INFORMATION REPORT

TO: Chair and Members Audit, Finance & Administration Committee	WARD(S) AFFECTED: CITY WIDE
COMMITTEE DATE: March 24, 2011	
SUBJECT/REPORT NO: Automated Vehicle Location (AVL) FTE Program Enhancement (FCS11034) (City Wide)	
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SIGNATURE:	

Audit, Finance and Administration Direction:

At the March 4th meeting of the Audit, Finance & Administration Committee a request was issued to the General Manager of Finance & Corporate Services regarding Item (b) of report FCS11023(c) - 2011 Tax Supported Operating Budget – Corporate Services (City Wide). Further explanation was requested to support the request for a 0.5 FTE enhancement with respect to support and sustainability associated with the City's AVL (Automated Vehicle Location) system.

Information:

The City of Hamilton utilizes an Automated Vehicle Location (AVL) system to track, monitor and manage City and/or Contracted mobile assets. The use of AVL across the City includes Emergency Medical Services (EMS – Land Ambulances), Municipal Law Enforcement (MLE), Building Services, Water/Waste Water Management and Solid Waste Collection. Currently, there are 159 vehicles connected to the system. The potential exists to implement AVL on all of the approximate 1100 City vehicles.

What is AVL

AVL is an enterprise-scale in-house system utilized by the City of Hamilton to:

- Capture, monitor and store vehicle location data, movements, status and behaviours or telemetrics (e.g., vehicle speed, lights and sirens on/off, brake

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on/off, etc.) for improved efficiencies, better resource management, compliance to legislation, worker safety and litigation;

- Track vehicle location and speed – capture and storage of x, y, and z spatial co-ordinates and velocity in the City's central database servers to ensure optimum service, route optimization and adherence to legislation;

- Send the location of Land Ambulances (every 20 seconds) to the Ontario Ministry of Health who are responsible for real time dispatching the City's EMS vehicles;

- Map display of vehicle location and telemetrics on Control Room monitors and Supervisor desktop computers to visually determine availability and status of mobile resources, for assigning most appropriate resource based on location, ensure resources remain in their assigned district, etc.;

- Enable EMS Supervisors to make immediate decisions on optimum deployment of ambulances to ensure maximum coverage and help assure compliance with legislated response times;

- Driver safety and network communications to City Vehicles – provide wireless network connectivity to vehicles; provides communication and positional information to mitigate Health and Safety issues of working alone;

- Dispatch service vehicles – send closest Public Works vehicle in response to situations thus improving customer service and operational efficiencies;

- Real-time and post-activity reports – re-create the vehicle travel path and telemetrics for specific times and locations (i.e., where was a vehicle; what was the vehicle doing) in order to better manage resources, optimize routes, defend City in litigation, etc.;

- Monitor vehicle compliance with provincial traffic laws. Because the AVL is integrated with the City's Enterprise GIS street network (direction and speed limit) database, staff is able to monitor driving trends for compliancy;

- Reduce liability – ability to recreate the vehicle travel history provides the City a defense against spurious and vexatious claims.

What AVL is Not

AVL is *not* the recreational GPS you have in your car which is used to show vehicle occupants their location in relation to their surrounding environment.

The AVL system does not provide a dashboard unit. It is not used to navigate from within the vehicle. The device is installed within the vehicle and not visible to the occupants.

AVL History

The City has utilized an AVL system since 2004 when EMS, as a response to meet legislated vehicle response times, contracted a vendor-hosted solution to track their vehicles. In 2007, it was determined that the hosted solution did not meet the needs of the City due to high costs, unreliable performance, limitations in access to sensitive data and management reports, and the inability to extend the system to meet the needs of other departments. As such, a pilot project was undertaken to investigate and pilot an 'in-house' solution based upon Intergraph's TrackForce product; a software package already licensed at the City of Hamilton in Public Works.

A pilot project focusing on the requirements of Public Works was undertaken and completed in December 2007. Based upon the success of the pilot project an SMT endorsed report was presented to, and approved by, the Emergency & Community Services Committee in March 2008 to implement a TrackForce-based AVL system as a City-owned in-house solution. As such, a second phase of the pilot, focusing on the requirements of EMS and other City departments was initiated in January 2008. This second pilot phase was successfully completed in 2009.

Upon project completion, EMS, due to legislated requirements for mandatory response times, had the AVL solution installed on the majority of its vehicles (53). EMS began using the solution as an operational system for Provincial ambulance dispatch and for vehicle tracking and management. With both EMS and Public Works utilizing the system, the Municipal Law Enforcement (MLE) division of Planning and Economic Development adopted the same AVL solution to support and manage its By-Law Officers.

AVL Today

In April 2010, Information Services established a corporate AVL Steering Committee, composed of senior management from each participating Department/Division and IS, to oversee the governance, growth, sustainability and maintenance of the system.
The following Table depicts the user Departments/Divisions and the number of vehicles registered on the system. **Note:** the Public Works vehicle numbers are low as increased participation was delayed to allow other departmental inclusion. Also, the addition of the Building Services and Parking Control vehicles in 2011 represents a 30% growth rate which we believe will be indicative until full adoption.

Department / Division	# of Vehicles (Current)	New Vehicles (Scheduled)
Public Works		
• Water Wastewater	10	
• Solid Waste	13	
• CSCO	6	
• Forestry	4	
PED		
• MLE	24	
• Building Services		35
• Parking Control		15
EMS	52	
Total	109	50

AVL Sustainability and Request for FTE

The AVL system is a complex enterprise-scale solution comprised of multiple components to support legislative and corporate requirements. The solution consists of in-vehicle hardware, wired and wireless network hardware and software, multiple central databases, multiple computer servers, application software and GIS mapping data and software. The system must be available 24/7 to meet the requirements of provincial ambulance dispatching, EMS deployment and the daily support of Public Works and Planning mobile resources. Currently, there is only Network and Hardware support (servers), with very limited application and database support available outside normal business hours. This after-hour availability requirement is satisfied by the current IS On-Call model for hardware and network support, however, application and database support is on a best effort basis only. The visual map displays and reports required by City staff and operations are, to date, provided through best effort support only through the use of multiple non-dedicated IS internal staff (i.e., no dedicated AVL subject matter expert). This is done to the detriment of other corporately prioritized projects.

The **AVL Steering Committee**, recognizing the demands placed upon Information Services to operationally support and sustain the system, implemented a *Sustainability model* to assure system viability. The Steering Committee agreed to fund the equivalent of 0.5 of an FTE through the operating budget of each user department. Cost allocation to each participating department is based upon a calculation comprised of a percentage of deployed vehicles and system utilization.

The adopted sustainability model assures a zero (0%) percent impact on the IS operational and capital budgets. The AVL system is deemed to be sufficiently critical to the operations of the Corporation that IS requires it be supported by a **permanent 0.5 FTE resource** and not through a contract or temporary engagement. To our best possible ability, we need to ensure the knowledge, skill set and subject matter expertise

required to maintain and sustain the system is retained internally and not subject to the drawbacks of potentially transitory contract staff.

This 0.5 FTE resource would become the subject matter expert (SME) for this application and provide primary system support. In addition to the development of new program components, the SME will be responsible for the creation and support of the system information and vehicle history reports, support for the Oracle reporting database, co-ordinate system scalability and expansion and support the system application infrastructure. The SME will be a single point of contact for AVL issues. They will handle all application development activities, including reports and vendor co-ordination, monitor architectural needs to assure the system performs to realistic expectations. They will also ensure that the server architecture is sufficient to meet known requirements and will handle database licensing, maintenance, vendor development and system improvements.

How AVL works

The AVL system essentially consists of four (4) components:

1. In-Vehicle Hardware - the vehicle is installed with a modem and two "hockey puck" shaped antennas mounted just above the rear windows. The modem receives the GPS satellite signal and, in turn, sends location information (X, Y, Z co-ordinates) and any vehicle-specific telemetrics of which we are currently capturing to the City's centralized AVL servers. Examples of telemetric data are:

   - Vehicle Identification
   - Vehicle Speed
   - Light & Sirens On/Off
   - Brakes On/Off
   - Tipper up/down
   - Engine on/off

2. Wireless Communication – the information sent from the modem utilizes the Cellular communication network provided by Bell Canada.

3. The received signal containing the vehicle identification and location is immediately sent to the Provincial Dispatch Centre for EMS land ambulances.

4. IS Hardware and Software – IS maintains a series of AVL-specific Oracle database servers, data analysis and reporting servers and map display servers. Currently, there are 5 dedicated servers for this solution, growing to 12 by the end of this year. All information received from the vehicle modems is captured, manipulated, stored and displayed within this environment.

The following AVL Architecture Diagram illustrates the complexity and components of the system. Everything depicted in the coloured box is the IS managed hardware and software components and the managed data flow. This is a complex application that must be managed proactively by dedicated subject matter expert resources.
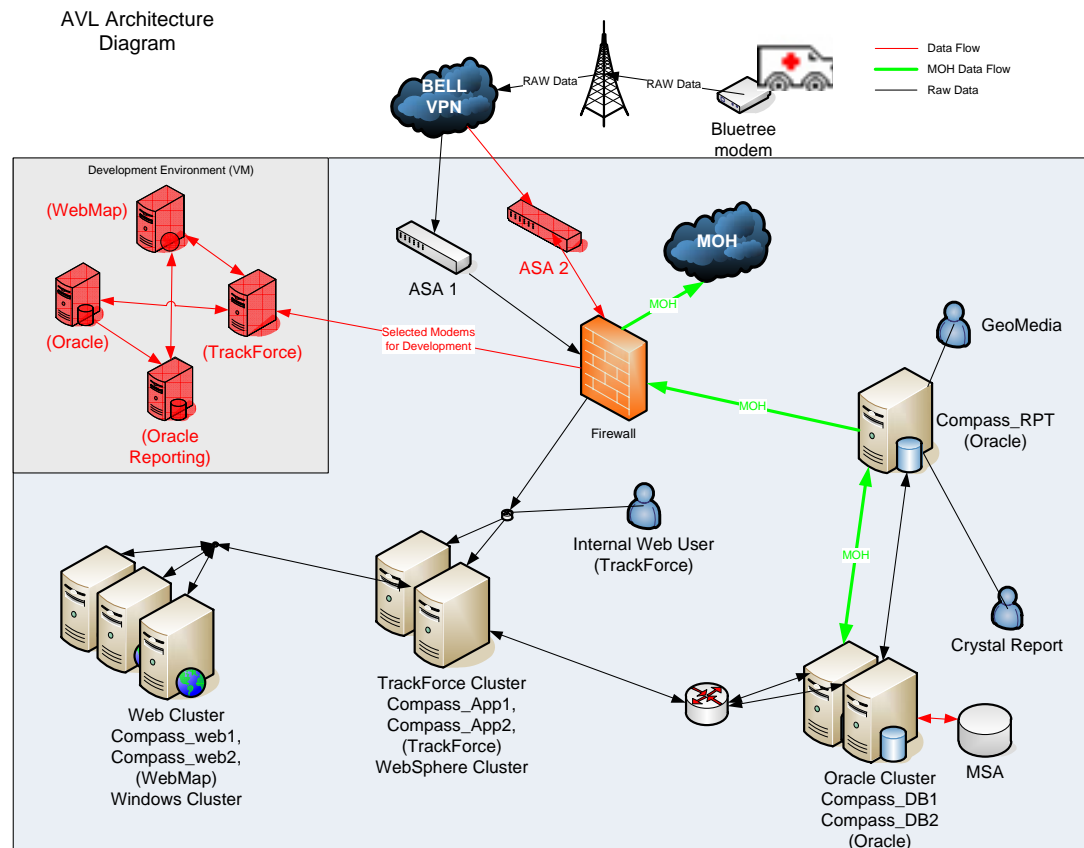
City of Hamilton Corporate AVL Architecture Diagram

AVL Software Components

A major component of the system is the heads-up map display that shows, in real time and as a historical data set, data related to the location of vehicles and information about the vehicles. The following images show some of the main functional screens. The following Figure 1 shows the ability to view all vehicles, categorized by type and display information about a specific vehicle.
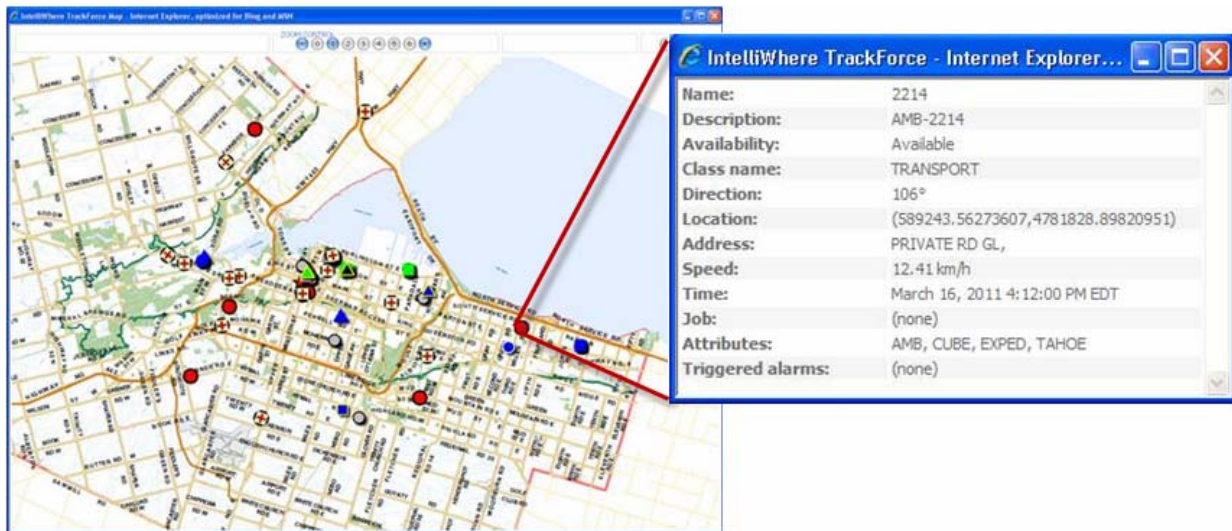
Figure 1. Overview Map of All On Road Operational Vehicles

Figure 2, below, shows the ability of the system to replay the route travelled by a specific vehicle, along with all captured telemetrics, for a specific date and time.
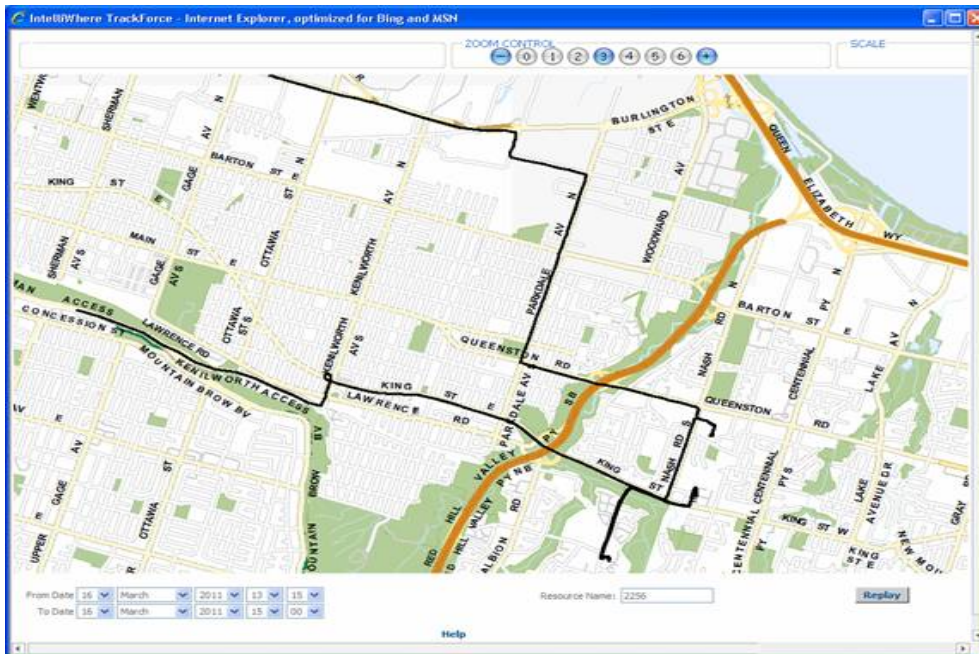

Figure 2. Vehicle Movement History Route

Reports Available in AVL

The two pilot projects identified the need for five (5) management reports:

- Track vehicle time, place, speed – real time
- Track simple telemetric information (i.e., engine on/off)
- Position History of Vehicle
- Vehicle Stop/Start history (for fleet maintenance, anti-idling compliance, etc.)
- Vehicle Telemetric Events (e.g., siren/lights on/off, brakes applied, etc.)

Conclusion

Any technology solution deployed, on behalf of new services or to produce efficiencies in a front-line department, will have an incremental maintenance and sustainability impact within the Information Services Division. In many cases, these solutions may be small, and the impact can be absorbed by existing IS resources. In other cases, especially large, complex enterprise-level solutions, the impact is greater. With every net-new system implemented, coupled with very little de-commissioning of other systems and no increases in financial or human resources, the capacity available to fulfil other technology requests of the corporation decreases.

Maintenance and sustainability of our information services infrastructures is no different than maintenance and sustainability of our sewer and water infrastructures. Neglected attention in the short-term may lead to failures and significant costs in the long-term.

Users of the current AVL system have recognized the importance of this maintenance and sustainability and have stepped up with the necessary funding to provide it. Although user departments were able to bring operational dollars to the table to fund sustainability, they were not in a position to transfer FTE's. Without the 0.5 FTE enhancement, all we can do is bring in a resource (or resources) on a temporary basis. The risk with this approach is the potential of losing that resource once subject matter expertise is gained and other opportunities are presented. Developing and retaining subject matter expert resources internally is the preferred, and recommended, option.