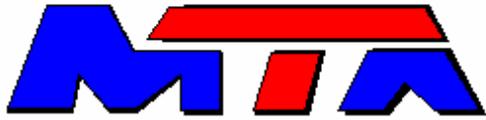


Intelligent Transportation Systems Technical Report MTA





Flint Mass Transportation Authority

ITS IMPLEMENTATION PLAN

REPORT

February 2005



TABLE OF CONTENTS

1.	INTRODUCTION	1
2.	GOALS AND OBJECTIVES	1
3.	EXISTING CONDITIONS	1
4.	NEEDS AND DEFICIENCIES	2
5.	EVALUATION OF ITS APPLICATIONS.....	4
6.	ITS CONCEPT OF OPERATIONS.....	6
7.	IMPLEMENTATION PLAN.....	8
7.1	Short Term Priorities and Long Term Framework.....	8
7.1.1	Short Term: MTA/Genesee County AVL System.....	8
7.1.2	Longer Term: Future ITS Applications for the MTA	9
7.2	Budget.....	12
7.3	Schedule	13
8.	IMPLEMENTATION CONSIDERATIONS.....	13

Appendix A: ITS Project Prospectus

1. INTRODUCTION

The Flint Mass Transportation Authority (MTA) is working to identify and adopt appropriate Intelligent Transportation Systems (ITS) solutions to improve the effectiveness and efficiency of transit service in Genesee County. The *Intelligent Transportation System Architecture and Deployment Plan* is a major initiative by the MTA to plan short and longer-term approaches to deploying ITS technologies.

The *ITS Architecture and Deployment Plan* is a four phase process addressing the agency-wide planning for ITS and the procuring and installation of basic ITS technologies for the *Your Ride* fleet as a first step toward a larger roll out of ITS technology throughout the MTA.

Building upon the Review of Existing Conditions, the Radio System Design and the Requirements Definition and ITS Alternatives Analysis reports, this report presents the ***Implementation Plan*** for the *ITS Architecture and Deployment Plan*. This report addresses Task 5 of Phase 1 (Implementation Plan) of the project. The approved Implementation Plan will establish the direction for the subsequent system specification and procurement efforts.

2. GOALS AND OBJECTIVES

The Mass Transportation Authority is developing an Intelligent Transportation System Architecture and Deployment Plan with the goal of leveraging technology to enhance its operational capabilities in meeting its ever-increasing service demands. This plan will improve the enterprise productivity of current operations, while providing enhanced service to the customer. This Implementation Plan document identifies the needs and opportunities for ITS technologies to meet these stated objectives. The Plan further sets the foundation for broader deployment by other interested parties in Genesee County.

3. EXISTING CONDITIONS

An extensive review of the MTA's existing organizational and operating conditions was an early step toward developing the ITS plan. Since ITS systems will reach across multiple business groups within the authority, this review included operational, facility, planning, personnel, financial as well as IT elements of the authority. The review incorporated an analysis of MTA historical documentation, discussions with MTA staff, on-site investigation and four stakeholder workshops held at the MTA in October 2004. The existing conditions review also provides an inventory of the MTA's current ITS assets and program as well as an opportunity to assess which functional areas within the organization could benefit the most from ITS deployments.

The key findings of the existing conditions review appear below. Further information on existing conditions can be found in the Existing Conditions Report.

- *Wide ranges of manual data-entry/handling processes are currently in place throughout the MTA.* These processes evolved from traditional approaches to transit operations and legacy technology systems. These manual systems are a burden to maintain as they require large amounts of manpower that is not consistently available and are prone to error and inaccuracies entries.

- *Current processes and technology platforms have only a limited ability to generate detailed performance measurements.* Current platforms are often incapable of generating detailed performance information, or hampered by backlogged data entry, uncollected data, lack of connections between databases, and limited accessibility/training to MTA staff.
- *A number of previous and parallel ITS and technology efforts have been attempted in the recent past with varying degrees of coordination and success.* Some legacy technologies, such as on-board video cameras, are obsolete and must be replaced. Other technologies, including fare box upgrades, have not been deployed due to incompatibilities with other technologies or changing MTA service objectives.
- *There is a strong interest in ITS solutions among MTA staff.* A certain amount of frustration with particular practices and technology processes/equipment was evident, as was the lack of interfaces between departments, such as maintenance, inventory and accounting.
- *Potential application for other stakeholders in Genesee County.* Several local agencies including the County Road Commission have expressed interest in utilizing AVL technologies to improve their own fleet operations.

4. NEEDS AND DEFICIENCIES

The areas where the MTA's and other stakeholder's needs may be positively impacted by ITS solutions were identified based upon field surveys of existing conditions, and discussions with MTA management and staff. The needs are reflected below as goals for the MTA's ITS plan. The ITS solutions should be applied in order to:

- ***Improve Safety & Security of Passengers and Operators on MTA Vehicles*** – The safety of passengers and employees on-board MTA vehicles is a crucial consideration. In concert with MTA security planning, ITS technologies should work to enhance security for passengers and operators on MTA vehicles.
- ***Increase Safety & Security of Passengers and Staff at Facilities*** – Safety at MTA facilities is also a key consideration. Technology can play a role in making MTA facilities more secure and safer, in particular the downtown terminal, bus stops, the multi-modal terminal and administrative buildings. In concert with MTA security planning, ITS technologies should work to enhance security for passengers and staff at MTA facilities.
- ***Improve the Safety of MTA Vehicle Operations*** – The configuration of the downtown terminal requires MTA buses to back out of parking bays, creating the potential for collisions with other buses or even pedestrians. ITS solutions should work to reduce this risk of collisions at the downtown terminal.
- ***Improve Mobile Communications*** – ITS and emergency coordination activities rely upon mobile communication networks. ITS solutions should improve communications between vehicles and MTA central dispatching.
- ***Provide Improved Information for Your Ride Planning and Scheduling*** – demand-responsive services like *Your Ride* are less efficient than fixed-route services. ITS solutions should help to improve efficiency by making *Your Ride* more effective at responding to scheduling changes.

- ***Provide Improved Information for Fixed-Route Planning and Scheduling*** – ITS solutions should be used to help make MTA transit operations more effective and efficient by providing information and tools to improve system performance.
- ***Allow Real-Time Vehicle Tracking*** – Transit operations rely on a precise knowledge of vehicle location. Improving service delivery is difficult without accurate information about system, route and vehicle performance. ITS solutions should provide the ability to monitor vehicle location in real-time.
- ***Enhance Multi-Modal Coordination*** - MTA riders frequently coordinate their trips with other transportation agencies such as SMART, Amtrak or Greyhound, or between the MTA's own services such as Regional transit to Oakland County and the fixed route service in Flint. Technology can help to coordinate different services and provide better information to the passenger in order to plan their trip. MTA ITS Architecture should be compatible with the regional ITS Architecture, work to coordinate ITS solutions with other agencies, and work to identify opportunities for coordination with other agencies in Genesee County.
- ***Improve the Usefulness and Accessibility of Traveler Information*** – Providing timely information about transit is crucial in serving current customers and attracting new riders. ITS solutions should provide accurate traveler information that is easy to access and use.
- ***Increase the Effectiveness and Efficiency of Maintenance Practices*** – Existing maintenance practices and technologies cannot effectively record, retrieve or help analyze vehicle performance or maintenance history. ITS solutions should provide accurate, up to date information about vehicle performance and maintenance history to aid staff in diagnosing repair needs and maintaining the fleet while making the maintenance activities of the MTA more efficient.
- ***Improve Incident Management for Planned and Unplanned Traffic Events*** – ITS solutions should work to provide information on the effects of unexpected and anticipated traffic congestion, both to improve MTA vehicle operations and help mitigate congestion on the road network.
- ***Reduce Traffic Delay at Signalized Intersections*** – Reducing unnecessary delays at traffic signals is a traffic flow and safety issue. ITS solutions should work to provide traffic signal emergency services vehicles as well as transit vehicles.

As a regional transportation agency, the MTA provides a platform for organizing and implementing regional responses to issues that affect residents and officials across the county. Such issues include safety, emergency response, congestion management and multi-modal coordination. The MTA's ITS planning effort provides an opportunity for regional stakeholders, including local governments, MDOT, county agencies, and emergency response agencies, to begin developing an ITS system that can help meet various needs across the county. In addition to needs identified for the MTA, regional stakeholders identified additional transportation system requirements from across jurisdictions but should be taken into account in the MTA's plan.

- ***Facilitate Coordinated Emergency Response*** – There is a strong desire to improve emergency response coordination in Genesee County. ITS solutions should work toward creating a coordinated countywide emergency response network.
- ***Expand On-Board Communications*** – Daily operations and emergency coordination depend upon flexible fleet communications. ITS solutions should work to improve communications between emergency services vehicles both with a control center.

- **Assist with Congestion Management** – Congestion is a safety hazard and reduces the county's economic competitiveness and quality of life. ITS solutions should assist MDOT, local governments and the road commission in managing congestion.
- **Reduce Intersection Collisions** – Intersection collisions are a hazard and hinder emergency response. ITS solution should work toward making intersections safer for vehicles and pedestrians.
- **Improve Traffic Management for Special Generators** – Large traffic generators, such as factories can create local traffic problems that impact regional traffic management. ITS should be used to manage traffic generated by large facilities such as factories.
- **Reduce Delays at Surface Railroad Crossings** – Delays at railroad crossings can slow response times of emergency vehicles. ITS solutions should work toward reducing and mitigating traffic delays at surface railroad crossings.
- **Improve Groundside Access to Airport** – Traffic management at Bishop Airport can be improved. ITS solutions should be utilized in coordinating groundside access at Bishop International Airport.

5. EVALUATION OF ITS APPLICATIONS

The Requirements Definition and ITS Alternatives Analysis report provided a refined list of ITS Market Packages and applications as defined in the ITS Architecture. This list was refined to those packages that were applicable to the MTA and Genesee County. These packages and applications were reviewed and discussed with the larger community at the stakeholder workshop. Stakeholders and the Project Team considered what functions are characteristic of a given need, and in turn how a given market package may improve upon that functionality. The workshop resulted in the identification of a shortlist of the most applicable market packages.

As included in the Requirements Definition and ITS Alternatives Analysis report, Exhibit 5 -1 maps the identified user needs to the market packages. Essentially, the table is a visual summary indicating the market packages that have the potential to address the identified needs and would be most useful as elements of an ITS strategy.

Exhibit 5-1: ITS Applications and Identified Needs

ITS Market Packages & Applications		MTA Needs										Stakeholder Needs									
		On-Board Safety & Security	Safety & Security at Facilities	Safety of MTA Vehicle Movements	Incident Management (Planned and Unplanned Events)	Mobile Communication	Information for Your Ride	Information for Fixed-Route Planning & Scheduling	On-Time Performance Monitoring & Scheduling	Multi-modal Coordination	Passenger Information	Information for Maintenance	Reduced Transit Delay at Signalized Intersections	On-Board Communications	Congestion Management	Reduced Emergency Response	Special Intersection Collisions	Delays at Railroad Crossings	Ground Side Access to Airport		
Advanced Public Transportation Systems	1 Transit Vehicle Tracking Automatic Vehicle Location	•				•	•	•	•	•	•	•	•	•	•						
	2 Transit Fixed-Route Operations MDT/CAD/SRC					•	•	•	•	•									•		
	3 Demand Response Transit Operations MDT/CAD/SRC					•	•												•		
	4 Transit Passenger & Fare Management Automatic Passenger Counters/Fare Collection									•											
	5 Transit Security Video Cameras, Alarms	•	•	•								•	•		•						
	6 Transit Maintenance On-Board Diagnostics										•										
	7 Multi-modal Coordination Coordination, Passenger Information					•	•	•		•											
	8 Transit Traveler Information Message Signs, Announcements					•				•											
Advanced Vehicle Control Systems	2,3 Collision Safety Warning Collision detection sensors	•	•	•																	
	8,9 Advanced Vehicle Control Vehicle control sensors	•	•	•																	
Emergency Management	1 Emergency Call-taking and Dispatch Emergency Call Taking, Coordinated Response	•				•	•				•	•		•							
	2 Emergency Routing AVL and dynamic routing	•				•	•														
Advanced Traffic Management Systems	1 Network Surveillance Fixed detectors/cameras in field					•					•	•						•			
	2 Probe Surveillance Traffic Probe Surveillance					•							•								
	3 Surface Street Control Dynamic traffic control and Signal Priority										•		•	•	•	•	•				
	6 Traffic Information Dissemination Driver information, variable message signs					•						•	•				•	•			
	7 Regional Traffic Control Coordination between traffic control centers					•					•										
Advanced Traveler Information Systems	8 Incident Management System Coordinated incident detection and response					•					•	•	•	•							
	13 Standard Railroad Grade Crossing Connected to traffic signals, message signs					•					•	•		•	•		•				
	1 Broadcast Traveler Information Transportation system information					•				•		•						•			
Advanced Traveler Information Systems	2 Interactive Traveler Information Interactive Voice Response, Mobile Communications					•				•											
	5 ISP Based Route Guidance Web-Based Trip Planning, Mobile Communications					•				•											

J:\11864\5.0 Design (Work) Phase\Stakeholder Meeting November\SCS_ITS_App_2004-11-09

6. ITS CONCEPT OF OPERATIONS

The concept of operations is the blueprint for ITS at the MTA. The MTA's concept of operations presents the application and integration of the priority ITS market packages in the context of the MTA environment. As such, it achieves the following:

- Identifies the MTA and other stakeholder operating environments where technology is applied;
- Identifies key technology components and their functions;
- Illustrates the communications interconnects within the MTA; and
- Illustrates the anticipated communications interconnects between MTA and regional stakeholders.

Exhibit 6-1 on the following page shows how the ITS system will be structured. Key ITS subsystems include:

- In-vehicle components such as AVL, radio equipment, APCs, security cameras, etc.;
- Central systems housed at the MTA offices such as CAD/AVL equipment and maintenance and record keeping functions; and
- Communications connections among the MTA entities, other relevant agencies, and the travelers.

The diagram indicates the type of information flows between the various entities, such as location data, schedule data, and messaging.

Flint Mass Transportation Authority
ITS IMPLEMENTATION PLAN

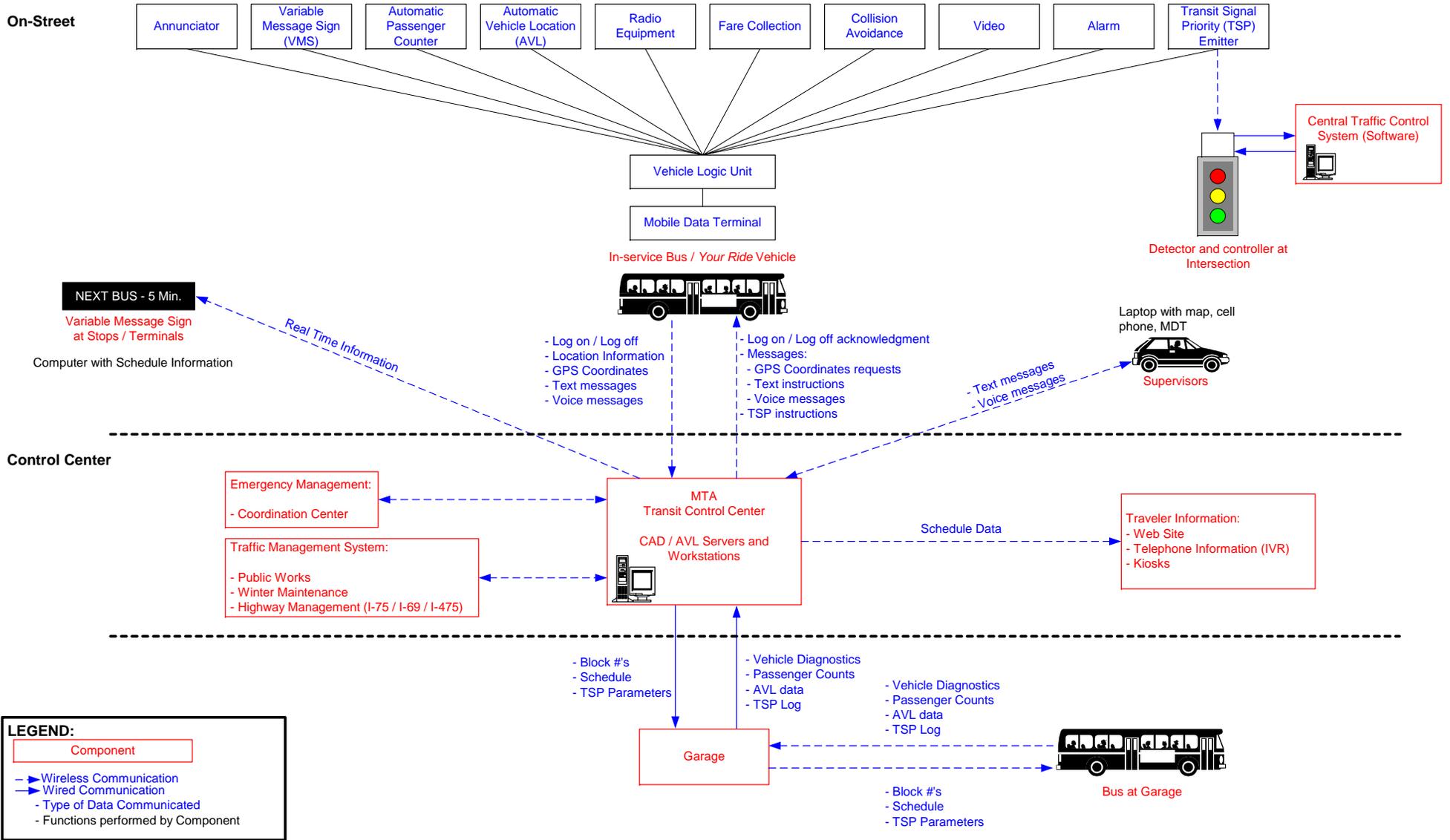


Exhibit 6-1 ITS Concept of Operations

7. IMPLEMENTATION PLAN

Based upon the findings of the previous technical reports, this report presents a technology implementation plan that can best meet MTA's needs within prescribed cost parameters.

The implementation plan is organized into *short* and *longer term* priorities. This provides a logical framework for staging the ITS deployment. Each section is comprised of a series of specific projects reflecting the ITS applications and the relevant ITS Architecture Market Packages:

- **Transit Operations (TO)** – Projects aimed at improving the effectiveness and/or efficiency of MTA operations.
- **Traveler Information (TI)** – Projects intended to provide better information for transit travelers.
- **Traffic Management (TM)** – Projects intended to help improve traffic and congestion management.
- **Communications System (CS)** – Projects to improve the MTA's communication infrastructure to support the various ITS applications.
- **Emergency Services (ES)** – Projects to allow better and more coordinated responses to emergencies.

Each project has been assigned a project number and is illustrated in greater detail in a Project Prospectus provided in Appendix A.

7.1 Short Term Priorities and Long Term Framework

This section defines the short and longer term priorities for the MTA to implement its full ITS concept. Short and long term recommendations are followed by a summary table illustrating the overall implementation framework. Individual projects are identified while later sections provide greater detail for each.

7.1.1 SHORT TERM: MTA/GENESEE COUNTY AVL SYSTEM

It is clear that the immediate priority for the MTA should be to develop an AVL system to provide countywide vehicle tracking for the Your Ride and fixed-route fleets. AVL is the backbone component for various ITS applications, and as such the AVL system will become the foundation of the MTA's ITS program.

From the stakeholders' perspective, a countywide AVL system is also desirable. Several local agencies, including the County Road Commission, expressed interest in utilizing AVL technologies to improve their own fleet operations. The opportunity to maximize the use of public funding by developing one countywide AVL system is well recognized. Such a system would need countywide coverage and a flexible opt-in program to allow participants throughout the county to purchase only the AVL functions they needed. Such an AVL system would be used efficiently by the MTA and the Road Commission alone, but open to other stakeholders in the County at their discretion. Such a customized approach to AVL would be beneficial to

There are five projects needed to establish the Genesee County AVL System:

1. **Radio System Upgrade (CS-1):** As noted before, the MTA's radio system currently does not cover all parts of Genesee County with sufficient strength to provide reliable vehicle tracking ability countywide. The radio system will require a significant upgrade, including new towers, to meet the AVL needs of the MTA or other in-county stakeholders. This project should receive the highest priority as it is a technological pre-requisite for all additional ITS applications.

2. **Your Ride AVL (TO-1):** The Your Ride service should be the first recipient of AVL technologies because it stands to benefit the most from AVL. MDTs should be installed to allow more efficient communications between drivers and dispatchers and also to serve as an in-vehicle platform for additional ITS technologies. This system will need to be closely coordinated with the MTA's ongoing implementation of CAD software.
3. **MTA Fixed Route AVL (TO-2):** Extending AVL abilities to the MTA's fixed-route fleet is the next priority. This will extend AVL abilities to the fixed route service in the City of Flint and the Regional intercity service that extends into Oakland and other counties.
4. **Public Works AVL (TO-3):** Extending AVL technology to stakeholders in Genesee County is the next priority. The AVL system will need to allow stakeholders to purchase only the AVL applications they need.
5. **Mobile Data Terminals (TO-4):** Building upon the AVL infrastructure, MDTs provide an interface between the driver and dispatcher, and provide a platform to support other ITS applications such as silent alarms. While MDTs are desirable for all MTA vehicles other stakeholders may not require them. MDTs are an optional feature for those stakeholders.

In addition, some components specific to MTA include:

6. **On-Board Security Cameras (TO-5):** For all MTA vehicles, digital cameras can increase safety by deterring crime and providing a visual record of what happens on the vehicle. To use radio capacity efficiently, a continuous feed is not recommended. Instead, images are stored on-board with live feeds to MTA headquarters initiated as needed by the dispatcher, or triggered automatically by the driver when the silent alarm is activated.
7. **Automatic Passenger Counters (TO-6):** APCs provide valuable information with a limited deployment. APC-equipped buses can be rotated among fixed routes providing boarding and alighting information the MTA can use to monitor and improve the performance of transit service.

7.1.2 LONGER TERM: FUTURE ITS APPLICATIONS FOR THE MTA

Once established, the Genesee County AVL System will provide the MTA with AVL/MDT capabilities in both its Your Ride and fixed route fleets. This section outlines the ITS applications the MTA should implement in subsequent phases to augment the system functionality and ultimately realize the full concept of operations.

1. **Traveler Information Systems (TI-1):** Automatic stop announcements and real-time information at the downtown terminal should be the highest priorities for providing information, followed by providing conventional bus schedules and maps on-line, and finally web-based trip planning on the internet and all-purpose kiosks at major destinations. The MTA has already begun installing ASA on some vehicles and is developing an IVR telephone system.
2. **Collision Avoidance (TO-7):** Given the backing movements necessary at the downtown terminal and the potential to reduce sideswipe collisions, collision avoidance technologies should be considered.
3. **Maintenance Software (TO-8):** A new purchasing/maintenance/inventory software platform will improve the effectiveness and efficiency of the MTA's maintenance efforts. It will allow more control of cost and could dramatically improve the efficiency of the maintenance department.

4. **On-Board Diagnostics (TO-9):** The AVL application can be interfaced to the On-board Diagnostic interface on the buses in order to record and transmit to central critical error codes. This will assist in diagnosing and responding to fault conditions and provide data for the maintenance management process.
5. **Back-Up Emergency Management Center (ES-1):** Stakeholders across Genesee County have begun the institutional and technological coordination necessary to mount a coordinated response to emergency management. In the future it may become necessary to provide centralized infrastructure to enhance that growing coordination or to serve as a back up or replacement of the existing coordination center in Flint. Such a nexus of infrastructure will require a well positioned and equipped site and facility. As an initial step, MTA facilities could be outfitted with the appropriate communications connections and stakeholder agency workstations to meet this need.
6. **Fare Collection (TO-10):** Advanced smart card based fare collection technologies for the fixed-route fleet will allow the MTA to improve customer experience and operational expense by reducing the need to use cash, improve service by reducing boarding and alighting times, and provide a complementary source of information on passengers for use in service planning.
7. **Traffic Signal Upgrade (TM-1):** There are significant technological barriers to implementing signal priority in Genesee County while the need does not appear to be immediate. For these reasons, this project has been designated a long term objective dependant on capital investments outside the MTA . To support real-time traffic signal priority for transit or emergency vehicles, intersections must be equipped with a micro-processor based controller architecture. As an initial step, priority bus corridors would be identified, and the requisite traffic signal control system upgrades could prioritized for these corridors.

Exhibit 7-1 provides a summary of the ITS projects. A *Project Prospectus* for each project in the Implementation Plan is provided in Appendix A. Each Prospectus includes:

Project Description: providing a high-level description of the specific project as well as contextual overview.

Benefits: a summary of benefits to be derived through deployment.

Barriers: commentary on potential barriers to implementation. Barriers may include institutional, legislative, resource, technological and/or funding.

Logistics: including relevant technologies, pre-requisite requirements and preliminary cost estimates.

Participants: key stakeholders including those with primary responsibility as well as those who will participate in the design and specification phases.

ITS Definition: cross-reference back to the ITS architecture.

Evaluation: reflects specific measures to be used to gauge the effectiveness of specific project deployment.

Exhibit 7-1 ITS Project Summary

ID #	Project	Description
CS-1	Radio System Upgrade	<ul style="list-style-type: none"> • 935 MHz and 452 MHz systems • Two additional tower sites
TO-1	<i>Your Ride</i> AVL	<ul style="list-style-type: none"> • CAD central System • On-Board equipment for 150 vehicles
TO-2	MTA Fixed Route AVL	<ul style="list-style-type: none"> • On-Board equipment for 100 vehicles
TO-3	Public Works AVL	<ul style="list-style-type: none"> • Possible extension to other stakeholders
TO-4	Mobile Data Terminals	<ul style="list-style-type: none"> • Driver messaging for 250 vehicles
TO-5	Security Cameras	<ul style="list-style-type: none"> • Cameras and digital video capture for 250 vehicles
TO-6	Automatic Passenger Counters	<ul style="list-style-type: none"> • Infrared door sensors for 10 vehicles • Rotate among each fixed route
TI-1	Advanced Traveler Information	<ul style="list-style-type: none"> • On-board annunciators • Schedule information via phone, internet, kiosks • Web-based trip planning
TO-7	Collision Avoidance	<ul style="list-style-type: none"> • Rear Obstacle detection on 250 vehicles
TO-8	Maintenance Software	<ul style="list-style-type: none"> • Maintenance management system for work order tracking and inventory control
TO-9	On-Board Diagnostics	<ul style="list-style-type: none"> • Interface AVL to engine control unit for 100 vehicles
ES-1	Back Up Emergency Management Center	<ul style="list-style-type: none"> • High-Speed communications and stakeholder workstations • Use of existing MTA facilities
TO-10	Fare Collection	<ul style="list-style-type: none"> • Smart Card fare collection system
TM-1	Traffic Signal Upgrade	<ul style="list-style-type: none"> • Microprocessor based control for selected corridors • Signal Priority for transit and emergency services

7.2 Budget

Exhibit 7-2 outlines the budgetary considerations for each ITS project. The table identifies the cost for equipment (capital) and ongoing operations and maintenance costs, presented as an annual figure. These figures are preliminary estimates of future costs and will be refined as each project moves forward.

Exhibit 7-2 ITS Project Budget Estimates

Project	Capital	Annual Operations and Maintenance
Radio System Upgrade	\$900,000	\$50,000
<i>Your Ride</i> AVL	\$1,750,000	\$250,000
MTA Fixed Route AVL	\$500,000	\$75,000
Public Works AVL	\$5,000 per vehicle	15% of capital costs
Mobile Data Terminals	\$1,000,000	\$100,000
Security Cameras	\$1,250,000	\$175,000
Automatic Passenger Counters	\$50,000	\$10,000
Advanced Traveler Information	\$1,500,000	\$225,000
Collision Avoidance	\$500,000	\$50,000
Maintenance Software	\$250,000	\$25,000
On-Board Diagnostics	\$200,000	\$20,000
Back Up Emergency Management Center	\$500,000	\$50,000
Fare Collection	\$2,500,000	\$500,000
Traffic Signal Upgrade	\$1,500,000	\$225,000

- **Hire New ITS Manager:** The MTA will require a full time employee familiar with technology deployments to oversee the implementation and upkeep of the wide array of ITS technologies being brought in house.
- **Data Analyst:** The ITS applications described in this plan will generate a tremendous amount of data. To be useful, this data will need to be maintained and analysed by a full time employee.
- **Training and Knowledge Transfer:** The ITS plan will impact all MTA employees. Operations and maintenance training for current positions will be necessary, and should be incorporated into the scope of work for system procurement.

Stakeholder Coordination

The MTA continues to work with partner agencies in Genesee County. The identification of vehicle tracking needs for other agencies (i.e. the Road Commission, Emergency Management agencies and various municipal fleets) has led the MTA to expand its emerging technology capabilities to provide a countywide AVL platform, the Genesee County AVL System. As elements of the ITS plan are implemented the MTA will seek to identify appropriate roles, solidify stakeholder support and inter-agency agreements. This process can include continuing communication, memoranda of understanding or formal agreements with partners such as the Genesee County Planning Commission, MDOT, Emergency Management and Homeland Security agencies, the County Road Commission and other regional agencies.

Customer Acceptance

New technologies ultimately benefit MTA customers. While some of the anticipated technologies will be passive to rider-ship (e.g. AVL, APCs), other technologies, such as advanced traveler information, will directly impact the way riders interact with the MTA. Steps should be taken to ensure the riding public accepts, and fully utilizes the new technologies. Another important constituency, taxpayers, should also be made aware of the improvements and efficiencies the MTA is creating with advanced technology. Specific activities include:

- **Focus on Customer Needs** – For systems such as fare collection the MTA should make certain to design systems based upon the identified needs of its customers and not only the internal needs of the agency. This ensures that the final product meets the genuine needs of customers.
- **Education** – Providing easy to understand information on how to use all customer-interactive technology will be crucial to ensuring the riding public are comfortable using the new technologies. Providing symbolic and written directions, and training customer service staff to help customers use the technologies are steps that can ensure all customers know how to take advantage of new technologies.
- **Promotion** - To reap the full benefits of some technologies such as telephone-based schedule information or on-board security cameras, the MTA may need to actively promote the technologies to the public to increase awareness and use. The improvements and efficiencies created by new technologies can also be a useful public relations tool to help county leaders and residents understand the benefits of ITS. Campaigns to promote awareness can be focused on current customers through in-vehicle and on-site advertisements in the downtown terminal and at bus stops. Separate campaigns can also be focused on attracting new customers. The two markets will perceive the benefits of the technology in different ways and must therefore be approached as separate markets.

APPENDIX A

ITS PROJECT PROSPECTUS

Project Description

- Upgrade existing radio coverage across Genesee County and into Oakland County
- Provide data communications capability to support AVL
- Add two tower sites
- There exists a possibility of coordinating this upgrade with the scheduled police radio system upgrade



Benefits

- Improved radio coverage
- Data communication for ITS applications
- System ownership
- Potential cost recovery options

Barriers

- FCC approval
- Institutional coordination issues

Logistics

- Existing relationship with vendors
- Option 1: Re-engineering the existing 935 MHz System
- Option 2: MTA 452 MHz Radio System
- Coordinate with State Police tower sites

Cost Estimate:

- \$900,000 capital
- \$50,000/year operations & maintenance

Participants

- MTA
- Genesee Intermediate School District
- Genesee County Regional Planning Commission
- Michigan State Police
- Other emergency services

ITS Definition

- Not applicable

Evaluation

- Size of coverage area
- Quality of reception
- Lifecycle costs

Project Description

- Implement county-wide vehicle tracking infrastructure
- Apply AVL to some 150 *Your Ride* vehicles
- Implement AVL application includes GPS tracking, mobile data terminals, and integration with CAD
- Coordinate routing and scheduling using CAD
- MTA is installing Trapeze PASS scheduling module
- Currently, all vehicle tracking and routing is done manually



Benefits

- More efficient routing and scheduling
- Improved customer service
- Automation will allow for better allocation of resources
- Improved safety/security

Barriers

- Current radio coverage
- User acceptance
- IT resources

Logistics

Relevant Technologies:

- Vehicle tracking (GPS)
- Communications infrastructure
- Data processing
- CAD system

Pre-requisite Projects:

- CS - 1

Cost Estimate:

- \$1 million AVL central system & \$5,000 per vehicle
- Total \$ 1,750,000 capital for 150 vehicles
- \$250,000/year O/M

Participants

- MTA
- City of Flint
- Genesee County Regional Planning Commission
- Your Ride partners

ITS Definition

- APTS 1 - Transit vehicle tracking
- APTS 3 - Demand response transit operations

Evaluation

- Number of passenger trips per hour
- Passengers per vehicle mile of travel
- Complaints per x number of trips
- Incident Response time
- On-time performance

Project Description

- Apply AVL to 96 full-size MTA buses
- AVL application includes GPS tracking, mobile data terminals, and integration with CAD
- AVL for conventional Fixed Route Service (92 buses), and Regional Service (4 buses)
- Implement AVL application includes GPS tracking, mobile data terminals, and integration with CAD & automatic stop annunciators



Benefits

- More efficient routing and scheduling
- Improved customer service
- Automation will allow for better allocation of resources
- Improved safety/security
- Increased coordination with SMART

Barriers

- Current radio coverage
- Radio coverage for Regional Service may be limited in Livingston and Washtenaw counties
- User acceptance
- IT resources

Logistics

Relevant Technologies:

- Vehicle tracking (GPS)
- Communications infrastructure
- Data processing
- CAD system

Pre-requisite Projects:

- CS - 1, TO - 1

Cost Estimate:

- \$500,000 capital (\$5,000 per vehicle for 100 buses)
- \$75,000/year O/M

Participants

- MTA
- City of Flint
- Genesee Intermediate School District
- SMART
- Genesee County Regional Planning Commission
- Oakland County
- SEMCOG
- DARTA

ITS Definition

- APTS 1 - Transit vehicle tracking
- APTS 2 - Transit fixed-route operations

Evaluation

- Number passenger trips
- Complaints per number of trips
- Incident Response time
- On-time performance



Project Description

- Make AVL service available to participants county-wide
- Provide flexible service/cost model, example AVL ability without MDT
- Customize to needs, example interface to spreader controller or plough up/down monitoring
- AVL application includes GPS tracking, mobile data terminals, and integration with CAD
- Coordinate routing and scheduling using CAD



Benefits

- Improvement of response times
- Tracking and records of work
- Complaint verification (assistance in potential litigation)
- Procurement economies of scale
- Share costs between agencies
- Better management of de-icing materials

Barriers

- User acceptance
- Deployment across municipal and institutional boundaries
- Crew education

Logistics

Relevant Technologies:

- Vehicle tracking
- Communications infrastructure
- Data processing
- Mobile data terminals (optional)

Pre-requisite Projects:

- CS - 1, TO - 1

Cost Estimate:

- \$5,000 per vehicle
- 15 % of capital/year

Participants

- Genesee County Road Commission
- City of Flint
- Genesee County Regional Planning Commission
- Michigan Department of Transportation
- Local municipalities

ITS Definition

- MC 1 - Maintenance and Construction Vehicle and Equipment Tracking

Evaluation

- Response time
- Number of valid complaints
- De-icing material costs

Project Description

- Mobile data terminals installed in vehicles
- Optional for non-MTA participants
- Provided interface for communication between driver and dispatcher/in-vehicle ITS systems
- Provides platform for future ITS applications



Benefits

- More efficient vehicle-dispatch communication
- Automates communication
- Allows interface with on-board ITS systems
- Optional technology

Barriers

- Operator acceptance
- IT resources
- AVL is pre-requisite
- Bandwidth capacity

Logistics

Relevant Technologies:

- Vehicle tracking (GPS)
- Communications infrastructure
- Data processing

Pre-requisite Projects:

- CS – 1, TO –1, 2, 3

Cost Estimate:

- \$1,000,000 (\$4,000 per vehicle)
- \$100,000/year O/M

Participants

- MTA
- Genesee County Road Commission
- Genesee Intermediate School District
- Genesee County Regional Planning Commission
- Other stakeholders

ITS Definition

- APTS 1 – Vehicle Tracking

Evaluation

- Driver-Dispatch communications
- Bandwidth capacity

Project Description

- Deploy in-vehicle digital video systems fleet-wide, including *Your Ride*
- In-vehicle storage and potential for live feed
- MTA had on-board cameras that recorded images on tape
- MTA is replacing the old system on Flyer fleet. The new system still uses analog tape recording

**Benefits**

- Deterrent to crime
- Increase perception of safety
- Provides a record of activity on bus
- Reduced maintenance costs
- Send appropriate response team

Barriers

- Privacy Concerns
- User Acceptance

Logistics**Relevant Technologies**

- Digital video recording equipment

Pre-requisite Projects:

- AVL (TO-1, TO-2, TO-3) and CAD

Cost Estimate:

- \$1,250,000 (\$5,000 per vehicle)
- \$175,000/year O/M

Participants

- Genesee Intermediate School District
- MTA
- Genesee County Regional Planning Commission
- City of Flint
- Genesee County Sheriff Department

ITS Definition

- APTS 5 - Transit security

Evaluation

- Number of trips
- Number of incidents
- Response time



Project Description

- Install automatic passenger counters (APC) on 10 MTA fixed route vehicles
- Combine with AVL to collect detailed transit passenger ridership information
- APCs to be installed on a subset of vehicles to be cycled through all fixed-routes

**Benefits**

- Detailed boarding and alighting information
- Tool for system planning and performance monitoring
- Fare management/auditing

Barriers

- Ability to assign buses to specific routes

Logistics**Required Technologies:**

- AVL (TO-2 and TO-3) and CAD are pre-requisites for some features
- Infrared automatic passenger counters

Pre-requisite Projects:

- AVL (TO-1, TO-2, TO-3) and CAD

Cost Estimate:

- \$50,000 (\$2,500 per vehicle)
- \$10,000/year O/M

Participants

- City of Flint
- MTA
- Genesee County Regional Planning Commission

ITS Definition

- APTS 4 - Transit passenger and fare management

Evaluation

- Data collection costs

Project Description

- Use technology to provide travelers with better schedule and trip planning information
- Automatic GPS-based announcement system being deployed (9 buses on Flyer fleet have system). Expand fleet-wide.
- Provide real-time arrival-departure information at terminal
- Deploy web-based trip planner.

**Benefits**

- Provides accurate, consistent information
- "Real Time" traveler information
- Greater accessibility to information
- Automated system frees up personnel
- Has been widely shown to improve customer satisfaction

Barriers

- Effectiveness of web-based trip planner depends on access to internet
- Integration across regional boundaries
- Funding availability
- Customer acceptance
- Reliability of schedule information

Logistics**Relevant Technologies:**

- CAD
- Communications infrastructure
- Data processing and handling capabilities
- Web interface

Pre-requisite Projects:

- Vehicle tracking (TO-1, TO-2, TO-3)

Cost Estimate:

- \$1,500,000 capital
- \$225,000/year

Participants

- MTA
Genesee County Regional Planning Commission
- Genesee County Sheriff Department
- Genesee Intermediate School District

ITS Definition

- ATIS 1 - Broadcast traveler information
- ATIS 2 - Interactive traveler information
- ATIS 5 - ISP based route guidance

Evaluation

- Increase in ridership
- User acceptance and satisfaction
- Reduced number of call center hours



Project Description

- Install electronic fare collection equipment on all MTA vehicles

**Benefits**

- Improved customer experience
- Speeds vehicle loading
- Tool for system planning and performance monitoring
- Fare management/auditing
- Reduces costs associated with fare boxes

Barriers

- Customer & staff acceptance
- Additional planning efforts required
- Coordination with SMART

Logistics**Required Technologies:**

- AVL (TO-2 and TO-3) and CAD are pre-requisites for some features
- MDTs recommended

Pre-requisite Projects:

- AVL (TO-1, TO-2, TO-3) and CAD

Cost Estimate:

- \$2,500,000 capital
- \$500,000/year O/M

Participants

- MTA
- SMART

ITS Definition

- APTS 4 - Transit passenger and fare management

Evaluation

- Data collection costs



Project Description

- Install collision warning systems on fixed-route fleet
- Reduces collisions by signalling driver when collision with pedestrian or vehicle is likely
- Rear facing sensors to make pulling back out of terminal bays
- Left side mounted sensors to assist buses re-entering traffic

**Benefits**

- Reduced collisions
- Less stress on operators
- Greater safety around MTA properties
- Potential for insurance reduction
- Experience is transferable to local partners

Barriers

- Technology is not still being tested for transit
- Operator acceptance
- Training

Logistics**Required Technologies:**

- Unknown

Pre-requisite Projects:

- Unknown

Cost Estimate:

- \$500,000 capital
- \$50,000/year O/M

Participants

- MTA
- Road Commission
- Municipal Public Works

ITS Definition

- AVSS-03 (Longitudinal)
- AVSS-04 (Lateral)

Evaluation

- Reduced collisions
- Operator acceptance
- Ongoing maintenance costs

Project Description

- Implement new purchasing/inventory/maintenance software to improve effectiveness and efficiency of MTA maintenance operations
- Support with training and new operational procedures

Benefits

- Reduced maintenance time per bus
- Fewer break downs
- Greater efficiency
- Inventory purchasing and control.
Direct connection with accounting
- Ability to track vehicle repair history

Barriers

- Established maintenance procedures
- Staff acceptance

Logistics**Required Technologies:**

- In shop hardware
- In shop software
- MDTs recommended

Pre-requisite Projects:

- CS-1, AVL, CAD,

Cost Estimate:

- \$250,000 capital
- \$25,000/year O/M

Participants

- MTA

ITS Definition

- APTS - 06

Evaluation

- Data collection costs



Project Description

- Install interface with in-vehicle sensors (if available) to monitor mechanical performance, collect performance data, and alert driver and dispatch of any malfunction
- Part of larger maintenance improvement program
- On-board diagnostics interface to return or store error codes

Benefits

- More efficient maintenance operations
- On-road trouble shooting

Barriers

- Established maintenance procedures
- Staff acceptance

Logistics**Required Technologies:**

- Supporting in-shop software program
- AVL & MDTs recommended

Pre-requisite Projects:

- Maintenance Software
- AVL and CAD

Cost Estimate:

- \$200,000 capital (\$2,000 per vehicle)
- \$20,000/year O/M

Participants

- MTA

ITS Definition

- APTS 6 - Transit Maintenance

Evaluation

- Data collection costs



Project Description

- Provide additional infrastructure for coordinated emergency response
- The early stages of emergency response coordination are underway in Genesee County
- MTA administration building as possible location. As MTA's AVL and CAD systems come online they will facilitate emergency management

**Benefits**

- Better response time
- Improved coordination between agencies

Barriers

- Institutional Coordination
- Communication between primary and MTA emergency management facilities

Logistics

Relevant Technologies:

- Close circuit television
- Variable message signs
- Detector loops
- Dynamic traffic signals
- Communications infrastructure
- Center-to-Center communications

Pre-requisite Projects:

- AVL (TO-1, TO-2, TO-3) and CAD are pre-requisites

Cost Estimate:

- \$500,000 capital
- \$50,000/year O/M

Participants

- MTA
- Genesee County Regional Planning Commission
- Genesee County Sheriff Department
- Fire Department
- Ambulance and EMS
- City of Flint

ITS Definition

- EM 1 - Emergency call-taking and dispatch
- EM 2 - Emergency routing

Evaluation

- Emergency response times
- User acceptance and satisfaction

Project Description

- Upgrade traffic signal controllers across county
- Pre-requisite for signal priority for buses or emergency vehicles
- At minimum, upgrades required along bus routes in Flint for TSP
- 2/3 existing City signals have little or no connection to central control or their environment

**Benefits**

- Ability to implement TSP/EVP
- Better connectivity to central control
- Improved signal timing capabilities
- Reduced signal delay

Barriers

- Traffic conditions may not warrant TSP/EVP resulting in little benefit
- Acceptance of the system by the public and by industry
- Need to train City Personnel in using/maintaining a new system
- Compatibility with neighbouring municipalities

Logistics

Pre-requisite for TSP/EVP

Relevant Technologies:

- Detector loops
- Dynamic traffic signals
- Communications infrastructure

Cost Estimate:

- \$1,500,000 capital
- \$225,000/year O/M

Participants

- City of Flint
- MTA
- Genesee County Regional Planning Commission
- Emergency services

ITS Definition

- ATMS 7 - Regional Traffic Control
- ATMS 8 - Incident Management Systems
- ATMS 13, 14 - Railroad Grade Crossing

Evaluation

- Vehicle delay
- On-time performance

