Command, Control and Communications: Assessing the New Technologies

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1.0 Introduction

Today's Fire Services must be able to train for, organize, and execute complex operations. To do this effectively requires a solid Command and Control (C&C) environment.

The practice of Fire Command has been "people-based" and pragmatic. History is important and traditions are strong. Radios in apparatus freed Chiefs from having to travel in order to communicate. Dramatic change came when portable radios entered service. Before then, the traditional "command position" for the Chief at a fire was inside the building, alongside the companies he was directing. Communications between the Chief and company officers were face-to-face.

Modern departments and the procedures and tactics used by Chief Officers today are different from those of the past. They contain expertise of unprecedented quality, sophisticated technologies and a supporting infrastructure that allows rapid and flexible actions. Command and Control must reflect these characteristics.

2.0 Background

There are three dimensions to Fire Command and Control:

- Strategic
- Operational
- Tactical

Each dimension has distinct technologies available, which ideally should be complementary to, and integrated with each other.

Strategic decisions can be supported by mature and well-understood technologies. Records Management Systems (RMS) usually supply the type of data required for analysis. Assistance from Universities or other research institutions is practical because the decision reached and its implementation are rarely time-critical. By their nature, progress on strategic issues is often measured in years. Manpower deployment, station location and apparatus mix are typical problems addressed.

From the operational perspective, Computer-Aided Dispatch (CAD) systems are often referred to as Command and Control systems. There is credibility to this description since these systems usually provide functionality for Staffing/Rostering, Incident Handling, Unit Recommendation and Status Keeping. These can arguably be described as cornerstones of C&C.

At the tactical level, the availability of immediate, accurate location and unit information to the Incident Commander through wireless data communications from the fire-ground presents information not previously available in the areas of Accountability and Incident Management.

Bringing Wireless Mobile Workstations equipped with Global Positioning System-based (GPS) Automatic Vehicle Location (AVL) to the Fire Service provides tremendous benefits at the Operational and Tactical level, and some at the Strategic level. For maximum impact, a robust Voice and Data Communications environment must exist, along with a fully integrated, feature-rich CAD system.

The 1998 amalgamation of the City of Toronto, resulting in a single Fire Service - the fifth largest in North America - created a unique opportunity to cross this technological divide. Rather than incremental evolution, it allowed for a revolution in Fire Command and Control communications.

3.0 Project Definition - the WHO, WHAT, WHEN, WHERE, and WHY

There are number of situations by which a public safety agency embarks on any type of project or significant procurement. These include:

- A genuine need
- A perceived need
- An opportunity for shared or outside funding; and
- Everyone else is doing it – we can't be left behind…

3.11 WHY

An honest appraisal of the motivation for identifying a project of this type will help answer the **WHY**.

In the case of Toronto Fire Services (TFS), the context of a major amalgamation provided a convergence of all of the factors above. Primarily, the need was driven by the inability to realistically expand any existing system and infrastructure to accommodate the new dynamic for both Command and Control (Computer-Aided Dispatch) and Voice Communication systems. Secondly, the extraordinary circumstances of such an amalgamation also presented some unique funding opportunities.

Recognition of the tremendous challenge, coupled with the political pressure to quickly demonstrate progress was sufficient to ensure adequate, if not generous funding of significant "transition" projects. A "one-time" pool of funds was made available to the City by the provincial government to assist with "transition" projects. Approximately $44 million (CAD) was allocated to specifically address Fire Command, Control and Communications. A comprehensive set of requirements, although quickly defined, was drafted and included all reasonable technologies available such as a new Voice radio system (to be shared with Toronto Police and EMS), a new Fire Station Alerting radio system, a Computer-Aided Dispatch system incorporating GPS/AVL and Mobile Data, as well as a fully-featured Records Management System. Funding approval was quickly obtained, allowing the project team(s) to proceed with all stated objectives.

Other parallel initiatives such a new Communications Centre and fully-functional Back-up facility were also included and funded in this major restructuring of Fire Services within Toronto.

3.12 WHAT

WHAT the scope of the project is will most likely be determined by the factors of "time and money". In the case of TFS, specifically as relates to mobile wireless data communications – time was the most pressing, with money being less of a concern, at least in the initial stages. A review of the agreement between the project prime vendor (Intergraph Public Safety – IPS) and the City reveals a completely different vision for the project than what is now being implemented.

A change in Project Managers at a difficult point in the project forced a complete review and re-evaluation of the implementation strategy. Where the CAD and mobile data projects had initially been parallel tasks, the risk with proceeding in this manner was deemed to be too high. Consequently, it was decided to sequence the projects consecutively and to de-couple their execution.

One critical issue prompted a fundamental alteration to the project scope. The original proposal and agreement provided for the mobile data communications to use Cellular Digital Packet Data (CDPD) on a public network. For business decisions made by the carriers, CDPD was never implemented in the Greater Toronto Area – with the carriers opting to forego deployment until introducing CDMA based networks. As a result, TFS was forced to investigate alternatives and elected to completely abandon the original approach, preferring instead to adopt a private network solution.

Consequently, the project was completely redefined in terms of scope and deliverables. TFS would now have to design and build its own private network and maintain it, thereby assuming the responsibility for coverage, throughput and reliability. On the other hand, we would be able to enhance our "in-vehicle" presence to reflect a modern environment. Whereas the original agreement provided for thirty-seven (37) ruggedized laptops and one-hundred and forty (140) limited-function LCD four (4) line display status data terminals, the project would now implement a single architecture for all one-hundred and fifty (150) front-line response apparatus, consisting of a combined radio/modem with integrated GPS receiver connecting to full-function ruggedized laptops.

This would allow us to pursue our vision of providing responding crews with the following benefits:

- Full dispatch, response and location details
- Status-keeping functionality
- On-board mapping and navigation
- Unit-to-unit and unit-to-control digital messaging; and
- In-vehicle access to general information (replacing various books and manuals) in electronic form

thereby greatly exceeding original project expectations.

3.13 WHO

WHO will perform the project is perhaps one of the easiest questions to answer, primarily because it translates directly to the subject of risk. The organization's tolerance for risk, combined with existing internal technical expertise and availability of funding will usually determine whether the project will be handled internally, jointly and in close co-operation with public or private partners, or in the traditional "turn-key" method.

When evaluating the internal capability of the organization versus the cost of external resources, stakeholders should never underestimate the effort required to participate in a complex project – decision makers must remember that the road to failure is paved with good intentions and that hope is not a method.

The use of external resources is also not a guarantee to success. Only a well-written and defined agreement, complemented by a comprehensive Statement of Work and list of deliverables, delivered within the framework of an effective project management and delivery methodology will significantly reduce most of the risk associated with complex mobile data projects.

3.14 WHERE

Although the question of **WHERE** sounds superfluous, since it has an obvious answer, it should not be dismissed lightly. The "Where" in mobile data is a direct relation to the desired coverage, which is a function of terrain and geography, density, land-use and to some extent spectrum availability.

It is imperative that conservative coverage prediction models be developed when designing private radio networks. Even when considering public networks, it is important to obtain assurances from the carrier that coverage will be suitable, what mechanism exists for filling in any coverage gaps, and that a high degree of network reliability can be expected. These factors are at least equally as important as the cost of system access.

3.15 WHEN

WHEN to implement mobile data is a two-part inquiry. Before the decision can be made as to when within the project schedule we should "do data", the answer must be known as to when is the right time for the organization to implement mobile data services. Consequently, the WHEN and the WHY must be answered in conjunction with each other. Some questions that should be answered rigorously include:

- Do we actually have data that we can transmit in real-time to responding crews ?
- Is the data being transmitted static and better suited to on-board retrieval ?
- Is our existing infrastructure capable of accepting mobile data communications ?
- Are there other, suitable technologies available – cellular fax ? alpha/numeric paging ?
- Is there existing wireless service available – or has the “build” decision been made for us ?
- Is there a potential partnership with our public-safety partners ?
- If we transmit AVL data to a central point – how will we use it ?
- Would this project divert funds from more critically needed initiatives – PPE ? Training ?
- Is the radio system inadequate for our current volume ?

4.0 Project Execution - the HOW

The execution of a wireless mobile workstation project can be divided into four broad components:

a) The RF infrastructure;
b) The “in-vehicle” environment;
c) The systems integration; and
d) The User software.

Each of these components poses different challenges and require adherence to accepted engineering practices to ensure maximum user acceptance, satisfaction and system reliability.

4.1 The RF Infrastructure

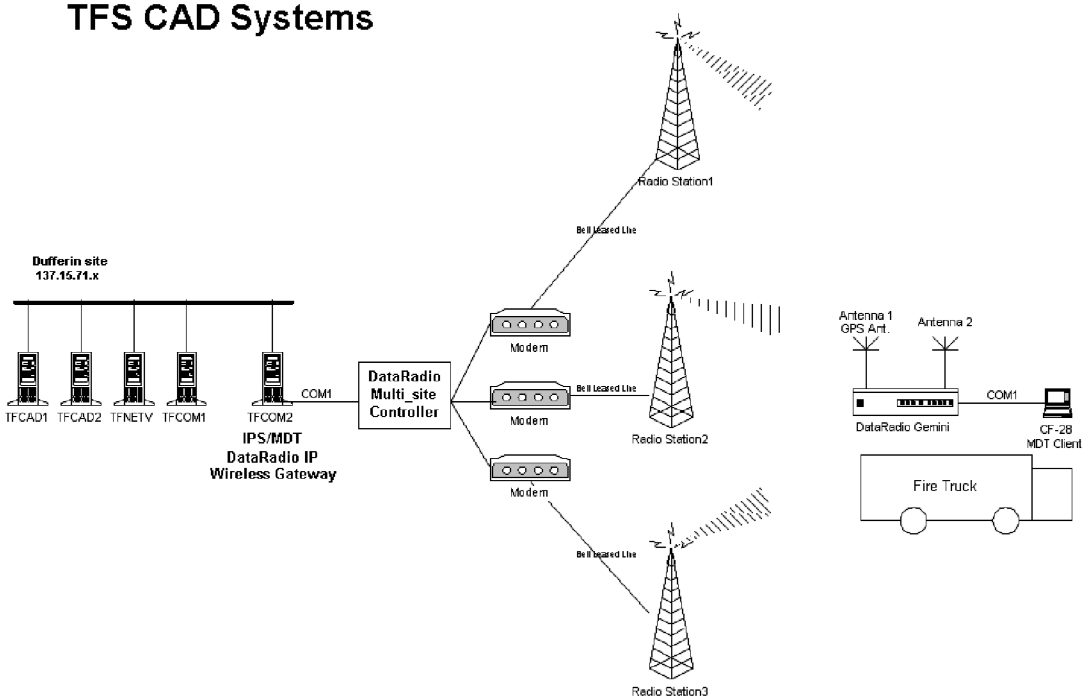
4.1.1 Private vs Public, Dedicated vs Shared with Voice

The decision to implement a private versus a public wireless mobile environment is as much an economic as a technical decision. Whichever approach is taken will dictate the network and coverage tasks that need to be performed.

In the TFS scenario, the original option to proceed with CDPD was eliminated due to the failure by carriers to implement service. In the time between the original contract specifying CDPD and the re-evaluation undertaken at the end of 2001, early 2002 – it had become apparent that the initial popularity of public networks was under broad review. Costs to agencies were ballooning and concerns over system access and survivability were surfacing, following such events as 9/11 and the Seattle earthquake. Several agencies also experienced the unpleasant situation of being advised that CDPD service was being discontinued as of a certain date, forcing another sizeable investment in modems and system access equipment. Our other consideration was the timetable of CDMA/1XRTT implementation in the area, along with other general concerns such as security and encryption. All of this contributed to our decision to abandon the public network approach.

Once committed to a private network, we faced the choice of adding wireless services to our data-ready Motorola SmartZone voice system. This was explored with our Police partners but dismissed as a viable approach, largely due to potential degradation of the system’s voice capacity. It was at this time that the decision was made to proceed with a stand-alone data system. Working in conjunction with the vendor (DataRadio) and our system supplier (Intergraph), we designed a two (2) channel, three (3) site system. Using independent computer coverage modeling software and previously conducted transmitter test data at 800MHz, the three preferred sites were identified. All sites were from our existing inventory of 16 sites. This was facilitated by the fact that we held two (2) licenced 800MHz (806-821) not used in our voice system.

Mobile Data Terminal
TFS CAD Systems



4.1.2 Proof of Concept and Pilot Projects

It has been my experience that predictions do not always turn out as planned. It was with this in mind that the project was divided into three broad phases – a Proof of Concept Phase, a Pilot Phase and a Roll-out Phase. The Proof of Concept was considered important as this project marked the introduction of a completely new technology to the Fire Service. There had been a few limited attempts at mobile data prior to amalgamation, but nothing of this scale or complexity. With the collaboration of the vendor, the site offering the most coverage to the City was installed, along with middleware to support IP-based access to existing systems. One vehicle and one "test-bench" installation were completed, and access to the live CAD system was arranged through the use of existing browser-based software.

A number of important lessons were learned from this phase. From a technical perspective, the most significant discovery was the interference caused between the data radio/modem and the voice radio during testing. We were also concerned about known and documented iDEN interference at 800MHz since the data mobile by default has lower IM rejection characteristics than our voice radios as well as the fact that we had less RF signal available to overcome or combat any interference we might encounter.

We performed our own tests and found that we could not guarantee adequate separation between voice and data radios in all vehicle platforms resulting in a situation where the voice radio would desense the data radio and vice versa. Although the voice radio had adequate margin to tolerate the desense, (up to 6db) the data system radio did not. Such a design would definitely run counter to best practices from an engineering perspective.

Due to the inherent additional difficulties, risk and cost associated with adding in-band filtering equipment to both the fixed and mobile radios, the project team made the difficult decision to suspend the implementation and request frequencies in the 400MHz UHF band. Since we were aware of the spectrum availability in our market and had vendor support, we applied for spectrum at range 1 (403-420) UHF.

This delayed the project by several months and forced the team to repeat the process of coverage prediction and modeling. Ironically, both were frequencies that had been previously relinquished by the City of Toronto, making co-ordination easier for Industry Canada, the spectrum regulatory body.

4.1.3 GPS/AVL in the Fire Station and Downtown – Signal Loss, Multi-path Fading

An additional benefit of the Proof of Concept Phase was confirmation of our suspicions on GPS coverage in the downtown "glass and concrete" canyons. We would also be facing loss of coverage for apparatus "In Station". It was determined that there is nothing that can practically be done about loss and multi-path fading of the GPS signal. Fortunately, the downtown density is such that there is a fire station approximately every 8-12 blocks, the street grid is simple and well known, and the call volume minimizes the instances where AVL-based unit recommendation is truly an advantage.

Nothing except preliminary research has been done about bringing GPS signal into the station. Anecdotal evidence from discussions with other large AVL-equipped Fire agencies (Phoenix, Chicago) would tend to indicate that it is not as big a problem as would first appear. Most newer GPS receivers (such as is included in our equipment) capture a snapshot of the satellite constellation when they lose coverage, in order to minimize re-acquisition time. This has proved sufficient in other jurisdictions and will be closely monitored and addressed if necessary at the conclusion of the Pilot Project.

4.2 The "In-Vehicle" Environment

4.2.1 Ruggedized laptops vs. other technology

The choice of what user equipment to purchase can be complicated. There has been wide debate over the merits of ruggedized versus standard office laptops, modular mobile computers and tablet devices. Each of these types of devices has advantages and disadvantages. Based on previous experience with other projects, TFS rejected the office laptop without further serious consideration, although it was the lowest price option. It was believed that the fire apparatus cab environment is simply too hostile to support a device designed to sit on a desk and travel in a case while powered down.

The use of a tablet or laptop is dependent upon the intended use of the device. Both of these have the advantage of being portable and easily removable from the vehicle. TFS does not currently anticipate a service delivery scenario where this would be necessary, other than for swapping defective units. The fact that we do not deliver EMS responses (unlike the common US model) eliminates the obvious attraction for a tablet to capture patient information. Tablets also have the challenge of a pen-based interface, or require an external keyboard, which removes another installation-related advantage.

Modular systems have enjoyed recent popularity and were considered by TFS. One of the limitations is linked to a more complicated installation scenario. There are several cables involved in connecting the peripherals to the remote CPU and the maximum length of the video cable limits the distance between the two. This eliminates some of the flexibility of the modular device in the Fire Service when compared to a typical law enforcement application. These also tend to be one of the most expensive options.

When TFS opted for the Panasonic CF-28, it did so with the realization that this was also a compromise. Small function keys, marginally acceptable screen brightness and other inconveniences were all accepted consciously. On the other hand, when compared to non-consumer devices like the Cycomm "PCMobile" unit among others, it has the advantage of frequent upgrades and technology advances of a specialized consumer product, and tends to be priced slightly lower than non-consumer products.

For TFS activities not related to Command and Control such as Inspections, it is the intent of the project team to adopt a hand-held device suitable for the purpose. A tablet in a docking station is most likely to be used due to the possibility to transmit the inspection data over the private data network when docked.

4.2.2 Mounting, installation

The problem of mounting computers in fire apparatus is one of the most difficult issues to solve. The primary reason is that there is no single solution, in fact, each vehicle has to be considered individually. Even those who's experience includes several law enforcement/police car installation and mounting scenarios can be challenged by the problem. Unlike law enforcement where the problem is usually confined to 1 or 2 vehicle models over 1 to 3 years, fire apparatus are individually built and the problem has to be solved for each and every vehicle. This situation makes the use of "packaged" component mounts difficult to successfully implement.

The approach used by TFS was to involve 2 mount manufacturers and 2 installation firms in a competitive evaluation process to determine the highest quality product and installation. The two mount manufacturers selected were both Canadian firms to avoid the premium of an unfavourable US currency exchange rate. The installation firms were both local and had extensive public safety experience. This was deemed to be important to ensure prompt service and quick turn-around times. The responsibility for negotiating the business arrangements – limited to the Pilot project – was left with the data radio system vendor, who was also responsible for the preparation of an installation guide. TFS reserved the right to contribute to the specifications and to evaluate the test installations. The difference in quality of workmanship in both the mounting hardware and installation was clearly evident. Consequently, the 20 vehicle Pilot project was awarded to a local installation firm and the mounts were procured from Precision Mounting Technologies of Calgary.

4.2.3 Power

In order to have the mobile workstation powered on at all times, ready to receive dispatch messages while in station, it was decided to use shore power. This decision was taken after consultation with other Fire agencies. The actual installation in the truck(s) consisted of upgrading the gauge of wire to 6 AWG, fusing both the positive and negative runs to a terminal post, adding an in-line noise filter to suppress alternator and battery noise, used to power all (and only) comms equipment, with a low-voltage disconnect on the feed to the laptop and data radio. All of this is powered in station by using a truck-mounted battery charger (w/external gauge preferred) connected to an AC power source.

One of the side effects of amalgamation was a lack of standardization in vehicle configurations and station shore power availability. Of the 149 front-line apparatus in daily service, some are equipped with a power inlet connector (Kaussmal Auto Eject or similar) and a trickle charger for the braking systems, while some are not. Consequently, some stations have retractable power cord reels on the diesel recovery system hose track and others do not. Since all vehicles are now being ordered and purchased with an Auto Eject connector and a battery charger, any apparatus that does not have this equipment will have a battery charger installed and a power cord connector to be fastened to the driver's seat. The prohibitive cost of retrofitting apparatus with Auto Eject connectors is driving this measure. The outcome of the Pilot project will validate or dismiss this approach.

4.3 System Integration

4.3.1 Proof of Concept and Pilot Projects

One of the advantages of both Proof of Concept and Pilot projects is that you are provided with the opportunity to learn as you go, making incremental changes and adapting as problems present themselves and are solved. You also have a living laboratory of users who become troubleshooters and salespersons for the new system. The value of these resources cannot be underestimated. As important as these phases are to the development of the infrastructure, they are equally as important to the function of system integration.

These phases allow time to solve network and system access, firewall and security issues, identify band-width limitations, throughput, end-to-end software compatibility, modify CAD system software as required, and to determine the best possible configuration(s) to ensure minimum maintenance and maximum functionality. Hardware issues with peripherals can be identified and addressed. This will be most apparent and critical should you be acting as your own System Integrator, or when using third-party products to provide the mobile functionality to the users.

4.3.2 Operating System and Lock-down

Choice of an Operating System is best left to the software provider. On the recommendation of Intergraph, we opted to go with Windows 2000. This fit with our technology platforms and we have experience with the environment.

The most important part of the MWS configuration is the OS "lock-down". This lock-down is absolutely essential to literally protect the users from themselves. Desktop maintenance is an onerous enough task when centralized remote access can allow the system administrator or Help Desk to seize a PC and effect whatever reconfiguration or remedial action is necessary, but it is virtually impossible to do so in a wireless, mobile environment. With a widely dispersed user base, it is best to make the environment as robust and "tamper-proof" as possible.

Steps to be taken include locking down the desktop so that a user cannot change any of the optional things under 2000 like background, screensaver, etc. as well as taking away the ability to use things like command.com and fdisk, and even blocking access to the FDD and HDD. Ideally, the user can get him/herself out of trouble simply by rebooting.

4.3.3 Updating Software and Maps

Another important consideration when implementing wireless mobile workstations is the future. No computer environment remains static forever. In order to realize the maximum benefit from the investment made, frequent changes will be made to the deployed devices, either to perform software maintenance and upgrades, or to add useful functionality.

This is critically important if maps are going to be resident in the mobile workstaion to support AVL based navigation. To remain releavnt, the maps must be updated at least as often as the CAD system maps used to support it. Map update mechanisms should ideally be structured so that only the changes need to be loaded, not the entire map base file.

Ideally, enough band-width will be available to allow for map and other file updates to be done "over-the-air". There is now file synchronization software available to take advantage of nights or other times when there is little network traffic to do the file updates and monitor the progress of the process until all vehicles have been updated. If feasible, it may also be possible to implement broad-band capabilities through the use of 802.11b devices. These are particularly suitable to the Fire Service because of our deployment patterns and are becoming increasingly affordable. This approach however, adds another level of complexity and makes the system integration effort that much more difficult. It also requires that each Fire Station have a network presence to be effective.

In the absence of these mechanisms, a disk ghosting device containing the entire workstation image can be effectively used to update software, but it does require manual intervention. This may be a minor issue for smaller agencies but can be a logistical burden on large, widely distributed departments.

4.4 User Software and the Human Factor

4.4.1 Software

The selection of software to be used inside the vehicle is probably the single most important factor to ensuring user acceptance of the system. This statement might be misleading because it is not only the look and "ease-of-use" which will influence user acceptance, but overall system reliability. It is in this area that the potential for risk exists when using independent third-party software. The link to the CAD system must be as easy to use and as reliable as you can make it. Integrating mobile software to a foreign CAD system, although frequently achievable and often accomplished, is not always as simple or as obvious as it may appear.

The training investment made by the project, along with the incorporation of as many features and suggestions as possible from the Pilot project participants, will provide the highest likelihood of success in this regard. Use consensus to configure the software when determining items like font size, size and location of icons and function keys, screen lay-outs and expect feed-back which you must be prepared to implement.

4.4.2 The Human Element

Perhaps one of the most important lessons to be learned from implementation is that there is a level of consciousness that is required before Incident Commanders realize the usefulness of having real-time access to incident and unit information. It is not always obvious to them that it is available and how they can use it. It is important that District/Battalion Chiefs and above are aware of the technology and that a special effort is made to expose them to it's benefits. This task can be made easier with the help of enthusiastic Company Officers and Chief's Aides.

Another lesson is that the classic profiles of individuals with regards to implementing technology is found in the Fire Service – these can be categorized[i] as 1) the Innovators and Early Adopters, 2) the Early Majority, 3) the Late Majority and 4) the Laggards. Fortunately, it appears that there exists sufficient numbers of the first categories to prevent the project being derailed by user indifference or lack of acceptance by the latter.

4.4.3 Training

NEVER UNDERESTIMATE TRAINING.

5.0 Conclusion

The decision to implement a mobile wireless workstation is an important one. For a number of reasons, the Fire Services have not adopted this technology as quickly as law enforcement. The two most obvious explanations for this are that the law enforcement environment is dependent on inquiries to external systems to perform criminal and vehicle checks as a core function. The use of wireless devices directly from the field is perfectly suited to this application. Secondly, the highly mobile nature of vehicle deployment and comparatively high call volume also encourage this technology.

Once committed to implementation, every effort must be made apply sound engineering and project management practices to ensure success. I hope that this paper has helped elucidate some of the risks generally associated with mobile workstation projects, provided useful tips, and explained the strategies and solutions employed by Toronto Fire Services in our own project.

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[i] From Everett Rogers and Geoffrey Moore as cited by Leyla Namiranian and Renee Hopkins in *"IS THERE SUCH A THING AS 'EARLY ADOPTERS FATIGUE'?"* (http://www.decisionanalyst.com/Downloads/EarlyAdopters.pdf) as of March 25, 2003

Author Biography

Division Chief M.C. (Mike) Dubé is a member of the senior management team for the Toronto Fire Services (TFS), reporting to the Deputy Chief of Communications and Staff Services. TFS is the fifth largest municipal fire service in North America. Primary role is advisor on IT and radio communications matters affecting the TFS, as well as "hands-on" Project Manager for the Computer-Aided Dispatch, Fire

Records Management and Mobile Data (including GPS/Automatic Vehicle Location) project. Directly responsible for the administration of the joint Toronto Police/Fire Motorola SmartZone Trunked radio system as well as a 900 MHz Fire Station Alerting system and wireless mobile workstation digital data communication system for front-line firefighting apparatus.

A total of 3,136 personnel are served in 95 work locations (including 80 fire stations), for both alerting, tactical voice and data communications in both a WAN and wireless environment. More than 450 individual workstations and a Command and Control (Computer-aided dispatch) system which includes a fully redundant back-up communications centre are also deployed and supported in this mission-critical real time environment.

Prior professional experience includes being the Director of Operations in Canada for Litton/PRC (now Northrop Grumman Information Technology), during which he served as a Project Manager on numerous CAD and MDT/MWS projects and as a product specialist for developing PSI's mobile and wireless data products and strategy.

Between 1979 and 1991, Division Chief Dubé also served in Law Enforcement, leaving as the Sergeant in charge of the Planning and Research Branch of the York Regional Police, where he was responsible for the review of all technology affecting law enforcement, and acted as the Project Manager for the Design Phase (Phase 1) of the Voice Radio project. He was introduced to the field of public safety technology in 1984 while assigned to the CAD/MDT project and subsequently as the CAD Instructor for the Communications Branch of the Calgary Police Service.

He has accumulated more than eighteen years of direct experience in system design and project implementation for public safety computer systems, both as a user and client project team member and in increasingly responsible vendor assignments and as a consultant in support of various public and private sector organizations. He has been directly involved in various capacities ranging from system design through to training, testing and overall implementation of more than 20 wireless mobile data/workstation projects, including Toronto, Philadelphia, Montréal, Chicago and Calgary.

He holds a Bachelor of Arts (BA) in Political Science with concentration in Public Administration from the University of Toronto, a Certificate in Advanced Police Sciences from Mount Royal College in Calgary, and a Diploma (AA) in Law and Security Administration from Humber College of Applied Arts and Technology in Toronto. He is a certified Project Management Professional (PMP) – the Project Management Institute, and is eligible for professional designation as both a Certified Law Enforcement Planner (CLEP) and a Certified Municipal Manager Level 3 (CMM III) and holds a Canadian Federal Government Top Secret (Level III) Security Clearance. He continues to serve as a Communications and Electronic Engineering (CELE) Officer in the Canadian Armed Forces Primary Reserve.

He is a current or former member of the Project Management Institute, City of Toronto Works and Emergency Services IT Steering Committee, City of Toronto Corporate Project Management Development Team, Associated Public-safety Communication Officers (APCO) (International), Telecommunications Committee of the Canadian Association of Chiefs of Police, Technology Committee of the Ontario Association of Chiefs of Police, the Police representative to the 9-1-1 Steering Committee of York Region, National Association of Police Planners (North America) and the Ontario Police Forces Planning Association.