



**Homeland  
Security**

Science and Technology

U.S. Department of Homeland Security



System Assessment and Validation for Emergency Responders

The U.S. Department of Homeland Security (DHS) established the System Assessment and Validation for Emergency Responders (SAVER) Program to assist emergency responders making procurement decisions. Located within the Science & Technology Directorate (S&T) of DHS, the SAVER Program conducts objective assessments and validations on commercial equipment and systems and provides those results along with other relevant equipment information to the emergency response community in an operationally useful form. SAVER provides information on equipment that falls within the categories listed in the DHS Authorized Equipment List (AEL).

Information provided by the SAVER Program will be shared nationally with the responder community providing a life-saving and cost-saving asset to DHS, as well as federal, state, and local responders.

The SAVER Program is supported by a network of technical agents who perform assessment and validation activities. Further, SAVER focuses primarily on two main questions for the emergency responder community: "What equipment is available?" and "How does it perform?"

For more information on this and other technologies, please see the SAVER website or contact the SAVER Program Support Office.

RKB/SAVER Telephone: 877-336-2752

E-mail: SAVER@dhs.gov

Visit SAVER on the RKB website:

<https://www.rkb.us/saver>

Opinions or points of view expressed in this document are those of the authors and do not necessarily represent the view or official position of the U.S. Government.

This SAVER TechNote was prepared by the Space and Naval Warfare Systems Center Atlantic for the SAVER Program.



# TechNote

## Automatic Vehicle Locating Systems

Automatic vehicle locating (AVL) systems designed for surveillance operations enable law enforcement to discreetly track and monitor vehicles. AVL systems can report vehicle information, such as location, speed, and stops, to investigators by obtaining data from global positioning system (GPS) satellites. AVL systems are field-deployable and most can be mounted to the undercarriage of a vehicle in a matter of seconds.

### Technology Overview

There are two types of AVL systems: passive and active. Passive AVL systems, also known as data loggers, store location information and other relevant data to an onboard storage device for later retrieval. Active AVL systems can report events in near real-time and log data when communication is lost if the tracking device is equipped with onboard storage options. At a minimum, an AVL system is comprised of a tracking device attached to the tracked vehicle and a mapping application used to access the vehicle track information.



### Tracking Device

Components of the tracking device vary and are dependant on system type—passive or active.

**Passive AVL tracking devices** are typically comprised of a GPS receiver and an onboard storage device. Timing and navigation data is processed by the GPS receiver to provide location information, which is saved to an onboard storage device for retrieval at a later time.

Downloading data from a passive tracking device may require device removal from the vehicle and/or:

- A direct connection from the tracking device to a computer
- The removal of a memory module (e.g., secure digital 'SD' card) from the tracking device for data download
- A wireless network such as 802.11a/b/g that will automatically download the stored data when the tracking device is within range.

**Active AVL tracking devices** contain, at a minimum, the GPS receiver and a communication module. The communication module consists of a cellular, radio, or satellite modem that receives location information from the GPS receiver and transmits the data via a communications provider's

network for a monthly fee to the end user. Most active AVL systems permit the end-user to adjust the frequency of location updates through the user-interface. The communication module receives these adjustments from the end-user via the communications provider's network. Active tracking devices may feature onboard storage options to store location information if the real-time reporting capability is temporarily interrupted.

Some tracking devices are equipped with sensor inputs and/or contact outputs to monitor and interact with the vehicle. Sensor inputs enable the user to monitor the vehicle's activities such as door or trunk opening. Contact outputs can interface with vehicle systems to, for example, lock the doors or shut off the engine when commanded by the user. Sensor inputs and/or contact outputs are typically only available on permanently installed tracking devices.

## Mapping Application

The mapping application enables end-users to access and interpret the data collected by the AVL tracking device(s). The mapping application may be client-based and installed on individual computers that can retrieve the data for analysis from an agency's local network, or the application may be Web-based and permit users to access the data through a secure Web address.

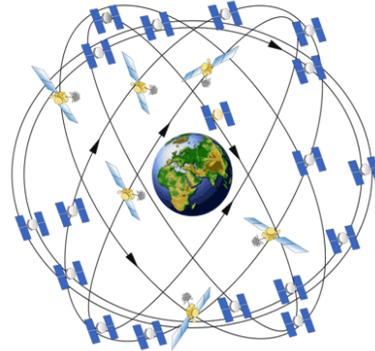
In addition to viewing location information, users may be able to use the mapping application to run analytical reports (e.g., number of vehicle stops, vehicle location history), export data, adjust the tracking device settings, and monitor the system status. Power management options, such as sleep mode, may be accessible through the mapping application and can be used to save battery life. Sleep mode is the ability of a tracking module to go into standby mode if the vehicle remains stopped for an extended amount of time and 'wake up' when the vehicle begins to move again.

## Location Accuracy

GPS receivers require data from at least four GPS satellites to calculate a true three-dimensional location. Some AVL systems feature assisted GPS (A-GPS), which aids in calculating the position of the receiver if data from at least four satellites cannot be collected. A-GPS also improves the receiver's time to first fix; the amount of time required for the receiver to calculate its position when it is first powered up.

Most GPS receivers, including those with A-GPS, can provide a location reading that is accurate within approximately 50 feet. The accuracy can be improved

to within 15–20 feet if the system is compatible with differential-GPS (D-GPS) or Space Based Augmentation Systems (SBAS). The SBAS that provides coverage in the United States is the Wide-Area Augmentation System (WAAS).



D-GPS uses local reference stations, such as radio towers, to correct errors in the original calculation and improve location accuracy. WAAS-enabled GPS receivers collect data from stationary satellites to acquire the necessary correction data to improve location accuracy. GPS receivers enhanced with WAAS or D-GPS send data to the tracking device's communication module via the communications provider's network.

## Power Requirements

Passive tracking devices have very low power demands and internal batteries can typically provide enough power to continuously log data over extended periods of time. Active tracking devices have greater power demands due to constant data transmission; therefore, active tracking devices may feature multiple power options to better suit varying operational needs. An onboard power source or small battery pack option may suffice for short-term operations; however, in order to limit the need for frequent battery replacements, mid- to large-sized battery packs or connection to the vehicle's battery may be well-suited for extended operation.

## Legal Considerations

When considering the application of AVL systems in surveillance operations, agencies should consult state and local regulations to ensure the system is being used lawfully and appropriately since regulations vary from jurisdiction to jurisdiction. Sources for guidance include the International Association of Chiefs of Police (IACP), <http://www.theiacp.org>, and the National Institute of Justice (NIJ), <http://www.ojp.gov/nij>. Tribal, local, and state law enforcement agencies, state attorney generals, and state associations of sheriffs and chiefs of police may also offer guidance.