Computer Aided Dispatch (CAD):

An overview of the 'business', processes, Technology, market and potential for Zetron

DRAFT – Pre-Editorial

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Executive Summary

Zetron recently established a relationship with a CAD vendor who will market Zetron products under their own brand. The question has arisen whether we should get into the CAD business, and whether it would be feasible, practical and appropriate to build our own CAD or acquire one. This report has a variety of subjects; each is offered to increase the body of knowledge in-house about CAD, the current state of CAD and potential futures.

The CAD market is active and robust. It is projected to generate more than $761 million dollars in revenue in the next few years (through 2002) for the over one hundred CAD vendors in the US, Canada and United Kingdom. There is potential for new players in the business to capture a share of the market.

CAD is a management software tool that automates and refines dispatching functions. It allows for quick and accurate incident entry, provides access to information such as databases, and fosters two-way communications between the dispatcher and mobile units. It enables a communications center to integrate all communications and information processing into one system.

A CAD system allows public safety dispatch center operations and communications to be augmented, assisted, or partially controlled by an automated system. It can include, among other capabilities, computer controlled emergency vehicle dispatching, vehicle and officer status updates, incident data collection and reporting, and management information and statistics.

The primary function of any public safety or emergency services agency is to respond to citizen calls for assistance. It is critical that agencies respond to calls for service in the shortest possible time, with the appropriate resources and with the most accurate information available in order to meet the public safety goals of protecting the peace, crime control, responding to citizen calls for service and to preserve the public well being.

The communications center of any public safety or emergency services agency serves as the focal point in the initiation and response of resources to the immediate citizen need for service. In order to accomplish this in the most efficient and expedient manner, CAD automates and combines many of the key functions of communications center personnel for Law Enforcement, Fire, Emergency Medical Service (EMS), and other agencies such as utilities or public health.

There are several key advantages to a CAD system. These include the speed with which dispatch recommendations can be made to the dispatchers, a more accurate assignment of appropriate units to specific-type incidents at reported locations, improved dispatcher access to critical information, hazards, etc., regarding specific locations, and enhanced recordkeeping and reporting capabilities.

For communication operators a CAD must be intuitive, almost a mind reader in it's ease of use in providing key data entry and functions that allow for quick response to what is happening at any given moment. CAD is truly a mission critical application and real time transactional oriented.

Over the last ten years there has been a movement by vendors to supply distributed, client server CAD systems, with a graphical user interface (GUI) and integrated mapping. Two of the most important market drivers in the Cad market are: the demand for integrated systems, both for public safety agencies

and for the whole criminal justice community; and the rapid pace of technological innovation. Even though procurement can take upto 12 months there is a significant and robust market.

There are about 23, 683 law enforcement communications centers in the United States. Statistics show that 96% of Police agencies, 90% of sheriffs, 57% of State Police, and 90% of County Police were using computer aided dispatch. The lower end of the agency size continuum makes up 94% of the total. This is Zetron's market.

The dedicated CAD vendors who have been in the business for the long haul dominate the market share. Over 100 CAD vendors were idenitifed, some 28 of this total consider Zetron a partner. No officially recognized relationship exists except for one, Interact Systems.

Vendors almost always have an advantage in the geographic area where their offices are located. It means closer support staff and better service. This translates into excellent customer references.

The CAD of the near future will be characterized by integration. The future successful CAD vendor will be able to provide a soup-to-nuts communications environment, practically turn key.

Technology developments just ahead of the curve will effect the CAD market in a positive manner and may provide opportunities for Zetron or other companies looking at future product development.

Developing a CAD system is an expensive proposition. Larger CAD vendors usually have the luxury of skilled and seasoned staff. Dedicated CAD vendors usually produce the best product. Public safety is a market where reference accounts are elemental. New CAD systems built using new or advanced technology typically haven't been tested under fire. That is a tremendous risk for any agency to bear. A risk like that can make headlines.

A vendor without the experience under their belt in developing new technology based software, a previous CAD development, and domain expertise with knowledge of CAD systems, communications process and procedure can have difficulty entering the market. How could the vendor expect to develop and create a CAD system that can be 'generalizeable' in the market place? The answer is they can't.

As a company we must recognize that to be a player in the CAD market we would need to step up and commit ourselves to it. The CAD market and public safety dislike companies who dabble. We have the luxury of having public safety reference accounts based on Zetron sales of peripheral equipment (tone remotes, telephony, etc.) that we could leverage for potential CAD sales. This is a clear advantage over other companies just entering the market.

We could buy a CAD system or acquire a company that has a quality, mature CAD and adapt it to our own goals. If Zetron would consider acquisition the success factors would be much greater. Not only would product be acquired, but implementation and support expertise would also, one of Zetron shortcomings relative to the CAD market.

It's difficult to visualize Zetron kicking off a CAD development project when considering the current table of organization. There stands a greater chance of sustained success, return on investment and long term growth if we acquire a CAD system or company. This strategy would allow Zetron to position itself as a player in that market in a much the shorter term. CAD as a business strategy for Zetron would

initially be an expensive undertaking requiring more technical (particularly software engineering), line of business expertise (communications) and implementation (integration expertise) staff; all skill-sets that Zetron could stand more growth in if getting into and committed to the CAD market. The investment we make now in this business strategy will allow us to get some of that $761 million up for grabs through the year 2002. It would also permit us to focus our business and resources to a growing market.

It could take as long as three to five years to build a CAD from scratch that is anywhere near market competitive. Meanwhile the technology curve is more like three years. By the time a solid CAD was built it could conceivably be obsolete. There is a potential of course, that any CAD acquired could be obsolete in 3 to 5 years but that is after being in the market for several years. Some of the money made through accelerated entrance into the market can be used to continue to keep our CAD competitive.

Zetron probably couldn't displace the incumbent CAD specific vendors in terms of market share in the short term but a profitable dent could be made. Zetron should capitalize on its reputation of quality, reliable products and sell many systems given the market prospects. Long term, Zetron has the potential to be a significant player.

Consider the belief that the 'state of the art' CAD is a relatively known quantity. Innovations are in the bolting on of peripheral equipment and integration of new and emerging technologies.

Does Zetron want to be in the CAD market? Ultimately it's an issue of dollars and the strategic vision of the stockholders as to whether the CAD market is appropriate and viable for the company. Our stated marketing position is that we want to provide complete communications systems, this should include CAD.

Introduction

Purpose

Zetron recently established a relationship with a CAD vendor who will market Zetron products under their own brand. The question has arisen whether we should get into the CAD business, and whether it would be feasible, practical and appropriate to build our own CAD or acquire one.

The CAD market is active and robust. It is projected to generate more than $761 million dollars in revenue in the next few years for the over one hundred CAD vendors in the US, Canada and United Kingdom. There is potential for new players in the business to capture a share of the market.

I offer the following report. This report has a variety of subjects; each is offered to increase the body of knowledge in-house about CAD, the current state of CAD and potential futures. Much more could be said about CAD and CAD systems than is presented in this report, particularly from a process data flow, technical interface, and development point of view.

The purpose of this report is not only to profile CAD and potential futures, but to generate some excitement about the possibility to moving into the communications world of CAD. The idea, if pursued will make Zetron a major player in CAD market in the long term. We would be one of the very few companies who could provide the breadth of product to outfit a communication center 'soup-to-nuts", in that it could provide almost the entire suite of communication center products. There are pitfalls to be sure, but if done right, any challenge can be overcome.

Perspective

This report was born of the personal and professional experiences of the author in the commercial industry of public safety systems development, implementation, support, marketing and sales. In the twelve years involved in public safety systems, I was integral in two CAD systems development projects and several records management systems. My experiences covered the entire gamut of CAD system software product activities covering the entire lifecycle from requirements identification, functional and detailed design (user interface and feature functionality), coding oversight, technical documentation, training, implementation, support, pre and post sales marketing support. I was the recipient of numerous awards at Unisys for technical and professional excellence and awarded the Information Systems organization 'Winner Circle' award as part of a sales team winning 4 million dollars in new business. In 1996, I was awarded the Consultants University Plaque; the highest consultation award within Unisys for new business development in the public safety domain for my work in computer aided dispatch systems. These were nice tokens after a lot of hard work.

Unfortunately, the author has also had to participate in the downside: The less positive aspects in the lifecycle of a CAD system. These experiences included demonstrations of incomplete software to users ("demos-from-hell"), premature implementations of software releases, project schedule delays, glitches, bugs, turf wars, scope creep, power struggles, staff turnover, incompetence, support and marketing organization collapse, project default and finally product retirement. One product is still alive in the hands of two separate CAD vendors having been sold upon decommission.

I have mixed emotions about my CAD experiences and hope one-day to be involved in the development of a future generation of CAD system.

In dealing with public safety, particularly law enforcement, there is a certain way to do things, a way to say things (i.e., in the language of the user), and a pursuit of quality in product that demands unique functionality to their jurisdiction, superior performance, unsurpassed reliability and zero defect tolerance. It goes to the heart and meaning of public service and due diligence. I would point out that vendors in action rarely perform to the same standard.

It is more than a concept to a public safety customer when you say you are representing their interests. There is trust involved, your integrity and your own sense of the idea of quality is at stake. Often the best interest of a customer isn't always in the best interest of your company. The bottom line is public safety is inherently a close knit, closed society; if your screw up your reputation is tarnished and will be for some time.

The experiences and perspectives of the author are based on wisdom won through hard knocks. All of the experiences fostered an ability to view many sides of a problem, particularly the ability to translate a user's functional requirement into a CAD's operational process and vice versa. Complex problems sometimes require non-traditional creative solutions. And sometimes complex problems require change in processes and even in an organization where there is resistance to change. This characterizes the author's personal style: patient, observant, creative, conceptual, diplomatic, problem solving and goal oriented. I would suggest that a company, in considering the CAD market for opportunities consider these traits as well. The voice used in this report is my own. I remain dispassionate but the subject is close to my heart. The opinions expressed in this report are my own.

On CAD Futures (In a far distant future)

The CAD of the future may be a seen in some future sci-fi thriller titled Tech Cop, or some such name. In a bunker like structure far from the activity on the street, or perhaps air or land mobile, perhaps one of many, public safety communication systems are linked and feeding central operation computers. The central operation computers are assimilating data, making predictions, analyzing context, developing models and making recommendations to the government in real time.

In a low light, cool chamber, a combination call taker/dispatcher - CAD Pilot, reclines in his ergonomic chair. The chair has numerous controls that work in concert with the fully integrated console pod. Suspended in a chassis above his head are four large flat screen monitors. At eye level is a large circular monitor displaying a tactical map of some future city area. Two more monitors are on either side of the map. The two monitors above, on the outside seem to cycle though video cams: traffic, doorways, cellblocks, vehicle cameras, personal cams and air cams. On the eye level tactical map in the center, the space age looking display, reminiscent of an old style air traffic control screen, seems to be moving. Various graphics, seemingly ant-like, denote movement of vehicles, people, and aircraft. In this day and time everything can be tracked real time. Imbedded micro-GPS devices allow people, equipment, vehicles; virtually anything.

A nod or soft word, seat or console action, automatically zooms to images, data, voice, video and the selection comes alive on monitors to the right and left of the tactical map. A device-like headset, but with an extension, fits over the right eye like a gun scope. As the operator's eye moves about the console he is able to stop, focus, zoom and drill into a camera scene or tactical map. Like a video game, disembodied voices from voice traffic float un-intrusively, with the computer handling most of the communications. Most voice, video and data is captured in the field passively without intervention of field officer or comm. officer. The operator talks to the computer and the computer talks back, interactively; the dialog is recorded into the multi-media record. The computer also talks to the field, relaying warnings and information. There is touch screen control and manual overrides throughout the system. Data collection is a by-product of the technology. The future points toward full inter-operability integrated controls. The innovation in this advanced system is what the system can do with the mass of sensory input.

The lower displays on the console on either side of the tactical map come to life in another scene. On the right display, thermal infrared imaging is tracking running individuals through city streets. These individuals are followed by satellite cams having made contact through the microchip of their ID or through some biologic identification. These low level satellites are part of a ring that circle the Earth. Once they have your ID they will keep you tagged until released by the law enforcement/communications; there is no escape or place to hide.

Expert systems have built the intelligence, wisdom and experiences of generations of cops, communications, and public safety professionals into an advanced computer system that is "situation aware". This artificial intelligence computer learns as it goes. More than another pair of eyes and ears, a

lesser task of this 'Computer Aided Dispatch System' of the future will be to handle all routine activity in a communications center and in communications with field staff. The Communicators Center operator will be a hi-tech multi-media pilot able to look and listen for the queues and alarms from the computer requiring second judgement, referral or monitoring. The operator can override the computer anytime or change the monitoring mode as necessary.

Behind the operator sits another person, a supervisor of sorts and co-pilot; but this person is scanning alerts and activity for intelligence purposes, most of which is provided by the computer. The computer flags people, vehicles, images, video, barcode, magnetic stripe swipes, and fingerprint scans and immediately cross-indexing. One of it's jobs is to draw inferences to locate 'identity thieves', multiple identity persons, aliens or wanted individuals, crimes occurred and in progress, known offenders, plots, weapons holders, even underage kids in the wrong places or with the wrong people. Officers on the street are autonomous public safety entities with full technology in their own vehicles.

The master computer is mission control and its job is more than vehicle tracking, it's the eyes and ears of the world. Is this the big brother of the future or an example of future tools that enable law enforcement to keep tabs on our cities and people, for crime control, in crime prevention, the goal-to protect and serve?

The point of this little slice of the future is to suggest that innovation is a continual process, the technology products of the future are rooted in the products and ideas of today. Innovation is also a creative process that shouldn't be boxed or shut down when examining or considering possibilities. Each new innovation is based on a history of actions that came before. Sure, this type of command control system is sci-fi, but look at all the products once depicted in the movies or in books which are actual products today.

Vision is key to innovation. It is said 'what we dream can be' and 'thoughts are things'.

What is CAD?

Computer Aided Dispatch (kad) *n*. Abbr. CAD: a management software tool that automates and refines dispatching functions. It allows for quick and accurate incident entry, provides access to information such as databases, and fosters two-way communications between the dispatcher and mobile units. It enables a communications center to integrate all communications and information processing into one system.

As originally conceived the CAD system was an automation of the paper workflow used to record information from call receipt to resource disposition. In the old days a phone call would come into the communications center. A card would be time stamped and basic detail collected from the caller, often just a description of the incident and location, in the most general sense. Details could be sketchy. There were few actual standards on collecting information. Pre-printed punch cards, the kinds used in the old style computer card readers, were used for recording the information. In a larger center a call taker might record basic information on the card and send the card down a conveyor belt to the appropriate dispatcher handling that part of the jurisdiction. Each call taker and each dispatcher were connected by a series of conveyor belts. The dispatcher would review the available units by examining a status board where cards were grouped into slots by those working a call, handling an incident or in some other activity. Location is always a key decision point. If assigned, a pink call card would be clipped to the unit card. The call card was used for recording status times and disposition information. Unit status changes were often recorded by a time clock, but rarely kept after incident closure. The incident card would show when the incident was received and when closed. Any detailed information received about the incident was usually the result of an officer report and that was forwarded to the records department.

As city size and activity increased it became much more demanding to keep up with communications activity. Communication centers had a difficult time justifying expenses, staffing and really had few operational statistics available. The Law Enforcement Assistance Administration (LEAA) arose out of the 1967 President's Commission on Law Enforcement and Administration of Justice. This program stressed the need to push toward modernization. The government stepped in, providing millions of dollars in grants. With the introduction of basic computing it was recognized that many routine tasks could be completed through automation. This would free some basic data collection tasks from the call taker and dispatcher. Early systems were replications of paper flow. They provided the means to collect data for analysis, and were used as rationale in developing rudimentary standards. This incremental step was necessary. Each step forward enabled the development of the next generation of CAD system.

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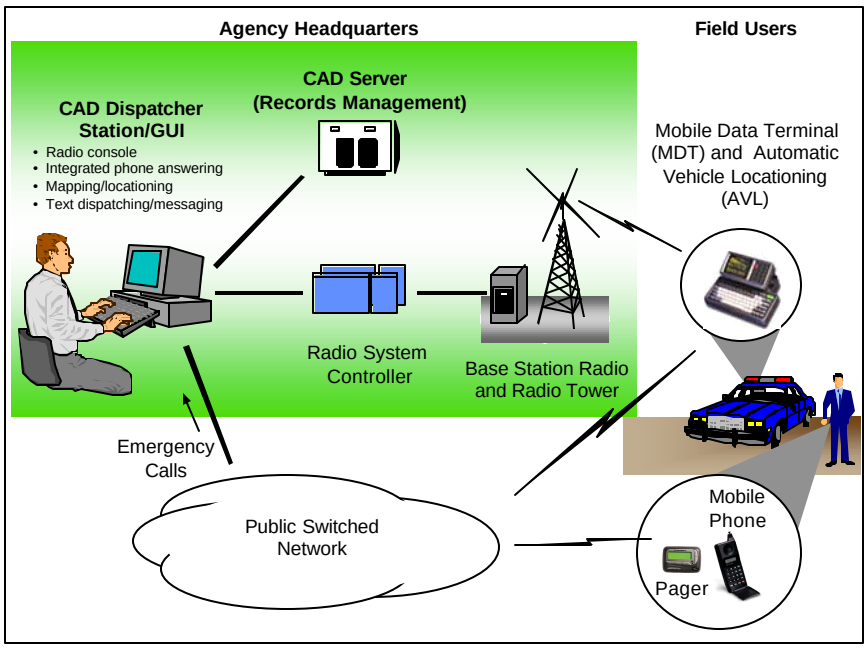


Typical CAD System Configuration and Components
(Source: PSWN, Commercial Service Assessment)

Traditionally, communication centers of the past have been bunkers: highly secure, often dim places. The job is stressful, there is no way around that, and usually has a high turnover.

Today, new Communications centers are built in an open design with natural lighting; added esthetic touches like quiet rooms, interior courtyards, waterfalls and plants are common. Changes in communications centers are part of the growing trend toward looking at environmental factors and the role they play in job satisfaction, quality of life and customer service under the public safety umbrella.

The primary function of any public safety or emergency services agency is to respond to citizen calls for assistance. It is critical that agencies respond to calls for service in the shortest possible time, with the appropriate resources and with the most accurate information available in order to meet the public safety goals of protecting the peace, crime control, responding to citizen calls for service and to preserve the public well being.

The communications center of any public safety or emergency services agency serves as the focal point in the initiation and response of resources to the immediate citizen need for service. In order to accomplish this in the most efficient and expedient manner, CAD automates and combines the key functions of communications center personnel for Law Enforcement, Fire, Emergency Medical Service (EMS), and other agencies such as utilities or public health.

CAD Basic Processes

Call Taker	Dispatcher	CAD Map	Status Monitor
Receives calls from E911, TDD, and non-emergency type calls. May work medical or call type protocols.	The Dispatcher reviews priority of call on the status monitor. Monitors and handles radio communications.	Identifies the jurisdiction graphically on a map. May have radio integration.	Shows unassigned incidents by priority, geographic area plan and agency or agency type assigned
Determines/verifies address and validates location. Tries to pinpoint location. May have map integration	Reviews detailed call information, premises history and determines agency and resource response. Dispatch.	Has layers denoting various types of data including geopolitical features	Shows available units and current status and location by geographic area.
Determines call for service type, priority and agency response. Can refer to outside organizations\agencies	Tracks and monitors assigned and unassigned resource activity including statuses	Shows streets and geographic and natural boundaries and attributes	Shows assigned resources by incident, location, status, etc.
Based on priority routes call immediately to dispatcher or records for additional information. This creates the incident	Appends incident data and manages the call to disposition. Interactive with status monitor and map.	Shows unassigned and assigned calls. Interactive with dispatcher screen and status monitor	Shows elapsed times, resource updates, warnings, exceeded timers, etc.
The call taker records: What happened Were weapons involved Are there injuries When did it occur Where did it happen Suspect description Vehicle description Direction of travel Reporting person and call back/contact information Narrative of observations	Handles resource and personnel movement and scheduling, Interfaces with other agencies, can conduct local\state\national inquiries.	Shows assigned and unassigned resources. With Automatic Vehicle Location (AVL) shows dynamic resource location.	Interactive with dispatcher screen and map.

In addition to CAD systems, emergency personnel must have access to a wide range of computer controlled devices or information systems that have been designed to improve communications with the public and their public safety resources, and to provide access to critical information residing on remote computer networks. Although these systems provide extremely valuable information and are crucial to effective communication center operations they have begun to cause automation overload for the operators. These systems, at a minimum, provide some type of digital display that requires manual interaction or come with a complete separate terminal and keyboard for interactive communications. The CAD system should provide an interface with all of these automated systems and, to the greatest extent possible, provide a single point of interaction with these systems.

The types of devices or other systems to which the CAD system can be interfaced can be subdivided into the following categories:

- Telecommunication Devices
    - E911
    - Telecommunications Device for the Deaf (TDD)
- Radio Communication System Devices
    - Vehicle Status Functions
    - Radio/Telephony System Management Functions
    - Mobile Data Terminals
    - Station Alerting
    - Instant Recall Voice Recorders
- Remote Computer Systems Access
    - Regional, State and National Crime Information systems
    - Local government systems
    - in-house Systems, including Records Management
- Monitoring Devices
    - Alarm Systems
    - Time Synchronization Systems
    - Remote video cameras
- Informational Tools
    - Emergency Medical Dispatch protocols
    - Standard Operating procedures
    - Tactical Maps
    - Weather information
    - Best Routing and Resource Status Management

The CAD Business

When thinking about what a CAD does and the business problems addressed, think of it like a system that provides an easy and efficient way of collecting data on routine communications activity. CAD provides standardization of data entry and coding of event/incident elements. Time stamps are provided for any event/incident or resource activity. At the core of CAD is a geographic based file or map which supplies information to verify and locate addresses and locations quickly and accurately while providing supplemental information such as floor plans, premise history, etc. It is a tool to provide timely and proper response to citizen calls for service and at the same time provide automation in communications and informational tools to maximum officer safety.

Primary and Secondary CAD Users

Officers in the field and most impacted by CAD
Call Takers and Dispatchers and most interaction with CAD
Records personnel and records management systems as the data depository of CAD data
Command Staff/Planning use CAD statistics, management information, resource deployment for planning and decision making
Data processing as CAD systems operators, data administration and system maintenance
Telecommunications/Network staff for telephony, network and infra-structure effecting CAD
Legal, Purchasing and Budgeting
Local Government for political and financial support

(Source: LEIM Guidelines)

There are several key advantages to a CAD system. These include the speed with which dispatch recommendations can be made to the dispatchers, a more accurate assignment of appropriate units to specific-type incidents at reported locations, improved dispatcher access to critical information, hazards, etc., regarding specific locations, and enhanced recordkeeping and reporting capabilities. With mobile computing (Mobile Data Terminals, e.g.) voice traffic on the radio is reduced, officers are able to update their own statuses. Incident data provided by the officer is stored in the incident record and provides a secure way of communicating sensitive information as opposed to broadcasting it over the air. In addition, MDT's let officers bypass a dispatcher to access the department's databases, as well as state and local databases. With automatic vehicle location (AVL), the dispatcher has a visual on the map of the officer's location at any given time. Understandably, a CAD map with AVL is an outstanding decision making tool in a communications center environment.

CAD System Goals and Objectives

Improve call taking service to the public
Provide greater accuracy, efficiency, and speed in responding to calls for service
Minimize data handling
Increase officer productivity and resource management
Enhance officer safety with detailed information on call locations
Provide accurate, up-to-date information for management control

(Source: LEIM Guidelines)

For communication operators a CAD must be intuitive, almost a mind reader in it's ease of use in providing key data entry and functions that allow for quick response to what is happening at any given moment. CAD is truly a mission critical application and real time transactional oriented. This is a key concept because you can never really know what's going to happen next. For the call taker, one moment they may be knitting, the next instant a hysterical person is reporting a multiple vehicle accident with injuries or fatalities. The dispatcher in a large jurisdiction on a busy night, handling perhaps 40 to 60 units, has to stay focused and must keep up with the activity in the CAD as well as with the radio. A CAD system better be able to handle the volume. After twenty years, volume is one of the most important critical core business problems that should be examined in any company looking at developing or providing solutions to public safety. Equally important are response time and system reliability/availability. If a CAD system loses data in the routing from call taker to dispatcher, the prospect of liability can sink a project fast. Consider this: will you be liable if the product you produce is used, or in its use is determined to have problems, which cause injury or death to officers or citizens?

There are lesser business issues to consider in the operational use of a CAD system that are opportunities for any company looking at providing solutions. Some of these items are based on the fact that even in the year 2000 there are still agencies working with manual procedures, on legacy systems, with poor standards, and low integration. These include:

- Critical calls for service are not responded to in a timely manner;
- Positive identification of persons (wanted or suspect) is not timely;
- Sufficient data is not collected and entered at the initial event in the process;
- Lack of data integrity (incomplete, incorrect or inconsistent); and
- Access to important criminal justice information within the e*nterprise* is not available in real time. Related to this are reports or inquiries that correlate or provide inferential data; citing the recent example of the delay in identifying common modus operandi (MO) in a series of assaults in Tacoma resulting in the death of a young man.

Current Drivers in the CAD Market

Over the last ten years there has been a movement by vendors to supply distributed, client server CAD systems, with a graphical user interface (GUI) and integrated mapping. Systems released prior were host, character based systems. The development of newer CAD systems has paralleled the introduction of new technologies. It's hard to imagine but even to this day there are agencies with old character based systems, and CAD vendors selling them.

During the last several years new market drivers have emerged, based mostly on changes in technology. There is also a trend based on the public's demand for greater communication with public safety and a push toward better accountability. Budgetary constraints have always been an issue in public safety.

Some of the current drivers in public safety result from the following or include:

- Demand for integrated systems, both for public safety agencies and for the whole criminal justice community. This includes cross-jurisdictional integration.
- Changes in police strategies, as police have moved toward community oriented policing to focus on neighborhood patrol and local responsibility and have introduced concepts of problem-oriented policing as opposed to simple response to notification of incidents.
- Dramatic increases in the demand for mobile computing systems for field entry, officer autonomy in record checking and productivity tools.
- Evolution in technology. Technology cost, especially on the hardware side has been steadily going down. However, software costs have been rising. Software systems often have localization issues requiring modification, while technical staff billing rates have risen. Even with standards, systems are becoming more complex and require a significant level of integration.
- Changes in organizational delivery; dispatch centers are being consolidated to serve police, fire, and EMS agencies, often at the county level.
- Increased emphasis on digital mapping and application or process integration at the local government market
- Interoperability between components in a communication center or proprietary vendor components
- Federal mandates, such as NCIC 2000, creating a national mugshot and on-line fingerprint file, with workstations that operate from the local police department or patrol car.
- APCO 25 and the dramatic increase in the use of digital wireless technology.
- The emergence of the Internet and web based information depositories.
- Other industry standards and technical initiatives.
- Emerging technologies. Voice pattern recognition and the integration and digitalization of voice and data are examples of where the industry is moving. Bandwidth is a major issue.

One of the biggest communications problems faced by law enforcement for years is the inability to communicate across jurisdictions. Law enforcement has been hampered for years because database files stored in one department are inaccessible from a department only a few miles away.

The following table shows the distribution of all law enforcement agencies in the US according to the number of sworn officers. This metric can be used as a general yardstick of where the majority of funding will be allocated for law enforcement agencies. More officers require more vehicles, more potential MDT's, a higher volume of calls and responses, larger communications infrastructure, more reports, and increased arrests.

Consider the modal categories at the low end. There is a considerable market for entry level CAD products.

Distribution of Law Enforcement (Police and Sheriff) Agencies

# Officers	Size	# Agencies	% Agencies	# Officers	% Officers
Over 1,000	XL	68	0.4%	252,210	30.0%
500-999	L	71	0.4%	75,483	9.0%
250-499	M	172	1.0%	85,145	10.1%
100-249	M-S	525	3.0%	117,001	13.9%
10-99	**S**	**6,507**	**37.5%**	**262,450**	**31.3%**
Under 10	**VS**	**10,015**	**57.7%**	**48,810**	**15.5%**
Total		17,358		841,099	

(Bureau of Justice Statistics, 1993 and 1997)

There are about 23, 683 law enforcement communications centers in the United States, roughly 20% of these are consolidated operations. The Bureau of Justice Statistics reported in 1997 that 96% of Police agencies, 90% of sheriffs, 57% of State Police, and 90% of County Police were using computer aided dispatch. (Bureau of Justice Statistics, 1997)

On CAD Procurement

There are long sales cycles (12 months to three years) in the criminal justice/public safety markets that are significantly impacted by the procurement laws and funding cycles in state and local government. The following considerations need to be considered in future development and sales cycles. The following steps are typical of a major procurement in the public safety market:

Interest in a new technology. This is an "education" phase in which the customer seeks out information at trade shows, by talking to other users, contacts with vendors, and attending vendor presentations. Sometimes an RFI could be issued during this first stage. How ever high the level of interest, the customer cannot make a purchase at this stage. This is a very time-consuming stage for vendors assisting with the customer's initial education. However, involvement at this stage gives the best opportunity to influence the RFP. This phase typically lasts three to six months.

Decision to seek funding. At this stage, the customer sees the benefit in the new technology and seeks to have this included in the next budget cycle. Often, the customer is also favoring a particular supplier of the technology. Cost justification is often critical here, especially if the technology is not as yet routinely accepted. If the agency is successful in getting funding approval, this state may last two to three months. However, if the funding is struck from the next budget (often at the last minute), the agency must usually wait a year before the funding can again be sought. Extended sales cycles most often result from an agency getting "stuck" in this stage.

RFP issued. Although agencies may say they can select a system and buy sole source, this is indeed a rare situation in the state and local market. In 95% of the cases, an RFP will be required. The procurements, even the rare sole source procurement, will always be fixed price. Cost plus contracts, common in the federal government, are just not used in the local government arena. Usually the RFP cannot be issued until the beginning of the fiscal year. Typically, at least three to six months are required to issue the RFP and elicit responses.

Finalists selected. This usually is accomplished within a month of the time the RFP's are submitted. Since most local and state agencies are not driven totally by low bid, the short list will not always include the lowest bidders, but will include the most cost-effective, valid solutions. There is price elasticity in these procurements, but only within the range of other comparable, suitable solutions. Price will become a more important factor in discriminating among the finalists.

Orals/demonstrations. Usually all finalists are asked to give on-sight demonstrations and presentations. These presentations are a critical step in the sales cycle. The vendor has an opportunity to build confidence in his offering by showing the functionality in a manner that clearly reflects an understanding of the customers' needs. Understanding the culture is critical to staging a winning presentation. There is also some price sensitivity among equally qualified vendors. Users can be won here and this goes a long way.

Award and contract negotiation. This step typically takes three months. There is no standard for the types of contracts required by different state and local agencies. Performance bonds, milestone payments, and payment holdbacks are often required to provide protection for the customer. Agencies that have had a previous experience with unsatisfactory performance with a technology vendor can be the most demanding.

CAD CHECKLIST

- Do I need a CAD system?
- Where do I need a CAD system? Locally? Regionally? Nationally?
- Will a CAD system work in my operational environment?
- Will it support mission-critical requirements?
- What software and hardware is included as part of the CAD workstation package?
- What is the storage capacity of the records management server?
- What is the storage capacity and processing power of the CAD workstation?
- What add-on modules or enhanced features are included?
- Which enhanced features/services is the CAD system compatible with?
- Are software upgrades available and included?
- What type of leased-lines are necessary to link the CAD system to commercial wireless services and/or third-party databases?
- What type of training is available and included?
- Which of our existing systems is the new CAD system compatible with?
- Which additional features or components can be added to this CAD system in the future?
- What hardware beyond the CAD workstation is included?
- What additional software and hardware would be required to integrate an existing LMR network into the CAD system?
- Does the CAD system's mobile data interface with any third-party system?

User Checklist of Questions to Better Understand the CAD Service

(Source: PSWN, Commercial Service Assessment)

One of the challenges in effectively selling to the public safety market place is to correctly identify the decision-makers in procurement. This has to be determined in each situation. The local political climate always provides an over-lay that influences the entire decision-making process. The planning department is usually one of the best sources for intelligence gathering. Some key tools available in the public domain, usually for the cost of photocopying, is the local budget which usually profiles a department nicely, the department's strategic plan, and even the department annual report. The annual report is the first document I try to get my hands on when 'scoping' out a prospect, but many departments cannot afford to produce these (pr/marketing oriented but factual documents) anymore.

The marketplace for a CAD system is composed of local law enforcement agencies and/or communication centers that dispatch emergency service personnel, including law enforcement, fire services, and emergency medical services (EMS). Primarily these centers are operated by city or county agencies. The trend has been toward consolidated centers dispatching all three services. However, it is common in very large agencies and in communication environments established more than 10 years ago, to find fire/EMS dispatched separately. In Tacoma, the Law Enforcement Support Agency (LESA) through city and county inter-agency agreement handles law enforcement dispatching as the primary Public Safety Answering Point (PSAP) for the city, seven other smaller cities, and Pierce County. Fire and EMS dispatching is done by the city fire department (Fire Communications). Fire and EMS calls are routed to Fire Communications upon call receipt.

Other providers of public safety services include state police agencies, universities, airports and railroads. One can even view maritime and long haul vehicle tracking, taxi/people movers and utility vehicle tracking, even air traffic control systems are a kind of CAD system. Any of these organizations could potentially be a part of the market for a CAD system.

The decision-makers tend to cover three areas (funding approval, functional suitability, and technological acceptability). For each of these areas, there may be many people who have input and can generally say "no" and one person or committee in each area that can give final approval.

In a joint procurement, it is more common to see the law enforcement requirements dominate. Often fire/EMS and law enforcement agencies do not get along well. The Police or Fire Chief or the Sheriff may not be very involved in the selection of the particular vendor, although his or her support is key to securing the initial funding approval. In a separate communications agency, the Emergency Operations Center (EOC) Director is more likely to have direct involvement in the process.

There is generally a tension between the data processing department and the end user. The role of data processing varies significantly and it is key to understanding any particular account. Solutions that are sponsored by data processing will often encounter strong resistance in the user community. Domain expertise in data processing can often offset this problem.

Consultants can further complicate understanding the decision process. Agencies typically use a consultant at some stage in the procurement cycle. It is important to know the consultant and to understand

who has hired him. One problem with consultants is continuity. After project kick off or sometimes in later project phases a very junior staff member is assigned to the project to 'cut-their-teeth', usually to detriment of the project. The senior consultant comes in to fight fires only as necessary.

The funding source has a significant impact on the decision making process. Many CAD and records management systems are funded through either annual operating budgets or through capital improvement budgets or bonds. A new system is often a part of some other capital improvement appropriation, such as a new building.

Within the past several years, E9-1-1 surcharges have been an important source of funding in many states. These surcharges vary per phone line and represent on-going revenue sources. Each state has different restrictions on how these funds can be used, but the funding restrictions are moving in the direction of allowing more flexibility to spend the funds on systems that will improve the over-all ability to deliver emergency services to the community. In some states, for example Pennsylvania, the legislation required a countywide consolidated dispatching environment before a county could levy the surcharge. This usually necessitated all new supporting systems. If the surcharge is over $1.00 per phone line, the funding may be adequate for the county to afford a much more comprehensive system than the population figures would predict.

Funds from narcotics seizures (RICO) can be an important source of funding, depending on state and local laws. The advantage to seizure funds is that they are often not subject to the same type of scrutiny as funds provided from general appropriations. Often, RFP's are not required for purchase made from drug moneys. However, it is not as common to see drug moneys used to buy a CAD system.

There has been a new influx of grant moneys during the past year as a result of the ('the current perpetual') Crime Bill and the associated COPS MORE grants introduced a few years ago. There is still money available today.

Consider the expected dollars to be spent on public safety technology and CAD:

State and Local Government Public Safety Spending	
Total Information Technology:	
1997:	$1.29 billion
2002:	$2.59 billion
Computer-Aided Dispatch Systems:	
1997:	**$395 million**
2002:	**$761 million**
Mobile Data Terminals:	
1997:	$95 million
2002:	$217 million
Integrated Justice Information Systems:	
1997:	$59 million
2002:	$147 million
Source: Gartner Group, (G2R Inc.)	

On the CAD Market

The CAD market has always been fragmented. No single CAD vendor holds a clear dominant position in this market. PRC and Tiburon claim the lion's share of the market. PRC holds about 30% market share and has for the last ten years. Tiburon has teamed with large system integrators like TRW to win a large customer like San Francisco. They have made a few acquisitions. G2 publishes a marketing report that breaks CAD market share down into a science. It would nice to get our hands on their latest data.

Several large federal integrators with large-scale, complex systems experience (such as SAIC and TRW) have been successful at refocusing their talent and experience in the CAD marketplace. Related to this and quite ominous is the fact that even Motorola recently bought a CAD vendor. Historically, successful integrators in the CAD market have always had their own core product or solution components. Notice I didn't mention development. Developing a CAD system is an expensive proposition. Systems integrators have many core business areas. None are dedicated CAD vendors though these large vendors are probably the better bet in pulling off large projects. They often have minions to marshal and can pay for talent and components. These large systems are usually custom-built large integration projects that are not easily transferred from agency to agency as designed.

TRW has several large projects in progress that makes it the leading industry systems integrator. They are re-designing and developing the Los Angeles Emergency Command, Control and Communications System (ECCCS). This project is unique because two centers will be tied together at opposite ends of the valley. Each shares data but can function independently in the event a major earthquake takes one center out. Other very large projects include Chicago O'Hare Airport, The United Kingdom, San Diego and San Jose.

There were 114 CAD vendors recently identified by the author through a series of internet searches, domain knowledge, Buyer's Guides, etc. Ten years ago 70 percent (SWAG) were not in the market. Rapid development tools, employee spins off, mergers and acquisitions have changed the landscape in the CAD market. The big players are still around (PRC, Intergraph, Tiburon, PSSI, etc.) and will probably be around 10 years from now. The 70% (SWAG) will not. The thing is, each of these seventy 'percenters' probably have managed to make a sale or two.

The smart money is on the larger CAD vendor willing and able to acquire the competition and most importantly their customer base. Theoretically they could "upgrade" the customer system to their own CAD, or better yet one of several CADs each based on the market tier or agency type. This strategy assumes the vendor has a robust implementation and support organization.

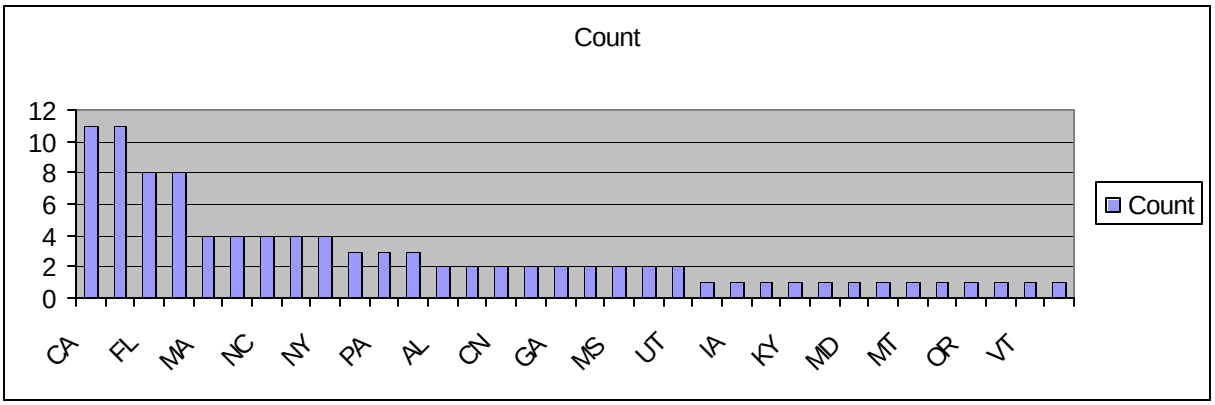
The fallacy is easy to spot with a little experience in the industry. That is, each jurisdiction seems to do things just a little differently, the local data is completely different (geographic files, units, officers, etc.) and almost always there is some type of localization or modification required. Throw into the mix the differences qualitatively from law enforcement, fire and emergency medical services. What's a true CAD vendor to do? It is my professional opinion that the reason every agency does it differently is a function of

lack of standards and lack of integration across the state or national public safety enterprise. This will change someday and true 'turn key' systems could be produced.

This is a good time to mention that many agencies have been known to develop their own CAD system. This was common in the old days beginning in the late 1970's. Today it's more expensive to build then buy. The SEARCH Group, as 'the clearinghouse of criminal justice information' used to provide departments with a basic CAD system, which in turn they could modify. This CAD system was actually the for-runner of many of the contemporary CAD systems sold today. Vendors who have been in the business for 20 or more years probably were involved in some way in these early systems developed by government grants. As a side note, early vendors involved in product modifications for a customer would often take the product and make it there own. PRC started their first generation CAD product with a system developed for the City of Tacoma.

Vendors almost always have an advantage in the geographic area where their offices are located. It means closer support staff and better service. This translates into excellent customer references.

CAD Vendors By State (*n*= 98)



Oregon and Montana have one CAD vendor; Washington and Idaho have none.

CAD and Emerging Technology

The CAD of the near future, at the top of the curve, will be characterized by integration. A vendor should be able to provide a soup-to-nuts communications environment, practically turn key. Communications will be digital. Analog systems will have a place. One day soon there may be user interface standards but none currently exist.

Computer software expert systems have existed for a several years. The FBI has developed them for offender and criminal profiling. One day this same technology will be applied to other knowledge banks.

Voice pattern recognition programs will virtually eliminate common call data entry. VisionTek recently release a version of their CAD that uses speech recognition to automate the receipt and acknowledge of common status changes by officers.

The CAD will be able to accept and process multi-media input into the incident record. This technology could be done today but no vendors has done it except to save photographs and drawings as part of premise history and information, often these are just bitmapped files attached through hypertext.

Data will be able to be shared via the WEB and will launch spirit of agency cooperation for common goals. XML enabled systems being developed currently will be in a position shortly to move toward the forefront of CAD system providers with the ability to interface to other open systems.

Today security firms allow users to summon help by the push of a button. Citizens will be able to log their own incidents for non-emergency calls (called 'silent calls') via the web and monitor/keep track of incidents in their own area. The California Highway Patrol is doing just that today. Voice over IP technology, and computer prompting will provide a clean data set.

The CAD will have a central map component. As bandwidth and technology moves forward officers will be able to view this data and even add their own multimedia input via their ever growing number of portable devices.

One day soon privatization will be more prevalent like that in the emergency medical services market.

Here is a list of some of the technology developments just ahead of the curve that will effect the CAD market in a positive manner and may provide opportunities for Zetron or other companies looking at future product development:

- Continuous speech dictation
- Ubiquitous language user interfaces will use continuous speech recognition and natural language understanding
- Translating telephone technology, combining bi-directional continuous speech recognition.
- Text to speech synthesis
- Portable speech to text machines for Deaf persons
- Print to speech reading machines
- Effective technological convergence of multi-media

- “Blue Tooth” - short distance wireless
- Wearable computing devices and Internet, the ‘internet whisper concept’
- Artificial intelligence, interactive computers, context based ‘intelligent assistants’
- Embedded microchips in appliances and devices
- Computers and telephones will have integrated video bi-directional displays
- Unused computing power harvesting (like the current SETI project used in home based data analysis)

(The Gartner Group)

The Gartner Group foresees the continued development of two new paradigms. The era of ‘contextual computing’ will be characterized by a proliferation of devices with functions and differences optimized for their physical and logical context (e.g., the Gates home). Secondly, the ‘era of spontaneous computing’, meaning the anytime and anywhere access to information and messaging through portable or wearable devices.

On CAD Development

Back on Earth present day; small newer CAD vendors will most always try to get their initial product offering built through customer funding. The result in more often than not a "one off" or a simple single agency system with minimal data, features and interface functionality. Often these vendors will manage to sell to smaller agencies or a group of agencies in surrounding areas coming together in a cooperative arrangement for budget savings. Vendors meeting this market level don't usually have the breadth to expand and are probably lucky to keep up with their customer support activity. Such vendors should have other marketable products and markets to succeed.

Larger CAD vendors usually have the luxury of skilled, seasoned staff. Still and again, any CAD development is an expensive proposition. Dedicated CAD vendors usually produce the best product. Here is the Catch 22. Public safety is a market where reference accounts are elemental. New CAD systems built using new or advanced technology haven't been tested under fire. That is a tremendous risk for any agency to bear. A risk like that can make headlines. Long time CAD vendors are in the best position to sell the idea of beta testing and have deep pockets of references.

In the early development of Windows based client server CAD systems there were many debates about the efficiency of the graphical user interface (GUI) versus the speed of a command line type data entry. Very few agencies were willing to risk this new technology. Reluctance of first or beta sites to "own' the system had merits and the reliability and architecture of Windows made matters much worse. Industry people knew early Windows programs were prone to crashing. Product demonstrations could be hell and the term GPF became a lexicon. The mouse was viewed with contempt. With all the dialogs popping up the neophyte user tended to get confused or get lost easily. That was very bad in the beginning of the Windows era but now the technology is the defacto standard. CAD systems built during this period were viewed as inferior and the doubts about unreliability took a long time to dissipate.

We used to joke about going to customer sites where the "users wore guns". In one early install the customer, a Communication Manager and Inspector in the police department, actually placed his gun on the table and stepped away; he was that furious. The issue here was the system integrator didn't have any domain expertise.

Unless a vendor has the experience under their belt from a previous CAD development, or domain expertise with knowledge of CAD systems, communications process and procedure on staff, how could any vendor expect to develop and create a CAD system that can be 'generalizeable' in the market place? The answer is they can't.

Look at the normal steps an E911 call goes through from call receipt to disposition in CAD. Most CAD systems are capable of the following normal workflow processing of an incident even though there are differences by agency type required:

- ANI\ALI\TDD feed
- Location is determined
- Call for Service is determined
- Basic data collection (who, what, where, when, perhaps why)
- Referral to outside resources
- Priority determined
- Location refined
- Duplicate call determination
- Agency type determined
- Agency determined
- Persons identified
- Routing to appropriate dispatcher
- Identification of appropriate resource assignment
- Dispatch of resources
- Follow-up data collection and disposition
- Incident closure

At this point let me say that I am not going to hit every area were domain expertise is required, but here is one example that requires significant expert knowledge. I would point out that the developer may have top coding skills, and let's say the design is detailed. Translating expert rules can definitely be lost in the translation to code.

For example, address validation/verification. When an entry is made in the location field on the Call Taker screen usually through an E911 interface providing ANI\ALI, the data is validated against the geographic file. A CAD should allow a call taker to enter the following permutations of location:

- Standard address
- Rural address (grid based addressing scheme)
- Intersection
- Commonplace name (like McDonalds)
- ALI information
- Alias street names (usually variations of a street name like I5 for Interstate 5)
- Telephone number (for reverse look-ups)
- Alarm permit ID
- Artificial intersection (area of a parking lot at a commonplace address)
- Special address/landmark (a statue in a park)

This list seems reasonable. CAD should provide the call taker with the ability to perform partial and sound-alike street searches when an ALI is not available. For example, a call taker can enter a partial street name or partial commonplace name and CAD should display an appropriate list for user selection or provide a direct hit if the entry has enough 'appropriate' data for system identification. This is where local knowledge cannot be taken for granted.

If a call taker misspells a street name, a sound-alike search is automatically performed to identify possible alternatives. All name search algorithms are created alike. The difference can be maddening when seemingly straightforward names misspelled return choices way off the mark. Soundex systems like CAD systems are quite different and I don't believe there is one single standard. The National Center of Crime Information (NCIC) developed name search algorithms in the late seventies that are still used today (in one

variation of another). During any point in the validation, the operator should have the ability to override the validation and create the incident at a non-verified address.

The next key thing occurs when we don't have a valid address. In this case the system can't very well tell us where to send a unit. In CAD terms, the agency areas of responsibility cannot be determined; therefore we don't know what agency should handle the incident. In a multi agency and multi jurisdiction all the call taker can do is route the call to the dispatcher specifying agency type since we know that by the call for service.

The dispatcher will have to manually assign an agency and won't have the normally provided unit recommendation.

If the entered location is successfully validated, the CAD system should provide the following associated to the incident:

- agency (s) to respond
- geographic area plan (for resource recommendation)
- cross streets
- commonplace or alias street name
- location identifier (some unique data element)
- Jurisdiction code
- Municipality code
- keymap reference
- grid
- zone
- X\Y coordinate (longitude and latitude)
- temporary geographic constraints, such as road closures
- premise history

The complexity of a geographic file in terms of address validation is exacerbated with a map based CAD. Without a valid location how do you map the incident?

To bring a CAD to the market requires resources based on a sound plan, a commitment to the market and the long-range view of product development, implementation and customer support.

The development group should have people who know the technologies you are going to be working in. A development project is no place to learn new skills unless that is factored into the schedule. Critical benchmarks must be set at all levels. The development manager should also be well reversed in the application technologies. Outside consultants for coding activities can be appropriate but their cost is usually very significant. Contractors should be held to the same standard as the rest of the development team. A structured project development structure is best with proper project management methodology in place before kick-off.

A side note about budgets is in order. It will be difficult to actual budget without a solid plan. Initially a budget should be scenario based on the project scope of work. Later once the requirements or functional specification are on hand a better more definitive budget can be published.

The structured software systems development methodology will be used here to discuss the necessary issues to work out in order bring a CAD product to market. Recognize that the level of detail is

light in this venue and that many of these issues here are normal for any good development project. The purpose here is to introduce some of the considerations, tasks, activities and challenges facing any company or organization considering CAD systems development.

A software development effort only begins when an actual decision has been made for a specific user or market. The first actual step is a need assessment for which hopefully this document offers insight.

As an overview here, it's been mentioned already that the development process is an expensive proposition. Lets assume here for the purpose of this write-up that we have sources to document a need assessment and requirements analysis. A design analyst usually with line of business expertise or domain knowledge can accomplish this task. Usually the requirements analysis is more conceptual based. Next, this person or team of people can document the functional requirements as well. Functional requirements are concerned with how the requirements will be actualized systemically. It has been said you cannot design without considering the technology you'll be implementing the solution on (this includes hardware, software, and database), and this is true to a certain large extent. In today's open systems software environment as long as you are being to Intel standard you can't go wrong though other hardware and operating systems are suitable. The next issue is design. Design should be a team effort between the domain expert and engineering. We all know the phrase 'garbage in garbage out' (GIGO), database work and report/inquiry design should be considered in the detailed design phases. Coding and testing by engineers and pure code writers with superior technical skills should be utilized. Coding standards should be in place and should not only include how programs are documented but should include version control and user interface standards. One item that must always be factored in is performance. In CAD development it's not only important to code to functionality, performance and efficiency but to eventual support as well. This might include the active building of the help system and methodologies of problem resolution.

This first active step in software development is a clear definition of the end users requirements. This step can be accomplished in a number of ways. Foremost however is the ability to see problem or business process from the user's point of view. The user may have an existing automated system, a set of manual procedures, a model set of requirements provided by an agency or organization. Often users will recycle an RFP from another agency. Regardless the job here is to document as clearly as possible the functional requirements of the system.

There is one methodology called 'user centered requirements analysis' that is an excellent tool in accomplishing this effort. Using one of the normal dataflow diagramming methods, it really doesn't matter which, document the actual flow of information from one process to the next. It's more than just documenting the business process as if the manual system were being automated. Consider improvements to the existing processes.

The deliverable and initial working document should be a detailed descriptive picture of the automated system from a dataflow and conceptual process. It should however include as much detail as possible to document the functional elements of the system as well as the flow.

This step in the development process is most important if the CAD system is to be a multi agency, multi jurisdiction. Law enforcement, fire and EMS requirements, though sharing common functions and data elements have data and functional requirements unique to their agency type. Fire functionality for example should be able to collect data as necessary to feed a fire reporting system to comply with the National Fire Incident Reporting Systems (NFIRS). Functionally, fire CAD is different in the handling as well as recommendation of resources. Fire resources don't patrol, there are based at a physical station but may be required to physically move to another place to cover another station resource out for a call, training, or disaster. Consider EMS, here pre-arrival instructions or emergency medical dispatch protocols for the functionally rich system are built into the call taker functionality. EMS also has an important functional requirement to capture data for eventual billing processing.

In the requirements analysis it's important to look into the operating system you will build to. If Windows NT for example, there is already graphical user interface standards to code to. Think again now about how users need to accomplish the tasks at hand. Efficiency, performance and ease of use are very important considerations. The debate about command line versus GUI is moot, a CAD system should have both elements and the user should be able to use either as activity, function, time or preference demands it.

The requirement analysis and functional requirements make up to blueprint to which the system is designed. Design is the most difficult step in the entire development process and is the most time consuming aspect.

For a CAD design and development point of view the following technical issues will require discussion, decision points, research and development:

Technology - What is the best environment? NT, Linux or Unix. Is there something better on the horizon? Open systems are hardware independent. Opens systems employ standard methods of communicating between components through an Application Program Interface (API) that provide the ability for other systems to communicate and integrate the functionality of each component. Ideally, a CAD, mapping, radio and telephone should all be combined in a single user interface (even if more than one monitor is used) to make the job of communications as uncomplicated as possible. This level of integration is technically feasible today but debatable if ever done in practice.

Architecture - A three tiered architecture using open database connectivity (ODBC) permits flexibility of the front end in the application layer to be localized easily and the backend flexible for database selection and element modification. The stable interface engine requires no or little re-engineering.

Systems Evolution – CAD systems have evolved from mainframe and mini systems to personal computer client server networks. Distributed systems can be deployed across an entire enterprise and permit growth.

Design – At Unisys I spent a month researching and testing several Lower CASE (computer assisted software engineering) tools and made a recommendation. Although the development would have been accelerated and the final product tighter and better documented, the learning curve from an

organization standpoint would have delayed the initial startup six months. Because CASE tools would have changed the structure and function of many departments and required an organization buy-in, it was felt that it was too much of a stretch. It is important to use the best tools/methodology in the development process and not that necessary in place. Functionality in a CAD system is complex enough to warrant looking at 'systems analysis' software. Many of these CASE tools also permit rapid prototyping.

Look and Feel – What will the user interface look like? Will it be based on recognized user interface standards, including those for ADA (including color blindness)? Will the look and feel of the architecture effect performance? The tool used in creating the application layer can effect the available real estate available to use on a display. Do you code for a larger display, which in turn can increase the price? A CAD system should have both a GUI interface and a command line. As mentioned earlier the user should be able to switch to the function as appropriate to the situation. Ease of use should be the primary concern. There are discussions on various vendor web sites demonstrating the benefits of single screen design as opposed to functions requiring tiling of windows (parent and child overlapping windows). In terms of field placement, in CAD this is critical. Call takers are interrogators and their methods are based on tried and true methods of extracting information from callers as quickly and as efficiently as possible. Use of color should be restricted and used for informational purposes. Blinking should be a rare occurrence. Sounds, like beeping should be minimized. Sounds are magnified in a communications center when there may be 20 operators. Scroll bars could be necessary but data should be sorted logically and users should have ad-hoc configuration flexibility of windows. These standards are just several of the de facto standards of good CAD user interface design where there are no standards.

Systems Issues – Design and code to performance, feature functionality, flexibility, reliability and redundancy. Consider the market level too, the technology and sophistication shouldn't price you out of your target market. Proprietary technology can be market limiting trap unless you hold most of the cards in the market.

Database – A database should be built for efficiency and performance. Reporting, both standard and ad-hoc third party reporting tools should be integrated and permit users to get the data through inquiry or report design methods. In public safety there are standards for Federal/State and local reporting, whether that is NFIRS, you will have to develop for these standards. A base set of reports and inquiries should be a natural by-product of any well-designed CAD system.

Interfaces – Code for the standard interfaces and consider future technology and built hooks. Consider how standard interfaces will work with your design from an ease of use, almost ergonomic way.

Coding - Coding complexity will be a function of the design and technology environment chosen. Code reviews should standard practices with the developers and the designers. Code should be well annotated for support future enhancement or modification.

Online Help – Help systems should be top notch and include not only user oriented but system level help including error messages. A good help system will be descriptive, informative and procedure/process oriented.

Localization Issues - Using a CAD system in a foreign country built for a US market will require modification, even if we talking about an English speaking country like the UK. Address format is the most significant issue. Geographic file validations will require logic changes and screen will require reformatting. In regards to foreign countries, screens will require major format change because word character counts and meanings can mean multiple words. You can blow out your available screen real estate.

Tables – Much of the CAD data displayed to the user based on activity and data can be table or parameter based. Table and parameter based design permits changing qualitative data without code change. This can include call for service codes; unit and officer tables, geographic area plans, status codes, standard operating procedures, water sources/hydrants and the geographic based file.

Systems development is not done in a vacuum and it is not done without a sound plan based on industry knowledge, technology, a strategic vision and commitment to the market that is fundamentally user driven. The following guidelines are offered:

- Understand and control the development process
- Define, document and implement a project plan
- Establish organizational roles and responsibilities
- Establish formal lines of communication among the administrators, manager, engineers and end users
- Identify and secure technology and tools
- Identify and allocate technical resources
- Develop realistic and accurate costs, schedules and control them throughout the development process
- Design, validate and deliver a quality system that is responsive to the end user's needs.
- Be responsive to the market

(Search Group)

Zetron and Development

Through years of product development evolution Zetron has developed detailed organizational and process protocols to ensure quality products are developed and released. This is appropriate and necessary. There is a lot of talent in the engineering organization. It is the author's opinion that there are also some challenges. Some of the following observations are unfortunately based on too little time and exposure at Zetron. However, some of the items are based on direct observation. This is a basic assessment and management should validate the following observations.

It seems at times as if there are competing goals between development and testing/quality assurance. There appears to be tendency to 'pass the buck' in problem resolution. This is probably due to not enough resources, the right resources are committed, or there isn't a sense of urgency to problem resolution. These observations point toward fuzzy accountability.

There seems to be layers of bureaucracy in certain approval processes that require way too many signatures, way too many times. It appears that key individuals must have content review each and every time edits/changes are done. Documentation is one example. This would appear to be an issue of strict departmentalization.

At times it has been said by Zetron employees there is a culture of "not invented here'. The concept speaks to a number of possible issues. Is it better to build versus buy in the goal of receiving a return on investment? If a product is developed in house is the product better, a 'known quantity'? Zetron does not have a significant history of software product development. Can an acquired software product meet requirements and be acceptable to a company known for it's device development and manufacturing?

Development coordination among teams must increase. Development should be based on a common set of standards. The user interfaces between E911 and Radio Dispatch is not consistent. It appears to have been developed without 'integration' in mind. Although in a communications center different operators will use each product, from a product presentation point of view this is less than perfect.

Zetron is an engineering company and highly device oriented. The world is moving (has moved) toward software systems. Although in public safety it's best to have device backup, software based systems are the future and we risk appearing archaic in the marketplace. We should be porting our hardware/devices to software systems particularly IP based systems and other digital technologies.

There is a lack of clarity between engineering and marketing when it comes to considering strategic initiatives. Engineering R&D waits for Product Management to call the shots. Who is better suited to calling technology trends? Product Management and Marketing should know the industry and marketplace. R&D should have its finger on the pulse of the technology curve. The R&D group should also be change agents and not wait for Product Management or Marketing to set strategic direction. There should be more communication and creative dialog between groups across the 'matrix' organization to consider new ideas for current or legacy products.

Zetron has many knowledgeable staff on different aspects of public safety communications. Often though this is a narrow focus often product based at its core. There needs to be more organization and cross-organizational training and exposure to the public safety marketplace. Zetron should invest in building a technology center that has other vendor products relevant to public safety, even competitor products to help us understand the market, products, approach and to compare our products feature functionality while looking toward future development.

The key to CAD, CAD development and public safety is understanding the basic core processes. In a communications center product ideas should be examined in context with what the call taker and dispatchers do in relation to officer activity in the field, officer safety, agency response and public expectations.

Zetron and CAD - Potential

Zetron professes on it's website that it 'equips communications centers with some of the most flexible and capable communications control systems available". Zetron does develop and market a number of CAD compatible products including Fire Station Alerting, Telecommunications Device for the Deaf (TDD), Two-tone Paging, and Instant Recall Recorder. With the release of the Integrator 9-1-1 and Integrator Radio Dispatch we are better prepared to offer CAD vendors and their customers more alternatives in meeting their needs and also fulfilling our stated goal. However, we would be more true to our stated mission to offer a CAD solution as one component of a "total communications system". In order to consider your solution to be a complete 'command and control system', CAD must be included. Radio and telephony are only two of the three of the legs of a true command and control system that must include CAD.

We don't have a lot of CAD expertise in house, and while our knowledge of the CAD market is growing, technically it would be a significant stretch to try to develop one ourselves without an enhanced skill set in our engineering department. Increased expertise would be required in software development, testing, implementation and support. The engineering organization would need to be staffed with engineers or programmer analysts with relevant coding skills. Engineers would either need to be trained, receive additional training or we would need to hire the expertise. Our service and support organization would be effected because we would be tasked with implementing and supporting these systems. It would also be appropriate to hire additional staff with line of business experience in public safety communications, CAD vendor experience, or public safety consultants as necessary to fill roles required or act as a resource for development and support

As a company we must recognize that to be a player in the CAD market we would need to step up and commit ourselves to it. The CAD market and public safety dislike companies who dabble. We have the luxury of having public safety reference accounts based on Zetron sales of peripheral equipment (tones remotes, telephony, etc.) that we could leverage for potential CAD sales. This is a clear advantage over other companies just entering the market.

Zetron has a solid reputation of quality within public safety. However, our sales channel utilizing 3rd party resellers may be inappropriate for CAD sales and implementation. Since our reputation is on the line we would want to be very 'hands on'. A CAD implementation requires systems integration expertise, including project management. We would need to develop our systems integration capabilities and build the solid backbone of a CAD implementation and support organization. If we were to get into the CAD market and were committed to it, we would need to step up and either train staff in the technologies or skills relevant or hire people to fill the need.

Our direct sales force is small and their mission is focused. The sales model would require modification or perhaps a new model for a direct sales force would need to be developed. Accounts are

won at the early stages of procurement. The challenge will be to identify prospects early and develop a consultative relationship. Our reseller relationships could provide invaluable intelligence.

Alternatively, we could buy a CAD system or acquire a company that has a quality, mature CAD and adapt it to our own goals. If Zetron would consider acquisition the success factors would be much greater. Not only would product be acquired, but implementation and support expertise would also, one of Zetron shortcomings relative to the CAD market.

Of the 114 CAD vendors mentioned earlier in this report, three expressed a partnership with Zetron on their web site although no formal relationship currently exists. These vendors have built interfaces to Zetron products or recommend Zetron products to their customers. The other vendors in the above list also indicated to the author that they consider themselves a Zetron partner. We do have a formal agreement in place with Interact Systems but there is nothing to indicate this on their website. It is suggested here that one of the vendors professing to be a Zetron partner would be a good choice to consider for acquisition. It is probable that they already have developed some of the required interfaces to Zetron products. In product or company selection our sense of quality, technology strategy and core business values should not be compromised.

Zetron -CAD Partners

This is a list of vendors who consider themselves Zetron partners.

*** Indicated on Website**

911 Mapping Systems Inc	Litton/PRC Public Sector, Inc.
Avel-Tech, Inc	**Logistic Systems, Inc. ***
CriSys Limited	MaSys Corporation
Data911	New World Systems
Dispatch Automation	Printrak International
EmergiTech, Inc.	Public Safety Systems, Inc. (PSSI)
ET Software *	**Queues Enforth Development, Inc. (QED) ***
Geac Public Safety	Spillman Technologies, Inc.
Global Dispatch Technology Corp.	Tel Control, Inc.
Hitech Systems, Inc.	TRACNET Corporation
HTE, Inc	TriTech Software Systems
Information Technologies, Inc.	Valor Systems, Inc.
Interact	Viking Technology, Inc.
Intergraph Public Safety	Vision Software, Inc.

Zetron has historically been a manufacturer of components and equipment that allow devices to communicate. The latest development of products with the Integrator 911 and Integrator RD products, together with the move toward formalizing technical relationships moves Zetron out of the peripheral business and 'backroom' supplier to the potential of being able to offer all elements of a public safety system. There is much potential given the specialty products that Zetron can offer the market.

Our market strategy historically has been conservative. The Integrator Suite shows a lot of promise and it is expected to generate significant sales for Zetron. Without a CAD though, Zetron will not be able to legitimately say they provide customers a complete command and control system.

The destiny of Zetron should be characterized as a company that can provide a totally integrated communications system, "soup to nuts". We position ourselves as a company to be this ideal. Our major competitor, Positron is much further ahead of the game and they too have a CAD system. Unless we begin planning and moving toward the future our potential market share won't be realized.

The logical business target model for Zetron should be the smaller agencies in the United States representing the 57% of the total number of agencies. This is the level that Zetron products have traditionally been marketed to. Unlike the larger CAD customers, smaller agencies are more willing to purchase off the shelf products as long as they meet core functionality. This is where real money can be made.

If Zetron for some reason decided to remain conservative in its business approach to the CAD market, at a minimum Zetron should integrate its CAD compatible products with any vendor's CAD system (at least to those vendors who consider us partners). Zetron should establish and formalize relationships with every CAD vendor it can to offer its products and even under their own company brand potentially. This is the less risky strategy, keeps Zetron CAD neutral but limits significant growth. This strategy will provide the CAD vendor with a greater product suite that they can market as such. In effect, the CAD vendor becomes a higher tier reseller for Zetron.

When thinking big picture, think about how small the world is getting everyday. Look at the trends. The future success of Zetron will be based on it's ability to 'connect, integrate, interface' disparate technologies. Zetron should begin thinking about building appliances to interface analog systems to digital.

Motorola is an 800-pound gorilla that has gotten it's way every step of the technology curve, like Microsoft. If it's inevitable, we should capitalize on it. There will be a great void in the market in the ability to provide interface appliances from older systems to digital systems. When the IP world really gets moving, companies and organizations are not just going to be able to jump on the technology wave. There will be a great demand for interim solutions (appliances) to give existing systems additional shelf life and/or to provide inter-operability or interfaces between components.

Conclusion

It's difficult to visualize Zetron kicking off a CAD development project when considering the current table of organization. There stands a greater chance of sustained success, return on investment and long term growth if we acquire a CAD system or company. This strategy would allow Zetron to position itself as a player in that market in a much the shorter term. CAD as a business strategy for Zetron would initially be an expensive undertaking requiring more technical (particularly software engineering), line of business expertise (communications) and implementation (integration expertise) staff; all skill-sets that Zetron could stand more growth in if getting into and committed to the CAD market. The investment we make now in this business strategy will allow us to get some of that $761 million up for grabs through the year 2002. It would also permit us to focus our business and resources to a growing market.

It could take as long as three to five years to build a CAD from scratch that is anywhere near market competitive. Meanwhile the technology curve is more like three years. By the time a solid CAD was built it could conceivably be obsolete. There is a potential of course, that any CAD acquired could be obsolete in 3 to 5 years but that is after being in the market for several years. Some of the money made through accelerated entrance into the market can be used to continue to keep our CAD competitive.

Zetron probably couldn't displace the incumbent CAD specific vendors in terms of market share in the short term but a profitable dent could be made. Zetron should capitalize on its reputation of quality, reliable products and sell many systems given the market prospects. Long term Zetron has the potential to be a significant player.

Consider the belief that the 'state of the art' CAD is a relatively known quantity. Innovations are in the bolting on of peripheral equipment and integration of new and emerging technologies.

Does Zetron want to be in the CAD market? Ultimately it's an issue of dollars and the strategic vision of the stockholders as to whether the CAD market is appropriate and viable for the company. Our marketing position is that we want to provide complete communications systems, this should include CAD. As to whether it's better to build or buy, you have to spend money sometimes to make money.

Recommendations

1. Organize and schedule an internal public safety market strategic planning summit.
2. Make a decision about the CAD market. Does Zetron want to be a player? If so, decide on the approach: develop or acquisition, make a plan, staff to the plan and move forward.
3. Develop a marketing plan for formalizing relationships for mutual benefits with as many of the 27 other CAD vendors as soon as possible. This would create another direct channel for sales and another way to 'get the word out' about Zetron. At a minimum there should be a banner exchange for linking purposes, but a program similar to the Reseller CO-OP program may be appropriate.
4. This will be dependent on the answer to item number 1. If the answer were yes, we want to be a player, this would put us into direct competition. But we will be in the game. If no, this strategy will enable us to remain CAD neutral, which has benefits from a marketing point of view. The upside and downside of the market expectations through 2002 with the $761 Million at stake is, as a CAD neutral vendor, we could sell a lot with the vendors scoring the hits. The downside is we wouldn't make as much money.
5. If we choose to develop a CAD a significant amount of research will be required. Staffing will become an issue. Standards and efficient development methodologies should be instituted.
6. If we choose to acquire a CAD make the selection based on careful consideration based on many of the concepts presented in this paper.
7. Research and develop products anticipating the trends, the 'connect, integrate, interface' idea.
8. Begin research and development to support IP connectivity in our relevant product lines.
9. Reach consensus and lay out a multi-year strategic marketing and development plan for public safety.

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