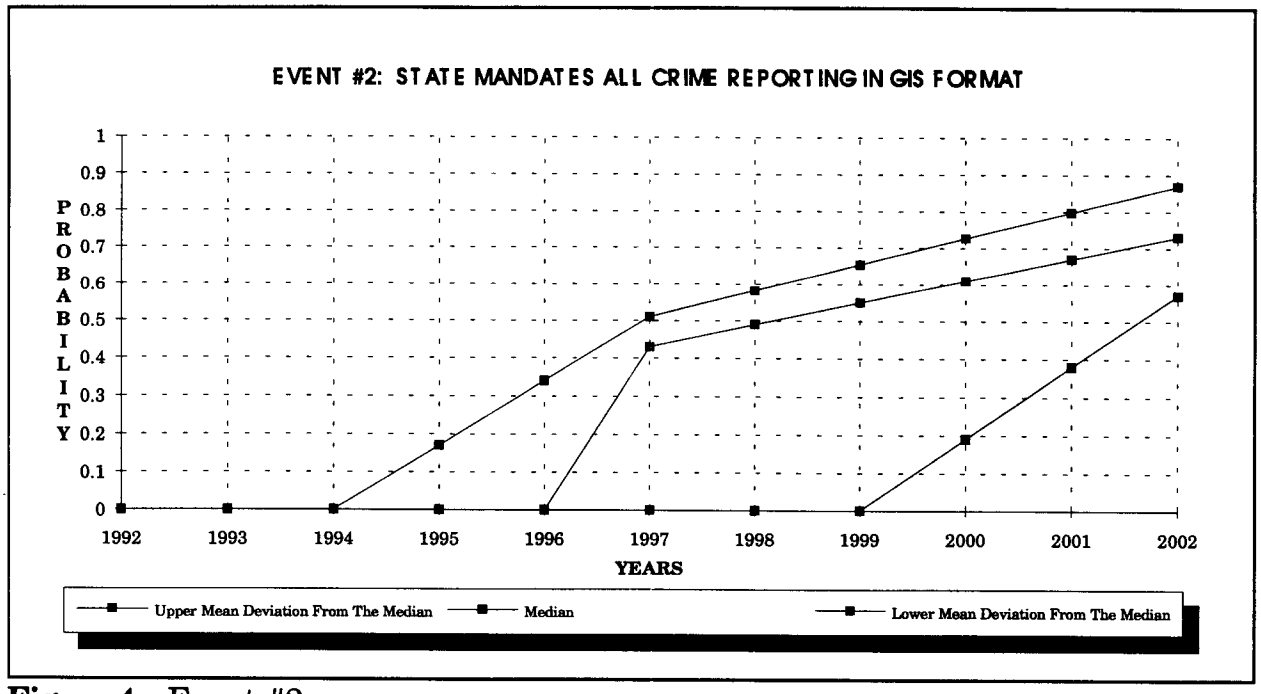


Figure 4 - Event #2

INTERPRETATION

During the NGT process this event was the 6th listed during the round-robin recording of ideas. It was selected 3rd in the initial selection of events and, when the events were prioritized at the conclusion of the process, was placed in 2nd position in the final ranking.

As the chart reflects, the second round of the delphi process identified the median for years until the probability passed zero as 4 with a mean deviation of 7/2.8. The median for probability for 5 years from now was .43 with a mean deviation of .51/.29. At 10 years, the median was .73 with a mean deviation of .87/..57. I should note there was a slight narrowing (.08) of the mean deviation at 5 years from the first to the second round of the delphi and no significant change at 10 years. The use of the upper and lower mean deviations from the median softens the possibility of a single individual or small group of individuals from skewing the data. This was used on all groups even if there may have been consensus on the issue.

The group believed that the occurrence of this event would have a positive

impact on the issue. During the discussions, the graph indicates that the probability of this event occurring increases dramatically past the 4 year point but there are considerable differences in opinion as noted by the broad spread in the mean deviation. Group participants felt that there is a movement at the federal level to use GIS for many purposes and that the nature of the systems are particularly relevant to the law enforcement purpose. They believed that a state mandate for reporting in the GIS format would force all agencies in the state to implement the technology and would cause other states to follow.

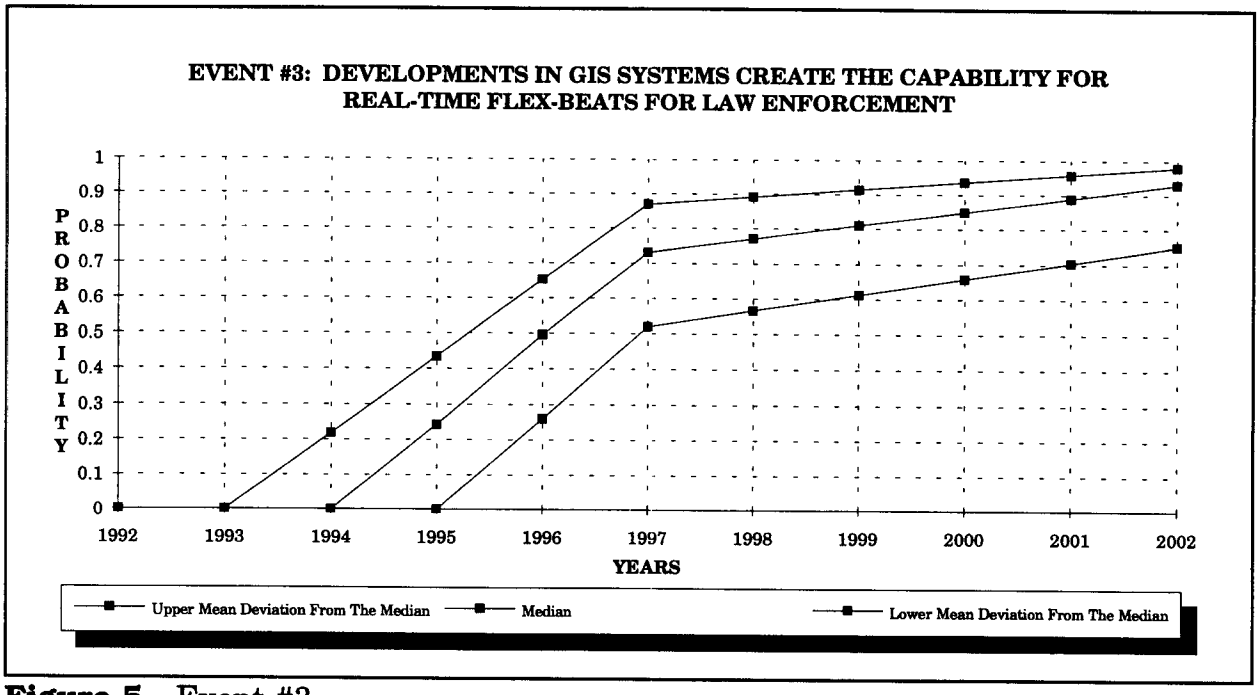


Figure 5 - Event #3

INTERPRETATION

During the NGT process this event was the 14th of 33 listed during the round-robin recording of ideas. It was selected 2nd in the initial selection of events and, when the events were prioritized at the conclusion of the process, was placed in 3rd position in the final ranking.

As the chart reflects, the second round of the delphi process identified the median for years until the probability passes zero as 2 with a mean deviation of 3.7/1.8. The median for probability for 5 years from now was .73 with a mean deviation of .87/.52. At 10 years, the median is .93 with a mean deviation of .98/.75. It should be noted that there were extremely small changes, narrowing the mean deviation by .02 at 5 years and by .04 at 10 years, for the first to the second round of the delphi. The use of the upper and lower mean deviations from the median softens the possibility of a single individual or small group of individuals from skewing the data. This was used on all groups even if there may have been consensus on the issue.

The group believed that the occurrence of this event would have a very

positive impact on the issue. During the discussions, many opinions were offered that the GIS development will allow for large scale flex-beat implementation at 2 plus years. They defined "real-time, flex beats" as the ability of a system to evaluate crime and patrol data as it occurs and provide the ability to have flexible beat boundaries from day to day, if not from shift to shift. The group believed that the increased speed of new chips, the ability to parallel process with smaller, linked computers and improvements in GIS programming will speed up the time that this event occurs.

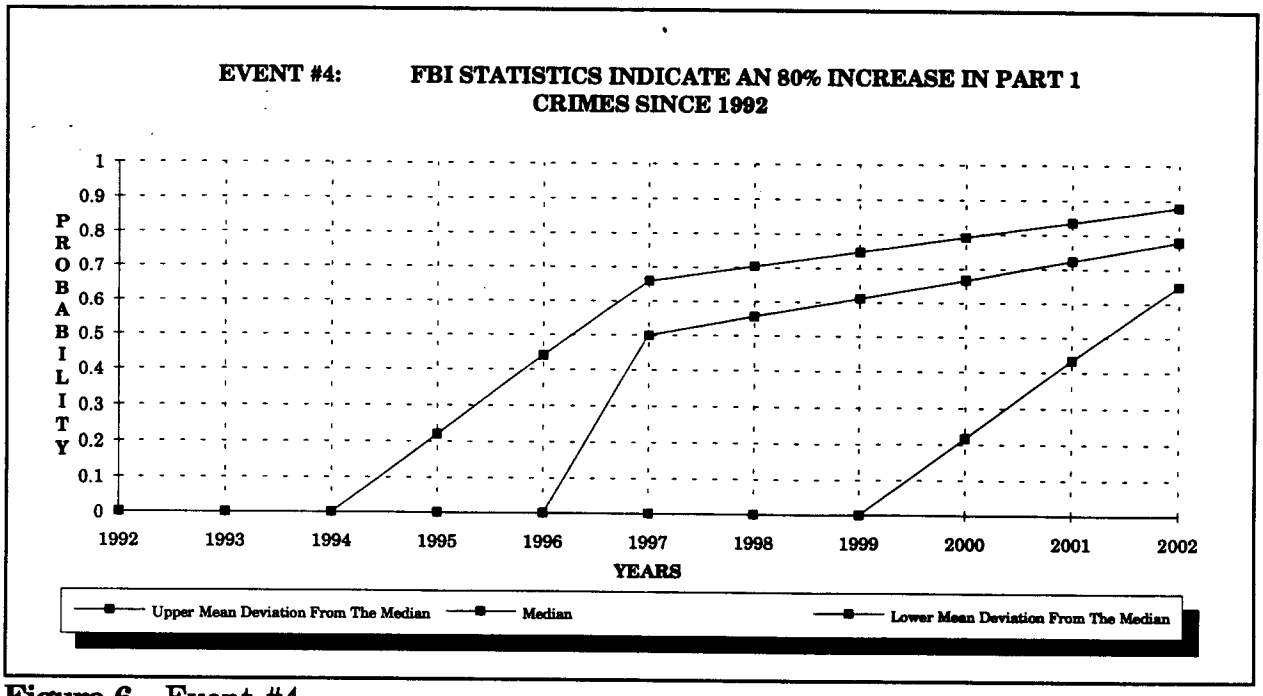


Figure 6 - Event #4

INTERPRETATION

During the NGT process this event was the 31st of 33 listed during the round-robin recording of ideas. It was selected 5th in the initial selection of events and changed to 4th position after the events were prioritized in the last part of the NGT.

As the chart reflects, the second round of the delphi process identified the median for years until the probability passed zero as 4 with a mean deviation of 7.5/2.17. The median for probability for 5 years from now was .5 with a mean deviation of .66/.31. At 10 years, the median is .78 with a mean deviation of .88/.65. It should be noted that there were extremely small changes of the mean deviation by .03 at 5 years and there was no change at 10 years, from the first to the second round of the delphi. The use of the upper and lower mean deviations from the median softens the possibility of a single individual or small group of individuals from skewing the data. This was used on all groups even if there may have been consensus on the issue.

During the discussions, the group believed that the occurrence of this event

would have a very positive impact on the issue. Although the probability of this event occurring may not be as high as other events, many opinions were offered that an increase of this magnitude would force government to abandon some of the resistance to changing information systems to get the maximum use of scarce and expensive resources - particularly manpower. GIS would enable police agencies to address emerging crime problems in real-time and to deploy resources to the problem while it's occurring, not after the fact.

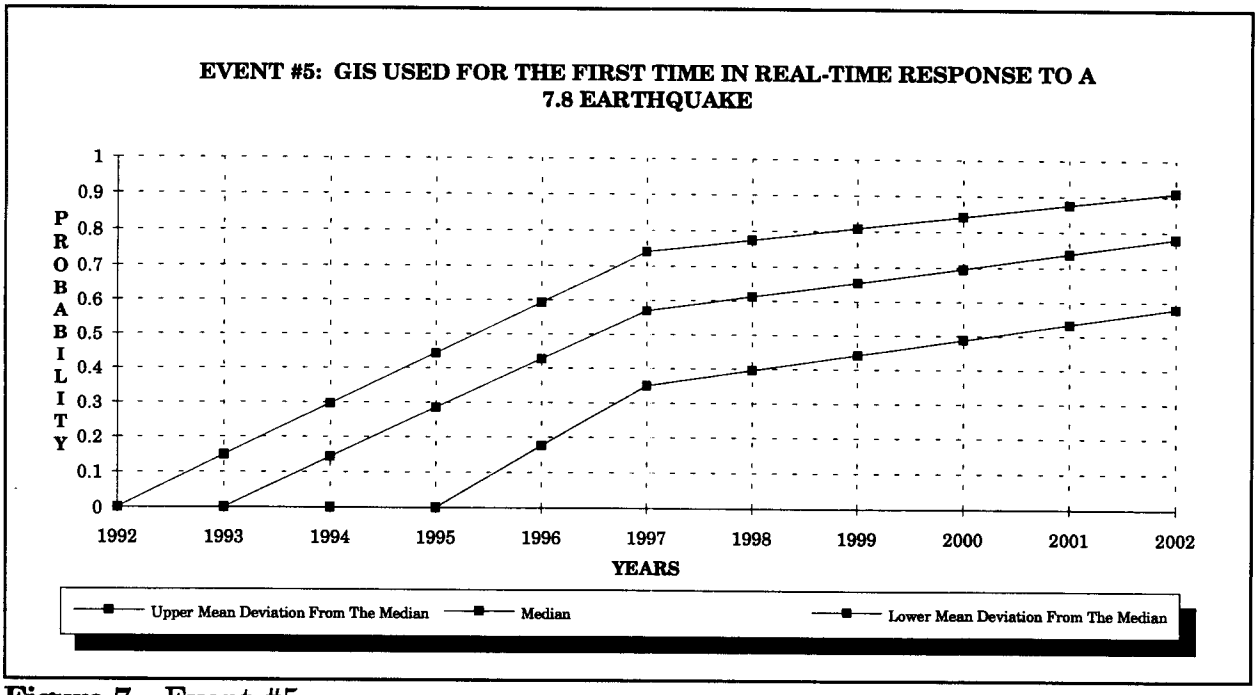


Figure 7 - Event #5

INTERPRETATION

During the NGT process this event was the 22nd of 33 listed during the round-robin recording of ideas. It was selected 4th in the initial selection of event and moved to 5th after the events were prioritized in the last part of the NGT.

As the chart reflects, the second round of the delphi process identified the median for years until the probability passed zero as 1 with a mean deviation of 3.5/.2. The median for probability for 5 years from now was .57 with a mean deviation of .74/.35. At 10 years, the median is .78 with a mean deviation of .91/.58. It should be noted that there were extremely small changes, narrowing the mean deviation by .02 at 5 years and by .01 at 10 years, from the first to the second round of the delphi. The use of the upper and lower mean deviations from the median softens the possibility of a single individual or small group of individuals from skewing the data. This was used on all groups even if there may have been consensus on the issue.

During the discussions, many group members (particularly those from the GIS field) felt that law enforcement is "technically" capable of this action today if

we had access to military or military-quality satellite data in real time. They believed that response to a major earthquake could be coordinated be examining satellite images for major building damage, smoke plumes, fires, flooding and downed bridges. They expressed the belief that the occurrence of this event would have a positive effect on the use of GIS in the future as they believe that a GIS-backed response would be significantly and noticeably improved.

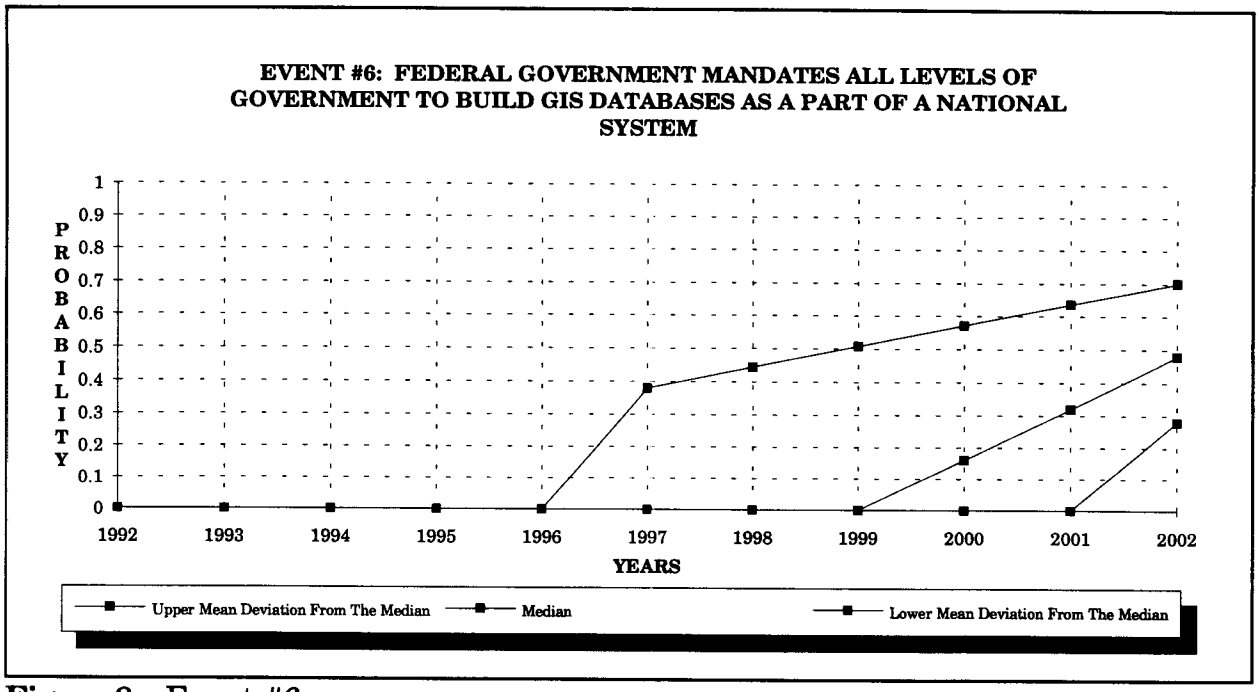


Figure 8 - Event #6

INTERPRETATION

During the NGT process this event was the 15th of 33 listed during the round-robin recording of ideas. It was selected 6th in the initial selection of events and remained in that position after the events were prioritized in the last part of the NGT.

As the chart reflects, the second round of the delphi process identified the median for years until the probability passed zero as 7 with a mean deviation of 9.7/4.8. The median for probability for 5 years from now was .23 with a mean deviation of .38/.11. At 10 years, the median is .48 with a mean deviation of .70/.28. It should be noted that there were small changes, narrowing the mean deviation by .10 at 5 years and by .04 at 10 years, from the first to the second round of the delphi. The use of the upper and lower mean deviations from the median softens the possibility of a single individual or small group of individuals from skewing the data.

This was used on all groups even if there may have been consensus on the issue. The group believed that the occurrence of this event would have a very

positive impact on the issue. In the discussions, all participants agreed that a federal mandate of this type would greatly advance the implementation of GIS. The group believed, however, that the first probable opportunity of this event occurring was at least 7 years away. The group did not foresee any downside in the occurrence of this event in relation to GIS.

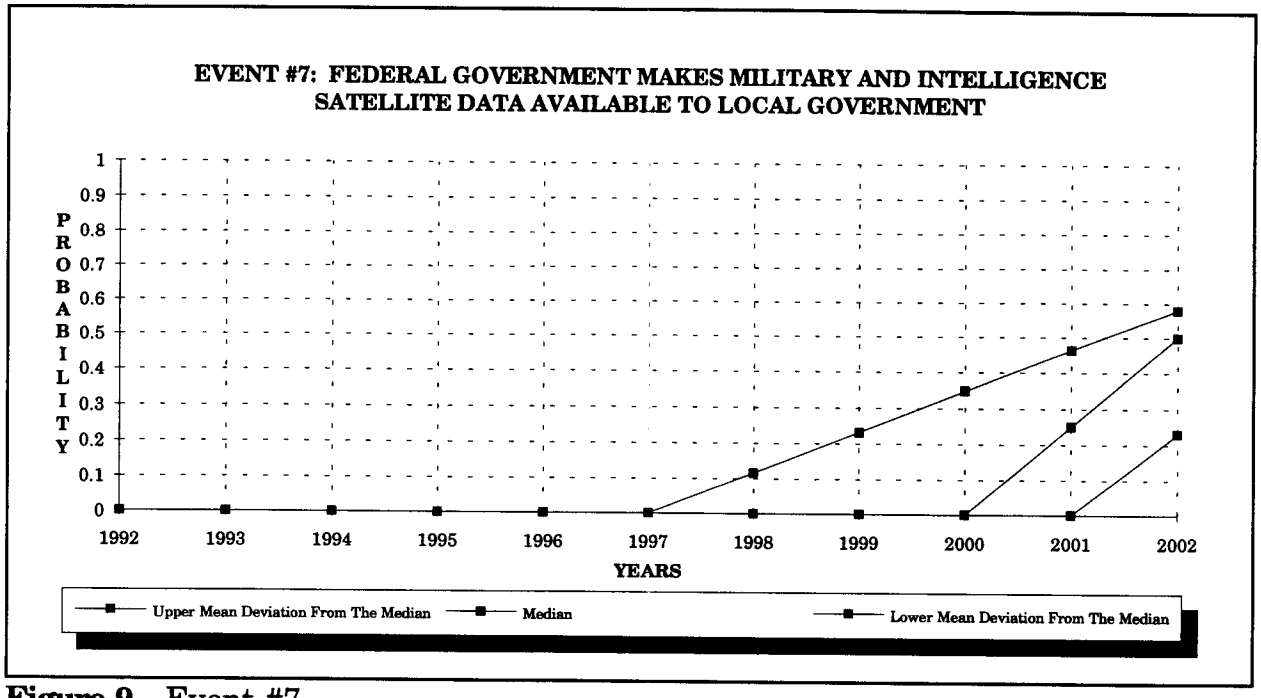


Figure 9 - Event #7

INTERPRETATION

During the NGT process this was the 7th event of 33 listed during the round-robin recording of ideas. It was selected 6th in the initial selection of events and changed to 7th position after the events were prioritized in the last part of the NGT.

As the chart reflects, the second round of the delphi process identified the median for years until the probability passed zero as 7 with a mean deviation of 9.7/4.5. The median for probability for 5 years from now was .33 with a mean deviation of .56/.12. At 10 years, the median is .50 with a mean deviation of .74/.23. It should be noted that there were small changes, narrowing the mean deviation by .09 at 5 years and by .04 at 10 years, from the first to the second round of the delphi. The use of the upper and lower mean deviations from the median softens the possibility of a single individual or small group of individuals from skewing the data. This was used on all groups even if there may have been consensus on the issue.

The group believed that the sharing of military and/or intelligence satellite

data with local and state governments would increase the effectiveness of GIS systems and, therefore, encouraged the use of the technology. The majority of the group indicated that this would be an extremely positive event for GIS, but several believed that public concern about privacy might detract from this event in fear of creating a "Big Brother", Orwellian environment. The group did not see this event occurring prior to 7 years from now without some type of external, severe event to act as a catalyst (such as a dramatic rise in major crimes over an extended period of time).

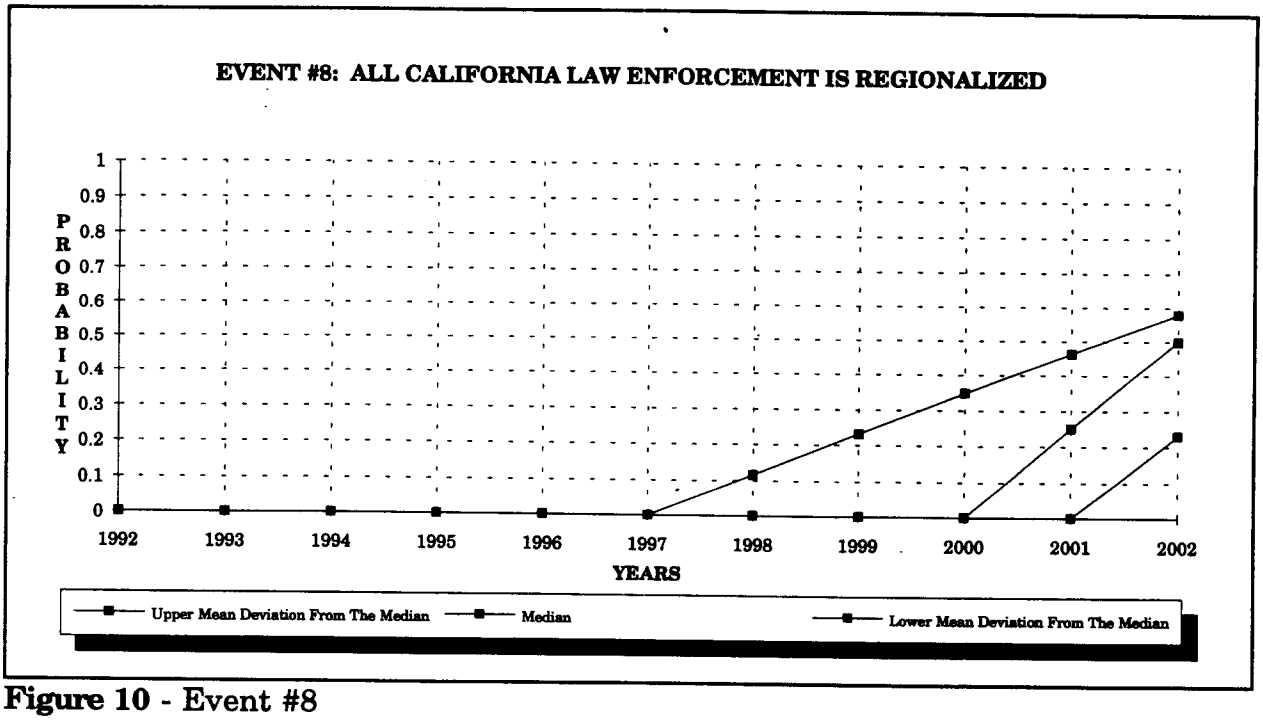


Figure 10 - Event #8

INTERPRETATION

During the NGT process this event was the 19th of 33 listed during the round-robin recording of ideas. It was selected 9th in the initial selection of events and changed to 8th position after the events were prioritized in the last part of the NGT.

As the chart reflects, the second round of the delphi process identified the median for years until the probability passed zero as 8 with a mean deviation of 9/5.7. The median for probability for 5 years from now was .23 with a mean deviation of .44/.11. At 10 years, the median is .5 with a mean deviation of .58/.23. It should be noted that there were extremely small changes, narrowing the mean deviation by .02 at 5 years and by .05 at 10 years, from the first to the second round of the delphi. The use of the upper and lower mean deviations from the median softens the possibility of a single individual or small group of individuals from skewing the data. This was used on all groups even if there may have been consensus on the issue.

During the discussions, there was some disagreement as to whether the

occurrence of this event would have a positive or negative affect on the issue. Eight of the twelve participants believed that regionalization would free up funds to enable the agencies to afford geobase technology. The remaining four members felt that it would take a severe financial situation to force cities to abandon their local police departments in favor of a less personal, regional law enforcement agency. They believed that this financial situation would deter the regional agency from entering the GIS field.

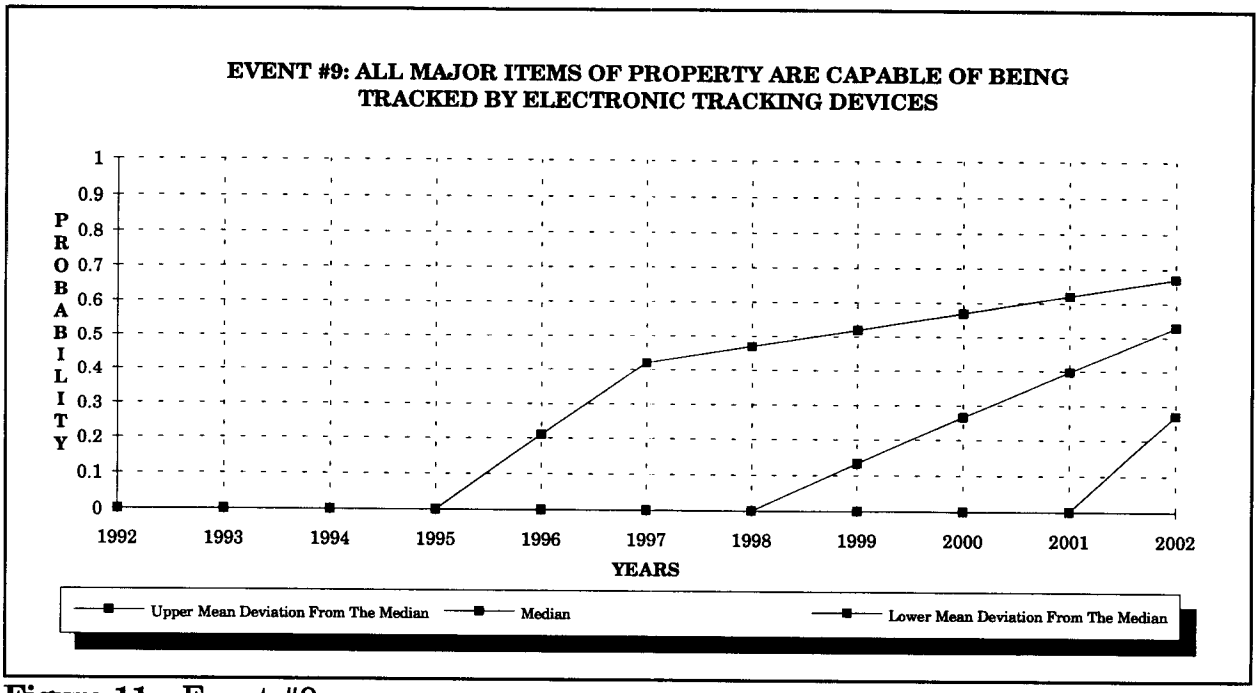


Figure 11 - Event #9

INTERPRETATION

During the NGT process this event was the 10th of 33 listed during the round-robin recording of ideas. It was selected 7th in the initial selection of events and changed to 9th position after the events were prioritized in the last part of the NGT.

As the chart reflects, the second round of the delphi process identified the median for years until the probability passed zero as 6 with a mean deviation of 9/3. The median for probability for 5 years from now was .23 with a mean deviation of .42/.08. At 10 years, the median is .53 with a mean deviation of .67/.27. It should be noted that there were small changes, narrowing the mean deviation by .08 at 5 years and by .03 at 10 years, from the first to the second round of the delphi. The use of the upper and lower mean deviations from the median softens the possibility of a single individual or small group of individuals from skewing the data. This was used on all groups even if there may have been consensus on the issue.

There was a strong consensus among the group that the implementation of

electronic locating devices to track major items of property would have an extremely positive effect on increasing the use of geobase information systems. There were some minor concerns about the effects of this tracking on personal privacy but, after some discussion, these concerns were put aside by all members. The group classified major items of property as property valued at more than $500 and believed that electronic tracking could easily be offered as an accessory just as maintenance contracts are sold for appliances today.

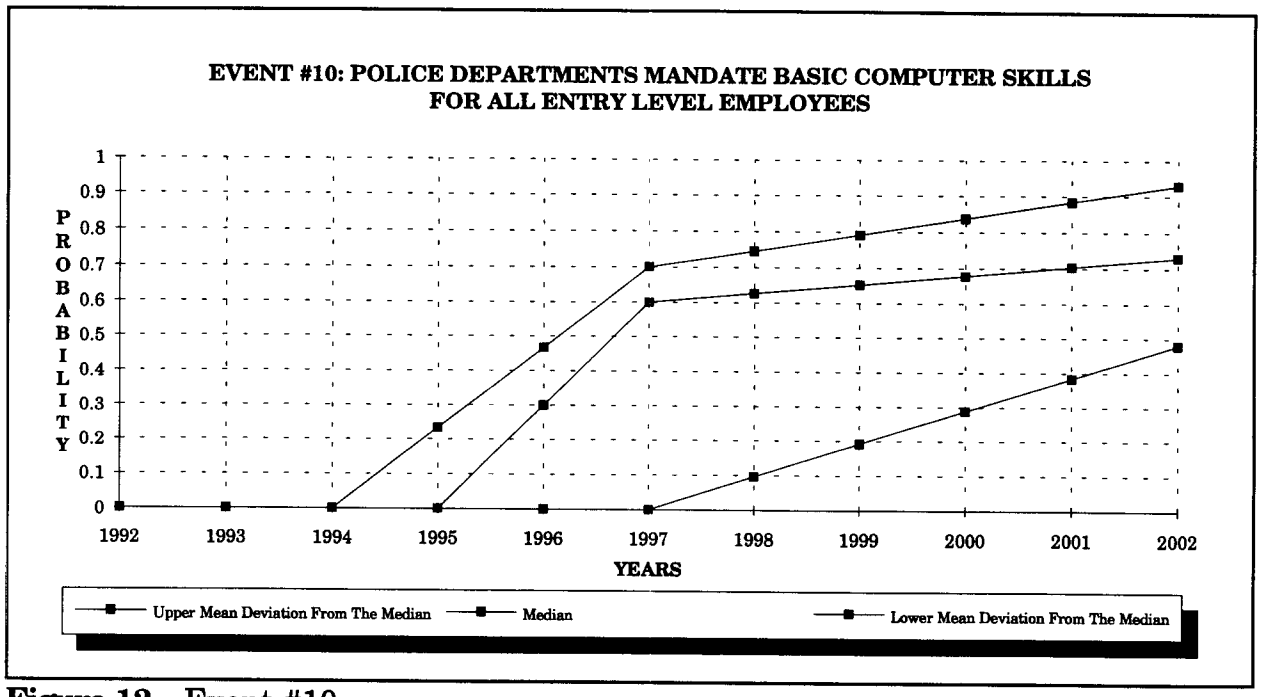


Figure 12 - Event #10

INTERPRETATION

During the NGT process this event was the 2nd of 33 listed during the round-robin recording of ideas. It was selected 8th in the initial selection of events and changed to 10th position after the events were prioritized in the last part of the NGT.

As the chart reflects, the second round of the delphi process identified the median for years until the probability passed zero as 3 with a mean deviation of 5/2. The median for probability for 5 years from now was .6 with a mean deviation of .7/.34. At 10 years, the median is .73 with a mean deviation of .93/.48. It should be noted that there were extremely small changes, narrowing the mean deviation by .04 at 5 years and by .05 at 10 years, from the first to the second round of the delphi. The use of the upper and lower mean deviations from the median softens the possibility of a single individual or small group of individuals from skewing the data. This was used on all groups even if there may have been consensus on the issue.

The group felt strongly that all police agencies should be requiring basic

computer skills for entry level employees today but believed that it would be 3 years before the probability of this occurring exceeds zero in the majority of police departments. The group felt strongly that the more computer literate the workforce becomes, the quicker the implementation of more sophisticated technology such as GIS. The group also noted that the failure of departments to require those skills today merely delays the introduction of certain technology and narrows the number of people capable of using it. The implementation of this requirement would have an extremely positive effect on the issue and the group did not identify any negative issues.

Trend Identification From the NGT

In the next part of the NGT the facilitator solicited potential trends from each of the panelists until, once again, it appeared that they had exhausted their ideas. The ideas were recorded on an easel and posted in view of the panel. Although there was no target number for trends or events, the panel developed a list of thirty-three trends. The thirty-three original trends in the order they were recorded were:

1. Training needs and requirements.
2. Number of high-tech businesses leaving California.
3. Cost of computer hardware and software.
4. Level of funding for law enforcement computer systems.
5. Level of awareness of successes using geobase (geographic) information systems.
6. Number of new state and federally mandated law enforcement programs.
7. Level of data and technology sharing between the government and the private sector.
8. Impact of home security systems on local crime.
9. Level of crime data available to the public.
10. Level of compatibility of computer systems.
11. Level of regionalized specialization in law enforcement.
12. Changes in laws regarding "right to know" versus "need to know".
13. Ability to manage large volumes of information.
14. Levels of economic stratification in the United States.
15. Educational level of entry level Police Officers.
16. Level of advancement in demographic analysis.
17. Level of funding for law enforcement computer systems.
18. Level of funding for law enforcement.
19. Changes in the law enforcement function.
20. Level of understanding of needs between the law enforcement and

geobase (geographic) information fields.

21. Changes in crime trends.
22. Improvements in expert systems for law enforcement.
23. Alternative funding sources for law enforcement.
24. Use of citizen volunteers in law enforcement.
25. Level of public confidence in law enforcement.
26. Level of civil unrest.
27. Use of multimedia computers and software in law enforcement.
28. Level of law enforcement staffing.
29. Level of private policing in the United States.
30. Types of organizational structures for law enforcement.
31. Availability of computer databases to local government.
32. Level of urban forecasting utilizing geobase (geographic) information systems.
33. Level of regionalization of law enforcement.

After thirty-three original trends were recorded, there was a discussion among the eleven panelists of each trend for the purpose of clarification. After this discussion, each NGT panelist individually ranked the trends so that the top ten could be determined. Each member then provided their scores which were recorded and tallied to arrive at the top ten. The top ten selected from the original list of thirty-three trends were:

1. Level of data and technology sharing between the government and the private sector.
2. Changes in crime trends.
3. Availability of computer databases to local government.
4. Level of compatibility of computer systems.
5. Level of law enforcement staffing.
6. Level of funding for law enforcement computer systems.
7. Level of urban forecasting utilizing geobase (geographic) information systems.

8. Number of new state and federally mandated law enforcement programs.
9. Level of understanding of needs between the law enforcement and geobase (geographic) information fields.
10. Level of funding of law enforcement.

Selected Trends for Forecasting

The top ten trends were prioritized by the panel in rank order beginning with that trend which the group felt was most important. This was accomplished by each NGT panelist individually ranking the ten trends on a provided worksheet. The Recorder then scored the sheets to determine the final order. The final list of ten trends in order of ranking were:

1. Level of data and technology sharing between the government and the private sector.
2. Changes in crime trends.
3. Availability of computer databases to local government.
4. Level of funding for law enforcement computer systems.
5. Level of law enforcement staffing.
6. Number of new state and federally mandated law enforcement programs.
7. Level of urban forecasting utilizing geobase (geographic) information systems.
8. Level of understanding of needs between the law enforcement and geobase (geographic) information fields.
9. Level of compatibility of computer systems.
10. Level of funding of law enforcement.

Trend Forecasting

A discussion followed to insure that all members of the group understood each trend and, following the discussion, the group engaged in the first round of

trend level evaluation using a form designed by the author (Appendix D). The median, as well as the upper and lower mean deviations from the median, were calculated and there was a discussion of possible reasons for scores that were excessively high or low for each event. A second round of scoring was undertaken to finalize the median and deviations.

	Today	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Trend #1	100	108	114	120	127	132.5	142	150	159	167	175
Trend #2	100	105	110	114	119	122.5	132	141	150	159	167.5
Trend #3	100	110	120	130	140	150	160	170	180	190	200
Trend #4	100	105	110	114	119	122.5	131	138	146	153	160
Trend #5	100	100.5	101	101.5	102	102.5	106	109.5	113	116.5	120
Trend #6	100	105	110	115	120	125	132	139	146	153	160
Trend #7	100	105	109	114	118	122.5	133	143	154	164	175
Trend #8	100	106	112	118	124	130	136	142	148	154	160
Trend #9	100	109	118	127	136	145	156	167	178	189	200
Trend #10	100	99	98	97	96	95	96	97	98	99	100

Figure 13 - Trend Estimates

Trends:

1. Level of data and technology sharing between the government and the private sector.
2. Changes in crime trends.
3. Availability of computer databases to local government.
4. Level of funding for law enforcement computer systems.
5. Level of law enforcement staffing.
6. Number of new state and federally mandated law enforcement programs.
7. Level of urban forecasting utilizing geobase (geographic) information systems.
8. Level of understanding of needs between the law enforcement and geobase (geographic) information fields.
9. Level of compatibility of computer systems.
10. Level of funding of law enforcement.

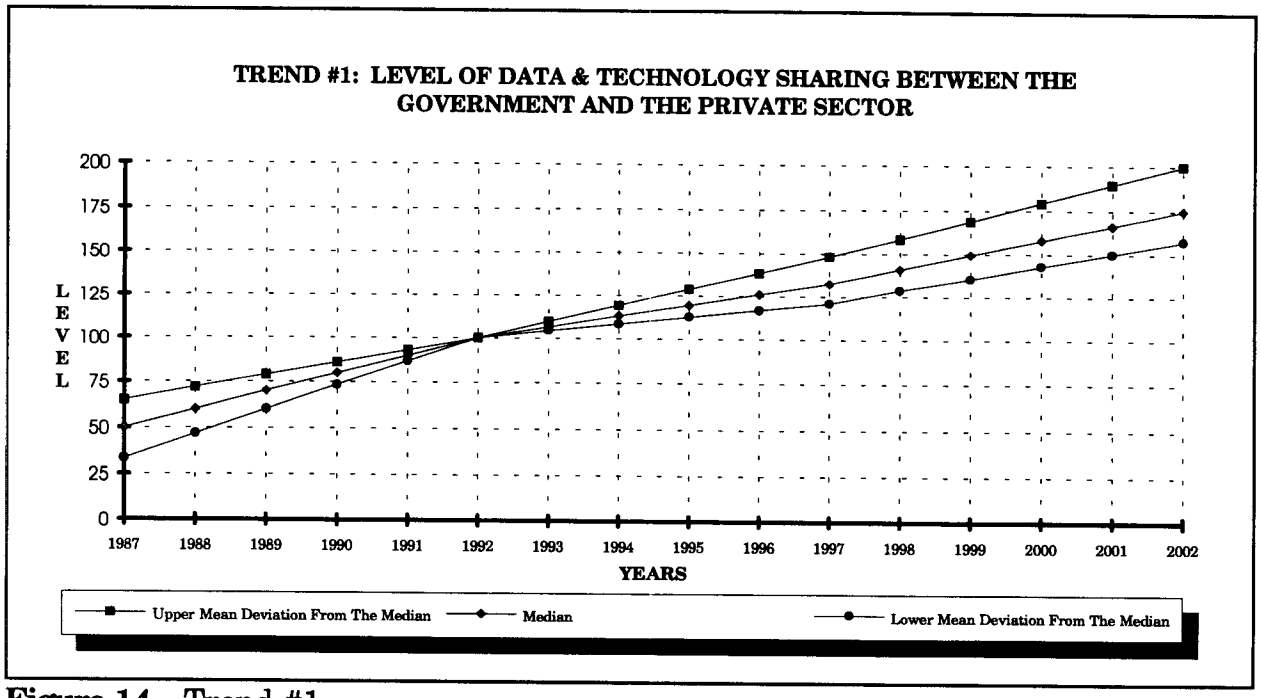


Figure 14 - Trend #1

INTERPRETATION

This trend was among the first proposed through the NGT process. There was considerable discussion within the group after the facilitator suggested splitting "data" from "technology" but the group consensus was that these two issues were so linked in this issue that they should not be separated. When the group made its first selection of the top 10 trends after the initial recording of 33 potential trends, this was the issue which had the highest priority. In the last part of this evolution, evaluating the selected 10 trends to determine their final rank order, this trend remained the overwhelming first choice.

In the initial round of delphi the consensus of the group had only a slightly larger spread than resulted from the second round. In the delphi, the medians both remained unchanged (l32.5 for 5 years from now and 175 for 10 years from now) while the upper mean deviations decreased slightly (5 and 4.2 points respectively) and the lower mean deviations increased slightly (1.6 and 6.7 points respectively). The use of the upper and lower mean deviations from the median softens the possibility of a single individual or small group of individuals from

skewing the data. This was used on all groups even if there may have been consensus on the issue.

In group discussions, members expressed a strong opinion that very little data and technology information is currently shared between various levels of government and even less between government and business. They felt that this issue has a major impact on GIS as an emerging opportunity for law enforcement and local government. The trend level figures generated by the group, as well as their expressed opinions, indicated a strong feeling that the economic situation which exists within the nation is not a short term problem. They believed that economics will force people and organizations in government and business to abandon many of their parochial attitudes and mandate increased data and technology sharing between government and business in order to solve problems.

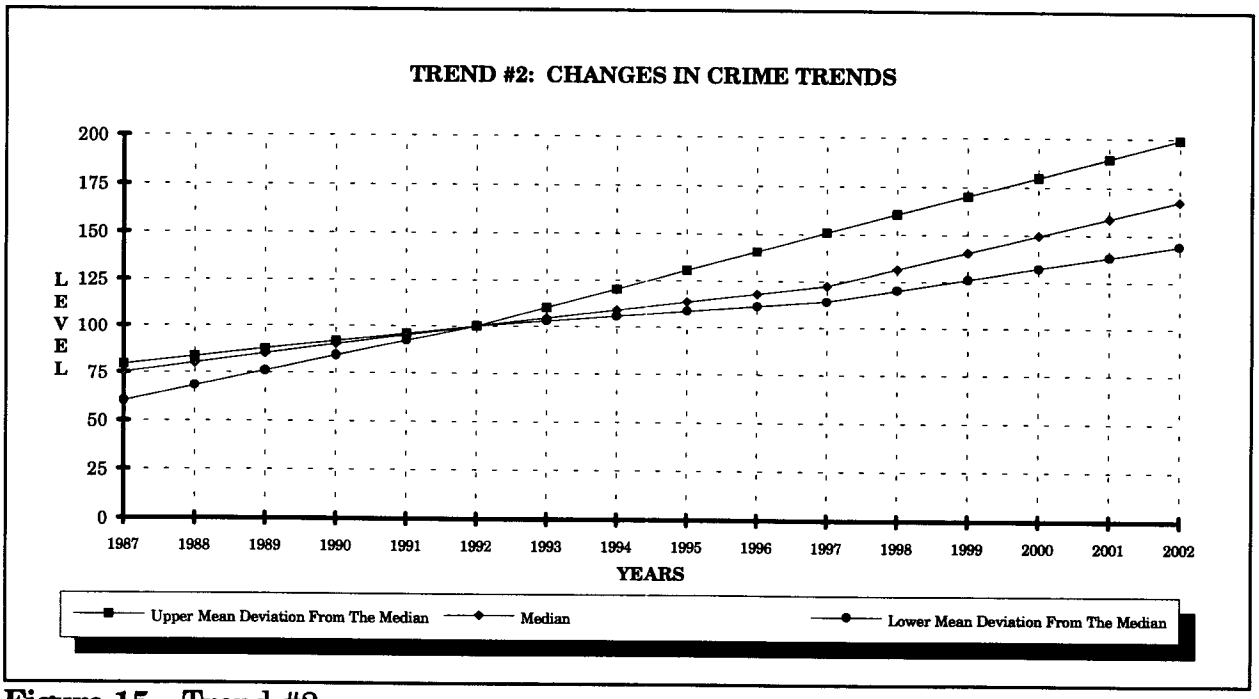


Figure 15 - Trend #2

INTERPRETATION

In this trend the group indicated its belief that it would be extremely valuable to know what type of crime trend changes or shifts will occur over the next 10 years. During the NGT process, discussions indicated that knowing what major areas of crime might be the "new" Part 1 crimes of tomorrow would be very useful in addressing the question of law enforcement GIS utilization in the next century. This trend was selected as the second most valuable choice when selecting the top 10 trends from the initial list of 33 and it remained in this second position when these 10 were prioritized by the group.

In the delphi portion of the process, this trend at 5 years from now initially had a 36 point spread between the upper and lower mean deviation (150/114.1) while the median was 120. In this first round of delphi the spread at 10 years was 85 points (224.1/139.1) with a median of 167.5. In the second round of delphi the mean deviation spread at 5 years remained relatively unchanged (the upper mean deviation increased by .8 to 150.8) but the median increased to 123. At 10 years, however, the spread (199.1/144.1) was reduced by 30 points and the median

changed slightly to 168. The use of the upper and lower mean deviations from the median softens the possibility of a single individual or small group of individuals from skewing the data. This was used on all groups even if there may have been consensus on the issue.

The graph indicates that the value of knowledge of potential changes in crime trends would become even more valuable as we look farther to the future as noted by the increased angle in the median after 1997 (5 years) and going towards 2002. Some of the explanations for the greater impact at 5 plus years were that crime analysis and expert systems will be improved in the future and, coupled with improved hardware, will allow law enforcement to anticipate and/or identify crime trend changes much earlier.

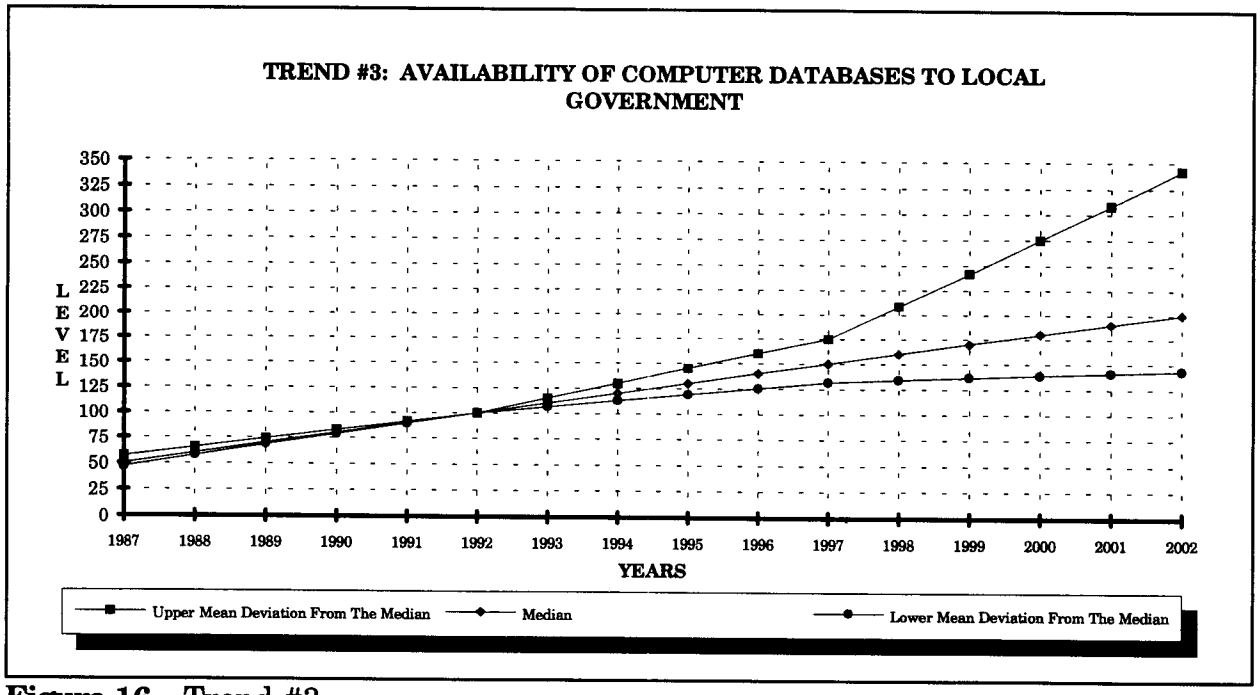


Figure 16 - Trend #3

INTERPRETATION

The NGT process actually identified this trend in the latter part of the process as it resulted from discussions of other related, proposed issues. Like trends #1 and #2, this trend remained consistent in that it was selected in the third position out of 33 initial trends and remained in this position when the selected 10 trends were prioritized.

In the delphi process, there were minor changes between the two rounds in the mean deviation at 5 years (from a 52 to a 44 point spread) but the median increased from 145 to 150. At 10 years, the initial spread in the mean deviation was 286 points (425/139.2) with a median of 200. In the second round of delphi the spread was reduced to 198 points (341.7/143.3) but the median remained constant. In the discussions between the first and second rounds of delphi many of the participants reduced some of their figures while only one increased. The use of the upper and lower mean deviations from the median softens the possibility of a single individual or small group of individuals from skewing the data. This was used on all groups even if there may have been consensus on the

This trend chart indicates that the delphi group anticipates a much greater availability of computer databases to local government including law enforcement. In the discussions they believed that tighter budgets, fewer personnel, reduced costs of databases and demands by the public for increased accountability are some of the driving forces for the dramatic increases. The greatest spread in the mean deviation is above the median which indicates that there is a significant feeling among some of the group members that the availability of databases will be substantially higher than the median. They explained that they believe that increased demands by government for submission of computerized data in mandatory reports must result in improved compatibility standards and, if this occurs, the increased availability of numerous databases.

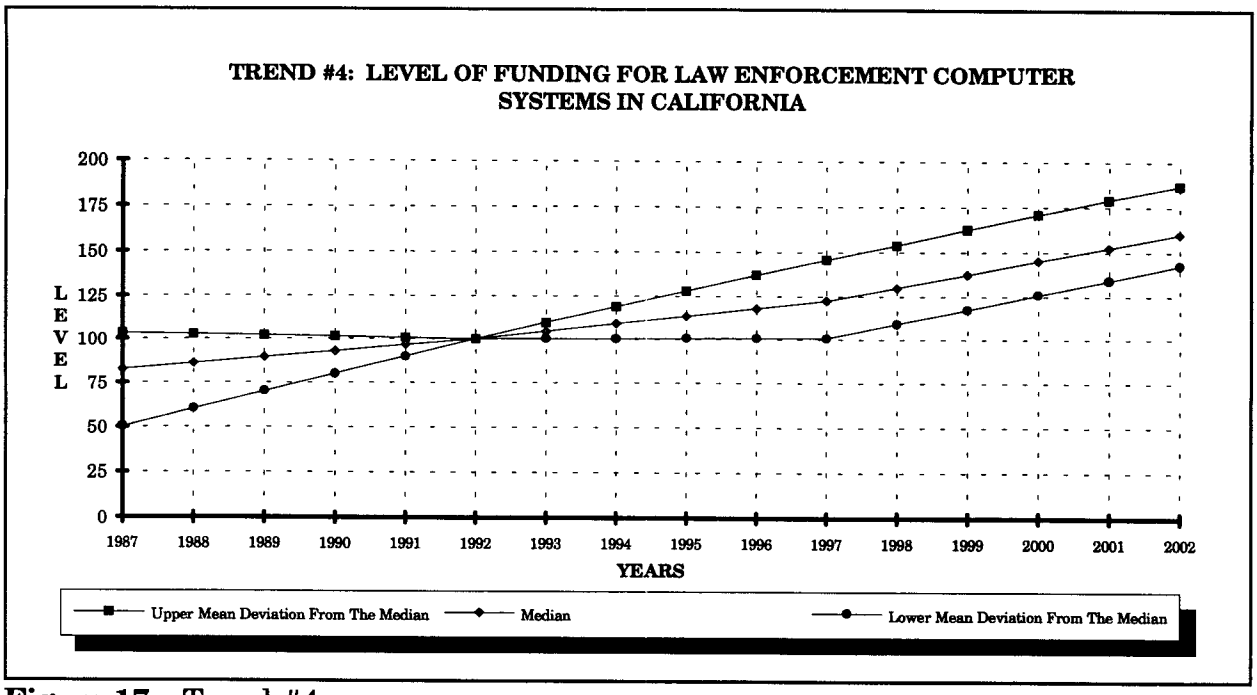


Figure 17 - Trend #4

INTERPRETATION

During the NGT process this trend was selected in the 6th position when the top 10 trends were selected from the original list of 33. When the selected 10 trends were prioritized in the last part of the nominal group process it was placed in the 4th position on the final list.

The two rounds of delphi were successful in providing a projected level for the trend at both 5 and 10 years while also narrowing the spread in the mean deviation. In neither case was the median changed. In the initial round of delphi, the spread in the mean deviation was almost 56 points at 5 years (155.8 to 100) and at 10 years was approximately 83 points (220 to 136.7). After discussion of the issue and possible reasons for both high and low scores, the second projection was made which reduced the 5 year spread to 45 points (145.8 to 100.8) and reduced the 10 year spread to 44 points (186.7 to 142.5). The use of the upper and lower mean deviations from the median softens the possibility of a single individual or small group of individuals from skewing the data. This was used on all groups even if there may have been consensus on the issue.

This trend chart indicates a gradual but steady increase in the level of funding for law enforcement computer systems in California in the next 10 years. The median line does indicate that the rate of increase is higher after 1997 and group comments indicate that they believe that the current economic situation in the nation will have been resolved, although a substantial upturn may not be the result. The very flat line for the lower mean deviation (from 100 to 100.83) over the first 5 years is a reflection of a belief by some group members that the poor economic situation in our various levels of government will not permit expenditure of additional funds for law enforcement computer systems. The other members of the group believed that reductions in personnel will force greater reliance on computer systems and, therefore, increased expenditures on hardware and software.

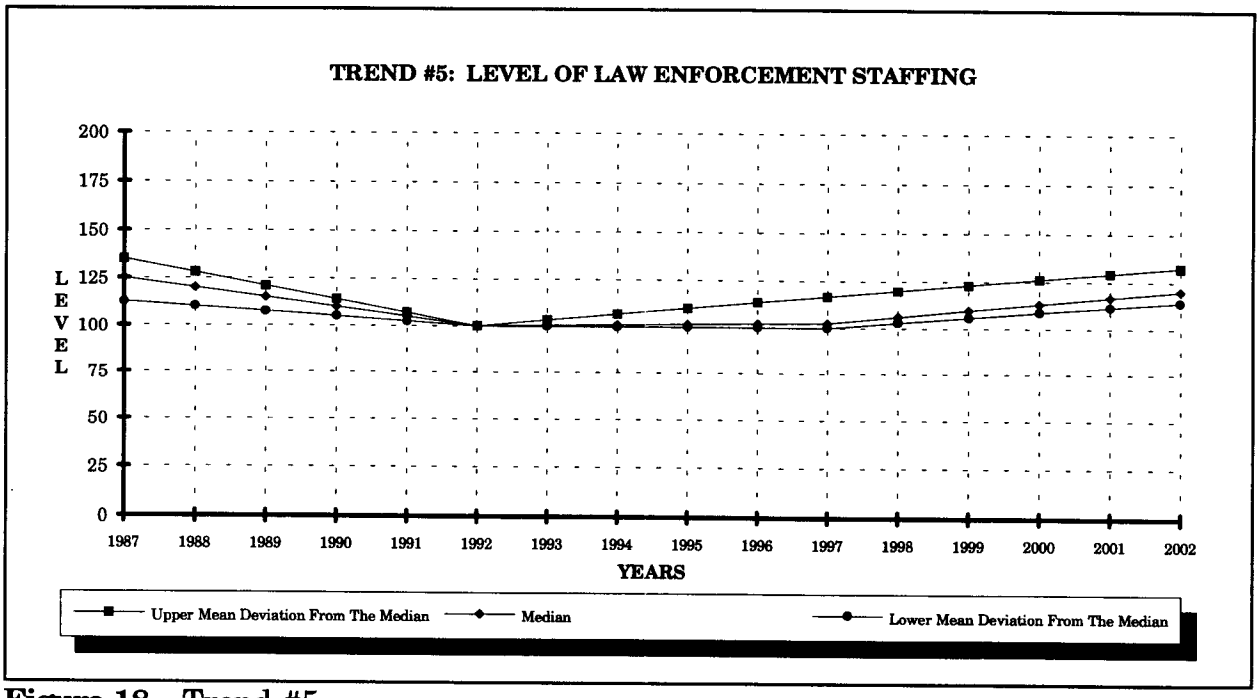


Figure 18 - Trend #5

INTERPRETATION

This trend was the 28th proposal during the NGT process. It was selected in 5th position in the selection of the 10 trends from the original list of 33 and it remained in this position after these 10 were prioritized.

During the delphi process it was noted that the level of trend projections at 5 years resulted in a small increase in the mean deviation spread from 14 points initially to almost 17 in the second round and caused a small increase in the median (100 to 102.5). In the first round, the mean deviation was 110.8/96.7. After discussion and a second round of delphi, these figures changed to 116.7/100. At 10 years the second round of delphi narrowed the mean deviation spread from 31 points (131.7/100.8) to 18 points (132.5/114.2) while the median remained constant at 120. The use of the upper and lower mean deviations from the median softens the possibility of a single individual or small group of individuals from skewing the data. This was used on all groups even if there may have been consensus on the issue.

This trend chart reflects the group's belief that there will not be significant

increases in law enforcement staffing levels and that this lack of staffing increases will have a positive effect on the use of GIS by law enforcement as departments are forced to work smarter with fewer people to meet ever-increasing demands by the public. This lack of staffing will force departments to look for the best real-time information systems available to law enforcement and the group believed that this points directly to GIS.

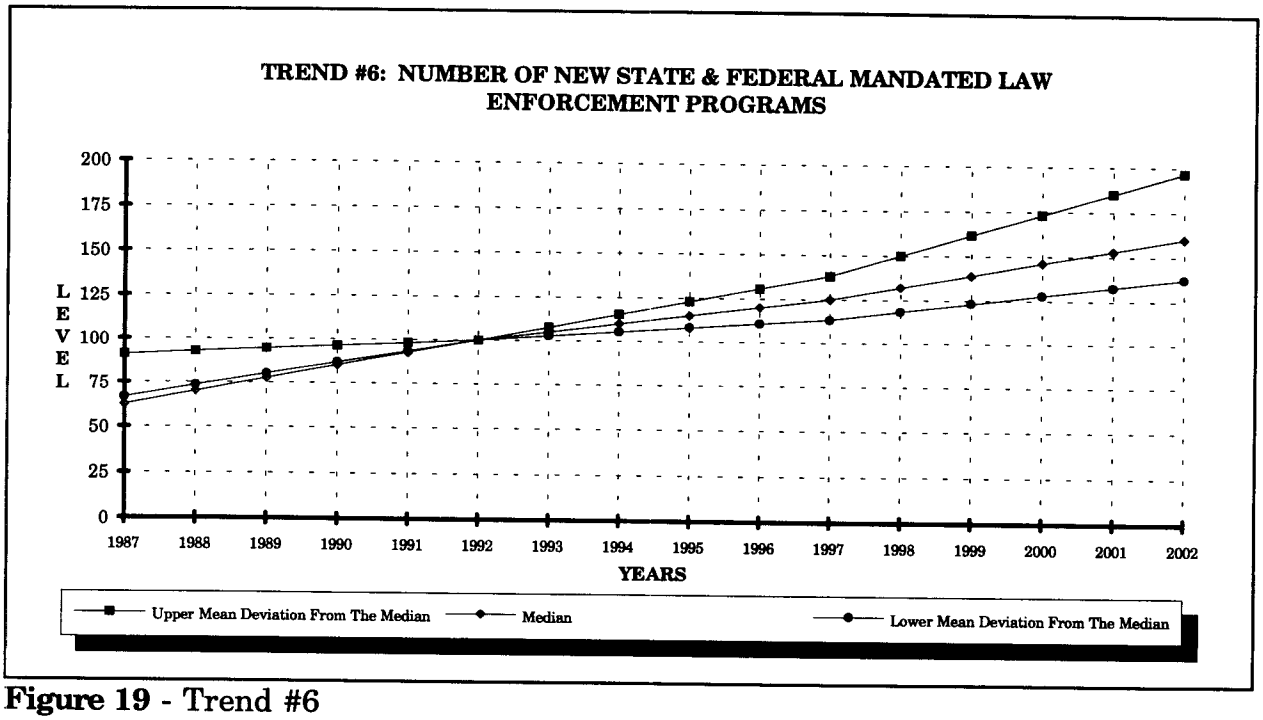


Figure 19 - Trend #6

INTERPRETATION

This trend was the 4th one proposed in the NGT process and was selected in 8th position of the 10 trends selected from the initial list of 33. After discussion in the last part of the process, this trend was prioritized in the 6th position of the top 10.

The delphi process in this trend resulted in no changes in the median (125 at 5 years and 160 at 10 years) and minimal changes in the mean deviation. The mean deviation at 5 years was 147.5/113.3 in the first round and changed to 138.3/113.3 in the second round. After discussion of the possible reasons for high or low scores, the mean deviation at 10 years changed from 213.3/133.3 in the first round to 196.7/137.5 after the second round. The use of the upper and lower mean deviations from the median softens the possibility of a single individual or small group of individuals from skewing the data. This was used on all groups even if there may have been consensus on the issue.

The trend chart indicates that the group believed that there would be a substantial increase in state and/or federally mandated law enforcement programs

in the future. In fact, the median projects a 60% increase in mandated programs through 2002. This increase, coupled with lower staffing levels, tough economic times and increased public demands would, in the groups opinion, have a positive effect of GIS use in the next century. The group believed that even if the government were to mandate crime reporting in a non-GIS format for their use, the advantages of GIS in daily operations and crime analysis would over-ride this situation as the data could still be published in standard formats.

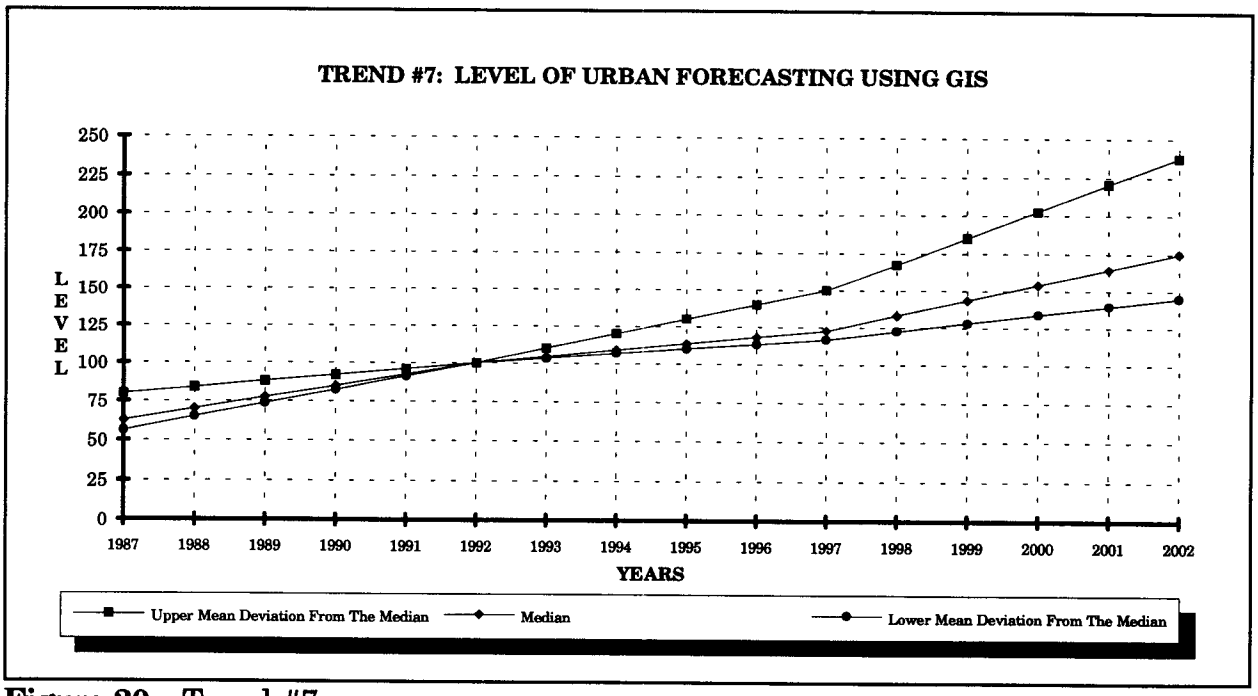


Figure 20 - Trend #7

INTERPRETATION

This trend was the 32nd of the 33 trends generated through the NGT. It was selected in the 7th position in the initial selection of 10 trends and was also prioritized in the 7th position in the final NGT process.

After the first round of delphi the mean deviation spread for 5 years was 83 (200/116.7) and the median was 122.5. After the second round of delphi the spread had been narrowed to 33 (150/116.7) while the median remained unchanged. At 10 years, the first round of delphi indicated that the mean deviation spread was 194 (337.5/143.3) and after the second round it had been narrowed to approximately 93 (237.5/145). The median at 10 years remained unchanged through both rounds of delphi. The use of the upper and lower mean deviations from the median softens the possibility of a single individual or small group of individuals from skewing the data. This was used on all groups even if there may have been consensus on the issue.

The discussion throughout the group process all centered on the fact that the more other governmental entities utilize GIS in their functions, the more it

will encourage law enforcement to aggressively enter the field, and the quicker its use will expand to other police agencies. The group discussions centered on an opinion that once urban forecasting through GIS is successfully implemented from city to city, the success and flexibility will force police departments to look at GIS to meet their needs. Please note that the group projected a 75% increase (median) over the next 10 years in the use of urban forecasting through GIS.

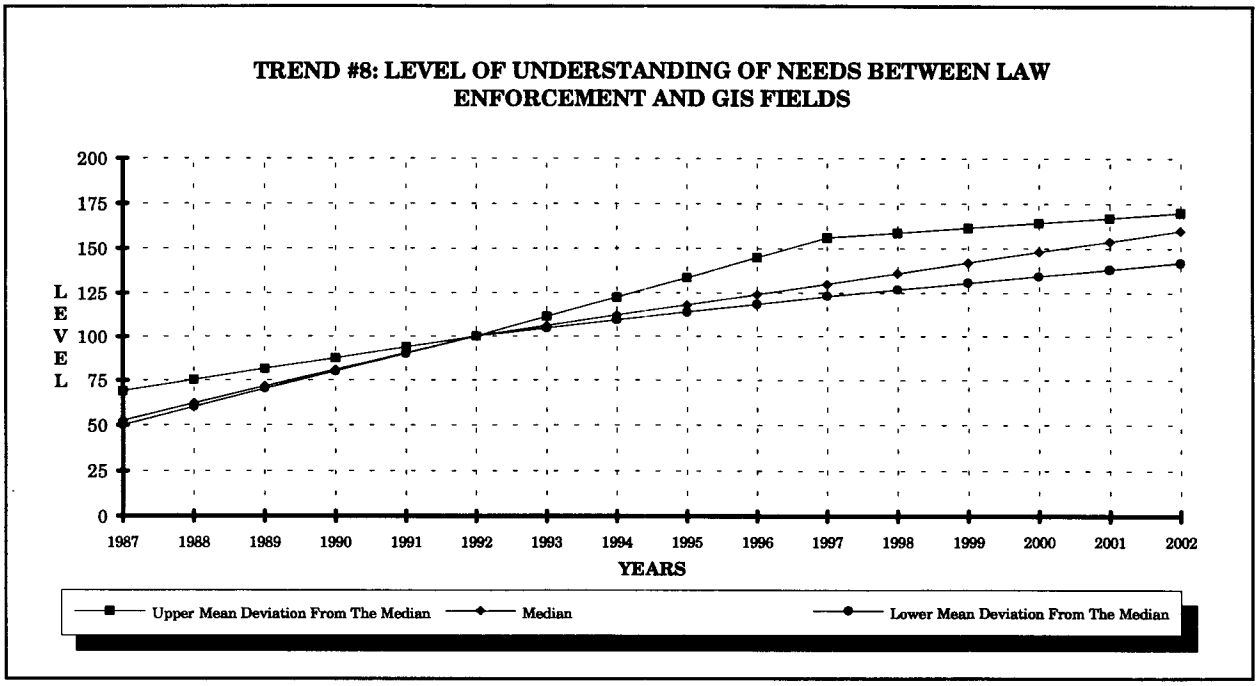


Figure 21 - Trend #8

INTERPRETATION

During the NGT process this trend was the 20th proposed and was selected in the 9th position in the initial selection of 10 trends. After discussion and a second round of prioritization by the group, this trend fell in 8th place.

The first round of the delphi resulted in a 5 year median of 130 with a mean deviation of 163.3/102.8 and a 10 year median of 160 with a mean deviation of 236.7/140. After discussion of the high and low scores and a second round of delphi there were no changes in the medians but there were substantial changes in the mean deviations. The mean deviation had been substantially narrowed by 69 points to 170/142. The lack of change at 5 years and large change at 10 years is noticeable on the graph when the upper mean deviation is examined. The use of the upper and lower mean deviations from the median softens the possibility of a single individual or small group of individuals from skewing the data. This was used on all groups even if there may have been consensus on the issue.

This trend chart indicates that the level of needs understanding between the law enforcement and GIS fields will continue to grow at a steady if not high

rate. The information from the nominal group process indicated that there is a lack of knowledge by law enforcement of what GIS developers need to design software precisely tailored to law enforcement needs. On the other hand, the GIS developers lack good information on what law enforcement wants a GIS system to do. All members of the group agreed that this understanding of needs will improve but not at a rate that they would like (60% of 10 years). Factors that might speed this needs understanding include mandated use of GIS in reporting, increased compatibility of computer systems and increased used of GIS by other government agencies/departments.

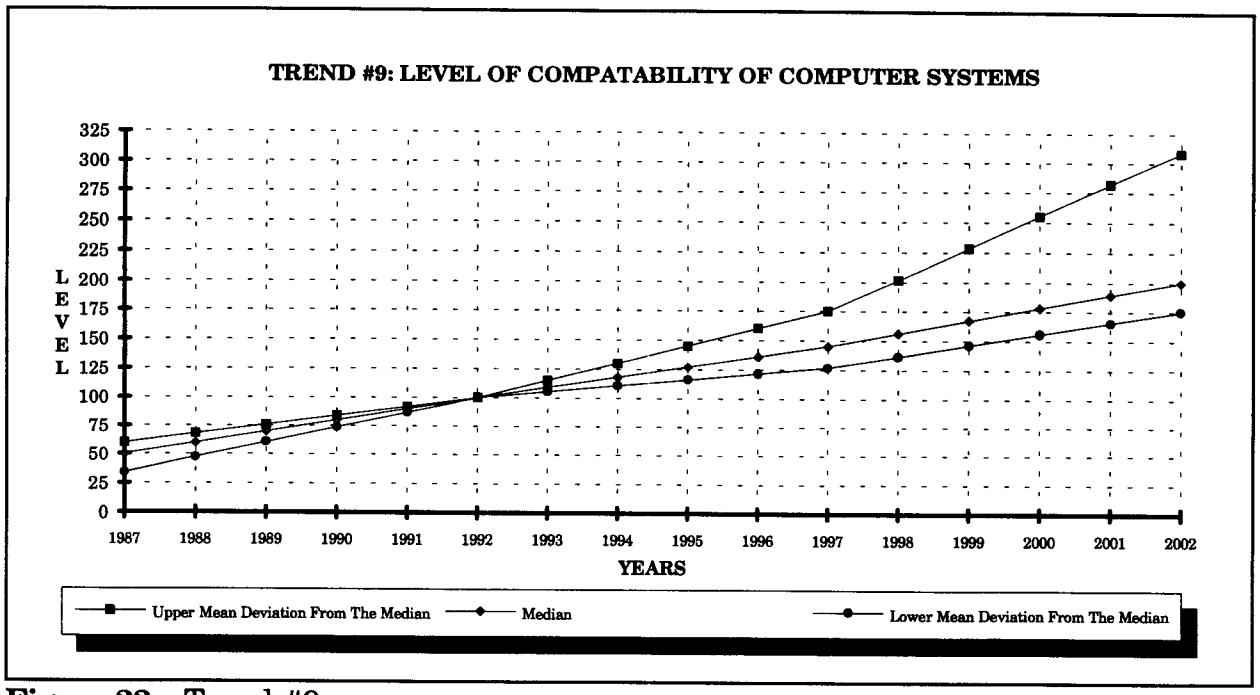


Figure 22 - Trend #9

INTERPRETATION

This trend was the 10th of 33 suggested during the NGT process. It was selected in the 4th position as one of the 10 trends for this study and, in the prioritization of these 10 trends ended in 9th position.

In examining the scores in the level of trend evaluation the medians remained constant throughout both rounds of delphi at both the 5 and 10 year points. The mean deviation from the first round at 5 years (175/123.3) was only slightly narrowed in the second round of delphi (175/126.7). The mean deviation at 10 years was initially 350/165 but after the second round had considerably narrowed to 308.3/175. The use of the upper and lower mean deviations from the median softens the possibility of a single individual or small group of individuals from skewing the data. This was used on all groups even if there may have been consensus on the issue.

The median line indicates a substantial (75%) improvement in computer compatibility between 1992 and 2002. The discussion revealed that many systems are already moving in this direction (i.e. - Apple Computer's new systems that also

work in the DOS environment) and that parallel computing, LAN's and other multi-computer systems will push the industry in that direction. The steep line for the upper mean deviation beginning at 1997 (year five) indicated a strong feeling by many of the computer professionals in the group who felt that this progress would be much more dramatic. Their feeling was not that one system would evolve as the standard but that computers capable of functioning in several operating environments would become the norm.

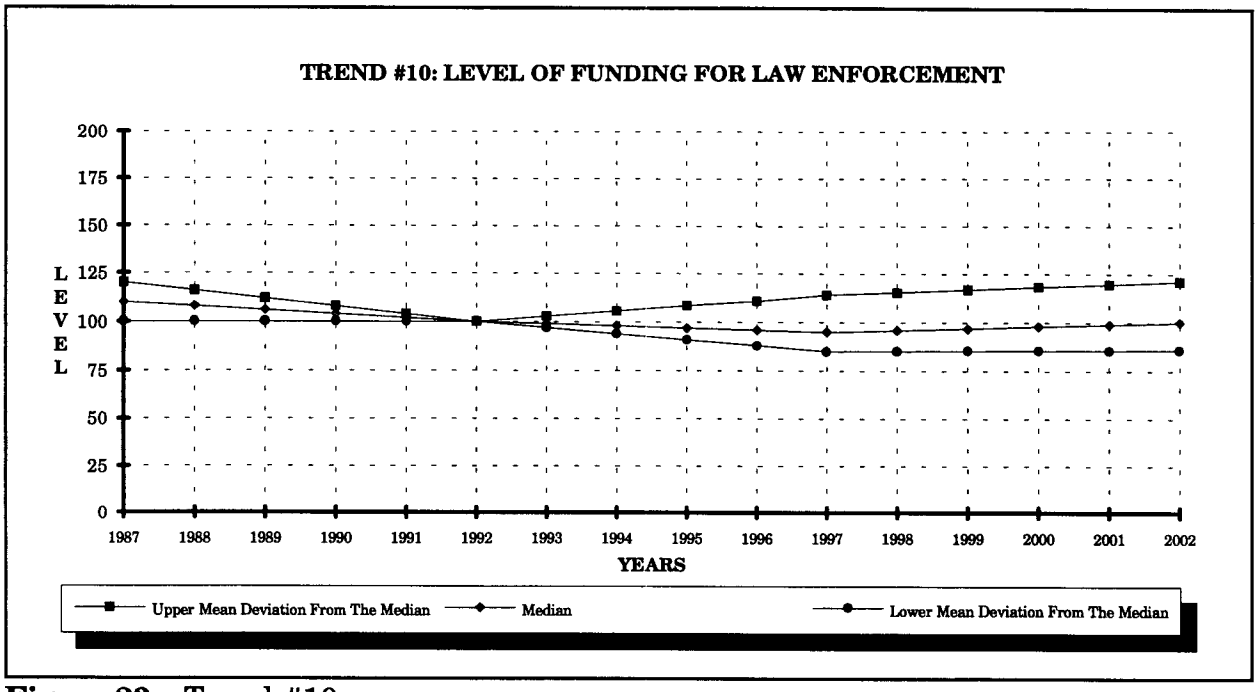


Figure 23 - Trend #10

INTERPRETATION

In the NGT process this trend was the 18th listed among 33. It was selected as 10th among the 10 trends picked from the 33 originals and, after discussion, was prioritized 10th again among the 10 selected trends in the final ranking.

The delphi process established a first round median of 90 with a mean deviation of 114.2/83.3 for the trend level 5 years from now. The trend level for 10 years in the first round had a median of 100 with a mean deviation of 121.2/84.2. After the discussion and a second round of delphi, the median for 5 years from now changed to 95 while the mean deviation narrowed very slightly to 114.7/85. After the same process, the trend level for 10 years showed no change in the median and extremely minor changes in the mean deviation (121.2/85.8). The use of the upper and lower mean deviations from the median softens the possibility of a single individual or small group of individuals from skewing the data. This was used on all groups even if there may have been consensus on the issue.

The graph clearly indicates that the group believed that the sources of law

enforcement funding are declining and funding for law enforcement will continue to decline slightly through the next 5 years and then make a slow, gradual upturn. Even looking at the upper mean deviation, it is easy to see that the group does not foresee any great influx of funds or new sources of funds available to law enforcement. In discussions with the group, it was believed that the "tax revolt" mentality, coupled with the reality of a weak economy, will hinder efforts to find new sources of funding for law enforcement. Dramatic increases in crime or federal crime program funding similar to those of the 1960's and 1970's could cause this trend to increase faster.

Cross Impact Analysis

After conclusion of the NGT process the raw data was graphed and recorded appropriately. Event-to-event and event-to-trend cross matrices were completed on forms designed by the facilitator. The forms were completed by the facilitator and a member of his department (Lieutenant Cletus F. Hyman) with a background in GIS applications. All of the data was then converted according to the directions provided for the XIMPACT program. The data was entered and 100 iterations were performed. *Two of these iterations were selected and developed as the nominal and hypothetical scenarios.*

The Event-to-Event Cross Impact Matrix

The event-to-event cross-impact analysis revealed that of the 90 fields in the matrix, 38 of the fields indicated an impact on the occurrence of specific events with 52 of the fields showing no direct impact in the analysis. The fact that there was an impact in 38 fields indicates that there was a strong relationship of the events to the issue and a strong interrelationship as well with the events (see "Event-To-Event Cross-Impact Matrix" on next page). It should be noted that all of the impacts were positive.

XIMPACT Computer Program

A computer program (XIMPACT ver. 1.X) was used to develop alternative futures based upon the originally generated trends and events (10 each) from the NGT. The data was entered to provide the tables from which to develop alternative futures. This data included the event-to-event cross-impact matrix results, the event-to-trend cross-impact matrix results, the cumulative event probability for 10 events and the median forecasts of 10 trends. The program compiled and correlated the sets of input data and generated 100 iterations or alternative futures. Two iterations were then selected from the 100 to be developed into scenarios to compliment the "most likely" scenario developed in the NGT. The two scenarios were selected for their unique and interesting futures.

Figure 24: Event to Event Cross-Impact Matrix

EVENT TO EVENT CROSS-IMPACT MATRIX	MAXIMUM IMPACT (Maximum % of change)									
	E1. Expert systems developed that tie GIS...	E2. State mandates all crime reporting in GIS format	E3. GIS systems allow for real-time flex beats...	E4. 1995 FBI statistics show 80% increase in Part I...	E5. GIS used in real-time response to 7.8 earthquake.	E6. Federal government mandates GIS databases for states...	E7. Federal government allows use of satellite data...	E8. Calif. law enforcement regionalized by 2000	E9. Major items of property tracked by electronic devices...	E10. P.D.'s mandate computer skills for all employees
E1. Expert systems developed that tie GIS to CAD and...		20	75	0	15	5	0	0	10	15
E2. State mandates all crime reporting in GIS format	60		10	15	0	0	0	0	0	10
E3. GIS systems allow for real-time flex beats...	5	0		0	0	0	0	0	0	5
E4. 1995 FBI statistics show 80% increase in Part I...	20	0	15		0	0	15	15	15	0
E5. GIS used in real-time response to 7.8 earthquake...	0	0	0	0		15	10	0	0	0
E6. Federal government mandates GIS databases for	25	75	15	0	30		25	0	0	5
E7. Federal government allows use of satellite data...	5	0	0	0	20	25		0	45	0
E8. California law enforcement is regionalized by 2000	15	0	10	5	0	5	5		0	0
E9. Major items of property tracked by electronic devices...	15	5	0	0	0	0	10	0		0
E10. P.D.'s mandate computer skills for all employees	5	10	0	0	10	0	0	0	0	

The Event-to-Trend Cross Impact Matrix

The event-to-trend cross-impact analysis revealed that of the 100 fields in the matrix, 47 of the fields indicated an impact of the occurrence of specific events on listed trends while 53 of the fields showed no direct impact in the analysis. The fact that there was an impact in 47 fields indicates, once again, that there was a strong relationship of the events to the listed trends relevant to this issue (see "Event-To-Trend Cross-Impact Matrix" on next page). It should be noted, again that all of the impacts were positive.

Figure 25: Event To Trend Cross-Impact Matrix

EVENT TO TREND CROSS-IMPACT MATRIX	MAXIMUM IMPACT (Maximum % of change)									
	T1. Level of data and technology sharing between govt. & bus	T2. Shifts in crime trends	T3. Availability of computer databases	T4. Level of funding for law enforcement computer systems	T5. Level of police staffing	T6. Level of state mandated programs	T7. Level of urban forecasting with GIS	T8. Level of needs understanding b/t L.E. & GIS fields	T9. Sources of funding for law enforcement	T10. Compatability of computer systems
E1. Expert systems are developed that tie GIS with CAD...	0	20	0	15	15	0	15	15	10	0
E2. State mandates all crime reporting in GIS format	0	5	0	10	0	5	5	0	15	0
E3. GIS development creates real-time flex-beats...	0	20	0	5	10	0	0	0	0	0
E4. 1995 FBI stats show an 80% increase in Part I...	15	0	0	10	15	5	0	5	0	10
E5. GIS used for 1st time in response to 7.8 earthquake...	10	0	5	5	0	0	10	5	0	0
E6. Federal govt. mandates all govt to build GIS databases	5	5	10	15	0	0	25	10	5	0
E7. Federal govt. makes satellite data available...	0	15	0	0	0	0	10	0	5	0
E8. All California law enforcement is regionalized by 2000	0	5	0	5	15	10	0	0	0	10
E9. Major items of property are capable of being tracked...	35	25	0	30	0	10	0	0	30	10
E10. P.D.'s mandate computer skills for all employees	0	0	0	15	0	0	0	0	0	0

Scenarios

Scenario #1: The Monster (Nominal Model)

This scenario is built on the ideas, events and trends developed by the nominal group panel.

"The more you give 'em, the more they want", he thought. Ed Turner smiled when he thought about it. He had helped create the monster and now he had to live with it but the "monster" was friendly and incredibly useful. Twelve years ago he had been selected to attend the POST Command College and his selection of an independent study project had started an interest that continued to this date. Geographic information systems....it didn't mean anything when he first looked at it as a potential ISP topic but it had grown into a personal mission. He had researched the topic in depth and became somewhat of an expert in its use and implementation. He had been fortunate that his city had already incorporated GIS in many of the other city departments and was able to bring the police department on board at a basic level. As a Lieutenant he had managed to pigeon-hole himself in the crime analysis/data processing section of the department but this was where his true interests really were. The rest is a matter of history.

Ed was able to bring the police department on-line in late 1992 but there was some initial resistance as few others understood the technology and fewer still were computer literate. Ed decided that the first thing he needed to do was create additional knowledge about computers and their capability within his police department. To this end he offered classes on his own time to interested officers and civilian personnel. This created a few new allies but did little at the time to promote GIS in the department. Between 1993 and 1995 Ed gradually was able to incorporate GIS into more areas of the department's MIS function and had demonstrated some of its unique capabilities to his superiors and to city administrators. This was beneficial because in 1995 three GIS developers released their versions of an expert system that linked GIS with computer-aided dispatch and crime analysis programs. Ed was on top of the development, ready to

incorporate it in his department. He was able to convince his superiors that despite recent declines in city revenues, he could make the new software pay for itself over time by filling the void of a recently laid-off crime analyst with the expert system and by allowing for more effective use of personnel through CAD. On the heels of this development came the capability of designing beats on a real-time basis that could address the problems for this month, this week or today. These developments became particularly important because of the dramatic rise in Part 1 crimes in the early to mid-1990's. GIS had even developed capabilities that could assist in the real-time response to a large earthquake but, fortunately, Ed had never had to test this module to date.

In 1997, the federal government mandated that all levels of government were to build GIS databases for incorporation in a national system by 2001. This event triggered a similar response from the state which now expected its crime reporting data in GIS format. These actions created an environment that improved the ability of various governmental agencies to share data as more cities were using GIS for urban forecasting. It also increased the impetus to make computers more compatible but there was still a long way to go in this area. This had also caused some of the major software companies to recognize an emerging market and the result had been the development of new expert systems for a variety of purposes that interfaced with GIS. There had been a steady increase since 1996 in the level of technology sharing between various levels of government but private industry was still protecting its business interests. The federal government was even considering the release of certain types of data currently accumulated by military and intelligence but, as of 2002, this has not occurred. The successful use of GIS had also forestalled the regionalization of police departments by improving effectiveness of personnel and resources. While certain functions had been regionalized (such as narcotics enforcement), the majority of functions had remained local. Ed still believed that the biggest problem was the department's continued failure to hire personnel with basic computer skills. The officer hired today without these skills could be the administrator five years from

now, making decisions on software and hardware or even whether to use the technology at all.

Today, Ed has a department that is making good use of the GIS function but he does not believe that it is operating to its full ability. He wishes he could have imposed a basic computer literacy standard for all new employees and he wishes that the funding for computer hardware and software had been higher. The early optimistic predication of satellite links for police or even real-time data transfer has not yet occurred but are still being discussed. Because of this, electronic tracking devices for valuable property can not be effectively implemented at this time. But Ed also knows that he has won a more important battle. His people now rely on GIS in their daily efforts. They have confidence in the system and its ability to make seemingly unrelated correlations. Ed now had the problem of training more people to use the system, knowing that after they use it a few times they will be apt to continue their familiarization. Ed now had a constant stream of requests for information, particularly from the old-timers who are still reluctant to use the system themselves but who are not reluctant to use the information it generates. This is his "monster" and this returned him to his earlier thought, "The more you give 'em, the more they want".

Scenario #2: "The Right Place and The Right Time" (Hypothetical Mode).

It is the year 2000 and the cross-impact analysis has identified that every event occurred while all of the trends identified from the nominal group process have continued (Iteration #53).

The information he had requested earlier today was on his desk awaiting his review. Chief Martin Owen couldn't believe how much valuable information was available to him on demand and presented in a graphic, concise format by the department's Geographic Information System. His Data Processing Manager had left him a note advising him that the report was printed in hard copy for circulation and possible public release but suggested that Chief Owen refer to the actual stored report to check on real-time data updates and to refer to on-screen

information. He thought about how far they had come in ten years and couldn't believe how well providence (and a gut feeling) had smiled on him during this time.

Back in 1992 he had taken over as Captain of the Support Services Division and, being somewhat of a computer buff, had vowed to reduce the paper trail in the department and to computerize many of the repetitive or data intensive operations. He had gone to a Neighborhood Watch meeting and was presenting some information about the specific neighborhood when some questions arose that he either did not have an answer for or for which he could not make the data correlation with his current information data system. It was after this meeting, and over a cup of coffee, that a woman had stepped up introducing herself as an applications software developer for a local company. Captain Owen knew of the company but had no idea they were a computerized mapping firm moving rapidly into developing geographic information systems (GIS). She explained her interest in his information problems and, as a computer buff and the person responsible for the department's computers, he was intrigued with the systems she described. They agreed to meet the following day at her facility for a tour and orientation.

The following day he followed up and met with her at the facility. He brought his Data Processing Manager and his second in command (also well-versed in computers) mainly to allow them to tour the facility. What they saw that day altered the course of their operations forever. They were introduced to GIS technology and in turn carried the message back to the city. Soon, other departments were visiting the facility and the City Manager, a forward-looking administrator, asked for a proposal to move the city into this technology as soon as possible. A proposal was made, accepted and implemented in the 1993-94 budget to purchase a GIS system for the city. Captain Owen would only realize years later how prescient his actions were.

In late 1993, developments in hardware and software permitted real-time evaluation of call data and allowed for the department to create beats that were relevant to the time of year, month or day. The development in late 1994 of an

expert system linking GIS with computer-aided dispatch (CAD) and crime analysis actually gave the department the capability to create flex-beats that could change from shift-to-shift or day-to-day if they desired. More databases were becoming available in the GIS format. This had a positive effect on police staffing levels as resources were now able to be directed to tasks in a much more efficient and timely manner. Captain Owen also realized that it was time to require all new employees to have basic computer skills upon entry to the department and he also began an in-service training program for existing employees. The versatility and capability of GIS were recognized by many cities and, despite dwindling revenues, many realized its value in managing resources and managed to purchase GIS in these early, difficult years of the decade.

Crime in 1995 was particularly bad after two previous bad years. In fact, an 80% increase in Part 1 crimes since 1992 had caused both the federal and state government to release additional funding for law enforcement through grants and specific taxes. Also as a result of 1995's statistics, in 1996 the state required all crime reporting in GIS format and gave local departments three years to implement. Captain Owen was able to comply in the first year, a fact that did not go unnoticed by city administrators. Later in 1996, the federal government mandated that all levels of government begin to build GIS databases in order that a national system could be developed with a completion mandatory by 2001. In 1995, Captain Owen's department used its GIS to greatly improve its response to a 7.8 earthquake. The databases shared with Planning, Water, Building and Safety and Fire were used with the Police database to identify hazards, improve damage assessment and determine where resources were needed first. This success plus the successful implementation of GIS from city-to-city and state-to-state put pressure on the computer companies to either create a standard operating system or to construct computers that could function in several operating environments. The result was the release of Intel's new "MultiChip" in 1997 and Sun's "Mix" (Maximum Information eXchange) chip in 1998 which significantly improved compatibility in new computers of all sizes.

As part of the federal government's recognition of the value of GIS they had made selective information available from military and intelligence satellites to be used in natural disasters, large scale civil disturbances and other specialized functions in 2000. This transfer of technology from the military to civilian sectors created new economic opportunities for the GIS sector and new application challenges for law enforcement. The result was a closer working relationship and better understanding of the needs of both fields. Additionally, at the state level, numerous cities combined their efforts to create regionalized police agencies to eliminate duplication and save money. This seemingly unrelated step created additional impetus to improve computer compatibility as the combined agencies attempted to share databases. The use of satellite technology to aid law enforcement became an important issue in 1998 when private vendors began offering computer chips that could be incorporated into electronic and other major items which served as electronic tracking transmitters that could be pinpointed by satellite and ground monitors. The federal government established a grant program to fund a number of law enforcement agencies as they explored this new technology shortly after its implementation. In late 2001, new programs were begun to assist law enforcement agencies in updating and purchasing computer systems. This new program has already made an impact as evidenced by the expenditures by local agencies for computer hardware and software in early 2002. This combined with the dramatic increases in law enforcement funding for the 2002 budget year and a recent dramatic rise in data/technology sharing between the government and private industry offer great promise for the GIS field in the future.

Captain Owen was satisfied that he had been involved with the right technology at the right time for all the right reasons. He made a note to share this report with the new Chief of Police when he took office next week. He also reminded himself that while closing the door on his 31 year law enforcement career, he was opening the first chapter of his new career as an applications development consultant for the local GIS firm.

SCENARIO #2: XIMPACT VALUES

Trend Values for Iteration No. 53

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Event #1	100	108	111.9	115.9	134.8	127.9	135.6	135.7	134.9	140.8	209.3
Event #2	100	105	110	133.8	125.1	138.7	151.5	152.9	169.4	177.9	205.8
Event #3	100	110	118.8	127.7	144.4	153.3	163	172.7	179.9	202.6	209.8
Event #4	100	105	109	117	118.5	126.3	144.1	142.6	138.4	158.1	203.7
Event #5	100	101.5	101	109.6	103.5	105.1	106.6	107.2	107.7	121.4	134
Event #6	100	105	110	115	120	119	131.7	136.3	140.6	155.1	175.9
Event #7	100	105	108	110.1	119.9	134.3	149.1	156.8	171.2	204.7	205.8
Event #8	100	106	111	116.1	122.2	138.5	142.4	146.4	148.2	163.4	171.9
Event #9	100	109	118	127	131.7	142	173.5	176.1	183.3	191	236.9
Event #10	100	99	98	97	96	90.1	90.5	89.7	88.8	95.4	111.7

Occurences in Iteration No. 53

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Trend #1	0	0	0	0	1	0	0	0	0	0
Trend #2	0	0	0	0	0	1	0	0	0	0
Trend #3	0	0	1	0	0	0	0	0	0	0
Trend #4	0	0	0	0	0	0	0	0	0	1
Trend #5	0	0	0	1	0	0	0	0	0	0
Trend #6	0	0	0	0	0	0	0	0	1	0
Trend #7	0	0	0	0	0	0	0	1	0	0
Trend #8	0	0	0	0	0	0	0	0	1	0
Trend #9	0	0	0	0	0	0	0	0	0	1
Trend #10	0	0	0	0	1	0	0	0	0	0

Figure 26 - Scenario #2: XIMPACT Values

Events:

1. Expert systems are developed that link geographic information systems with computer-aided dispatch and crime analysis.
2. State mandates all crime reporting in geographic geobase information format.
3. Developments in geographic information systems create the capability for real-time, flex-beats for law enforcement.
4. FBI crime statistics indicate an 80% increase in Part 1 crimes since 1992.
5. Geographic information systems are used for the first time in real-time response to a 7.8 earthquake.
6. Federal government mandates all levels of government to build geographic information databases as part of a national system.
7. Federal government makes military and intelligence satellite data available to local government.
8. All California law enforcement is regionalized.
9. All major items of property are capable of being tracked by electronic tracking devices.
10. Police departments mandate basic computer skills for all entry level employees.

Trends:

1. Level of data and technology sharing between the government and the private sector.
2. Changes in crime trends.
3. Availability of computer databases to local government.
4. Level of funding for law enforcement computer systems.
5. Level of law enforcement staffing.
6. Number of new state and federally mandated law enforcement programs.
7. Level of urban forecasting utilizing geobase (geographic) information systems.
8. Level of understanding of needs between the law enforcement and geobase (geographic) information fields.
9. Level of compatibility of computer systems.
10. Level of funding of law enforcement.

Scenario #3: "Reflections" (Exploratory Mode)

In the year 2000 several of the events developed in the nominal group have occurred and the identified trends have continued. The driving force in the scenario is a lack of funding created by national and regional economic problems which has resulted in many missed opportunities (Iteration #38).

Frank Estes sat at his console in the Crime Analysis unit, grumbling to himself about the latest request for information from the Area Commander. Here it is, he thought, two years into a new century and he was still using technology that was not only from the last century but was a decade old. What could he tell the Commander about the affects on crime by the closing of city recreation centers for 4 days each week and reducing street lighting by 50% citywide? How could he make the comparison between these seemingly unrelated situations in any kind of timely manner with the information systems available to him today? And, if he could accomplish the data analysis, how could he possibly present the information in a visual, concise presentation that was understandable to all? In Frank's 22 years with the city he had never felt so frustrated or so handcuffed by the lack of foresight by the department and city leaders.

Frank stared out the window and reflected back upon ten years of lost opportunities and short-sighted decisions. The budget situation in 1992 had been poor but, in retrospect, it was positively rosy compared to today and today was still better than 1997-98. In 1992 he'd made an excellent case for entering into the geographic information age. He'd negotiated an agreement with one of the premier companies in the GIS field that happened to be headquartered in his city and whose founder had grown up in town. They were willing to donate the GIS software, making the city a "beta" site for future developments. They were even willing to assist the city in the purchase of the appropriate number of work stations by encouraging their vendors to give them the best price possible but they wanted the city to buy the work stations so that they could be assured that there was a "buy-in" on their part. The city had ultimately rejected the project rather than spend $57,000 on work stations. In order to save a few thousand dollars,

they had thrown away hundreds of thousands of dollars in software and support, not to mention the thousands of lost manhours making correlations that even the old GIS systems could do quickly and routinely. The GIS developer picked another nearby city as their beta site and his counterpart at that agency (which was now part of the same area in his region) took great pleasure in reminding him that, to this day, they are still receiving the benefits his city might have had. While many local governments were expanding their forecasting abilities for all types of urban issues, his area was sitting still because of decisions made a decade ago.

In the ten years since 1992, the nation has suffered as the government finally made attempts to deal with the national debt. Although the economy leveled off and gave signs of making a turn for the better, spending for law enforcement continued to decrease very slowly for a few years. We still could have afforded the equipment then, he thought. In 1997, however, any thought of making this commitment vanished when President Clinton, just elected to his second term, announced his program to cut the national debt and everyone shared in the pain. He utilized the line-item veto obtained in his first term to trim the budget and eliminate pork-barrel projects and programs. As a result of this government "belt-tightening", what followed was a period characterized by an almost total lack of financial assistance to local law enforcement and a period that required law enforcement, more than ever before, to do more with much less. Now, to assist the field officer he had to use an antiquated information system to try to make correlations they desperately needed in order to make the most effective use of their meager resources. At a time when crime was increasing rapidly and manpower very slowly it was imperative to make sure that you were doing the right things with the right people. The lack of a modern information system coupled with financial problems had put his agency in a double bind: no money to significantly add personnel and poor information to make effective use of his people. Finally, his city had joined many others in establishing a regional police agency in 2000 and, although this will eventually free up funds and

personnel by eliminating duplication, the money has still not been found at this time to bring the entire region together under one GIS system.

During the past ten years, the poor economy has dampened the computer and software markets significantly. Only this year, expert systems have finally been developed which link computer-aided dispatch and crime analysis with geographic information systems. Although the level of data and technology sharing between government and private industry has never become as high as once forecast, a few computer manufacturers have developed some computers with the capability of working with a number of operating systems and this, in turn, has helped make a few more databases available to agencies. It hadn't really mattered in the past that the state had mandated that all crime reporting would be made in a GIS format or that the federal government had mandated all levels of government to begin building GIS databases as part of a national system, as they had also given those cities and regions who were not into GIS, several years to meet the requirements and money had been tight. Those few agencies that had GIS were able to create flex-beats - beats that change daily based upon reporting district crime data and emerging crime trends. GIS had given them the ability to identify new crime trends hundreds of times faster and had provided a very visual format through real-time, computerized map generation. Unfortunately, an inability of computers to "talk" to one another coupled with the limited satellite access and lack of funds prevented agencies from using GIS to assist in their response to 1997's 7.8 earthquake along the San Andreas fault. At least some of the neighboring cities had begun developing GIS data bases and were able to use this limited information in disaster response and recovery. His city had "done it the old way", often working without pertinent information available to administrators in other cities and, while everyone had done their best, they could not hope to compare with the directed response possible with better information.

Frank awakens from his revery and realizes this type of negative thinking is counter-productive. It is difficult, however, for him to know that his agency could have been the vanguard of GIS technology showing other agencies how it

should be done. The failure by city administrators to position the city for the future by using the best available technology is history. Frank elects to direct his efforts towards implementing GIS in the future by attempting to get his department "on board" with some of the mandated programs from the state and federal governments and by continuing to fight for new equipment and software. He has learned that there is some grant money available to assist local government in meeting the governmental requirements and he is determined to give his city the chance to catch up. The economy seems to be improving, the President is talking about using technology to combat crimes and other ills of the nation and Frank has ten years left in his career. He decides that he will be a part of the solution rather than part of the problem and look to the future.

SCENARIO #3: XIMPACT VALUES

Trend Values for Iteration No. 38

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Event #1	100	108	125.9	129.9	134.8	127.9	135.6	135.7	141.9	140.8	139.6
Event #2	100	105	110	133.8	125.1	118.9	125.1	126.5	129.7	151.4	172.8
Event #3	100	110	126.6	135.5	144.4	153.3	163	172.7	195.4	202.6	209.8
Event #4	100	105	115.5	123.5	118.5	113.3	118.1	116.6	131.9	145.1	145.2
Event #5	100	101.5	101	109.6	103.5	89	90.5	91.1	91.6	105.3	117.9
Event #6	100	105	110	115	120	125.5	131.7	136.3	140.6	141.9	156.3
Event #7	100	105	121.4	123.5	119.9	120.9	129	136.7	171.2	191.3	205.8
Event #8	100	106	117.7	122.8	122.2	118.5	122.4	126.4	141.5	163.4	165.2
Event #9	100	109	118	127	131.7	149.6	158.2	160.8	168	183.4	191.1
Event #10	100	99	98	97	96	90.1	90.5	89.7	88.8	85.6	92.1

Occurences in Iteration No. 38

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Trend #1	0	0	0	0	0	0	0	0	1	0
Trend #2	0	0	0	0	1	0	0	0	0	0
Trend #3	0	0	1	0	0	0	0	0	0	0
Trend #4	0	0	0	0	0	0	0	0	0	0
Trend #5	0	1	0	0	0	0	0	0	0	0
Trend #6	0	0	0	0	0	0	0	1	0	0
Trend #7	0	0	0	0	0	0	0	0	0	1
Trend #8	0	0	0	0	0	0	0	0	0	1
Trend #9	0	0	0	0	0	0	0	0	0	0
Trend #10	0	0	0	0	0	0	0	0	0	0

Figure 27 - Scenario #3: XIMPACT Values

Events:

1. Expert systems are developed that link geographic information systems with computer-aided dispatch and crime analysis.
2. State mandates all crime reporting in geographic geobase information format.
3. Developments in geographic information systems create the capability for real-time, flex-beats for law enforcement.
4. FBI crime statistics indicate an 80% increase in Part I crimes since 1992.
5. Geographic information systems are used for the first time in real-time response to a 7.8 earthquake.
6. Federal government mandates all levels of government to build geographic information databases as part of a national system.
7. Federal government makes military and intelligence satellite data available to local government.
8. All California law enforcement is regionalized.
9. All major items of property are capable of being tracked by electronic tracking devices.
10. Police departments mandate basic computer skills for all entry level employees.

Trends:

1. Level of data and technology sharing between the government and the private sector.
2. Changes in crime trends.
3. Availability of computer databases to local government.
4. Level of funding for law enforcement computer systems.
5. Level of law enforcement staffing.
6. Number of new state and federally mandated law enforcement programs.
7. Level of urban forecasting utilizing geobase (geographic) information systems.
8. Level of understanding of needs between the law enforcement and geobase (geographic) information fields.
9. Level of compatibility of computer systems.
10. Level of funding of law enforcement.

Policy Implications

There are a number of policy considerations that could affect the outcome of this issue in the future. These include the following:

1. All personnel (sworn and civilian) must possess basic computer skills when hired and acceptable criteria must be developed for measuring these skills. There are few, if any, positions in a police department that do not require at least minimal interaction with a computer.
2. In-service training must be conducted regularly to continue the education process and educate those hired before the computer literacy requirement. This raises the knowledge level of the entire department and makes it more receptive to new technology.
3. Develop a mechanism to constantly examine the software and hardware available to insure that the agency is getting the full benefit of its system.
4. Alternate funding sources (grants, asset seizure, special assessments) must be regularly examined to provide the money to maintain and improve the technology.
5. Law enforcement must seek out software developers so that they know our needs and we understand their limitations.

Chapter Three
Strategic Plan

Background

The purpose of this section is the development of a plan to implement the strategy of the Orangedale Police Department to manage and bring about the desired future based upon Scenario #2 (hypothetical). This secton will include the elements of this plan including mission statement, situational analysis, organizational analysis, stakeholder identification and analysis, policy issues and a selected strategy.

For the purposes of exploring the use of geographic information systems in police service delivery this paper will examine the topic in the context of the Orangedale Police Department. The Orangedale Police Department is a medium-sized police agency located in southern California with an authorized strength of 70 sworn personnel, 24 non-sworn personnel and approximately 70 volunteers from a variety of auxiliary units (Reserves, Explorers and Civilian Volunteers). These personnel are responsible for policing a city of approximately 70,000 people living in 37 square miles.

As a Captain and Interim Chief of Police for the Orangedale Police Department it is my duty to insure the optimal police service delivery for the community with the resources available. The opportunity exists to employ the emerging field of geobased information to provide real-time, accurate data to optimize the assignment of personnel through the analysis of many seemingly unrelated data sources. The capabilities of the software continues to expand while the continuing increase in the number of computations per second and the rapidly decreasing cost for powerful computers promises a great future for GIS and an incredible opportunity for law enforcement. The costs to enter the GIS world are not that significant when compared to the opportunities it offers. The door to the next era of information systems is open and the time for the decision to enter this new world is NOW!

Challenges

GIS is a recent and rapidly growing field but successful implementation has many challenges. Many of the challenges of the past were of a technical nature but these are perhaps less important today than the organizational and procedural concerns incorporated with the successful implementation of GIS. Technically, users still have to address the cost, design and type of system to buy. Institutionally, there are still a number of critical issues to be addressed including:

- Expectations
- Training
- Staffing
- Access to information
- Interagency conflicts
- Financing
- Political constraints
- Integration with other systems

Mission Statement

The mission statement is presented in two similar but different forms. First, the macro mission statement which represents the department's overall mission to the community and, second, the micro mission statement identifies the department's commitment to the personnel in the department.

Macro

The officers, support staff and resources of the Orangedale Police Department are dedicated to providing community oriented, quality law enforcement services to the citizens of Orangedale while making the most effective use of the human and financial resources available. We recognize that the employees of the department are our most valuable asset and encourage their involvement in improving the quality of life in the city. We value our relationship with the citizens of Orangedale and to this end, we pledge ourselves to fair, impartial and humanistic law enforcement service with an emphasis on being

responsive to the needs of the community. We pledge to maintain the highest level of professional and ethical standards in all transactions, contacts and situations.

Micro

To this end, the Orangedale Police Department shall utilize GIS to improve and strengthen our strategic planning, resource allocation and service delivery to the benefit of our citizens and personnel. This will require us to:

- Promote an orientation towards innovation and the use of new technology to improve our service delivery and to assist in solving human problems.
- Encourage the participation of all employees in the search for improved systems, new technology and resource management.
- Encourage the involvement of all personnel in problem-solving in both the department and the community.
- Develop and implement sources for funding new concepts and technology.
- Encourage interaction and partnerships with other agencies, departments and community groups to find new approaches for solving human and technical problems.
- Develop a program to implement total quality management throughout the department.

Through implementation of the strategic plan, an environment will be created that will assist the Orangedale Police Department in meeting our law enforcement responsibilities to the community in the most efficient, cost effective manner possible.

Situational Analysis

The following situational analysis uses the "STEEP" model (**S**ocial, **T**echnological, **E**conomic, **E**nvironmental and **P**olitical) to present a well-rounded discussion on the current working environment. This review is coupled with an

examination of the organizational capability using "WOTS UP" (**W**eaknesses, **O**pportunities, **T**hreats, **S**trengths) analysis. To this end, the author met with two colleagues to develop the situational analysis and identify stakeholders with their assumptions. These individuals were:

- Lieutenant Cletus F. Hyman, Redlands Police Department
- Lieutenant James R. Bueermann, Redlands Police Department

Organizational Analysis

Strengths

The internal strengths of the Orangedale Police Department that will assist in meeting the mission include the following areas:

- There is a new, entrepreneurial management orientation in the police department.
- The interim Chief of Police, Staff and many officers have a strong interest in community-based policing, participative management and GIS.
- There is a strong desire by most Orangedale Police Officers for some type of change in law enforcement service delivery.
- The relatively small size of the Orangedale Police Department is more conducive to rapid change.
- The Police Officers and Staff are generally receptive to change.
- Despite the city's budget difficulties, the City Council and City Manager have promised that there will be no cuts in police personnel in the 1993-94 fiscal year.
- The city's financial situation is expected to slowly improve beginning in 1994-95 due to a balanced budget created by past lay-offs and other cost cutting measures.
- There are a large number of department personnel (both sworn and non-sworn) with interests in high-tech applications to law enforcement.

- There are a large number of personal computer owner/users in the department who are interested in expanding their skills and in using computers in law enforcement.
- The Orangedale Police Department has an excellent mid- and upper-level management team.
- Orangedale Police Officers and non-sworn personnel are generally well educated and well trained.
- The Orangedale Police Department has a large and varied pool of volunteers, many of whom possess good computer skills.

The organizational capacity for change is extremely high given the situation as described. The size, educational level of the personnel and technological sophistication within the department present excellent opportunities for a move to GIS.

Weaknesses

The internal weaknesses of the Orangedale Police Department to be addressed in meeting the mission include the following areas:

- There are still major morale issues caused by two years of internal fighting between the police association and the prior Chief of Police.
- The city's poor financial condition has severely cut the police department's budget and, without an economic reversal, could continue or worsen.
- The low officer-to-population ratio (approximately 1:1000) threatens to force the department to continue to be reactive, rather than proactive, to the city's crime problems.
- Due to morale problems, the Orangedale Police Department has had a poor record of personnel retention during the past two years and this has affected the level of expertise among police officers and dispatchers.
- A rewriting of the Rules and Regulations began almost three years ago and remains only 40% complete. Many of the rewritten sections

have been instituted singularly with the old Rules and Regulations causing confusion and frustration.

- The public reputation of the department has been damaged by two years of internal turmoil.
- There are a few members of the department who are resistive to new technology and change, wishing to perform "real police work" or reactive policing.

The most significant problem created by the listed weaknesses would seem to be the department's perception by the public. The damaged image, extended in-fighting and internal frustration will make it difficult to foster community and, more importantly, City Council support to allocate the necessary funds.

External Environment

Social Issues

Southern California has seen some dramatic social changes in the past few years and many of these changes directly affect society's view of law enforcement. The declining economy has added to the social ills including homelessness, family break-ups, gangs and drugs. Legal and illegal immigration has created a multicultural mosaic in California and this new ethnic and cultural mix does not stress assimilation so much as it stresses the native culture or ethnicity. The rising level of distrust of government has also affected law enforcement aided by public perceptions of the Rodney King incident, the riots in Los Angeles and a number of highly publicized police misconduct cases. Gangs and drugs continue to be a problem in all areas of southern California. Minority populations frequently view the police as an oppressor while some people in more affluent areas of a community see them as a protector. Amidst the declining government revenues is an increasing demand for police service and increased police interaction with the community.

Technological Issues

The recent exodus of many high-tech businesses from California is a direct

reflection on quality of life issues including crime, illegal immigration, riots and the difficulty of doing business (red tape) in the state. Despite the economic woes in southern California, it remains one of the high-tech centers in the nation offering ample resources for the implementation of technology to law enforcement. Parallel processing, smaller and more powerful computers, decreasing costs for hardware and the rapid increase in the development of expert systems are positive features in the technological area. The lack of computer compatibility, the lack of a mutual understanding of the needs between the law enforcement and GIS fields, and the lack of real-time data sharing between all levels of the government are problem areas.

Economic Issues

The United States' recession, coupled with its huge national debt, has resulted in decreased federal funding to the states even for many federally mandated programs. This condition has been exacerbated by California's deeper recession, unemployment in the 10% range, military base closures and loss of high-paying aerospace jobs. Earthquakes, floods and the Los Angeles riots have been additional economic drains on the southern California economy. San Bernardino County has suffered as bad, if not worse, than other areas in the state. In all, lost jobs, reduced housing values and burned out businesses translate to reduced property and income tax revenues which translate, in turn, to a crumbling infrastructure and municipal government lay-offs including law enforcement officers. Businesses and middle-to-upper income wage earners are leaving California in record numbers due to these factors plus high Worker's Compensation rates and the bureaucratic cost of doing business in this state. Many economists do not see an economic upturn until mid-1994.

Environmental Issues

The housing boom of the 1980's has ended but so has the revenue it brought in through increased tax bases, builders fees and construction employment. Many areas that were formerly fields and citrus groves now feature red tile roofs and swimming pools as well as 3.2 people and at least two cars per household. The

urbanization of many areas of southern California and particularly San Bernardino County, has occurred at a time when there is little money to improve traffic, water and air quality problems. Some cities were fortunate to fund and purchase green belt property but they are the exception rather than the norm. The State of California has just experienced one of the worst droughts in recent years and toxic dumping issues appear almost daily. San Bernardino County has the bulk of its population concentrated in the San Bernardino Valley and in one small area of the high desert. It is fortunate to have huge desert areas and mountains that are still sparsely populated and available for recreational use and open space.

Political Issues

The tax revolt mentality still dominates in the state and there are increasing demands by citizens for the government to do more with less, including law enforcement. This stems from a lack of trust of politicians, bureaucrats and the government as a whole. The taxpayers perceive grid lock in our legislative bodies, see taxing responsibility pushed down to local government and see many of their benefits (education, social security, etc.) under intense scrutiny. The choices are difficult, often pitting young against old (social security and education), rich against poor (taxes and entitlement programs) and urban against suburban (large and small cities). These problems become even more intense at the local level as cities wrestle with the cuts from the federal and state levels and declining sales and property values.

Opportunities For The Mission

There are a number of trends and events that provide opportunities in the accomplishment of the mission statement. Computer compatibility is improving as more computer companies develop machines that operate in a number of environments. Rising street crime and new variations (car-jacking, for example) demand rapid, real-time analysis as the level of law enforcement staffing decrease and it is necessary to optimize the use of valuable human resources. As GIS becomes more common in other areas of government and the private sector, the

level of needs understanding between law enforcement and GIS continues to improve as departments look to technology to improve response and resource allocation. The rapid development in GIS coupled with the decreased cost and increased speed of computers brings the opportunity for real-time flex-beats very close. Although GIS has not yet been used in response to a large earthquake, it was recently used successfully by the military in their response to Hurricane Andrew.

Other opportunities that lend themselves to the accomplishment of the mission are noted below.

- Long-term, but slow, economic improvement is expected to begin in San Bernardino County in early 1994 and continue through the end of the century.
- One of largest GIS developers is headquartered in Orangedale and the company owner, an Orangedale native, is desirous of seeing their software utilized locally.
- There is a strong desire by the community for changes in the delivery of law enforcement services and closer ties between the police department and the community.
- The 1993 City Council elections involve three City Council seats which has the potential of creating a more unified political environment and bringing new ideas to the city.
- The community as a whole is strongly supportive of law enforcement in general.
- Opportunity to dramatically improve the utilization of human resources.

Threats To The Mission

At this time, there is a very low level of data sharing between government and private sector and even between government institutions. This is not speaking to the "big brother" type of invasive data collection on individuals but utilizing data resources such as lighting districts, recreational facilities and land

use patterns to assist in law enforcement problem solving. Additionally, as the level of law enforcement funding continues to decrease, so does the level of funding for law enforcement computer systems.

Other threats that may deter the accomplishment of the mission are noted below.

- Due to economic problems throughout southern California and San Bernardino County, the threat of regionalization of law enforcement services is very real.
- The unstable political climate in the city creates a highly polarized environment that lacks consistency and meaningful participation by the City Council in problem solving.
- The 1993 City Council elections involve 3 City Council seats which could continue the current polarized political situation or create an even more divisive Council.
- There is a reluctance in the City Council to invest in new technology because of poor investments (on the advice of staff) in the past few years.
- A continuation of the current recession in the local and state economy.
- High inflation would damage the purchasing power of the city while increasing prices.

Organizational Capability

The Orangedale Police Department has the ability to accomplish the mission statement as evidenced by the strengths within the organization. The personnel within the department are well-educated and well-trained with a strong interest in employing technology to improve their response to community problems. The main weakness of the department is, first and foremost, the city's financial situation in light of the California economy. Further significant deterioration of the local economy could make the transition to new technology

almost impossible. The next most critical area of weakness revolves around the internal problems of the past two years. If the department personnel cannot put the past two years behind them and deal with the problems of the future there is little hope of accomplishing the mission.

In all, the strengths coupled with the opportunities give the department a great potential to accomplish the mission.

Summary of Environmental and Organizational Analysis

The environmental and organizational examination reveals an economic element in most areas. The current economic recession in California has affected almost every area of life in the state and, if the experts are to be believed, California hasn't hit bottom yet. Convincing political leaders to release funds in a tough economy will be difficult and requires convincing arguments for improved performance and/or cost savings.

Stakeholder Identification and Analysis

There are at least three "snail darters" contained in this list and they are identified by the symbol "□". Snail darters A discussion of each of the stakeholders follows this list with the assumptions for each individual or group denoted by their designated number and a separate letter (i.e. - 1A, 1B) to denote their assumptions. These designations also correspond with the Stakeholders Assumption Map in this section.

- Police officers (1)
- Police administrators (2)
- Chief of Police (3)
- Records Manager (4)
- Dispatchers (5)
- Finance Director (6)
- Data Processing Manager (7)
- Chamber of Commerce/Business Improvement District (8)

- ■ City Manager (9)
- □ Taxpayers/Citizens (10)
- □ City Council (11)
- □ Special Interest Groups (12)

Police Officers (1)

The Orangedale Police Department is predominantly a young department due to recent retirements and turnover. Many of these officers have a personal interest in technology as they own and use their own computers. (1A) The officers generally look at this technology as an opportunity but (1B) are concerned that it will not result in a fairer distribution of reports and other work.

Police Administrative Staff (2)

Like the police officers, the staff of the Orangedale Police Department is generally young when compared with neighboring agencies. (2A) The staff is open to new technology which will assist them in addressing the city's police problems. (2B) They will also expect a rapid installation and implementation of any new system.

Interim Chief of Police (3)

The new interim Chief of Police was appointed to make changes in the department as he sees necessary - not to be a caretaker. His only two directives from the City Council and the City Manager were to heal the department internally after two years of in-fighting and to address some policing issues with certain elements of the community with particular emphasis on the downtown business community. The rest is up to him. (3A) The interim Chief wants to implement problem-oriented policing concepts in the city and (3B) wants to change the department's focus with more emphasis on addressing/examining the needs of the department's customers - the taxpayer.

Records Manager (4)

(4A) The Records Manager has been involved in looking at new technology and will be receptive to any opportunity that improves information collection, retrieval and analysis. (4B) She will also be concerned that the system does not

create further problems for an already over-burdened Records Bureau.

Dispatchers (5)

The Dispatchers have long been under-paid, over-worked and poorly supported. (5A) They will expect that any new system will involve more work for them with no reward. (5B) Additionally, they will be resistive to any change that lacks their input.

Finance Director (6)

The current financial situation of the city is poor but better than prior years. The city faces a $1.7 million deficit of which they will try to save $700,000 from the current budget and make cuts of $1 million from the 1993-94 to create a balanced budget. (6A) The Finance Director will be concerned with overall cost of purchase, installation and implementation. (6B) He will also be concerned with the revenue source for purchasing GIS.

Data Processing Manager (7)

(7A) The Data Processing Manager will be concerned with the level of support required from his department due to staffing cuts suffered during the past three years and current service demands. (7B) He also has a high degree of interest in GIS, wishes it to be implemented city-wide but recognizes his inability to support it in large scale at this time.

Chamber of Commerce/Business Improvement District (BID) (8)

The Police Department has seen its relationship deteriorate with the downtown business community in the past year. The BID encompasses most of the downtown business community and the Chamber of Commerce encompasses businesses in the entire community including the downtown merchants. (8A) The downtown merchants have generally lost faith in the police department's ability and interest in addressing their crime and safety concerns. (8B) However, they wish to be involved and supportive in improving the relationship and the service.

City Manager (9)

The City Manager is generally supportive of the Police Department and the need for strong, effective law enforcement for the community. (9A) The City

Manager will support the use of technology to improve service delivery as it is a short-term cost as opposed to the long-term costs of additional personnel. (9B) He is, however, extremely concerned about the city's poor financial situation, the "protected" status of the police budget (at least in cutting personnel) and the affect that his support of this expenditure might have on the morale of non-police employees.

Taxpayers/Citizens (10)

The taxpayer/citizen is a potential "snail darter" as changes in the economy, political leaders and the crime picture can radically change their views in short order. (10A) They are concerned with current economy, the specter of additional taxes and government waste. They still believe that there is a lot of "fat" in government that needs to be cut to "put cops on the street". (10B) This is countered by their strong desire to be safe and secure in their homes and community.

City Council (11)

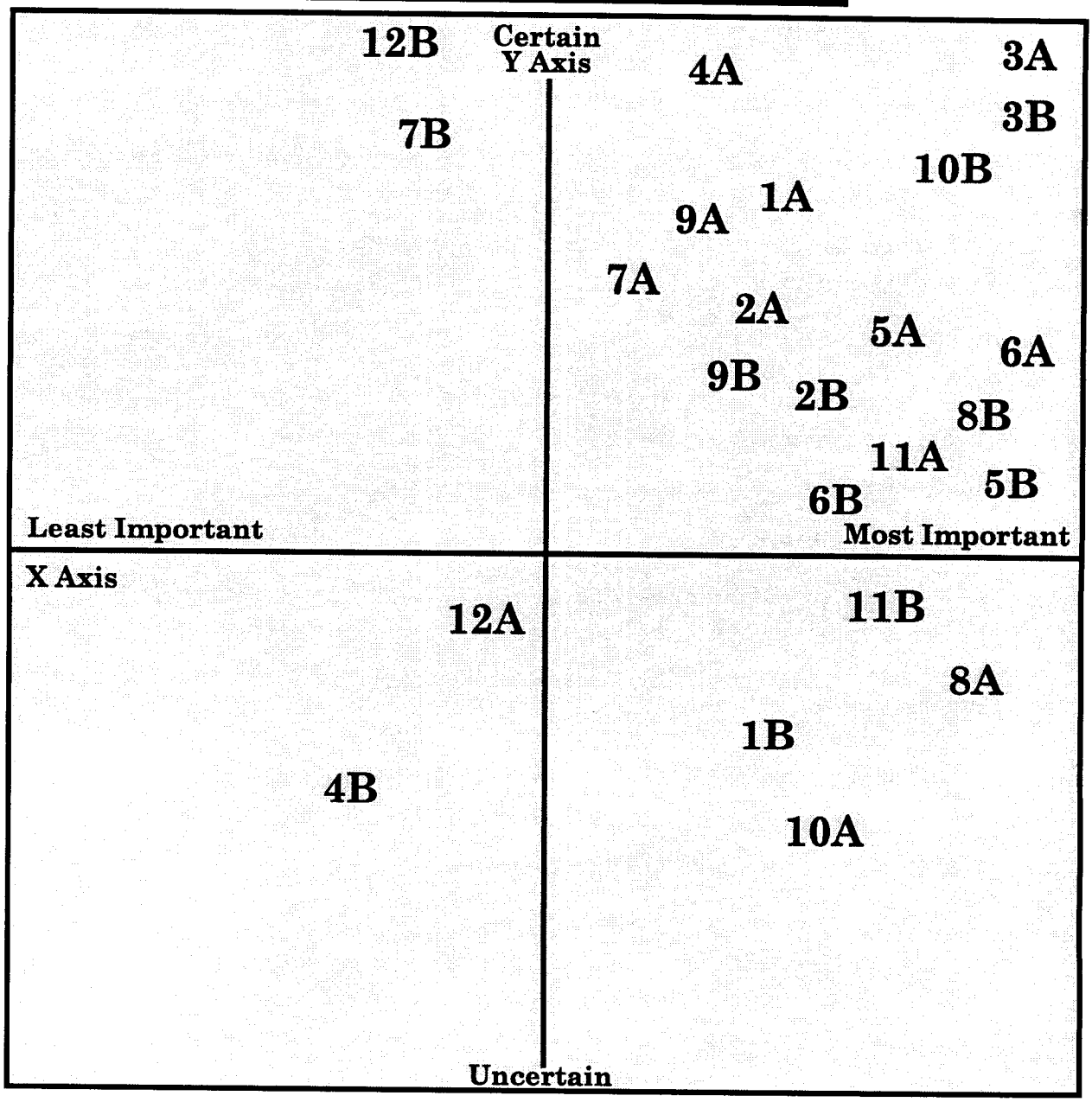
The City of Orangedale has a very divided City Council at this time with almost every vote being 3 to 2 with different majorities in almost every issue. This extreme polarization is particularly prominent in any issue involving growth or dealing with the problems of growth. Because of this, the City Council is a "snail darter" in the best meaning of the term. (11A) Their opinions and votes are subject to a combination of personal convictions, facts, "political correctness", political expediency and obligations to supporters and campaign contributors. (11B) They will want tangible, quantifiable results in the short term as they are subject to re-election every two years.

Special Interest Groups (12)

The special interest groups in the city are also potential "snail darters" in this plan. They include groups that deal with human relations (Coalition Against Racism, Sunday Concerned Group), slow growth (Friends of Orangedale), pro-growth (Board of Realtors), graffiti abatement (numerous groups) and civil liberties (ACLU). (12A) These groups are generally narrowly focused with a single

driving interest. (12B) They will examine any potential plan in the context of their special interest.

Strategic Assumption Map



Legend:

"X" Axis - Importance of stakeholder's assumptions to the department's issue management
"Y" Axis - Level of certainty regarding the stakeholders's assumptions

1A. Officers' interest in technology
1B. Officers' concern for workload fairness
2A. Staff interest in technology
2B. Staff desire for rapid installation
3A. Chief uses GIS for community policing
3B. Chief wants better customer orientation
4A. Records Mgr. receptive to technology
4B. Records Manager's concern for workload
5A. More work/no reward concern of Disp.'s
5B. Dispatchers' resistance to change
6A. Finance Dir.'s concern with General Fund
6B. Finance Dir.'s concern w/ revenue sources
7A. D.P. Mgr.'s concern for DP support level
7B. D.P. Mgr.'s interest in GIS
8A. Merchants faith in police department
8B. Merchants desire to support the police
9A. Manager's support of use of technology
9B. Manager's concern for bad fiscal situation coupled w/ morale of other city dept's.
10A. Taxpayer concern about government waste
10B. Taxpayer desire for security and safety
11A. Council opinions relative to GIS success
11B. Council desire for short-term results
12A. Special interests groups focus on GIS use
12B. Special interests examine potential plans in context of their issue and GIS

Figure 28: Strategic Assumption Map

Alternative Strategies

An examination of potential alternative strategies was conducted by a small panel composed of the following individuals:

- Lewis Nelson, Chief of Police, Redlands Police Department, Redlands, California
- Cletus F. Hyman, Lieutenant, Redlands Police Department, Redlands, California
- David Villegas, Data Processing Manager, City of Redlands, Redlands, California
- Fritz Maher, Manager, Applications Programming (Military Applications), Environmental Systems Research Institute, Redlands, California
- Lee Johnston, Regional Manager (California, Nevada & Hawaii), Environmental Systems Research Institute, Redlands, California

This panel examined the various methods of implementing GIS given the agency's technological sophistication, data processing capability and support, staffing and budget.

Strategy #1: "Take-out" Geographic Information System Using General Fund Monies

The City of Orangedale Police Department should purchase a complete "take out" geographic information software system (GIS) and workstation to be purchased from the General Fund by a one-time allocation. The "take out" system means that the GIS vendor sells the department the software, manuals and very limited customer support which the purchaser installs in a workstation. This is the most inexpensive way to enter the GIS field but is also the most labor intensive for department personnel. The "take out" system will require employee self-teaching within the organization with limited, usually telephonic, customer support from the vendor.

Pros

- The most inexpensive method of entering the full-featured geographic

information environment.

- Financial commitment for purchase is short term (one time purchase).

Cons

- Totally dependent on the technical skills of in-house personnel.
- Very labor intensive for department personnel.
- Implementation will be a slow, difficult process.
- High chance of failure due to a lack of skilled personnel and professional support.
- Purchase funds come from over-burdened General Fund.
- Financial commitment for support and implementation is high and long-term.
- System is a generic,"boxed" software package and not a custom design for the agency.
- Opportunities to customize the system are extremely limited due to lack of formal training and very limited support.

Stakeholder Assumptions

Police Officers

The officers will be generally supportive of this strategy but the lack of quality support will create implementation problems that will cause them to lose confidence. Fairness of work distribution will be an issue as the bigger problems will be found in getting the system up and running.

Police Administrative Staff

The staff will be supportive of the new technology but will become frustrated and unhappy when the "take out" system is slowly installed and implemented by department personnel. It will require a great deal of staff time to manage and maintain.

Interim Chief of Police

This basic approach will not satisfy the interim Chief who wants to quickly implement problem-oriented policing concepts in the city and wishes to change the

department's focus by developing an improved customer orientation.

Records Manager

This strategy will not be well received by the Records Manager as it will be extremely labor intensive and burdensome to her personnel due to lack of professional software support.

Dispatchers

The Dispatchers will see their worst assumptions come true. This system lacks intensive support and they will have to learn on the job while also assisting in building tables and maintaining the system. This type of system lacks the flexibility to make many changes which will create further frustration.

Finance Director

This approach will both please and disappoint the Finance Manager who sees a low cost for purchase, installation and implementation but sees money taken from the General Fund.

Data Processing Manager

Despite his interest in GIS, the Data Processing Manager will disapprove of this approach due to the need for sustained, high level data processing support.

Chamber of Commerce/Business Improvement District (BID)

The business community will be initially supportive but the risk of further damage in the relationship is very high if the system is not effectively installed and utilized to their benefit. The failure to speedily put this system in effect could create a feeling that the police department has misspent or wasted scarce funds.

City Manager

The City Manager will appreciate the cost of this approach but will not be supportive of the use of a number of sworn personnel to implement it and/or the addition of civilian positions.

Taxpayers/Citizens

The taxpayers will be initially supportive based upon their strong orientation to public safety. Like the business community, however, if the system is not effectively and quickly brought on line there will be a severe problem,

confirming their belief that there is widespread waste in government.

City Council

The City Council will like the lower price of the take-out system but will definitely not be pleased with the implementation time and personnel costs involved in bringing the system on line. The Council is one of the identified "snail darters" and their exact position is difficult to identify without knowing all of the other influencing factors.

Special Interest Groups

The majority of these groups will be ambivalent about the type of purchase but will be more concerned with its use relative to their issues. The groups involved with racism and human relations may have concerns about the system being used to identify specific racial/ethnic groups while the graffiti abatement groups may see an opportunity to track graffiti locations and tagging monikers.

Strategy #2: Purchase A "Technology Transfer" Geographic System Using General Fund Monies

The Orangedale Police Department should purchase a "technology transfer" geographic information system with limited support and training by using General Fund monies in a purchase amortized over three years. This "technology transfer" geographic information system is slightly more than twice as expensive as the aforementioned "take out" system but this extra money provides for installation of the system, moderate support and complete training of a number of department trainers by the vendor.

Pros

- A relatively inexpensive method of obtaining a full-featured geographic information system.
- Purchase price is spread across three years, minimizing the adverse affects on the General Fund.
- In-house personnel receive expert training by the vendor to prepare them to teach other department personnel.

- Moderate software support from the vendor assists trainers and trainees to identify and resolve problems.
- System is installed by vendor preventing initial problems caused by improper installation.

Cons

- System is a generic,"boxed" software package and not a custom design for the agency.
- Training and full implementation still relies on a large amount of in-house personnel resources.
- Purchase funds are derived from an already burdened General Fund for three years.
- Opportunities to customize the system are limited by skills of vendor-trained personnel.

Stakeholder Assumptions

Police Officers

The Police Officers will be supportive of this type of installation and the improved training and support should enable staff to alleviate fairness concerns in a more expedient manner.

Police Administrative Staff

The staff shall be very supportive in that the system will be available and in use in much shorter order than the "take out" system. They will still be pushing the full installation, wanting to take full advantage of GIS opportunities. They will probably find the process too slow and too labor intensive by department personnel.

Interim Chief of Police

The interim Chief of Police will find the new system valuable in assisting in crime analysis and problem identification as part of a problem-oriented approach but he will be unhappy with the level of personnel resources required to implement as well as the length of time to reach full effectiveness.

Records Manager

The Records Manager will be far more accepting of this system due to the installation and moderate support. She will still be concerned about any extra support issues (table building, etc.) for her personnel.

Dispatchers

Some of the Dispatchers will participate in the initial training-for-trainers but will have little input in system design as it is a generic package. This situation will still create frustration among them.

Finance Director

The Finance Director will still be unhappy with the General Fund expenditure but the amortization over three years will increase his level of support.

Data Processing Manager

The Data Processing Manager will appreciate and support the training of in-house trainers but will still oppose the extensive use of his personnel due to recent personnel cuts. He is still extremely committed to the use of GIS.

Chamber of Commerce/Business Improvement District (BID)

The downtown merchants will be supportive but the true test will be in the department's ability to utilize the system to identify, analyze and address problems. The lack of extensive professional support may hamper complete installation and use of the system thereby creating frustration in this group.

City Manager

The City Manager will not be very supportive of this proposal in that it involves the use of General Fund monies at a time when it can only come at the expense of other city departments. He will also recognize the need for considerable in-house support which must, given the Police Department's staffing levels, take personnel from field duties.

Taxpayers/Citizens

This large group of "snail darters" will remain generally supportive of this approach but will be looking for quick results too. The fact that this type of

system installation is still time consuming may prevent a full realization of its abilities and anger the taxpayer.

City Council

Another group of "snail darters", it is hard to predict what their position will be. They will be more acceptable to a faster implementation of this system.

Special Interest Groups

Again, the response of the special interest groups will be dependent on their interpretation of the impact on their issue. The groups involved with racism and human relations may have concerns about the system being used to identify specific racial/ethnic groups while the graffiti abatement groups may see an opportunity to track graffiti locations and tagging monikers.

Strategy #3: Purchase a "Turn-Key" Geographic Information System With A Combination Of General Fund And Asset Seizure Funds

The Orangedale Police Department should purchase a "turn-key" geographic information system with a combination of General Fund monies (initial down payment) and asset seizure funds (yearly payments) amortized over five years. This type of system is approximately five times more expensive than the "take out" system and more than twice as expensive than the "tech transfer" systems. The "turn key" system would be built, designed and installed for the Orangedale Police Department with all of the time consuming needs assessing, table building, trouble-shooting and software rewriting performed by the vendor. This system would be operational quickly but complete installation could take as long as 10 years as refinements and additions are made to the system into the next century.

Pros

- A totally customized system for the Orangedale Police Department.
- System is totally supported by software vendor.
- System is in full operation in a very short time showing benefits almost immediately.

- In-house personnel are trained on the job over an extended period (one to four years) by vendor supplied experts.
- Very small expenditure of personnel resources to bring system on line.
- Purchase price is shared between General Fund and asset seizure monies.
- System is constantly revised and improved over an extended period (up to two years).

Cons

- Expensive, even over five years. Part of purchase funds still rely on General Fund monies.

Stakeholder Assumptions

Police Officers

They will be excited about the technology and the working system should answer their questions about fairness and equality of workload.

Police Administrative Staff

The staff will enjoy using a ready-to-go system.

Interim Chief of Police

The interim Chief of Police will be happy to use this system to address problems in the community. This approach allows him to have full use of the system in short order.

Records Manager

The Records Manager will be able to have direct input in the construction and sign-off of the system. This procedure should give her ample opportunity to address her concerns regarding Records personnel.

Dispatchers

The Dispatchers will be able to have direct input in the construction and sign-off of the system. This should provide an excellent opportunity to build a system "friendly" to their needs. They will enjoy this opportunity but will also

still have the same concern about rewards.

Finance Director

The Finance Director will still be concerned with the use of General Funds in the purchase of the system in the first year. He will be happy with the fact that asset seizure funds are to be used in the remaining three years. If the department was able to get approval as a "beta" site his level of acceptance would be much greater.

Data Processing Manager

The Data Processing Manager will be very happy with this approach as it minimizes the support issues for his personnel while providing GIS to the department.

Chamber of Commerce/Business Improvement District (BID)

The downtown merchants should react positively to this system as it will be up and running faster and, therefore, available to address their needs sooner. The more the department can utilize this tool to their benefit, the better the support.

City Manager

The City Manager will be most supportive of this approach providing that the Police Department can generate the asset forfeiture money to make subsequent payments. As the use of these monies is extremely limited by law, this is a use and expenditure that he can support without having a negative affect on the morale of non-police city employees. The City Manager will probably insist on impounding all asset seizure monies for this purpose until enough is available to pay off the note. The extensive external support eliminates the need for extensive in-house support and the addition of new personnel.

Taxpayers/Citizens

As with the business community, the faster the system can be implemented and the sooner the benefits can be shown or publicized, the broader the support from the community.

City Council

The City Council will be concerned with the cost but the use of asset seizure

funds will mitigate this. They will also want short term results and this method provides the best chance of positive, less troublesome, results.

Special Interest Groups

Again, the response of the special interest groups will be dependent on their interpretation of the impact on their issue. The groups involved with racism and human relations may have concerns about the system being used to identify specific racial/ethnic groups while the graffiti abatement groups may see an opportunity to track graffiti locations and tagging monikers.

Selected Strategy

Although it is the most expensive, the panel selected Strategy #3, the purchase of a "turn-key" geographic information system with a combination of General Fund money for the down payment in the first year and asset seizure funds for three remaining payments in the following three years. An additional option would be added to the plan to offer GIS vendors, specifically the local vendor, the opportunity to use the Orangedale Police Department as a "beta" (or testing) site for new software products in exchange for discounted software and services. This might mitigate the remaining financial concerns of the City Council, the Finance Director and taxpayer groups. As mentioned before, this type of system is approximately five times more expensive than the "take out" system and more than twice as expensive as the "tech transfer" systems. The "turn key" system would be built, designed and installed for the Orangedale Police Department with the majority of the time consuming needs assessing, table building, trouble-shooting and software rewriting performed by the vendor. This system would be operational quickly but complete installation could take as long as two to three years as the system is refined and improved for the Orangedale Police Department.

Implementation Plan

The selected strategy (#3) was examined by the aforementioned panel and a plan was eveloped to implement the strategy in seven phases over a period of approximately 10 years.

Phase One - Politics

The framework for the implementation of a "turn key" geographic information system is partially in place. The Orangedale Police Department has an active asset seizure account and an average yearly balance to make the payments for the 5 years following the down payment. GIS already exists in a rudimentary form in the Planning Department but it is a minimal, "boxed" program with a very limited database. This has broken down some of the initial barriers as it has been successfully used to create new council districts with a great savings in time and money. The interim Chief of Police should be the lead official in the implementation of this strategic plan because:

- He has direct access to the political leaders of the community through Council Meetings and other forums.
- He is the primary law enforcement official in the city and has knowledge of, and interest in, GIS.
- He can make the necessary budgetary trade-offs necessary to make the initial down payment from the budget if the Council will not authorize additional funds for it.
- He has a staff with computer backgrounds and one staff member who has actively worked with a GIS vendor in table building and system troubleshooting in a limited "beta" site experiment at Orangedale PD.
- He has numerous community, service and other contacts that will enable him to put the GIS issue in the public consciousness.

It should be noted that the interim Chief of Police will need to maintain the support of the department and the Data Processing Manager while gaining the support of the Finance Director as well as the City Council. Once the decision is made to use asset seizure funds, the department will be committed to generating a

sustaining level of forfeitures but should the department convince the local vendor (or any GIS vendor) to use Orangedale PD as a "beta" site, the importance of this issue would diminish.

Approval of the City Council should be completed by April 1, 1995.

Phase Two - Assessment

While the interim Chief of Police should be the lead official externally at the outset, in the first phase of the implementation the Interim Chief shall appoint a project manager within the department. This individual will be the Administrative Lieutenant in the department who has an extensive background in computers and excellent organizational skills. A Project Management Team will also be created to work closely with the vendor. The Project Management Team shall conduct an internal needs assessment and examine the opportunity for links with other city departments. At the same time, the Team will examine the availability of out-sourced geographic databases that could save the city in file building. The Team shall evaluate the GIS capabilities and versatility of various vendors, coupling this with an examination of the costs of the various packages. The Team shall also design performance objectives for the software vendor after which the software vendor shall be selected and a contract awarded.

The Project Management Team should complete this phase by September 1, 1995.

Phase Three - Design

During this time the Project Management Team shall coordinate and review high level GIS design work by the vendor with table and record building within the department. The Team shall meet weekly with the vendor's software designers to avoid duplication of effort and unnecessary mistakes. Training of selected personnel from various representative areas of the department will occur to assist with the feedback for the next and subsequent phases.

This step should be completed no later than March 1, 1996.

Phase Four - Prototype

The next step would involve the construction of prototypes from the basic

system with a new iteration constructed every three months for up to one year. Each iteration is thoroughly critiqued and analyzed. The testing of the software design will occur during this phase with both "alpha" testing (at the vendors facility) and "beta" testing (on-site). This testing will take place with the constant feedback from the Project Management Team to the vendor's design and application personnel. Hardware (workstations, plotters and associated equipment) will be installed during this period. The personnel trained in Phase Three will be a vital part of the feedback loop as they use the software in real-world situations. The result will be the repeated generation of improved software versions as police department personnel report problems for correction by the vendor.

The target date for the completion of this phase shall be September 1, 1996.

Phase Five - Testing and Refinement

This is the final design and integration phase of the project. In this phase, the department's Project Management Team and the vendor's design and application personnel will work closely with one another as the lessons from alpha and beta testing are applied to the final design. The Project Management Team will seek input from previously trained personnel as well as from other personnel who have experimented with or self-trained on the prototype.

This phase should be completed by September 1, 1997.

Phase Six - Acceptance

The acceptance and continued testing phase is the final, prolonged, part of this project. At this point, final design has been completed, installed, tested and placed into operation. All additional personnel are trained in structured classroom and hands-on situations in this phase and the formerly trained personnel are brought up to date on the design changes. After the system is placed on line, continued testing and exploration of the system occurs over the next year so that software problems can be identified and corrected in that period.

The expected completion date for this phase shall be September 1, 1998.

Phase Seven - Feedback, Refinement and Improvement

This phase includes the identification and resolution of new problems or uses for the GIS software. It incorporates the ongoing identification of existing and emerging technologies, databases, software systems as well as prioritizing their importance for interfacing with the GIS system. In this phase, selected technologies, databases and systems shall be incoporated into the GIS system to maximize it's utility to line staff and management personnel.

This shall be an on-going process for the life of the GIS system and progress into the next century.

Plan Summary

This plan was designed to provide a controlled procedure to create a system that is customized to the needs of the department and its mission. The transition plan that follows will provide the structure for the Orangedale Police Department to successfully implement the strategic plan.

Chapter Four

Transition Management Plan

Transition Situation and Strategy

The target organization is the Orangedale Police Department as described at the beginning of Chapter Three. The hypothetical scenario (Scenario #2) was selected and the selected strategy (Strategy #3) was to purchase, install and implement a full-blown, "turn-key" GIS system using a combination of asset seizure and general fund monies over a period of 10 years.

Critical Mass

The critical mass for the selected strategy was examined by the following individuals:

- Lewis Nelson, Chief of Police, Redlands Police Department, Redlands, California
- James R. Bueermann, Captain, Field Services Division, Redlands Police Department, Redlands, California
- Cletus F. Hyman, Lieutenant, Support Services Division, Redlands Police Department, Redlands, California

Included in the examination was a discussion of current positions, desired positions and strategies to move/keep the groups or individuals in the desired positions.

It is extremely difficult to involve all stakeholders in the transition management process but by identifying those "stakeholders" who are part of the critical mass one can achieve a higher potential for success. Because of the fact that the Police Officers' Association generally reflects the views of the more vocal officers, the Association has been selected in the critical mass. The stakeholders identified from the strategic plan who are part of the critical mass are:

- Police Officers' Association
- Interim Chief of Police
- Records Manager

- Finance Director
- Data Processing Manager
- City Manager
- Chamber of Commerce/Business Improvement District
- City Council
- Special Interest Groups

Since the development of the strategic plan, an important player in the critical mass has appeared and will be added to the list above. This person is:

- Project Manager

The Project Manager's interest in the project and his organizational skills were paramount in the selection process making him/her a strong proponent of the project.

Current Positions

Police Officers' Association

The officers in the Police Officers' Association at the department are generally receptive to new technology with the caveat that it improves their work product and saves time. The Association, via their representatives, voice their concerns and, if not properly addressed, could be very detrimental to the success of the program. The officers' concerns center around fairness and equality in workload distribution and in achieving more proactive time to apprehend criminals. Less paper and more "real" police work would be the short form of this concern. At this time the Association is in a "let change happen" position.

Police Administrators

The Captains, Lieutenants and Sergeants are extremely important to this effort. Approximately one-third are very excited about GIS while another third invite the opportunity but are intimidated by the technology and the last third are ambivalent. Overall, they would have to be classified as "let it happen" players.

Interim Chief of Police

The Chief of Police is serving in an interim capacity after the recent,

unexpected retirement of the former Chief. He is thoroughly committed to the implementation of GIS and will be a "make change happen" player. His preference is that the GIS implementation is reasonably rapid and orderly so that he can address the concerns of the officers and show positive results to the City Council and Manager. He supports the "turn-key" strategy as it does not create a reliance on untested software on a day-to-day basis but delivers a customized, operational system ready to use. He is a "make change happen" player.

Records Manager

The Records Manager is the key to gaining support of virtually all of the non-sworn personnel. She is extremely competent and respected by her peers and co-workers but particularly by the Records and Communications personnel. The Records Manager is concerned about any addition to the workload of her personnel due to an extremely low staffing level. She is also cognizant that GIS could assist her in mandated reporting and special information requests. At the present time she would be a "let it happen" player.

Finance Director

The Finance Director is currently in a position to "block change" at this time because of his concern for the city's poor financial situation coupled with the use of general fund monies and unpredictable asset forfeiture funds in the purchase of the GIS.

Data Processing Manager

The Data Processing Manager has an interest in GIS and is currently willing to "let change happen" as long as it does not cause a high level of data processing support or otherwise adversely affect his unit due to recent lay-offs and cutbacks.

City Manager

The City Manager is a "let change happen" player as he appreciates the value of GIS but has some concerns relative to the financing. While the economic realities of the city are severe, he is understanding of the potential for cost savings by the proper use of GIS. The City Manager has brought several service and

technological innovations to the city, has a high interest in improving police service delivery and is very supportive of the Interim Chief of Police.

Chamber of Commerce/Business Improvement District

The Chamber of Commerce and the Business Improvement District organizations are supportive of law enforcement and desirous of improved police service for the business community. They have helped in the purchase or donation of equipment in the past (including computer software and hardware) when it was connected to service delivery to the business community. At this time they are in a "let it happen" position.

City Council

The City Council is composed of five members with a wide disparity of opinion and different political agendas. If the GIS proposal was brought before the City Council tomorrow it would be extremely difficult to predict the outcome. There are two members who generally vote against any large outlays of cash, regardless of where the money comes from. The fifth council member is very cognizant of public opinion via calls, letters and the newspaper. He is generally the swing vote on any significant issue. The City Council at this time would have to be placed in the "block change" position.

Project Manager

The Project Manager was selected because of interest, knowledge and support of GIS and must be categorized as a "make it happen" player.

CRITICAL MASS COMMITMENT CHART

STAKEHOLDERS IN CRITICAL MASS	BLOCK CHANGE	LET CHANGE HAPPEN	HELP CHANGE HAPPEN	MAKE CHANGE HAPPEN
1. Police Officers' Assoc.		X	O	
2. Police Administrators		X		O
3. Chief of Police				XO
4. Records Manager		X	O	
5. Finance Director	X	O		
6. Data Processing Manager		X	O	
7. City Manager		X	O	
8. Chamber of Commerce & Bus. Improv. Dist.		X	O	
9. City Council	X		O	
10. Project Manager				XO

X = Present Commitment
O = Desired Commitment

Figure 29 - Critical Mass Commitment Chart

Desired Positions and Strategy

Police Officers' Association

The Association must be invited into and involved in the GIS implementation. By presenting a concise, directed GIS presentation using vendor supplied examples from other law enforcement agencies, the Chief or Project Manager can demonstrate the ability of linking GIS to CAD to improve service, track workload, adjust beats and provide more proactive patrol time. At the same time, the Association's input would be sought in the creation of the system and members would be involved in the testing and evaluative steps. This action should reduce the chance of a "revolt" internally which could affect the acceptance of GIS by other groups in the community. The desired outcome would be the movement of the Association from the "let change happen" to the "help change happen" position. Once in this position, the Association's acceptance of GIS would have a positive affect on other groups including the City Council and Chamber of Commerce.

Police Administrators

The most effective method of getting the Police Administrators to move from the "let it happen" to "make it happen" position is to demonstrate the value of GIS to them as administrators. A demonstration of GIS capabilities and how it can simplify many of their tasks and make them more successful would be extremely helpful in this movement. Additionally, hands on use of GIS with a user-friendly graphic interface would help to remove some of the trepidation involving computer use.

Interim Chief of Police

The Chief of Police is already in the "make it happen" mode and should not change as he is critical as the primary "salesman" of GIS at Orangedale PD.

Records Manager

It is extremely important that the Records Manager move from "let it change" to, at least, "help change happen". It is critical that the Records Manager be involved in the implementation process as early as possible so that she can be

an advocate for her unit and assist in designing a system that she can identify with. She will also be representative of the non-sworn personnel in the department and with her buy-in the GIS project gets general employee buy-in.

Finance Director

The most difficult person with whom to effect change is the Finance Director. He will be an extremely difficult obstacle to get around if he continues in a blocking position. His concern centers chiefly around the expenditure of money from the General Fund. His concern must be countered with a strong argument that all but the initial payment will be made from asset forfeiture funds or a combination of asset forfeiture and offsetting reductions in the Police Department budget. This, combined by positive changes in the positions of the City Council and the Chamber of Commerce/Business Improvement District, presents a good opportunity to move the Finance Director from the "block change" to the "let it happen" position.

Data Processing Manager

The Data Processing Manager can be moved from the "let change happen" to the "help change happen" mode by involving him in the planning stage as he has an interest in GIS but wants to minimize the impact on his employees. This involvement will challenge his natural interest while allowing control over the impact on his employees. This change will provide the Police Department with its strongest internal technological advocate if properly handled.

City Manager

The City Manager is currently in a "let change happen" position due to his interest in the technology and his support of the interim Police Chief and the Police Department. The city's fiscal situation, balanced against the needs and impacts on the other city departments, makes it difficult for the Manager to be a real cheerleader without adversely affecting the morale of other departments who have suffered through significant budget and personnel cuts in recent years. The City Manager obviously serves at the pleasure of the City Council but also has a high degree of interest in the concerns of the business community and is

responsive to their needs. If the plan is successful in creating more positive positions for the City Council (which is absolutely essential for the vote to fund this program) and the Chamber of Commerce, the City Manager could easily move from the "let change happen" to the "help change happen" position.

Chamber of Commerce/Business Improvement District

The Chamber of Commerce and the Business Improvement District are very supportive of law enforcement and an excellent relationship exists between the Police Department and the business community. It is important that this group is moved from the "let change happen" to the "help change happen" position to increase pressure on the City Council to approve GIS (influence the swing vote) and to encourage increased support from the City Manager. It is important that the Police Department conduct a proactive information program to enlighten the Chamber and BID about the benefits of GIS, particularly to the business community. The business community must be encouraged to express its support for GIS to each City Council member, to the City Manager and through the "Letters to the Editor" feature in the local newspaper. These steps should cause this change.

City Council

The City Council presents the most imposing problem as there is rarely a clear majority except on growth issues in the city. Based upon prior votes regarding technological expenditures for the Police Department it seems that the two pro-growth advocates will vote for GIS while the two anti-growth advocates will vote against it. The remaining council member is cognizant of public opinion as he has always fashioned himself as a "grassroots" candidate and is cognizant of public opinion including input from the business community. The two pro-growth candidates are very sensitive to the opinions of the business community and it is necessary to win and hold their votes. It is critical that the Chamber and Business Improvement District members contact the swing council member as well as the two pro-growth council members to encourage their vote for GIS. A letter writing campaign may also prove to be effective in creating the necessary support

for the crucial third vote in the City Council.

Project Manager

The Project Manager is already in the "make it happen" mode and should not change as he is critical as the leader for taking Orangedale PD into this new technology.

Management Structure

A Project Management Team shall be the recommended management structure for this project. The team will be responsible for overseeing the successful planning, design, installation and review of the GIS system. This team shall represent a diagonal slice or cross-section of the department with representation from line, support and staff areas that deal regularly with records retrieval, input, review or reporting. All members of this team will serve voluntarily and their duties will be in addition to their regular responsibilities.

The interim Chief of Police will appoint the Administrative Lieutenant, who has extensive computer experience, to the team. First and foremost, he has developed, on his own time, a considerable expertise working in GIS by volunteering his time at a major GIS software company. Second, he is extremely knowledgeable in computer hardware, software and their capabilities. Third, he is extremely cost conscious, has managed government grants in the past, and will get the maximum value for each invested dollar. Fourth, he has served in virtually every area of the department and possesses an excellent knowledge of their needs. Lastly, he currently works out of the Office of the Chief of Police and has daily contact with both the interim Chief and other department staff members. He has also recently served as a Watch Commander in Patrol and currently has the Records Section as one of his responsibilities. The Administrative Lieutenant is not only the right person for the job but he's also in the right position for the job as three-quarters of the data input and retrieval will occur in his Bureau. He will also make the selection of the other team personnel after a thorough discussion with the interim Chief of Police. These personnel

should include:

- At least two (2) members of the Police Officers' Association
- The Records Manager
- One (1) Records/Accounts Clerk
- One (1) representative from the Investigation Bureau
- One (1) Police Dispatcher
- One (1) Patrol Sergeant
- One (1) representative of the city's Data Processing Department, preferably the manager, if he's willing to participate.

The Project Management Team provides representation from the critical internal groups including the Police Officers' Association, Administrative Staff, Records, Communications and the Investigation Bureau. Also included on this team is a data processing representative to represent their concerns and interests.

The Project Management Team has a number of tasks to accomplish initially including a preliminary needs assessment to determine the major areas to be addressed by GIS at Orangedale PD and writing the request for proposals (RFP) for putting the GIS to bid. Once the vendor is selected it will be the task of the team to meet regularly with the vendor's development team to communicate the department's general needs and assist with an in-depth needs assessment by the vendor.

Techniques To Support Implementation and Change

The Chief of Police must be the catalyst to bring the critical mass to action for GIS. It is imperative to obtain the political and financial support in order to provide the ability to implement GIS at Orangedale PD. To enable this process it is necessary to take the following steps:

- A carefully planned informational program is developed to inform the Chamber of Commerce, Business Improvement District, Police Officers' Association, Finance Director, City Council and others of the benefits of GIS such as:

- Improved resource allocation
- Improved long and short term planning
- Improved service delivery
- Potential long term cost savings
- Potential for increased operational effectiveness
- Financing method (including an examination of prior asset seizure levels)
- Future flexibility of the system

- The necessary implementation team will be composed of representatives of the police association, non-sworn personnel, police administration and data processing with the purpose of providing the necessary information to obtain and maintain their support. This implementation team uses the informational program to advise, solicit support and seek input. The Project Management Team will become the marketing group for GIS at the Orangedale Police Department.
- Preliminary investigation, assessment and preparation of requests for proposals (RFP) for putting the GIS system to bid are developed by the Project Management Team.
- The City Council votes to purchase and install a GIS system for the Police Department.

Technologies and Techniques to Implement Change

Much of the work in the implementation phase are vendor-driven but it is important that a computer generated time-line be established for the department and the vendor to insure that the custom GIS system is being developed and installed in a timely and cost effective manner. The time-line will be developed at the outset of the program with the assistance of the vendor. The vendor understands that they will be held to certain dates determined to be critical to successful installation. This time-line will detail those critical assignments and

dates to the responsible persons or groups.

The Records/Account Clerk will evaluate the time-line with planned costs using a computerized spreadsheet program for reporting to the Project Manager. This will insure that specific work is performed by the vendor prior to the payment for these services and will further assist in identifying shortcomings by any of the parties in the implementation.

Section Summary

The purpose of providing a transition plan is to translate a vision into reality with the least amount of problems and the greatest chance of success. This transition plan proposes to take a valuable emerging technology (GIS) and install it in a medium-sized department with the maximum chance of success. It is the intent of this transition plan to translate the vision and potential of GIS into reality in the Orangedale Police Department for the benefit of the community.

Chapter Five

Conclusion

Visualizing a Better Future

What will be the use of geographic information systems (GIS) by law enforcement by the year 2002?

- What will be the effect of advanced geographic information systems (GIS) on law enforcement resource allocation by 2002?
- What will be the effect of advanced geographic information systems (GIS) on law enforcement service delivery by 2002?
- What will be the effect of advanced geographic information systems (GIS) on law enforcement planning by 2002?

The future for GIS is unlimited. Today, people are looking at GIS technology to address any number of societal issues and one of the major areas of concern is crime with its related problems. For law enforcement personnel to realize the potential of GIS they must begin to accept and learn the technology now. According to marketing research in 1992, state and local government GIS use will grow annually by 27% for the next five years. Public safety related GIS spending, however, will grow at a 34% annual rate during this same period of time.[19]

One of the most significant potential areas for growth in GIS is multimedia. In fact, "multimedia organizes data types such as maps, video animation, graphics and audio in a nonlinear format - akin to the way the human mind works. When linked to a GIS, multimedia becomes a toolbox from which the user can access various models for exploring "what if?" situations."[20] It dramatically expands our ability to "see" data and, therefore, to put it to better use.

Database access is improving daily as more off-the-shelf type data bases (such as TIGER, DIME, Census, and USES) become more readily available and affordable. More government databases, including some former military and intelligence types, are becoming available although the costs vary as the different governmental entities attempt to establish a consistent pricing philosophy. In

many cases, the government has made its files available at no cost to other governmental entities and for specific private endeavors. Additionally, more sources are emerging for remote sensing databases including governments from all over the western world plus the emerging former East Bloc nations. Data conversion techniques are improving as well as the ability of systems to update themselves across the board as new data is entered and spread across the GIS system.

Hardware comparability will continue to improve as hardware costs decline. In fact, Jack Dangermond, founder of Environmental Systems Research Institute (ESRI) discussed the significance of plummeting hardware prices when he stated, "...the capital costs [of GIS implementation] are dropping and software prices are dropping with it". This change will have a significant effect as GIS becomes more affordable to local government even in the face of severe economic difficulties.

Another related technological change that will significantly affect GIS are efforts by vendors and governments to create standards in databases, GIS structure and database conversion. If more systems will accept more data from other systems efficiently it creates a better opportunity for the creation of state and national GIS systems.

What will be the effect of advanced GIS on law enforcement resource allocation by 2002? The data indicates that GIS will assist in tracking resources, eliminating duplication and preventing waste. Disaster response will be directed on a real-time basis including prioritization, evacuation, shelter set-up, hospital and other essential service identification. Additionally, GIS can help responders determine the serviceability of critical facilities and graphically display the information to prevent duplication of effort as well as to direct personnel, refugees and injured to these facilities. In the wake of Hurricane Andrew, the State of Florida is beginning the creation of a state-wide GIS to prepare the structure to permit such a response. The City of Oakland is using GIS as part of its disaster response to assist not only in rebuilding the city but also to assist in addressing other disasters or significant events of the future. Already, plans are being

developed for highly accurate, real-time tracking of "plume dispersion" in hazardous material situations in Clark County, Nevada.[21] GIS 's ability to generate real-time maps for different subjects (thematic overlays) will provide opportunities to track resources in a wide number of areas.

Searches for lost children or elderly walkaways, graffiti abatement and investigative tracking are all areas that can be improved through the utilization of GIS. Imagine a search for a missing child where the GIS system zooms into the neighborhood, identifies the location potential child molesters or sexual registrants in the area and then provides you with a corresponding aerial map that enables the incident commander to actually "see" the neighborhood - including backyards, bodies of water and other potential hazardous areas. The entire process is expedited and improved through the use of GIS. The ability to plot the residences of local parolees, probationers, registrants, taggers and gang members will allow police agencies to make event-to-suspect correlations in seconds for any number of crimes or issues. Community-based policing efforts will be enhanced as problem areas can be more readily identified and visually displayed. Neighborhood problems, blighted areas, high crime locations - all are easily tracked with GIS. GIS will also provide law enforcement the ability to locate and track resources whether they are "in house" or available from outside vendors and whether it is in day-to-day activities or large incidents.

What will be the effect of advanced GIS on law enforcement service delivery by 2002? Data indicates that real-time GIS will provide the opportunity for a true flex-beat system - beats determined by the criminal activity of the week, day or shift. It will enable departments to make seasonal changes to beats and patrol configurations in order to deliver the right personnel at the right time to a given problem. GIS will be able to identify high activity locations, provide contact relationships between criminals and known associates, track incidence of graffiti vandalism and provide crime trend analysis. Searches will be made easier through access to GIS and the links to actual aerial maps of a specific area. Responding officers will have knowledge available regarding parolees, gang

members or taggers living in proximity to or frequenting the location of a given crime. GIS will prioritize and direct the police to calls in the future as global positioning satellites in geosynchronous orbits talk to a database that identifies blocked or closed streets, tracks police units on patrol, tracks property with GPS locating devices and, perhaps, tracks probationers or parolees released on electronic "leashes". GIS will provide via mobile data terminal, full data on a 911 response address including owner/resident information, criminal histories, weapons violations and even floorplans. Eventually, GIS will enable the police officer of the future to anticipate criminal activity through sophisticated GIS-based crime analysis linked to expert systems and artificial intelligence.

What will be the effect of advanced GIS on law enforcement planning by 2002? GIS crime analysis systems will be linked with neural networks to look for crime trends and enable police officers to anticipate criminal activity in specific areas. One of the strongest current uses for GIS is in the area of modeling or asking "what if..." questions. Law enforcement has not made significant use of this ability to this date. Through modeling, potential patrol areas or beats can be examined for effectiveness and impact and potential housing tracts can be modeled for their impact on police services, potential patrol route problems and proximity to other hazards. Models will test scenarios for critical incidents that can assist police agencies in identifying hazards, evaluating critical facilities, acquiring resources and determining response levels. GIS has incredible potential in assisting with a number of areas of disaster preparedness. GIS can be used in modeling scenarios to assist government in mitigating disaster hazards so that previously unseen problems can be addressed prior to a crisis. Hazardous material spills at known locations can be modelled to determine evacuation areas and routes, depending on the type of spill. Another potential use for GIS is in traffic accident analysis where terrain modeling can be combined with mapping capabilities and other databases to examine potentially dangerous locations, visibility issues and cause.

What will be the use of geographic information systems (GIS) by law enforcement by the year 2002? Law enforcement organizations are already organized in a geographical framework with street addresses, streets, reporting districts, beats, areas and divisions. What GIS does is digitize this information to establish the exact spatial relationship of data, locations and occurrences within an area, city, county or other geographic entity. The result is that digital map overlays representing different themes can be instantly created and, if necessary, printed to provide specific, visual information in a real-time mode. Additionally, the ability of GIS to overlay various thematic maps creates the ability to easily examine possible correlations between seemingly unrelated data such as a correlation between the establishment of a new recreation program and crime in a neighborhood. With all of the technological and software improvements combined with the increased future investment in GIS by public safety agencies, what opportunities does this create for law enforcement in the future? GIS provides the opportunity to effectively allocate resources, engage in strategic planning and dramatically change our method of service delivery. With the continuing decrease in government revenues and, in many areas, the increased interest in regionalized service, another vital area for GIS will be regional planning. In New Mexico, regional government councils are realizing that GIS can be a valuable tool for providing human resource service, including law enforcement, to areas.[22] The geographical organizing of data will create better informed personnel which, in turn, will result in better decision making, improved resource allocation and superior service delivery. The uses of GIS by law enforcement by 2002 are only limited by law enforcement's imagination and willingness to learn and employ the technology.

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APPENDIXES

Appendix A

TRENDS AND EVENTS

EVENT:

There are 2 types of events. The first type are "discreet, one-time occurrences" that frequently "look" like newspaper headlines. The second type are "trend-based" events which reflect significant moments where this event "turned" the direction of a trend. The test of clarity of an event statement is "could a person in the future look back and say that the event happened or didn't happen"? Examples of an event would include:

1. An 8.2 earthquake causes severe devastation in San Bernardino County.
2. California enacts law placing the enforcement of environmental laws on local law enforcement.
3. Severe economic conditions result in the regionalization of law enforcement in San Bernardino County in 1995.
4. Introduction of improved language for parallel processing expands parallel processing to laptop computers in 1997.
5. State of California reports that response times to felonies increases by 25% statewide in 1994.
6. United States Geological Survey reduces cost for information from mapping satellites by 60%.

TREND:

A trend is a series of events that begin to show a definite pattern. Objective trends are frequently quantifiable or countable and often begin with the words "number of....", "amount of....", or "level of ...". Subjective trends often begin with the terms "concern for...", "demand for..." or "fear of...". These statements should not reflect value statements ("increase" or "decrease", "improve" or "worsens", etc.). Examples of trend statements reflect those areas that would be useful to know for forecasting the future such as the following:

1. Level of Part I crimes in Orangedale.
2. Response times to emergency (Priority 1) calls.
3. Willingness of citizens to act as volunteers to assist law enforcement.
4. Level of expenditures on computer software/hardware for law enforcement.
5. Demand by public for police accountability throughout the United States.
6. Public confidence in the police.
7. State crime statistic reporting requirements.

ISSUE:

You should look at your trends and events in light of the issue you are examining as well as the sub-issues. The issue and sub-issues at hand in this study are:

What will be the use of geographic information systems (GIS) by law enforcement by the year 2002?

- *What will be the effect of advanced geographic information systems (GIS) on law enforcement resource allocation by 2002?*
- *What will be the effect of advanced geographic information systems (GIS) on law enforcement service delivery by 2002?*
- *What will be the effect of advanced geographic information systems (GIS) on law enforcement planning by 2002?*

When examining the trends and events you should consider a variety of subject areas at various levels. Some examples are listed below:

SUBJECT AREAS:

Social
Technological
Economic
Environmental
Political
Other

LEVELS:

Global
Pacific Rim
United States
California
Southern California
San Bernardino County
Orangedale

Appendix B

WHAT IS GIS?

Geographic (or Geobase) Information System is an overall term encompassing the entire field of computerized mapping. GIS is also generally considered to be a specific subset of the overall field, referring to a high-end computerized mapping system.

According to Understanding GIS (ESRI, Redlands, Calif.) a true GIS can be used to perform each of the following functions:

- *Answer what exists at a specific location.* The location can be described using place name, ZIP code, latitude and longitude or other location system.
- *Find locations satisfying specified conditions.* (for example, an undeveloped parcel of land zoned for light industrial, at least 10 acres in size, with railroad access).
- *Spot changes in an area over a certain period of time.* For example, changes in vegetation brought about by drought.
- *Find patterns.* For example, it could test the hypothesis that proximity to PCB-laden transformers is a factor in the incidence of cancer in children.
- *Model various scenarios.* For example, if 10 inches of rain fell in a certain watershed in 24 hours, where would flooding occur and at what hour?

Appendix C

LEWIS W. NELSON — POST COMMAND COLLEGE

EVENT EVALUATION FORM

EVENT		YEARS UNTIL PROBABILITY FIRST EXCEEDS ZERO	PROBABILITY		IMPACT ON THE ISSUE IF THE EVENT OCCURRED	
			5 YEARS FROM NOW (0-100)	10 YEARS FROM NOW (0-100)	POSITIVE (0-10)	NEGATIVE (0-10)
1	1ST VOTE					
	2ND VOTE					
2	1ST VOTE					
	2ND VOTE					
3	1ST VOTE					
	2ND VOTE					
4	1ST VOTE					
	2ND VOTE					
5	1ST VOTE					
	2ND VOTE					
6	1ST VOTE					
	2ND VOTE					
7	1ST VOTE					
	2ND VOTE					
8	1ST VOTE					
	2ND VOTE					
9	1ST VOTE					
	2ND VOTE					
10	1ST VOTE					
	2ND VOTE					

Appendix D

LEWIS W. NELSON — POST COMMAND COLLEGE

TREND EVALUATION FORM

TREND		LEVEL OF TREND			
		5 YEARS AGO	TODAY	5 YEARS FROM NOW	10 YEARS FROM NOW
1	1ST VOTE		100		
	2ND VOTE				
2	1ST VOTE		100		
	2ND VOTE				
3	1ST VOTE		100		
	2ND VOTE				
4	1ST VOTE		100		
	2ND VOTE				
5	1ST VOTE		100		
	2ND VOTE				
6	1ST VOTE		100		
	2ND VOTE				
7	1ST VOTE		100		
	2ND VOTE				
8	1ST VOTE		100		
	2ND VOTE				
9	1ST VOTE		100		
	2ND VOTE				
10	1ST VOTE		100		
	2ND VOTE				