Automatic Vehicle Location (AVL) / Rural Transit
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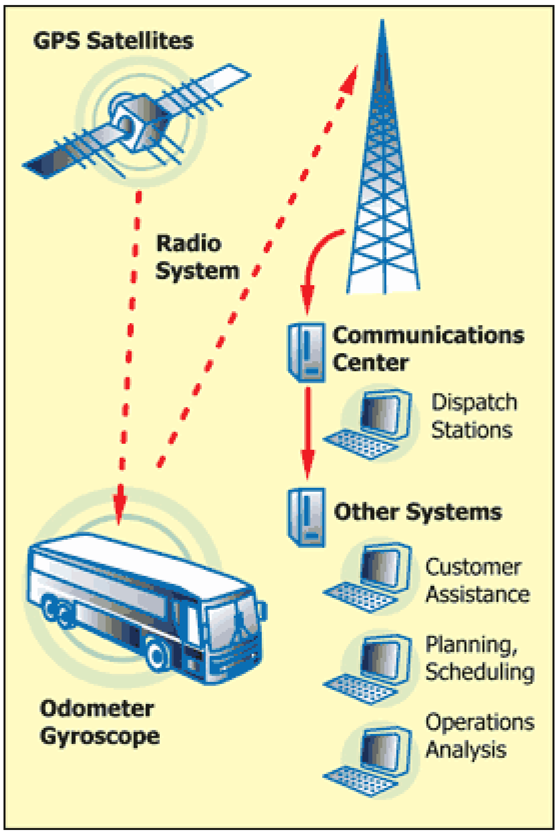
Technology Overview

Automatic Vehicle Location (AVL) systems calculate the real-time location of any vehicle equipped with a Global Positioning Satellite (GPS) receiver. Data are then transmitted to the transit center with use of radio or cellular communications and can be used immediately for daily operations as well as archived for further analysis.

Use AVL to:

- Enhance communication between vehicles and control center
- Optimize demand-response scheduling
- Provide real-time traveler information

As a stand-alone technology, an AVL system can be used to monitor on-time performance. When combined with other technologies, AVL can deliver many benefits in the areas of fleet management, service planning, safety and security, traveler information, fare payment, vehicle component monitoring, and data collection. Since the greatest benefits from AVL are achieved by combining it with other Intelligent Transportation System (ITS) technologies, AVL is most appropriate for **large rural agencies** with more than 30 vehicles that plan to implement a comprehensive ITS.



Common Technology Combinations

Daily Operations

Many rural transit agencies provide demand-response service. Combined with Computer-Aided Dispatch and Scheduling (CADS) and Geographic Information Systems (GIS), AVL allows vehicles to be rerouted in real time to accommodate schedule changes and optimize the number of trips provided. Agencies often realize reductions in nonrevenue miles, passenger wait times, and fleet size. With the addition of Mobile Data Terminals (MDT), drivers can be provided with maps and directions for each segment of their route.

Safety and Security

Many AVL systems incorporate **silent alarms** which allow drivers to covertly alert transit management and police of emergency situations. The vehicle location is displayed on a GIS map to facilitate incident response.

More Technology Facts

Traveler Information

Cape Cod Regional Transit Authority provides AVL data to passengers via its online GIS system. Passengers can check the status of their bus before going to the bus stop.

Maintenance

Ottumwa Transit Authority uses its AVL/MDT system to relay mechanical information about vehicles remotely. This allows maintenance staff to monitor the needs of remotely garaged vehicles.

Factors to Consider

Use of AVL by Ottumwa Transit Authority.
(Source: Rural ITS Best Practices)

Adequate Resources

- Capacity for data transmission and storage.
- Staff resources to analyze data and maintain and manage AVL system.

Integration

- Interoperability with existing and planned technologies.
- Flexibility for changes in fleet size.
- Component of regional ITS architecture.

Implementation

- Testing technology on a subset of vehicles.
- Contracting for adequate training of all staff.

AVL systems are core technology only for large rural agencies (30 or more vehicles) and medium-sized agencies (10-30 vehicles) that operate demand-response service. These agencies can spread the cost of the AVL system over a larger fleet size and are most likely to benefit from the increased systems planning and fleet management capabilities provided by AVL. Adding AVL to existing CADS or GIS systems greatly expands the capabilities of these technologies.

AVL systems are available at a wide range of costs and levels of sophistication to satisfy the budget constraints and needs of most agencies. Agencies with limited technical capacity and basic AVL needs may wish to consider off-the-shelf or even web-based systems. Agencies interested in integrating existing ITS systems or desiring specialized features can

Benefits and Costs

Benefits

- Kansas City achieved reduced incident-response time, from 7-15 to 2-3 minutes, with use of AVL.
- Ann Arbor saw voice-radio traffic reduced by 70% with use of AVL and MDTs.
- London (Ontario) saved $45,000 annually by eliminating manual schedule adherence checking.
- Collects driver log for use by payroll.
- Provides graphic or tabular report of vehicle activity (i.e., dwell time, speed).
- Sweetwater County, WY, almost doubled ridership without increasing dispatching staff by implementing AVL and CADS. Operating expenses decreased 50% per passenger mile.
- AVL and CADS allowed St. John's County Council on Aging in Augustine, FL, to reduce its scheduling, dispatching, and billing staff by half. Trips per vehicle hour have increased from 0.5 to 2.5.
- Collects driver log for use by payroll.
- Provides graphic or tabular report of vehicle activity (i.e., dwell time, speed).

Costs

Product Cost

Onboard GPS equipment ranges from $500 to $2,000 per vehicle; complete implementation costs (including control center hardware, installation, and training) range from $ 4,000 to $10,000 per vehicle. Required upgrades to communications systems can add significant costs. Additional ITS applications (CADS, real-time traveler information systems, automatic passenger counters (APC), automatic fare cards (AFC), video surveillance, silent alarms) are not included in these costs.

Operations and Maintenance

AVL alone provides limited operational savings. It facilitates communications and reporting and can improve systems planning. More significant savings are seen with the addition of CADS, which provides the ability to serve more customers with existing resources. Additional technology specialists are often needed to develop, manage, and maintain ITS systems. Consultants and manufacturers can provide some technical assistance, but in-house staff members are more effective for all but the smallest agencies.

Transit Agency Deployments

Agency	Contact Information	Number of Vehicles	Context / Success of Deployment
Ottumwa Transit Authority	2417 South Emma St. Ottumwa, IA 641-683-0695	51	Radio-based AVL system significantly improved communications, scheduling, and service management.
Arrowhead Transit (serving Northeast Minnesota)	221 West 1st St. Duluth, MN 800-642-7155	52	Deployed AVL-MDT technologies without CADS; some technical difficulties but moderate benefits.
Cape Cod Regional Transit Authority	P.O. Box 1988 Hyannis, MA 508-775-8504	80	Added AVL to existing CADS to create web-based vehicle location system.
Capital Area Rural Transportation System (CARTS)	2010 East 6th St. Austin, TX 512-389-1011	60	Added AVL to existing automated booking and CADS systems, which reduced paperwork and improved real-time scheduling.

Additional Resources

- Advanced Public Transportation Systems: State-Of-The-Art Update 2006 (March 2006), http://www.fta.dot.gov/documents/APTS_State_of_the_Art.pdf
- Best Practices for Using Geographic Data in Transit: A Location Referencing Guidebook - Defining Geographic Locations of Bus Stops, Routes and other Map Data for ITS, GIS and Operational Efficiencies (April 2005); http://www.fta.dot.gov/assistance/research/research_4611.html
- e-Transit: Electronic Business Strategies for Public Transportation (Volume 6) – Strategies to Expand and Improve Deployment of ITS in Rural Transit Systems - TCRP Report 84 / Project J-09 (2005); http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_84v6.pdf
- Geographic Information Systems: Applications in Transit - TCRP Synthesis 55 / Project J-7 (2004); http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_syn_55.pdf
- Guidance for Developing and Deploying Real-Time Information Systems for Transit (April 2003); http://ntl.bts.gov/lib/23000/23600/23663/RTTIS_Final.pdf
- Rural Transit ITS Best Practices (March 2003); http://www.itsdocs.fhwa.dot.gov/JPODOCS/REPTS_TE/13784.html
- Northeast Florida Rural Transit Intelligent Transportation System (February 2003); http://www.itsdocs.fhwa.dot.gov//JPODOCS/REPTS_TE//13654.html
- Guidebook for Selecting Appropriate Technology Systems for Small Urban and Rural Public Transportation Operators - TCRP Report 76 / Project B-17 (2002); http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_76.pdf
- Advanced Public Transportation Systems for Rural Areas: Where Do We Start? How Far Should We Go? - TCRP Web Document 20 / Project B-17 (June 2001); http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_webdoc_20.pdf
- Electronic Surveillance Technology on Transit Vehicles – TCRP Synthesis 38 / Project J-7 (2001); http://onlinepubs.trb.org/onlinepubs/tcrp/tsyn38.pdf