1. **J. Robert Havlick and Thomas H. Muehlenbeck Awards**
2. *Submit a cover sheet with your name, title, jurisdiction, mailing address, phone, fax and email address.*

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1. *Submit an opening paragraph with the program/project/product name and a short description of the innovation.*

**Project Innovation –Automatic Vehicle Location, Snow Plowing Mapping and Mobile Resource Management Solution**

The City of Ann Arbor’s Field Operations Unit, in conjunction with Information Technology Services, recently implemented a GIS-based Automatic Vehicle Location (AVL), Snow Plow Mapping and Mobile Resource Management System.

The system has been installed in 14 large dump/snow plow trucks and 33 other multi-purpose maintenance vehicles. All vehicles are used during snow events and field operations maintenance activities throughout the year. The system’s main objective is to increase the efficiency and effectiveness of field operations activities, including snow plowing.

The fleet is equipped with GPS navigation, mobile data terminals (MDTs) and sensors to detect plowing status, salt/sand spreader status and salt/spreader application rate. Mobile broadband technology transfers the data back to a geographic information system (GIS) for mapping, analysis and reporting. The system also captures critical data from on-board diagnostics computers that monitor engine performance and preventative maintenance alerts.

Operators are provided real-time navigation and the MDTs are used to communicate back and forth with Field Operations supervisors, enter current road conditions and even provide a data capture capability for identifying and geo-coding pot holes and other observed maintenance issues requiring attention or repair (e.g., street signs, lights, etc.). In the near future, this data will be integrated directly to the City’s GIS-based asset and maintenance management system for prioritization, routing and work order optimization.

In addition, the system provides a web-based mapping interface and displays real-time location information, status and vehicle activity for the entire fleet so Field Operations management can keep abreast of road conditions and street maintenance progress. The system provides Field Operations management a wide-range of reports that contain critical data and information used for optimizing street maintenance operations and other field-based activities where the vehicles are used.

Finally, the system offers public transparency using a public-facing website to track and view snow plows using web-based geographic information system technology. Interested users may zoom into the city snow route map to see the real-time locations and status of current snow plow activity (e.g., where the plows are right now and what they are doing). An easy-to remember link to a range of city winter street maintenance procedures is also available online at www.a2gov.org/snow. The direct link to the AVL snow plow tracking web page can be found at [plow tracker](http://64.27.15.44/AnnArbor/Public_Tracking.aspx).

The public is able to see where the snow plow vehicles are deployed in real time during a winter precipitation event. The vehicles are depicted on the map via icons indicating the type of actions underway—when and where a vehicle is actively spreading a salt-sand mix and/or when and where the plow blade is down and pushing snow. Users can hover a cursor over a vehicle icon and view a pop-up box describing the type of truck at-work—such as a large vehicle (used to de-ice or plow streets) or a smaller pickup truck, (typically used for clearing cul-du-sacs and tight spaces). The snow plow AVL page includes a step-by-step guide to using the online AVL system as well as providing additional winter street maintenance information.

1. *Submit a description of your jurisdiction, the history of the situation(s) which gave rise to the innovation’s need, and additional underlying factors.*

Ann Arbor has 114,000 residents, spans 27.7 square miles, and is frequently recognized as a foremost place to live, learn, work, thrive and visit. The city of Ann Arbor is committed to providing excellent municipal services that enhance the quality of life for all through the intelligent use of resources while valuing an open environment that foster fair, sensitive and respectful treatment of all employees and the community we serve.

Similar to many other cities, winter maintenance is a high priority for the City during the snow season and has established procedures and goals for the City of Ann Arbor regarding snow and ice control.

Snow and ice control operations fall under the jurisdiction of the Public Services, Field Operations Unit. Field Operations performs a variety of winter street maintenance procedures depending upon the type and amount of precipitation. Generally, the categories are described as "light snow", “heavy snow” and "snow emergency."

Field Operations takes the lead as it pertains to establishing and implementing the snow and ice control operations and is responsible for overall city-wide coordination and strategy with the public schools, public transit authority, local police agencies, and the Michigan State police.

For many years, the City of Ann Arbor managed snow events and other maintenance activities using traditional processes. Two-way radio communications were used to keep field staff and operations managers in contact with each other. Vehicle operators had no in-vehicle navigation to assist in way-finding and used visual landmarks, observation or prior experience to assist them in daily maintenance operations.

Field Operations Managers had limited knowledge of workers locations and where vehicles and snow plow assets were located at any given point-in-time. During severe snow events and emergencies, citizens also had little or no way of determining when their street would be cleared other than phoning into the City’s “snow desk” for status updates. They also wouldn’t know if the streets were save enough for travel.

For these reasons, it became imperative to initiate a program that would increase the efficiency and effectiveness of field operations and, at the same time, provide transparency to the public in a manner that was cost effective and sustainable.

1. *Submit a description of the innovation’s importance, internal impact, and community benefits.*
2. *Answer the following:* 
   1. *How is it a quantum leap of creativity?*
   2. *Who has benefited from the innovation?*
   3. *How was the innovation initiated and implemented?*
   4. *What was the environment in which the innovation was created and sustained?*
   5. *What were execution costs and savings?*
   6. *What lessons were learned that could be shared with other local governments?*
   7. *Which department and/or individuals championed the innovation?*

The innovation was initiated through executive sponsorship by Public Services Administration and championed by Field Operations management. Information Technology Services managed the project and worked with project champions and stakeholders to draft a business case and project charter for review and approval by the Information Technology Leadership Board. The business case provided a broad overview of the issue assigned to the team, as well as the rationale for why the particular project or program is a key business priority.

The project charter contained significant project and program details. It described, among other things, the symptoms arising from the problem to be addressed as well as roles and responsibilities for the project. It parallels the Business Case, but is more specific and focused. A Goal Statement matching the problem statements was also prepared as part of the project charter.

The Goal Statement included a description of what was to be accomplished (reduce, increase, eliminate), a measurable target for desired results, and a projected completion date to reach the goal--Simple/Specific Measurable, Accurate/Attainable, Realistic and Timely (SMART).

A clear vision and specific goals was paramount to success of this project (i.e., the Business Case in conjunction with a Project Charter articulated the Vision and Objectives for the Project).

If there was not a “clear” meaning that all stakeholders could see, understand, share and widely communicated to stakeholders, it would have been impossible for the project and team to succeed.

Critical success factors (CSFs) for the selection and successful implementation of the system were also created and reviewed prior to drafting a request for proposal (RFP).

Once the project charter was completed a clear statement of requirements was then written into an RFP and publicized on the City’s website for public viewing and bidding. After thorough review of RFP submittals, the project team selected Radio Satellite Integrators, Incorporated located in southern California to provide the preferred solution and assist with implementation.

The entire system cost the City $88,000 including costs for mobile broadband service in each of the 47 vehicles. Annual maintenance costs to sustain the system are approximately 20% of initial project costs.

At present, it is difficult to quantify the financial benefits of the system because it has been in operation for only a short period of time, but will be quantifiable in the near future.

As stated earlier, there are many operational and public benefits to the system. The system not only provides real-time mapping of snow plow activity, it also provides a mobile-resource-management solution that allows Field Operations to become more efficient and effective in delivering service to City of Ann Arbor businesses, residents and visitors.

Those detailed benefits and functions are:

***Vehicle location, tracking, monitoring***– The ability to know where workers and assets are, using web-based maps, can drive significant increases in productivity.

Worker location can be provided on a real-time and historical basis, with tracking that is typically refreshed every 30 seconds or minute. 10-second intervals are also available and are designed for those vehicles that have a higher need for immediate responsiveness and if any events change.

Positioning information is robust because it is integrated with GIS. However, no matter how robust the tracking mechanism, this function can break down when the worker travels outside the carrier’s wireless network coverage.

In these instances, the application can compensate with a store-and-forward or satellite modem arrangements.

***GPS navigation and optimized routing***– Text-based turn-by-turn driving directions are a minimum capability; however, audible turn-by-turn navigation is capable as well. Future enhancements include 3-D moving maps, truck-friendly routing, automatic rerouting instructions in the case of traffic, construction or accidents, and point-of interest/landmark information.

***Work order management (including scheduling and dispatch)***– Dispatchers transmit real-time job details out to mobile workers, with the specific job allocated on the basis of one or more of the following criteria: job type, job priority, worker skill set, worker location and transit time to the job site, mobile inventory levels.

Dispatchers can quickly reassign or reschedule jobs if a worker is running late or a high priority request comes in. The mobile workers provide status on their job progress using their handset – at a minimum, accepting or rejecting a job assignment, recording arrival at the job site, and recording completion of the job. Workflow applications can automatically react to worker events – logging workers in/out of jobs, starting and completing specific jobs, etc.

***Alerts and Geo-fencing***– Geo-fencing defines a virtual geographical area to ensure employees or vehicles follow approved routes. If a designated boundary is crossed, managers or employees receive a notification with a time, date and location stamp.

Reverse geo-fences also can be configured to alert managers to assets that enter an area designated as restricted. Exception monitoring is preferred due to the simple danger of information overload. Stop intervals, pending overtime violations, job running late, and speeding are common alert categories. Field Operations Managers can receive geo-fencing alerts when workers enter or leave a designated area. Geo-fences can also be used to trigger or initiate a workflow process involving capture of required data.

***Data collection***– Mobile workers are able to collect multiple forms of data in the field, enter the information directly on their handhelds, and transmit it to a central location.

Simply stated, the value realized by moving toward a *smart-system* will only increase with time, and the effectiveness of street maintenance operations will also increase, resulting in great benefit to customers, staff and the surrounding community as a whole. Those aforementioned benefits are summarized below by stakeholder.

**Benefit Analysis by Stakeholder**

|  |  |
| --- | --- |
| Stakeholders | Benefits |
| Community Users | 1. Improved Service Delivery (24/7 availability; flexible access; equitable access) 2. Reduced cost to users (time & effort; price of service) 3. Improved business and work opportunities ( improved processes; reduced cost of servicing) 4. More accessible government (policy familiarity; more transparency) |
| Agency | 1. Increased revenues from new and increased use of existing, chargeable services 2. Increased resource efficiency 3. Resource savings in peak load periods 4. Increased data accuracy 5. Less manual intervention |

There was significant risk and costs associated with the current process and “doing nothing” became increasingly difficult to defend. To simply “do nothing” is an expensive approach because the current process was simply not sustainable and it created added burden operations and provided little or no public transparency. Some additional risks identified during creation of the project and responses are listed in the table below:

|  |  |  |
| --- | --- | --- |
| **Description of Risk** | **Qualify the Risk** | **Risk Response** |
| Schedule overrun | Conflicting projects, mandated processes and other organizational priorities may cost time in the schedule | Maintain regular checkpoints, and allow reasonable room for project delays |
| Budget Overrun | Must find funds and not implementing on time | Detailed pre-planning and regular budget status reports to be analyzed by project team |
| Vendor Performance  Project slips | Failed project, legal issues | Be sure there are project management procedures in place prior to contract. Check references. Develop a services agreement that has distinct deliverables and milestones. |
| Cultural Resistance | Slows implementation, expectations of software value for cost savings not met due to lack of use among organization. | Keep employees well informed of upcoming functionality and provide initial and follow up training and surveys. |

Some of the lessons learned are to ensure that a thorough business case and project charter are created and communicated repeatedly, along with realistic expectations conveyed and re-conveyed to all stakeholders.

In turn, Project Ownership, Executive Management Support, User Involvement, and Adoption is critical to the success of any project.

Stakeholders, including vendors, must agree on realistic expectations, proper planning, smaller project milestones, and have focus and commitment to see the project through was vitality important to successful implementation and sustainability of the project and program.