Department of Transportation

EXHIBIT "A", SCOPE OF SERVICES

ITB-DOT-17/18-6153RC

TO PROVIDE AN AUTOMATED VEHICLE LOCATION (AVL) SYSTEM FOR ITS FLEET OF INCIDENT MANAGEMENT VEHICLES

PROJECT/PROPOSAL NUMBER:	ITB-DOT-17/18-6153RC
FINANCIAL PROJECT NUMBER:	441940-1-82-01

1.   Objective

The Florida Department of Transportation (FDOT), District 6 Traffic Operations, Transportation Systems Management and Operations (TSM&O) Office (hereinafter known as the "Department") is seeking a qualified Vendor to provide an Automated Vehicle Location (AVL) System for its fleet of Incident Management Vehicles. The Vendor shall provide an AVL system and supporting services as described in this scope of services document.

2.   Introduction

An AVL system for the Department typically consist of components such as, but not limited to; in-vehicle Global Positioning System (GPS) based transponder modem units, wireless communications services between transponder modem units and the SunGuide Transportation Management Center (TMC), supporting software that provides a visual depiction of the real-time location of the vehicle on a map along with vehicle status reporting capabilities and supporting services to operate, maintain, troubleshoot and repair all the equipment, hardware and software that make up the AVL system. The existing Department AVL system is integrated with the SunGuide software and any new AVL system acquired by the Department through a competitive procurement process shall also be integrated to the SunGuide software.

The SunGuide software is used by the Department to control and operate roadway Intelligent Transportation Systems (ITS) devices such as; closed circuit television cameras, highway traffic advisory signs (i.e. Dynamic Message Signs), vehicle detection devices, ramp signaling devices and express lanes tolling devices. By integrating the AVL system with the SunGuide software, the Department can monitor the Incident Management Vehicle fleet in real-time, view their location and vehicle status in the SunGuide map, thereby allowing the SunGuide TMC Operations staff to verify the number of incident management vehicles operational at any given time along with their travel route.

For the purpose of this scope of services, Incident Management Vehicles include road ranger pick-up trucks, flatbed trucks, incident response vehicles and tow trucks.

3.   Existing AVL System

The Department currently owns and has installed seventy-three (73) in-vehicle transponder units in the current Incident Management Vehicle fleet and is planning to increase the size of the fleet as demand grows for Incident Management Services. Table 1 below contains a list of the two (2) models of in-vehicle transponder units operational within the District. Detailed manufacturer's specifications cut sheets for both the in-vehicle transponder units are provided as Appendix A to this document.

Table 1 – District 6 Existing AVL Transponder Models

Description	Location	Number of Units
Xirgo Technologies XT – 2000 – G IntelliMatics GPRS Modem with Integrated GPS	Road Ranger tow trucks, flatbed trucks and incident response vehicle (IRV)	28
irgo Technologies XT – 2000 – O IntelliPort OBD II/GPRS Modem with Integrated GPS	Road Ranger pickup trucks and tow trucks	45

The existing AVL system currently uses an AVL module within the SunGuide software to display the AVL system data. The SunGuide software is not only used to control roadway ITS devices, but it is also used to exchange information between transportation agencies. A detailed SunGuide AVLRR System Interface Control Document and a Concept of Operations (ConOps) document are provided as Appendix B to this document. Appendix A and Appendix B are provided for reference information only. The new Vendor AVL system shall be capable of integrating with the SunGuide AVL module and have the same seamless functionality.

Upon a written request from the Vendor, the Department may allow the Vendor to visit the SunGuide TMC to obtain information regarding the current AVL system equipment and the SunGuide software prior to submitting their Contract Price Proposal.

To obtain access to the existing AVL system, the Vendor shall send a written request for approval to the Department two (2) weeks in advance of the planned visit. The Department shall have the right to deny the Vendor's request for a SunGuide TMC visit if the request is not made in the timeframe outlined in this paragraph.

No compensation shall be provided to the Vendor for performing the SunGuide TMC visit or associated research. The Vendor shall be completely responsible for any assumptions/inferences based on their review of the existing AVL system and SunGuide software, and for developing the technical proposal, contract price proposal or other documentation required to complete their proposal.

4.   Vendor Responsibilities

The Vendor shall be responsible for furnishing and installing all the equipment and devices required for an AVL system as defined in this scope of services. The requirements for the Vendor to furnish and install shall include all necessary hardware, software, communication services and incidentals for a fully functional and operational system for the term of this contract, which includes but is not limited to:

- **AVL System In-Vehicle Equipment:**

  Furnish, install, operate, and maintain brand new fleet tracking General Packet Radio Service (GPRS) transponder modem units similar to the Xirgo technologies transponder units (XT-2000 Series). After the transponder modem units have been furnished and installed, the Vendor shall be responsible for troubleshooting, repairing or replacing any malfunctioning devices.

  The Vendor may choose to propose alternate transponder units (non-Xirgo technologies) that meet the requirements of this scope of services document. The vendor shall submit the proposed equipment's manufacturer's specifications to the Department for review and approval prior to use on the Contract. All services supporting these units shall meet with the requirements of this scope of services document.

- **AVL Software:**

  Furnish, install, integrate, operate, maintain and upgrade (i.e. upgrade when   required by the Department) AVL software, including any hardware/equipment required to make the AVL software functional as described in this scope of services.

- **AVL System Communication Services:**

  Provide wireless communications between the in-vehicle equipment and TMC equipment.

- **AVL System Upgrades:**

o   Hardware or Wireless Communication Upgrade

For any upgrades deemed necessary by the Department related to the <u>hardware or wireless communications</u> components of the AVL system to support future SunGuide software upgrades, the Department shall amend the Contract Price Proposal and negotiate the price for the new hardware or wireless service.

o   Software Upgrade

For any upgrades deemed necessary by the Department related to the <u>software component</u> of the AVL system, refer to Section 8 of this scope of services document.

o   Firmware Upgrade

The Vendor shall notify the Department of any firmware updates, as needed, to the existing and new AVL system hardware components that become available during the term of the Contract, and upon approval by the Department, shall install the updates at no additional cost to the Department.

The Vendor shall be compensated for the work and services described in this section and throughout this scope of services under pay item "Monthly AVL Services". The only exception is for an AVL system software upgrade that is triggered by the Department as a result of a software upgrade to the SunGuide software. The pay item "AVL SunGuide Interface Software Upgrade" shall be used to compensate the Vendor for this activity. Vendor non-compliance may result in compensatory adjustments for non-compliance as described in Section 11.

5.   Transition Period

The Vendor shall have fifteen (15) calendar days from the beginning of the first LOA to install and furnish all incident management vehicles with new and compatible AVL equipment. That is, the Vendor shall begin full AVL system services by the sixteenth (16th) day from the start of the first LOA. If this requirement is met, the Vendor shall invoice the first full month for AVL system services. If this requirement is not met, the Vendor shall invoice the prorated price for AVL system services based on the calendar day they provide AVL services for all Incident Management Vehicles noted in the first LOA.

Before the end of this contract's term, the Vendor shall remove all AVL equipment from the incident management vehicles no earlier than ten (10) calendar days prior to the end of the contract, at no cost to the Department. The Vendor shall be allowed to invoice the full months' worth of AVL services provided.

No work activity under this Scope of Services shall start without a LOA/TWO issued by the Department's Project Manager. The Department shall have the ability to amend the Contract to obtain any additional materials or services not listed in this scope of services document, but exclusively related to the AVL system.

6.   System Requirements

The Vendor provided new AVL system shall meet or exceed the following minimum system requirements:

- The Vendor's AVL system shall support and be integrated with the current SunGuide software and shall be modified, as needed, to support all future SunGuide software updates within the term of the Contract per terms in Section 8.

- The Vendor's AVL system shall be compatible with and support the in-vehicle transponder modem units listed in Table 1.

- The AVL system shall provide incident management vehicle location as longitude and latitude. The AVL system shall report vehicle locations accurate to within sixteen (16) feet in weather conditions from clear to heavy rain and dense cloud cover, except when under or inside a man-made structure.

- The AVL system shall provide vehicle speed. The vehicle speed shall be provided in miles/hour (MPH).

- All hardware/equipment provided under this Contract shall provide a vehicle speed data accuracy of +/- 2 MPH.

- The Vendor AVL system software shall store and display a vehicle speed with precision of 1 MPH.

- The vehicle speed data shall not average more than a 5-second period.

- The AVL system shall provide vehicle heading in degrees accurate within 5 degrees.

- The AVL system accuracy required for location shall be achieved within one minute of providing power to the in-vehicle AVL equipment after being powered off for at least eight (8) hours when the device has not moved more than 25 miles since the last time if was powered on.

- Individual vehicle information shall be sent at least once per minute when powered-on, even if nothing has changed.

- The Vendor shall obtain certification from an independent party or demonstrate to the Department within thirty (30) days of issuance of the Contract Notice to Proceed (NTP) by the Department that the Vendor's AVL system is capable of meeting the vehicle speed, location and heading accuracy requirements as stated in this scope of services document.

- A Geofence is defined as a configured set of virtual boundaries for a real world geographic area. The AVL system shall be capable of defining Geofences as closed polygons with an arbitrary number of vertices using the AVL vendor software. The AVL system shall have a feature to allow for Department configuration of Geofences by drawing polygons on the map and specifying attributes of the geofences, including a unique geofence identifier, type of geofence (e.g., inclusion/exclusion) and maximum speed.

- The Geofencing feature shall allow for a vehicle to be referenced to one or more Geofences.

- The Vendor software shall produce a real time alarm whenever an incident management vehicle enters a Geofence configured for exclusion or exits a Geofence configured for inclusion, including the vehicle ID, geofence ID, type of alarm and time of alarm. In the case of an inability to communicate an alert due to a communication failure, these shall be communicated when connection is reestablished, but only if the geofence violation is still active, i.e. the vehicle is still in an exclusion geofence or has traveled outside of an inclusion geofence and remains there.

- The Vendor software shall generate a report showing all geofence violations within a specified date/time interval, regardless of whether an alert could be produced, including vehicle ID, timestamp to one second, vehicle location (lat/long), geofence identifier, and condition (entry or exit), and shall sort and group data by vehicle and sort data for each vehicle by timestamp.

- At the time of transmission to the SunGuide TMC, no transmitted datum may be more than 5 seconds old, except when queued due to transmission failure, and shall be time stamped with an accurate timestamp.

- The AVL system shall use an accurate time reference (e.g. GPS) and shall provide timestamps that are accurate to within 2 seconds.

- The vehicle data shall be communicated to the SunGuide TMC via an Internet connection or other means approved by the Department.

- Data shall not be used by or made available to outside organizations unless authorized by the Department.

- All data shall be stored by the Vendor for a minimum of ninety (90) days, unless otherwise requested by the Department or by Court Order.

- When requested by the Department, the Vendor shall provide new hardware/equipment that is capable of detecting and reporting the activation/deactivation of up to three 12V accessories.

7. <u>Software Requirements</u>

The Vendor provided AVL system software shall meet or exceed the following minimum requirements:

- The Vendor's AVL system software shall support and be integrated with SunGuide software.

- The Vendor's AVL system shall be a web based application.

- The AVL system shall have user account control to manage administrative and user privileges, e.g. username and password for system use and security access.

- The AVL system administrator accounts shall be capable of restricting a user's ability to modify configurable parameters.

- The AVL system administrator accounts shall be capable of restricting a user's access to a certain group of vehicles.

- The Vendor's AVL system software and license shall allow installing it on, and/or using it from, multiple workstations to operate the software simultaneously without any additional cost to the Department.

- The AVL system shall detect the following conditions and report them within 5 seconds after detection of the condition, via alerts based on the vehicle ID (allows different alerts for different vehicles) using the AVL system software:

  o Vehicle stopped for more than a user-configurable time (in seconds)

  o Vehicle moving after reporting a stopped vehicle condition

  o Vehicle engine transition between on and off in either direction

  o Vehicle is traveling outside of a Geofenced area/zone associated with that vehicle and that Geofence is configured for inclusion, or inside a Geofence associated with that vehicle and that Geofence is configured for exclusion, for more than a user-configured length of time, which shall be configurable from one (1) minute to forty (40) minutes

  o Vehicle's speed exceeds the configured maximum speed for a geofence by a configurable amount for a configured minimum time (default 1 minute)

- The Vendor's AVL system software shall include a web based graphical user interface (GUI) software module capable of providing the following visual and reporting capabilities:

  o Vehicle Tracking Screen:

- Provide each in-vehicle transponder unit with a unique identifier (ID). All vehicle IDs shall be configurable alphanumeric values so that they can be made to match the designations used in SunGuide – both for sending data to SunGuide and displaying in the vendor's map display.

- Support a roadway map view with the option of selecting or not selecting an aerial image background of Miami-Dade, Broward and Monroe Counties. The roadway system map shall show a graphic representation of each vehicle with its unique ID at its current location.

- The graphic vehicle ID icons when shown on the roadway map shall be color coded to distinguish among the following conditions:
  - Vehicles that are moving
  - Vehicles stopped with ignition "ON" for less than a configurable stopped vehicle threshold (minutes)
  - Vehicles that have been stopped with ignition "ON" for at least the stopped vehicle threshold
  - Vehicles with ignition "OFF"
  - Colors used shall be approved by the Department.

- Vehicle ignition status shall be updated every one (1) minute and shown on the roadway map for vehicles with ignition "ON". When the vehicle ignition is "OFF", the status shall be updated every one (1) hour after the initial transition to "OFF", which shall be reported within one (1) minute.

- When selected on the map by the User, each vehicle, at a minimum, shall show the following information:
  - ID;
  - Time at which the most current data was sent from the vehicle;
  - Vehicle heading (travel direction (e.g. N, S, etc., not degrees); and
  - Speed (MPH) at which vehicle is moving.
  - Allow the user to zoom-in to select a more detailed aerial view of a vehicle's location.

  - Email Alerts

    - The software shall be capable of providing e-mail alerts to a pre-selected e-mail distribution list.

    - An e-mail distribution list shall be configurable for each alert, which allows the User to add and/or remove e-mail addresses for that alert.

    - Each alert shall allow selection of one or more vehicles and, for each vehicle selected, the software shall support the following minimum e-mail alert conditions:

    - Transition in either direction between engine ignition "ON" mode and "OFF" mode;

    - Vehicle stopped - the vehicle stopped e-mail alert shall have a configurable minimum time (in seconds, to at least 9999) that the vehicle must remain stopped in order to produce the alert message;

    - No contact (communication) with the vehicle for a 1 hour period, unless the last status reported was engine "OFF";

- Geofence violations;

- Vehicle transponder device reconnected (to track system tampering).

o Reporting Capabilities:

The Vendor software shall provide, at minimum, the following reporting capabilities:

- Stop time report, which shall:

  o allow the User to select a time period (dates and times), vehicle IDs (individual or multiple selection), and minimum and maximum stoppage duration to be included in the report.

  o provide details about each vehicle stop for which the initial time and duration meet the selection criteria, including vehicle identifier, time at which vehicle stopped, duration of stop (or ending time) and location (longitude and latitude), on-screen with headings, sorted by vehicle ID (ascending) and then date/time (ascending),

  o include a map on which all selected stopped vehicle events are shown initially, which can be moved and zoomed when displayed on-screen,

  o allow the User to print the on-screen data, including the map, and

  o allow the User to save the data in various formats, including MS Word and MS Excel, including headings and alignment of data to support additional analysis.

- Map trace/playback, which shall:

  o allow the User to select a time period(dates and times) and vehicle IDs (individual or multiple selection).

  o play back every update for the selected vehicles throughout the specified time period on an on-screen map, including showing vehicle ID and speeds on/adjacent to the vehicle,

  o allow the user to pause, rewind (fast reverse, not restart) play, and fast-forward the vehicle trace map updates. Forward and reverse playback shall support at least 1x, 2x, 4x and 8x speeds.

  o Change icon color according to vehicle status (off, on, moving, etc.)

- Events Report, which shall:

  o allow the User to select a time period(dates and times) and vehicle IDs (individual or multiple selection)

  o provide an on-screen list of every AVL update, including vehicle ID, vehicle status (normal, ignition on, ignition off, and signal loss) and speed,

  o allow the user to print the on-screen information,

  o allow the User to save the data to MS Word and MS Excel documents, including headings and alignment of data to support additional analysis.

- AVL statistics Report, which shall:

  o allow the User to select a time period(dates and times) and vehicle IDs (individual or multiple selection)

  o provide various AVL system related statistics for the selected period for each vehicle, including:

- cellular signal quality (measured in percentage),

- GPS lock (measured in number of satellites),

- battery voltage (measured in volts to one decimal place), and over speed count (measured in number of events).

  o show the information in tables/charts.

  o allow the User to print and/or save the report to MS Word and MS Excel documents, including headings and alignment of data to support additional analysis.

  o Report over speed counts as the number of times a vehicle speed is in each of following speed intervals for more than one (1) minute:

    - >= 70mph and <= 79 mph

    - >= 80mph

8. AVL-SunGuide Interface Software Upgrades

For any upgrades deemed necessary by the Department related to software portions of the AVL system, the Vendor is responsible for performing the necessary updates. All AVL-SunGuide Interface Software Upgrades shall be paid on a per occurrence basis, using the "AVL-SunGuide Interface Software Upgrade" contract price proposal item. The software upgrade, shall include at a minimum, the following:

- Changes to the messages or XML schemas used to communicate with SunGuide.

- Arguments or elements that are added, removed or renamed and

- Changes to the structure of the data.

- Data not currently supported by the SunGuide XML schema, but required to be produced by the vendor's software shall be provided to SunGuide software if SunGuide software adds support in the schema for transfer of such data.

Updated software shall be available for testing with SunGuide software within sixty (60) days after delivery of updated SunGuide software interface documentation to the vendor. This shall also include software deployment and coordination with the SunGuide software developer.

For more complex changes to the SunGuide interface, the Department shall amend the Contract and negotiate a scope and a price for the upgrade.

9. Vendor Software and Platform Software Updates

For any Vendor software related updates other than the AVL-SunGuide Interface Software Upgrades that become available during the term of the Contract, the Vendor shall make the updates available to the Department at no additional cost to the Department. The Department shall not be required to install these updates. This cost shall be considered an incidental and shall be covered under the "Monthly AVL System Service" pay item.

The Vendor shall be responsible for changes required to be compatible with updates to platform software, such as operating systems and libraries and shall be compatible with the latest version of at least one of the following browsers: Internet Explorer 11, Edge, Chrome or Firefox.

10. Wireless Communications Services

The Vendor shall provide the necessary wireless communications services between the in-vehicle transponder modem units and the SunGuide TMC. The Vendor shall provide details of

the proposed data plan required to support the Vendor's AVL system along with the technical proposal.

For all new in-vehicle transponder units, the wireless communications services shall begin from the time of initial operation of the unit by the Department.

During periods of communications failures, i.e. where there is no connectivity between the Vendor AVL system and SunGuide software, the Vendor AVL system shall continue to record activities and shall report the information when the connectivity is resumed. The software shall provide the ability to configure how queued data are sent to SunGuide, allowing either in-order delivery or delivery of new updates immediately as they become available and transfer of other queued data as a lower priority.

11.   Non-Compliance / Non-Performance

This is a performance based contract in which the Vendor's compliance with this Scope of Services is evaluated periodically by the Department. On instances where the Department finds that the Vendor fails to comply with a specific provision(s) of this contract, the Department shall reduce from the monthly invoice the amounts indicated in Section 11.2 or, at the Department's discretion, may terminate this contract and/or any amendments.

If the Department determines that the performance of the Vendor is not satisfactory, the Department shall take the actions described in Section 6, of the Standard Written Agreement. Any necessary default action will be processed in accordance with the Department of Management Services Rule 60A-1.006(3).

11.1   AVL System Performance Measures

The Vendor shall be required to meet the AVL System Performance Measures described in this section.

Availability of the AVL system is calculated by subtracting downtime from the total time in the period, which shall be the calendar month for which availability is assessed and dividing by the total time in the period, expressed as a percentage. Downtime shall be calculated from initial Vendor notification until successful repair/replacement.

The Vendor shall meet or exceed the following minimum performance measure requirements:

- The Vendor shall maintain, in its entirety, the AVL software and hardware/equipment purchased using this Contract.

- The Vendor shall ensure that 98 percent of vehicle position and status reports are provided as required. If this is not met, the Department may assess a Non-Performance invoice reduction as per Section 11, Table 2.

- The Vendor shall ensure at least a 98 percent availability of devices installed in vehicles on a per-device basis. If this is not met, the Department may assess a Non-Performance invoice reduction as per Section 11, Table 2.

- The Vendor shall ensure that the AVL software availability is at least 98 percent. The Department may review the AVL software availability and assess a Non-Performance invoice reduction as per Section 11, Table 2 if the requirement is not met.

- The Vendor shall provide repair services for all AVL system software related issues and wireless communications services. The Vendor shall provide an acknowledgement within one (1) hour from time of initial notification by the FDOT Project Manager (or designee) of a failure. Failure by the Vendor to meet this

requirement may result in the Vendor being assessed a Non-Performance invoice reduction as per Section 11, Table 2.

- The Vendor shall repair/replace failed equipment for all equipment provided to the Department under this Contract. The Vendor shall provide an acknowledgement within one (1) hour from time of initial notification by the Department of a failure. Failure by the Vendor to meet this requirement may result in the Vendor being assessed a Non-Performance invoice reduction as per Section 11, Table 2.

- The Vendor is required to maintain an inventory of spare equipment as necessary to replace any failed equipment during the Contract-term.

  o Spare inventory shall not be considered as part of the active AVL equipment/system and shall not be paid as separate bid items and shall be included in the Contract Price Proposal item.

- The Vendor shall not be paid separately for the repair/replacement services; these shall be included in the unit price of the bid item.

- For all equipment which fails two (2) times within 30 consecutive days, the Vendor shall replace the failed equipment at no additional cost to the Department and shall no longer use this failed device on this Contract.

- Upon request by the Department, the Vendor shall submit a report within 5 business days detailing all failures during the life of the contract by device ID.

- The Vendor shall provide on-site maintenance at the SunGuide TMC, Road Ranger Contractor's yard and in the field (within Miami-Dade, Monroe and Broward Counties) which shall include, but is not limited to, replacing in-vehicle equipment, pick-up of equipment in need of repair, packing, and shipping of equipment to repair depot, delivery and reinstallation after repair, technician's travel time, and other travel-related expenses, i.e. fuel, vehicles, etc.

- The Vendor shall provide a contact person(s) along with their telephone number(s), email address(es), and fax number(s) to whom the Department will send notifications of AVL system failures. The Vendor is responsible for updating the contact information with the Department in writing, as needed (i.e., information changed) or as requested by the Department, during the term of the Contract to ensure that the Department has accurate contact information. The Vendor shall be responsible for ensuring that notifications sent to the previous telephone numbers, e-mail addresses and/or FAX numbers shall be received and handled by the Vendor for at least ten (10) days after the notification of a change is sent to the Department.

- The required response times shall begin when notification is first sent to any of the Vendor-provided telephone numbers, e-mail addresses or FAX numbers. All Vendor acknowledgments to the Department's requests shall be via email. Failure by the Vendor to meet this requirement may result in the Vendor being assessed a Non-Performance invoice reduction as per Section 11, Table 2.

- The Vendor shall notify the Department Project Manager of any changes in Vendor Program Manager in writing within three (3) business days of the change, including the date of the change and the new Program Manager's Name, Title, Telephone Number(s), and E-mail address. Correspondence sent by the Department to the previous Program Manager shall be routed to the new Program Manager by the Vendor for a minimum period of 30 days after the change. Failure by the Vendor to meet this requirement may result in the Vendor being assessed a Non-Performance invoice reduction as per Section 11, Table 2.

- All AVL system equipment that is replaced shall be replaced by equal or better equipment. When substituting equipment, the vendor shall prove equal or better equipment functionality and the substitute equipment must be approved by the Department prior to installation.

- All replacement/repaired equipment shall be reprogrammed (if applicable) and installed at the SunGuide TMC or incident management vehicles, whichever is applicable, at no additional cost to the Department.

- If desired by the Department, the Vendor shall coordinate directly with the Department's SunGuide software development team regarding AVL system software failures. Close coordination between the Vendor and the SunGuide software developer will help reduce the delays in identifying, isolating and resolving failures.

- The Vendor shall perform any firmware updates to AVL system hardware components that become available during the term of the Contract at no additional cost to the Department.

- The Vendor shall maintain a record of the current firmware version of each device and the date and approximate time at which the Vendor installed any firmware update. This data shall be made available to the Department upon request.

- The vendor shall maintain a record of which device is installed in each vehicle and the date and approximate time at which any change was made. This data shall be made available to the Department upon request.

- Exceptions to the Service Maintenance Plan: The repair or replacement of equipment that has become defective through, including, but not limited to, damage caused by accidents, physical or electronic abuse or misuse, acts of God, fires, use in environmental conditions not conforming the product specifications.

11.2   Penalties / Invoice Reductions

It is recognized that this contract is a "Performance Based" contract in which the Vendor's performance and compliance with the Scope of Services shall be evaluated periodically by the Department.

On occurrences where the Vendor does not meet or exceed the performance standards established herein, the Department shall reserve the right to assess the Vendor "Compensatory Adjustments" that shall be deducted from the monthly Vendor invoice. Compensatory adjustments to Vendor invoice payments may be assessed in combination for multiple infractions. The Department, at its discretion, may assess partial compensatory adjustments for each occurrence.

There will be a fifteen (15) day period from July 1, 2018 through July 15, 2018 during which no penalties will be assessed in which the Vendor shall install, configure and make all components operational as described in Section 5. Penalties in July 2018 will be calculated based on the remaining portion of the month.

Table 2 – Penalties / Invoice Reductions

Requirement	Threshold	Penalty
AVL software availability requirement on a monthly basis	98%	$500 per occurrence
AVL device availability requirement assessed on a monthly basis	98%	$500 per occurrence
Vehicle Position and Status reports provided as required assessed on a monthly basis	98%	$250 per occurrence
Acknowledgment of equipment failure	1 hour	$100 per occurrence
Vendor Project Manager Update	3 business days	$500 per occurrence

No penalties shall be assessed for the transition period (first and last month) as described in Section 5.

Failure by the Vendor to meet the requirements in Section 11 may cause the Department to terminate this Contract.

12. Optional Services

The Vendor shall provide other optional services as requested by the Department in support of the AVL system. The Vendor will, upon receipt of a Contract Modification from the Department, where both parties have mutually agreed to the compensation for time and/or material, perform optional services not otherwise identified in this Contract as may be required by the Department in connection with the scope of this Contract.

Appendix A - Existing Equipment Specifications

XT-2000G OBD II/GPRS Modem with Integrated GPS

XT-2000G is the most versatile and economical diagnostic device available today for communicating vital vehicle information to owners via ubiquitous GSM/GPRS networks. With an optional integrated GPS engine, embedded dual band cellular GPS antennas, and integrated OBDII interface, XT-2000G is the ultimate solution for fleet managers in need of monitoring location, speed, VIN, ignition status and many other codes available on the OBD port of vehicles. With an integrated J1962 connector, an extremely compact design powered through the OBD port, and low power consumption, XT-2000G can be installed in a matter of seconds by anyone without tools or manuals making it truly plug and play.

XT-2000G, which operates on GSM/GPRS network, supports TCP, UDP and FTP protocols and can be completely configured and updated over-the-air. The highly sensitive, discrete GPS antenna design provides optimal performance in a small package. The XT2000G supports countless standard OBDII protocols making it compatible with a majority of vehicles available in North America.

XT-2000G is another example of Xirgo Technologies' dedication to design and manufacture of superior products.

XT-2000G Summary

- GPRS class B multi-slot class 10

- Supports 850/1900 MHz

- LED status indicators for GPS lock, GSM registration and OBD II lock

- Over-the-air firmware upgrade

- Supports TCP, UDP, FTP

- Optional integrated GPS engine and antenna for tracking applications

- Supports SMS connectivity

- Supports all OBDII protocols

- No external antennas or power connectors needed

Specifications

Frequency Band   850/1900 MHz
Transmit Power   33 dBm@ 850 MHz
                                    30 dBm @ 1900 MHz
Status Indicators   Network registration/GPRS
                                    GPS position acquisition status
                                    OBDII lock status

GPS specification
- Receiver   50 channel
- Receiver Sensitivity   -161 dBm
- Accuracy   +/- 2.5m CEP
- Cold Start   <33 sec
- Hot Start   < 1 sec

Network Functionality
- Auto-Register to GPRS network
- GPRS Class B, Multi-Slot 10
- Supports TCP, UDP and FTP
- OTA Firmware Upgrade Using FTP
- SMS connectivity

OBD II Protocols Supported
- J1850 PWM
- J1850 VPW
- ISO-9141-2
- ISO-14230 KWP2000
- ISO-15765 CAN

Power Specifications
- D.C. Power   6-18 VDC
- GSM 850   35mA average @12V
- GSM 1900   30mA average @12V

Physical Connection
- OBD Connector   J1962
- GPS Antenna   Integrated
- Cellular Antenna   Integrated dual-band (850 and1900 MHz)

Mechanical
- Case Material   ABS plastic
- Dimensions   1.8" X 1.5" X 1"
- Weight   <2 oz.
- Operating Temperature   -30°C to +75°C

Available Configurations
- XT-2000G-X001 Standard OBD Modem
- XT-2000G-X041 Motion detector; limited direct OBD parameter parsing
- XT-2000G-X081 Standard OBD Modem + Accelerometer

Xirgo Technologies
www.xirgotech.com
(805) 426-5095

XT-2000-O
IntelliPort
OBD II/GPRS Modem with Integrated GPS

XIRGO TECHNOLOGIES

IntelliPort is a technology platform that allows Xirgo to rapidly develop customized telematics devices to communicate vital information from passenger vehicles and light-duty trucks using the OBDII protocol and the ubiquitous GSM/GPRS network. With an optional integrated GPS engine, embedded cellular, PCS and GPS antennas, and integrated OBDII interface, IntelliPort is the basis for the ultimate solution for fleet managers in need of monitoring location, speed, and parameters available on the OBD port of vehicles. With an integrated J1962 connector, an extremely compact design powered through the OBD port, and low power consumption, IntelliPort can be installed in matter of seconds, which substantially reduces the high cost of installation.

The mature firmware modules used in IntelliPort support TCP, UDP, FTP and are capable of firmware update over-the-air. With a highly sensitive GPS engine along with an integrated GPS antenna and multiple OBD II protocols supported, IntelliPort can be installed in majority of vehicles available in North America.

IntelliPort is another example of Xirgo Technologies' dedication to a flexible design-to-manufacture model that reduces time-to-market for customized products for various M2M and telematics verticals.

XT-2000-O
Summary

- GPRS class B multi-slot class 10

- Supports 850/1900 MHz

- LED status indicators for GPS lock, GSM registration and OBD II lock

- Over-the-air firmware upgrade

- Supports TCP, UDP, FTP

- Optional integrated GPS engine and antenna for tracking applications

- Supports SMS connectivity

- Auto-detects OBDII protocol

- No external antennas or power
- connectors needed

Specifications

Frequency Band	850/1900 MHz
Transmit Power	33 dBm@ 850 MHz
	30 dBm @ 1900 MHz
Status Indicators	Network registration/GPRS
	GPS position acquisition status
	OBDII lock status

GPS specification

- Receiver   16 channel
- Receiver Sensitivity   -158 dBm
- Accuracy   +/- 2.5m CEP
- Cold Start   <38 sec
- Hot Start   < 3 sec

Network Functionality

- Auto-Register to GPRS network
- GPRS Class B, Multi-Slot 10
- Supports TCP, UDP and FTP
- OTA Firmware Upgrade Using FTP
- SMS connectivity

OBD II Protocols Supported

- J1850 PWM
- J1850 VPW
- ISO-9141-2
- ISO-14230 KWP2000
- ISO-15765 CAN

Power Requirement

- D.C Power   6-18V
- GSM 850   35mA average @12V
- GSM 1900   30mA average @12V

Physical Connection

- OBD Connector   J1962
- GPS Antenna   Integrated
- Cellular Antenna   Integrated dual-band (850-1900 MHz)

Mechanical

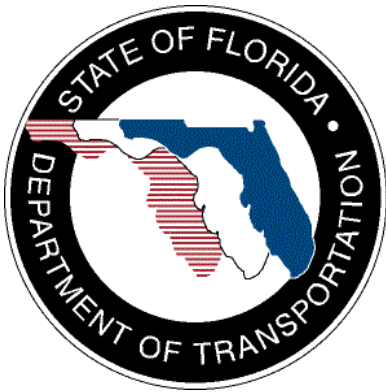|	
Case Material	ABS plastic
Dimensions	1.8" X 1.5" X 1"
Weight	<2 oz.
Operating Temperature	-30°C to +75°C

XIRGO TECHNOLOGIES

425 Constitution Ave.
Camarillo, CA 93012
Office- (805) 426-5095
Fax- (805) 389-1023

Appendix B - Existing SunGuide Software AVL Module Documentation

SunGuide®:

AVLRR System Interface Control Document

SunGuide-AVLRR-ICD-5.0.1

Document Control Panel			
File Name:	SunGuide-AVLRR-ICD-5.0.1		
File Location:	SunGuide CM Repository		
CDRL:	6-1		
	Name	**Initial**	**Date**
Created By:	Brandon Meiners, SwRI	BM	09/13/2007
Reviewed By:	Steven W. Dellenback. SwRI	SWD	10/16/07
	Steve Dellenback, SwRI	SWD	11/14/07
	Robert W. Heller	RWH	06/11/10
Modified By:	Meredith Moczygemba, SwRI	MRM	10/3/2007
	Steve Dellenback, SwRI	SWD	11/14/07
Completed By:			

Table of Contents

List of Figures

List of Acronyms

ATMS	Advanced Traffic Management System
AVLRR	Automatic Vehicle Location / Road Ranger
DOT	Department of Transportation
FDOT	Florida Department of Transportation
ITS	Intelligent Transportation Systems
ITN	Invitation to Negotiate
SwRI	Southwest Research Institute
TMC	Traffic Management Center
XML	Extensible Markup Language

REVISION HISTORY

Revision	Date	Changes
3.0.0	October 16, 2007	Initial Release
3.0.1	November 14, 2007	Added "how to use this document" section
5.0.1	June 11, 2010	Updated for Release 5.0.1

1. Scope

1.1 Document Identification

This Interface Control Document (ICD) describes the interface between individual SunGuide^{TM} clients and the Automatic Vehicle Location / Road Ranger (AVLRR) subsystem and between the AVLRR subsystem and the associated drivers. The general base architecture of the XML communications including connection information, byte order and base transaction classes is delineated in the general ICD. This ICD defines Extensible Markup Language (XML) schemas upon which XML requests shall be based in communicating amongst the various processes. Refer to the SunGuide-General-ICD document for details regarding data transfer.

1.2 Project Overview

The Florida Department of Transportation (FDOT) is conducting a program that is developing SunGuide software. The SunGuide software is a set of Intelligent Transportation System (ITS) software that allows the control of roadway devices as well as information exchange across a variety of transportation agencies. The goal of the SunGuide software is to have a common software base that can be deployed throughout the state of Florida. The SunGuide software development effort is based on ITS software available from the state of Texas; significant customization of the software is being performed as well as the development of new software modules. The following figure provides a graphical view of the software to be developed:
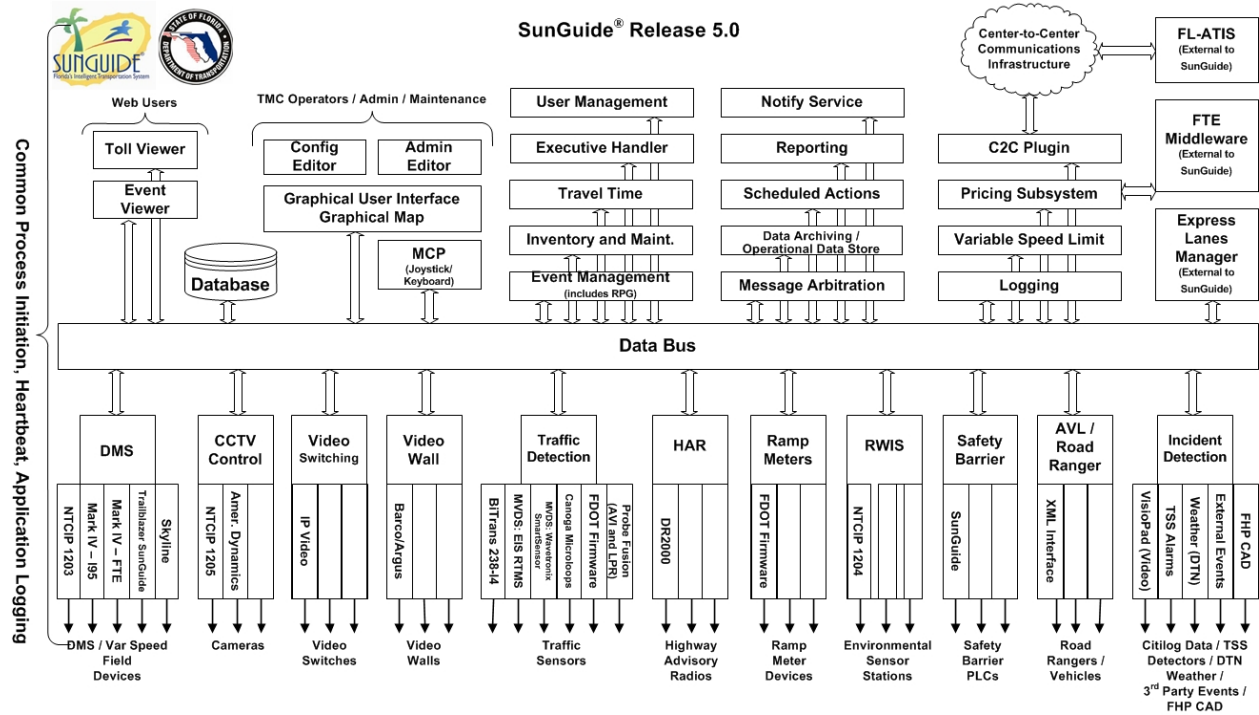

Figure 1.1 - High-Level Architectural Concept

1.3 How to Use This Document

The ICDs describe the specific interface between two SunGuide subsystems or between a SunGuide subsystem and a SunGuide driver. The relationship of appropriate documents is shown in the Figure 1-2.
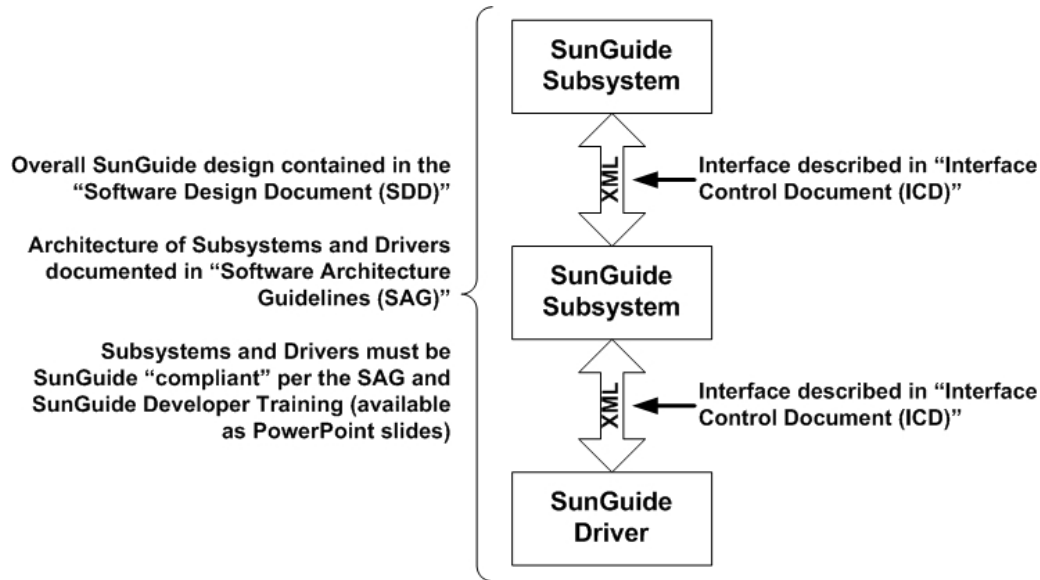

Figure 1-2 - SunGuide Developer Documentation

This document describes an *internal* SunGuide interface. The interface described is between two SunGuide compliant processes. The reader should review the following document to gain an understanding of how SunGuide compliant application is created (this will vary if the application is a driver or subsystem):

> *SunGuide Software Architecture Guidelines* (SAG)

The SAG describes what needs to be included in a SunGuide application to assure that it will work cooperatively in the SunGuide environment. Once the SAG is reviewed, the following document should be reviewed:

> *SunGuide Software Design Document* (SDD)

The SDD will provide an understanding of how individual components of SunGuide were designed. Finally the ICD, along with the associated schema should be reviewed to determine what data needs to be exchanged on the interface being defined in this document.

Additionally, a SunGuide "Developer Training" class is available that provides the students with an introduction into developing SunGuide processes. The SunGuide source code repository has a generic subsystem and a generic driver available that can be used as the basis for developing a new application.

1.4 Related Documents

The following documents were used to develop this document:

- FDOT Standard Written Agreement, BD826, Statewide Transportation Management Center Software Library System, dated: October 6, 2003.

- *Software Requirements Specification (SRS),* SunGuide-SRS-5.0.0-draft, April 24, 2010.

- *Standard Written Agreement Modification #22 for SunGuide® Software Release 4.3, 5.0,* January 5, 2010.

- World Wide Web Consortium (W3) website: http://www.w3.org.

- SunGuide Project website: http://sunguide.datasys.swri.edu.

1.5 Contacts

The following are contact persons for the SunGuide software project:

- Elizabeth Birriel, ITS Central Office, elizabeth.birriel@dot.state.fl.us, 850-410-5606
- Arun Krishnamurthy, FDOT SunGuide Project Manager, Arun.Krishnamurthy@dot.state.fl.us , 850-410-5615
- David Chang, PBS&J, Consultant Project Manager, David.Chang@dot.state.fl.us, 850-410-5622
- Khue Ngo, PBS&J, Senior ITS Analyst, khue.ngo@dot.state.fl.us, 850-410-5579
- Steve Dellenback, Map Task Lead, sdellenback@swri.org, 210-522-3914
- Robert Heller, SwRI Project Manager, rheller@swri.org, 210-522-3824

2. Data

The following sections detail the XML transactions that can be exchanged between client and server applications.

2.1 Schema

The schemas for these transactions may be located in the Schemas directory. The objects directory contains common data schemas that are used by the various requests, messages, and responses. Schemas are organized in the following tree structure:

- messages
    - addAvailabilityStatusMsg.xsd
    - addBeatMsg.xsd
    - addOperatorMsg.xsd
    - addRadioMsg.xsd
    - addTelephoneMsg.xsd
    - addVehicleMsg.xsd
    - deleteAvailabilityStatusMsg.xsd
    - deleteBeatMsg.xsd
    - deleteOperatorMsg.xsd
    - deleteRadioMsg.xsd
    - deleteTelephoneMsg.xsd
    - deleteVehicleMsg.xsd
    - modifyAvailabilityStatusMsg.xsd
    - modifyBeatMsg.xsd
    - modifyOperatorMsg.xsd
    - modifyRadioMsg.xsd
    - modifyVehicleAgencyMsg.xsd
    - modifyVehicleMsg.xsd
    - statusMsg.xsd
    - vehicleUpdateMsg.xsd
- objects
    - availabilityStatus.xsd
    - beat.xsd
    - entryType.xsd
    - geofence.xsd
    - operator.xsd
    - radio.xsd
    - vehicle.xsd
    - vehicleAgency.xsd
    - vehicleGroup.xsd
    - vehicleLocation.xsd
- requests
    - addAvailabilityStatusReq.xsd
    - addBeatReq.xsd
    - addGeofenceReq.xsd
    - addOperatorReq.xsd

- o addRadioReq.xsd
- o addTelephoneReq.xsd
- o addVehicleReq.xsd
- o approveGeofenceViolationReq.xsd
- o changeVehicleServiceReq.xsd
- o changeVehicleStateReq.xsd
- o deleteAvailabilityStatusReq.xsd
- o deleteBeatReq.xsd
- o deleteGeofenceReq.xsd
- o deleteOperatorReq.xsd
- o deleteRadioReq.xsd
- o deleteTelephoneReq.xsd
- o deleteVehicleReq.xsd
- o initializeAvlCacheReq.xsd
- o initializeEmCacheReq.xsd
- o modifyAvailabilityStatusReq.xsd
- o modifyBeatReq.xsd
- o modifyGeofenceReq.xsd
- o modifyOperatorReq.xsd
- o modifyRadioReq.xsd
- o modifyVehicleAgencyReq.xsd
- o modifyVehicleReq.xsd
- o retrieveDataReq.xsd
- o setOpStatusReq.xsd
- o subscribeReq.xsd
- o vehicleHistoryReq.xsd
- responses
  - o addAvailabilityStatusResp.xsd
  - o addBeatResp.xsd
  - o addGeofenceResp.xsd
  - o addOperatorResp.xsd
  - o addRadioResp.xsd
  - o addTelephoneResp.xsd
  - o addVehicleResp.xsd
  - o approveGeofenceViolationResp.xsd
  - o changeVehicleServiceResp.xsd
  - o changeVehicleStateResp.xsd
  - o deleteAvailabilityStatusResp.xsd
  - o deleteBeatResp.xsd
  - o deleteGeofenceResp.xsd
  - o deleteOperatorResp.xsd
  - o deleteRadioResp.xsd
  - o deleteTelephoneResp.xsd
  - o deleteVehicleResp.xsd
  - o initializeAvlCacheResp.xsd
  - o initializeEmCacheResp.xsd

- o modifyAvailabilityStatusResp.xsd
- o modifyBeatResp.xsd
- o modifyGeofenceResp.xsd
- o modifyOperatorResp.xsd
- o modifyRadioResp.xsd
- o modifyVehicleAgencyResp.xsd
- o modifyVehicleResp.xsd
- o retrieveDataResp.xsd
- o setOpStatusResp.xsd
- o subscribeResp.xsd
- o vehicleHistoryResp.xsd

Requests may be sent from a client to a subsystem or from a subsystem to a driver. Responses may be sent from a driver to a subsystem or a subsystem to a client. A message can be sent from any process to another process.

2.1.1 Subsystem communication

Initial communication to a subsystem is described in the general ICD. For AVLRR, the lists of availability statuses, beats, geofences, operators, radios, telephones, and vehicles in the system can be retrieved from the database on startup. Once a client has initiated the connection to AVLRR, the following requests may be made:

- Availability statuses, beats, geofences, operators, radios, and vehicles may be added, modified, and deleted.
- Vehicle agencies may be modified.
- Telephones may be added and deleted.
- Geofence violations for a vehicle may be approved.
- Vehicle services and states may be changed.
- AVL and EM cache data may be initialized.
- The operational status of a vehicle may be set.
- The vehicle history of a particular vehicle can be gathered.
- The client may subscribe for updates to geofences, vehicles, vehicle agencies, availability statuses, operators, beats, radios, telephones, vehicle statuses, and users.
- Current configuration information for the geofences, vehicles, vehicle agencies, availability statuses, operators, beats, radios, telephones, users, and general status may be retrieved.

The following table shows the various subscriptions a client may request. The last column shows the XML updates that will be received if a client has subscribed to this data.

Subscription	Description	Updates Received
geofenceData	Receive notification of changes to the geofence configuration	addGeofenceResp modifyGeofenceResp deleteGeofenceResp

Subscription	Description	Updates Received
vehicleData	Receive notification of changes to the vehicle configuration	addVehicleResp modifyVehicleResp deleteVehicleResp
vehicleAgencyData	Receive notification of changes to vehicle agency configuration	modifyVehicleAgencyResp
availabilityStatusData	Receive notification of changes to the availability status configuration	addAvailabilityStatusResp modifyAvailabilityStatusResp deleteAvailabilityStatusResp
operatorData	Receive notification of changes to the operator configuration	addOperatorResp modifyOperatorResp deleteOperatorResp
beatData	Receive notification of changes to the beat configuration	addBeatResp modifyBeatResp deleteBeatResp
radioData	Receive notification of changes to the radio configuration	addRadioResp modifyRadioResp deleteRadioResp
telephoneData	Receive notification of changes to the telephone configuration	addTelephoneResp deleteTelephoneResp
vehicleStatus	Receive notification of changed to the vehicle status	changeVehicleServiceResp changeVehicleStateResp setOpStatusResp
userData	Receive notification that user permissions have been modified.	updateSystemDataMsg

2.1.2 Driver Communication

Initial communication from a subsystem to a driver is described in the general ICD. For AVLRR, an initializeAvlCacheReq and initializeEmCacheReq is sent to the driver on startup.

After receiving these requests, the driver begins listening for requests sent from the devices. For each AVL request received, the driver will send a statusMsg to the AVLRR subsystem.

As in Section 2.1.1, additional availability statuses, beats, operators, radios, and vehicles may be added, modified, and deleted, vehicle agencies may be modified, telephones can be added and deleted, and vehicle services and states may be changed.

2.2 Examples

The example below in Figure 2.1 shows a typical sequence of adding a vehicle to the system. Once the subsystem verifies this is a valid new vehicle, the request is then forwarded to the appropriate driver. The driver adds the vehicle and sends an addVehicleResp to the subsystem. The subsystem then sends this response back to the appropriate client and to any clients who have subscribed to vehicle data.
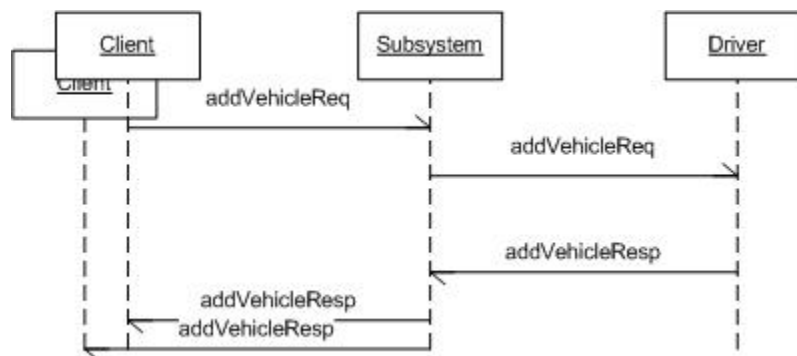

Figure 2.1 – Sample Transaction

The tables below show which requests can be sent from client to subsystem and which requests can be sent from subsystem to driver. The responses sent from driver to subsystem and from subsystem to client are also specified. Messages are sent when a response is not required.

2.3 Schemas

FC (From client), TC (To client), TD (To driver), FD (From driver)

Usage Description	Requests	FC	TD	Responses	FD	TC	Messages	TD	FD	TC
Used for a client to add a new availability status to the subsystem.	addAvailabilityStatusReq	X	X	addAvailabilityStatusResp	X	X	addAvailabilityStatusMsg	X		
Used for a client to add a new beat to the subsystem.	addBeatReq	X	X	addBeatResp	X	X	addBeatMsg	X		
Used for a client to add a new geofence to the subsystem.	addGeofenceReq	X		addGeofenceResp		X				
Used for a client to add a new operator to the subsystem.	addOperatorReq	X	X	addOperatorResp	X	X	addOperatorMsg	X		
Used for a client to add a new radio to the subsystem.	addRadioReq	X	X	addRadioResp	X	X	addRadioMsg	X		
Used for a client to add a new telephone to the subsystem.	addTelephoneReq	X	X	addTelephoneResp	X	X	addTelephoneMsg	X		
Used for a client to add a new vehicle to the subsystem.	addVehicleReq	X	X	addVehicleResp	X	X	addVehicleMsg	X		

Usage Description	Requests	FC	TD	Responses	FD	TC	Messages	TD	FD	TC
Used for a client to approve geofence violations.	approveGeofenceViolationReq	X		approveGeofenceViolationResp		X				
Used for a client to remove an existing availability status from the subsystem.	deleteAvailabilityStatusReq	X	X	deleteAvailabilityStatusResp	X	X	deleteAvailabilityStatusMsg	X		
Used for a client to remove an existing beat from the subsystem.	deleteBeatReq	X	X	deleteBeatResp	X	X	deleteBeatMsg	X		
Used for a client to remove an existing geofence from the subsystem.	deleteGeofenceReq	X		deleteGeofenceResp		X				
Used for a client to remove an existing operator from the subsystem.	deleteOperatorReq	X	X	deleteOperatorResp	X	X	deleteOperatorMsg	X		
Used for a client to remove an existing radio from the subsystem.	deleteRadioReq	X	X	deleteRadioResp	X	X	deleteRadioMsg	X		

Usage Description	Requests	FC	TD	Responses	FD	TC	Messages	TD	FD	TC
Used for a client to remove an existing telephone from the subsystem.	deleteTelephoneReq	X	X	deleteTelephoneResp	X	X	deleteTelephoneMsg	X		
Used for a client to remove an existing vehicle from the subsystem.	deleteVehicleReq	X	X	deleteVehicleResp	X	X	deleteVehicleMsg	X		
Used for the subsystem to send all AVL data to driver.	initializeAvlCacheReq		X	initializeAvlCacheResp	X					
Used for the subsystem to send all EM data to driver.	initializeEmCacheReq		X	initializeEmCacheResp	X					
Used for a client to modify an existing availability status in the subsystem.	modifyAvailabilityStatusReq	X	X	modifyAvailabilityStatusResp	X	X	modifyAvailabilityStatusMsg	X		
Used for a client to modify an existing beat in the subsystem.	modifyBeatReq	X	X	modifyBeatResp	X	X	modifyBeatMsg	X		
Used for a client to modify an existing geofence in the subsystem.	modifyGeofenceReq	X		modifyGeofenceResp		X				

Usage Description	Requests	FC	TD	Responses	FD	TC	Messages	TD	FD	TC
Used for a client to modify vehicle agency in the subsystem.	modifyVehicleAgencyReq	X	X	modifyVehicleAgencyResp	X	X	modifyVehicleAgencyMsg	X		
Used for a client to modify an existing operator in the subsystem.	modifyOperatorReq	X	X	modifyOperatorResp	X	X	modifyOperatorMsg	X		
Used for a client to modify an existing radio in the subsystem.	modifyRadioReq	X	X	modifyRadioResp	X	X	modifyRadioMsg	X		
Used for a client to modify an existing vehicle in the subsystem.	modifyVehicleReq	X	X	modifyVehicleResp	X	X	modifyVehicleMsg	X		
Used to retrieve data from AVLRR, data includes geofences, vehicles, vehicle agencies, availability statuses, operators, beats, radios, telephones, and users.	retrieveDataReq	X		retrieveDataResp		X				
Used for a client to set the operational status of a particular vehicle in the system.	setOpStatusReq	X		setOnlineStatusResp	X					

Usage Description	Requests	FC	TD	Responses	FD	TC	Messages	TD	FD	TC
Used to subscribe to updates from the system. Data includes geofences, vehicles, vehicle agencies, availability statuses, operators, beats, radios, telephones, and users.	subscribeReq	X		subscribeResp		X				
Used for a client to view the vehicle history for a particular vehicle in the system.	vehicleHistoryReq	X		vehicleHistoryResp		X				
Used for a driver to send status updates to the subsystem.							statusMsg		X	
Used for a subsystem to send vehicle updates to clients.							vehicleUpdateMsg			X

3. Notes

Information about XML and schemas can be found at the World Wide Web Consortium (W3) website at http://www.w3.org.

Concept of Operations

This page is intentionally left blank.

Table of Contents

List of Acronyms

AVL – Automatic Vehicle Location
FHP – Florida Highway Patrol
GPRS – General Packet Radio Service
GPS – Global Positioning System
GUI – Graphical User Interface
MDT – Mobile Data Terminal
PDA – Personal Digital Assistant
TIM – Traffic Incident Management
TMC – Traffic Management Center
UHF – Ultra High Frequency
RRAVLS - Road Ranger AVL System

1.   Overview

In May of 2007, an original Concept of Operations (ConOps) document was developed to describe the anticipated Road Ranger Automatic Vehicle Location (RRAVL) system which was being developed. This revision is an update of that document.

This section of the Concept of Operations (ConOps) document provides four elements: system identification, an overview of the document, a high-level overview of the current and proposed systems, and a brief description of the scope of effort required to take the system from the current state to the final future state of deployment that will be achieved at the conclusion of the proposed implementation.

1.1   Identification

This is version 2.0 of the ConOps document for the RRAVLS.

1.2   Document Overview

This document describes the current and proposed RRAVLS. The document is intended for the TIM Managers in the State, and for the SunGuide software development team.

The ConOps will include the elements developed by the SunGuide team that were distributed in August, 2006. It also contains the District Four revisions to those requirements, as well as the District Seven requirements based upon the current operation system that the District is now using. In March 2008, several new requirements were added to support mobile-initiated incidents.

This document is not intended to be a final ConOps. The state of the RRAVLS is in transition, and it is intended that this document will be periodically updated to add or revise the information that is presented here.

1.3   System Overview

The RRAVLS has many potential users, some of whom are:

- District Traffic Incident Managers
- TMC Operators
- District Traffic Operations Engineers
- Road Ranger Contractor Managers
- Public Information Officers

At its most basic level, the RRAVLS allows real-time tracking of the location of the Road Ranger vehicles. A map display with icons is utilized to indicate the location of each unit with an identification marker. Other features that are provided are:

- Activity monitoring
- Activity reports, including Performance Measures
- Personnel management

It is intended that eventually all Districts will utilize the RRAVLS. The District Road Rangers operations programs are in various states of maturity; therefore, not all elements of the RRAVLS can be implemented at this time. Districts with full operations which are expected to be able to implement the RRAVLS are:

- District 1
- District 2
- District 4
- District 5
- District 6
- District 7
- Turnpike

2.   Referenced Documentation

AVL Requirements Spec V2
District 4 Requirements Matrix

3.   Current System Situation

Four Districts (One, Four, Six and Seven) currently are developing or have developed some form of AVL system. These systems include the following elements:

- Data Collection
- GPS
- Data Transmission
- Reporting

As these systems are utilizing Cellular Data Networks, the coverage is generally available on a Statewide basis. It is not part of current designs to be compatible across systems.

There are several elements which may or may not be common among these systems. Data collection, performance measures, and Real-time status information are functions that are currently supported in the existing systems. .

The RRAVLS should standardize the functions and features of these systems within SunGuide as much as possible, and allow for cross-district operations in the event of an emergency situation.

3.1   Background, Objectives, and Scope

The RRAVLS module is being developed by the SunGuide team. This document outlines the basic requirements for the subsystem. The scope of this document covers this module only.

3.2   Operational Constraints

The hardware that has been obtained by the Districts varies in capabilities. District Seven has been using a mobile data terminal with 12 status buttons and a four-line liquid crystal display. The amount of data which can be transmitted to the control system is limited by this hardware. This hardware is currently being replaced with laptop computers with touch-screens and specialty software to support the Road Ranger operations. District Four utilizes a tablet form factor with different software to support it's operations.

The communications systems utilized by the various systems may or may not be compatible; this could limit cross-district operations in the event of an emergency.

Several Districts have no AVL or data collection hardware installed at all; data are collected manually and handwritten on paper.

3.3   Description of the Current System or Situation

Several Districts are using, have utilized or are planning on using a Road Ranger AVL system. Districts Six and Seven used a system based on the internal GPS in some Nextel phones. This data was sent to a third-party aggregator, and the information was presented on a map installed on an application at the TMC. The system proved to be unreliable; the GPS data from the phones was often inaccurate or untimely. The system was generic and not customized for Road Ranger use.

In November of 2005, District Seven installed a new system as part of a general communications upgrade. A GPS with external antenna was connected to a UHF two-way radio system, and software was developed by the District ITS GEC to provide tracking and management of the Road Rangers. This system was much more successful, with accurate, timely location data now being received, and real-time status information now being sent and recorded. The

communications was changed to a data packet modem using GPRS due to interference between voice and data on the UHF radio system. This system is being replaced as of the beginning of 2008 with Panasonic "Toughbook" laptop computers and new software.

District Four has obtained tablet PCs with internal GPS and Cellular data modems. This system is currently integrated into SunGuide and is in operation.

District Six is also in the planning stages for deploying new AVL system hardware.

3.4   User Profiles

There are several types of users which will interact with the RRAVLS. Typical interaction and uses of the system follows:

TIM Management
- Monitor vehicle locations for contract compliance and incident management
- Access reports for performance measures
- Research operator activities for complaint response

FDOT Management
- Monitor vehicle locations for incident management
- Access reports for performance measures

Contractor Management
- Monitor vehicle locations for driver management
- Access reports for driver compliance
- Research operator activities for complaint response

TMC Operators
- Monitor vehicle locations and real-time status for incident management
- Dispatch vehicles to incidents.

3.5   Support Environment

The Districts will provide support for the hardware utilized in the vehicles. As each District has unique hardware at this time, it is not likely that a central support system will be developed. If a standard platform is eventually utilized, a statewide support structure should be considered.

The SunGuide team will support the software elements of the RRAVLS as part of the SunGuide software.

4. Justification and Nature of the Changes

The RRAVLS should provide a common platform for operation of the Road Rangers on a Statewide basis. It will provide a software platform for Districts which currently have no TMC to operate under when a TMC is operational. The RRAVLS should provide a standardized mechanism for reporting consistent performance measures across all District Road Ranger programs.

4.1   Justification for Changes

The RRAVLS should be developed to provide consistency across the Districts for operations, and to develop consistent performance measures.

4.2   Description of the Desired Changes

Several features should be provided in the RRAVLS. The SunGuide team has identified 48 items which will be described in a later section, along with additions by Districts Four and Seven.

Capabilities to be added include:

- Vehicle location display
- Vehicle tracking replay
- System reports
- Consistent user interface
- Add/update/close incidents from Road Ranger Vehicles
- Allow SunGuide operators to send events to Road Ranger Vehicles
- Allow SunGuide operators to modify events entered by Road Ranger Vehicles

4.3   Change Priorities

As of Revision 2 of this document, the capability of a Road Ranger Vehicle to add/update/close incidents is the highest priority. Earlier priorities were display of vehicle, reports and driver management. These have largely been addressed.

4.4   Changes Considered but Not Included

None

4.5   Assumptions and Constraints

It is assumed that if a standardized hardware platform is specified to support the RRAVLS, funding will be available to purchase the required equipment. Current equipment capabilities can constrain the RRAVLS in the area of data collection.

5.   Concepts for the Proposed System

5.1   Background, Objectives, and Scope

The newly developed system should include the features specified in this document. Continued coordination with the Districts is vital to ensuring a fully useable and operational system.

5.2   Operational Policies and Constraints

Each District has/is developing operational polices for their Road Ranger operations. Some level of consistency is being attained though the Statewide Road Ranger meetings and Central Office support. This document does not discuss the Districts' specific operations policies.

5.3   Description of the Proposed System

The proposed system should integrate the features currently being utilized by Districts with operational programs, as well as adding features which will be useful to the systems in the future. The attached table includes requirements which were developed by central office, along with District Four and Seven comments and additions. An 'X' mark indicates general agreement with the requirement, with any comments included in the change/addition column. New requirements developed for Revision 2 of this document are so indicated by an "R2".

5.4   Modes of Operation

The system shall operate under the standard SunGuide modes of operation.

5.5   User Involvement and Interaction

Users shall interact with the system though the standard SunGuide interface. The Operators shall communicate with the Road Rangers utilizing the radio system selected by each District. Data from mobile units shall be entered automatically via their mobile device (MDT, PDA, Tablet, etc.) and operators may also enter status data should a mobile unit not be able to. Mobile units shall be able to Add/Update/Close an incident without SunGuide operator interaction, but SunGuide operators shall also be able to update or close an incident which was initiated by a mobile unit.

5.6   Support Environment

Support shall be provided by each District for the mobile vehicle hardware. This can be done by District personnel or via service contract. Support for the software will be by the SunGuide team and individual District contractors.

DESCRIPTION	CENTRAL OFFICE	D4	D7	REQUIRED CHANGE/ADDITION
The AVL subsystem shall acquire vehicle information containing position coordinates in XML format originated external to SunGuide.	AV001	X	X	
The AVL subsystem shall display vehicle position using icons on the SunGuide Map.	AV002	X	X	Each vehicle shall be represented on the map with an icon, placed at the last reported geo-coordinate location. The icon shall indicate the unit ID number (which may be abbreviated).
The AVL subsystem shall display vehicle status that is provided by the AVL data feed.	AV003	X	X	The relevant AVL Icon shall appear different (shape and color, depending on the availability status reported by the RR tablet. The "Availability Status" values shall be patrolling, dispatched, assisting, and out-of-service.
The AVL subsystem shall store vehicle position data by vehicle so that the vehicle's track can be replayed on the SunGuide map.	AV004	X	X	
The AVL subsystem shall support the generation of a report about vehicle position time line with vehicle status information that was associated with the date-time of the position report.	AV005	X	X	A reporting function shall be provided to managers through which they may enter a date/time range and a vehicle as parameters, and in return view the area covered and average speed. The data shall consist of truck number, beat, driver, radio/telephone number, truck position (roadway, direction, reference location, proximity to reference location), speed and status (availability).
The AVL subsystem shall update the vehicle position each time a new position is reported for the vehicle.	AV006	X	X	The depiction of the Road Ranger (icon) location on the map shall be updated in real-time, upon reception of new vehicle data. All mouse-over summary data shall be updated in real-time, upon reception of new vehicle data.
The operator shall be able to turn off the display of vehicle position information on the SunGuide map.	AV007	X	X	
The AVL data acquisition component shall be able to acquire a data file in XML format either from a URL or in a shared directory or by FTP pull.	AV001L	X	X	

DESCRIPTION	CENTRAL OFFICE	D4	D7	REQUIRED CHANGE/ADDITION
If multiple files are acquired containing more than one position for a vehicle, the acquisition component shall order the position reports by vehicle chronologically so the most currently reported position is last in the list.	AV002L	X	X	
If necessary, the acquisition component shall format the received data in accordance with the AVL Data Interface Specification.	AV003L	X	X	
As a minimum, the XML data file shall contain the following information: vehicle ID; latitude in decimal degrees; longitude in decimal degrees; vehicle heading; vehicle speed in mph; type of event vehicle is responding to; event data (classification) location the vehicle is traveling to; area of responsibility for the vehicle (zone ID or area ID); date-time stamp.	AV004L	X	X	The XML data file name should contain the truck number and date/time stamp in its name.
Geo-coordinates are expected to be reported to 3 decimal places at a minimum, if they are not, the acquisition component shall locate the closest road to the reported position and fill in the coordinates accordingly.	AV004L1	X	X	
Position reports that are corrected by SunGuide shall be flagged in the data log and indicated to the operator.	AV004L2	X	X	
Event data and event type codes shall use the Florida Highway Patrol codes.	AV004L3	X	X	We should be using the list of event types defined by Central Office.
Event type and data FHP codes shall be translated to the text description of the event code as listed in the FHP Code Table for display and reporting purposes.	AV004L4	X	X	D7 utilizes the FHP Codes in the display to save space – full translation may not fit.
The frequency that the AVL data is asked for by SunGuide shall be configurable in seconds.	AV005L1	X		In the D7 System, the central does not poll the mobiles. The mobiles asynchronously send location data at intervals depending upon their speed. This is more bandwidth efficient.
Default frequency for the data acquisition request by SunGuide shall be 30 seconds.	AV005L1	X		See AVL005L1

DESCRIPTION	CENTRAL OFFICE	D4	D7	REQUIRED CHANGE/ADDITION
The source location of the AVL data source shall be configurable using the SunGuide Administration function.	AV006L	X	X	
The icon symbol shall be able to be selected by an operator with administration rights on SunGuide and with appropriate permission for the subsystem.	AV002V	X	X	Icon symbol (image) would need to be selectable on a per RR (vehicle) basis. This is required to satisfy requirement D4-19.
The icon used on the SunGuide map shall be an SVG icon.	AV002V1	X		
The icon selected by the administrator shall be used to represent vehicles for which position reports are received.	AV003V	X	X	
If position reports are received for different service vehicles such as transit, road ranger service vehicle, fire vehicles, FHP vehicles, etc., the operator with appropriate privileges shall be able to assign an icon to represent the type of vehicle for the type of position reports received.	AV004V	X	X	
Vehicle icon color shall be configurable.	AV005V	X	X	
The text popup shall appear on the SunGuide GUI map when the operator right clicks the vehicle icon and selects "show status".	AV006V	X	X	D7 System utilizes "Hover" to obtain status instead of "click"
The operator shall be able to view the vehicle status via the SunGuide GUI Map.	AV006V1	X	X	
The popup text boxes shall use the same tinted background color as used by the vehicle icon.	AV006V2	X	X	
The popup text box shall move relative to the icon until "Hide Status" is selected.	AV006V3	X		This is not necessary if we use mouse-over functionality. In this setup, the user would have to "toggle" the summary mouse-over window using the menu.

DESCRIPTION	CENTRAL OFFICE	D4	D7	REQUIRED CHANGE/ADDITION
Vehicle status shall include, to the extent provided by the received vehicle data file, vehicle ID, Heading, Speed Destination, Event type and last date-time the displayed position was received.	AV007V	X	X	This may be a lot to fit into a pop-up box. There should be a separate text list showing each vehicle and its current status so that operators can see at a glance what all units are doing.
The SunGuide display of vehicles shall be refreshed whenever a new position report is available for display.	AV008V	X	X	D7 uses an update rate of once per minute.
If a position report is not displayed on the SunGuide map before a new position is received, the newer position will be displayed but the older one will be maintained in the track history and available for reply.	AV008V1	X	X	
Chronological position data shall be maintained for each vehicle reporting position for a configurable deletion period.	AV001T1	X	X	The data recorded shall be retained in the central database for a system-configurable length of time. The data shall consist of truck number, beat, driver, radio/telephone number, truck position (roadway, direction, reference location, proximity to reference location), speed and status (availability). The most recent record received from the AVL system shall be stored at a configurable interval, which must be greater than or equal to the acquisition (and display) interval.
After 180 days, the oldest vehicle position data will be deleted as new position reports are received.	AV001T2	X	X	D7 does not delete any old data.
The operator shall be able to right click on a vehicle icon and select "track display" and a number that will result in a plot on the map of the vehicle's last position reports for the number of position reports entered by the operator.	AV002T	X	X	Should be based on time.
Historical vehicle positions (tracks) shall be indicated by "+" symbols or similar leading away from the current vehicle position.	AV002T1	X	X	This can get cluttered quickly. Should be an option to turn this off.
There shall be an option to hide track display that applies to the track of the vehicle.	AV002T2	X	X	

DESCRIPTION	CENTRAL OFFICE	D4	D7	REQUIRED CHANGE/ADDITION
If the operator leaves "display track" on for a particular vehicle, the number of symbols representing the track shall follow the vehicle's position on the map with the oldest track symbol being erased as the next to current one is displayed.	AV002T3	X	X	
If a vehicle speed is "stopped" or "0", no more than one track icon shall be displayed.	AV002T4	X	X	If vehicle is stopped, mouse-over summary data shall include the amount of time that the truck has been stopped. If vehicle is moving, mouse-over summary data shall include the amount of time that the truck has been moving.
The operator shall be able to right click on the SunGuide map in an area without any symbols and get a menu of "AVL Replay" options to generate a historical track of a selected vehicle.	AV003T	X	X	(D4)We do not believe that (a) the AVL Replay should not be accessed through right-clicking an area of the map and (b) the Replay should happen on the active SunGuide GUI - a separate GUI should be provided for this purpose (not for operator use).
The operator may designate a vehicle ID, a span of time in date and time, and a replay rate when replaying vehicle track information.	AV003T1	X	X	
The operator may select to replay the vehicle's position in real time or faster than real time at a rate specified by the operator.	AV003T2	X	X	
The operator shall have the ability to delete from the display all of the historical tracks for a particular vehicle.	AV003T3	X	X	
The operator shall have the ability to globally delete all vehicles displaying a historical track.	AV003T4	X	X	
The operator shall be able to designate a vehicle or a group of vehicles and enter a date-time and time span that position reports are generated for.	AV004T	X	X	
SunGuide shall provide the option for the operator to sort report data by vehicle or by area of operation or by event type or event data codes or by date and time period.	AV004T1	X	X	

DESCRIPTION	CENTRAL OFFICE	D4	D7	REQUIRED CHANGE/ADDITION
SunGuide shall make available the report data selected by the operator so that a reporting function external to SunGuide can generate the desired reports and print them.	AV004T2	X	X	Reports should not be external to SunGuide. SunGuide should provide all required reports.
Position reports shall be displayed on the SunGuide workstation when requested by the operator.	AV005T	X	X	
The operator shall have the option to save the report format thereby preserving the order in which the data are grouped to use as a template for future reports.	AV005T1	X	X	
The operator shall have the option to save or delete a report.	AV005T2	X	X	Reports should be exportable
A "more noticeable" icon (e.g. flashing, larger, exclamation) shall be used when a vehicle stops or leaves the geo-fenced area without justification (non-patrolling status entered into the road ranger tablet).	X	D4-1		
If a vehicle leaves the geo-fenced area without justification, the system shall alert the operator with a popup notification and an audible alarm.	X	D4-2		""
A driver shall be able to justify leaving the valid geo-fenced area by entering a non-active status (gas, meal, inspection, etc.) in the Road Ranger tablet application.	X	D4-3		""
The AVL system shall provide a graphical user interface to define the geo-fences, both system wide geo-fences and beat specific geo-fences.	X	D4-5		""
If a vehicle is assigned to a beat which has beat-specific geo-fences defined, the AVL system shall use only the geo-fences for the specified beat to assess whether or not a given vehicle has left its beat zone.	X	D4-6		""
If a driver is stopped for a configurable length of time without accounting for the stop (arrival at an event) using the Road Ranger tablet application, the system shall notify the operator.	X	D4-7	X	

DESCRIPTION	CENTRAL OFFICE	D4	D7	REQUIRED CHANGE/ADDITION
The AVL system shall interface with the Road Ranger tablet application developed by District 4, and use the reported status as an input in decision points where required.	X	D4-8		
The AVL system shall be compatible with the PC tablet devices used by the District 4 Road Ranger tablet application.	X	D4-9		
The AVL system shall operate over the communications network designed for the Road Ranger tablet application by District 4.	X	D4-10		
The AVL central software shall be distributed as part of a SunGuide software release.	X	D4-11	X	
The AVL central software shall use the SunGuide oracle database to store and record vehicle location and speed history.	X	D4-12	X	
The AVL software shall implement operator notifications within the SunGuide software.	X	D4-13	X	
The AVL software shall provide summary data when an operator "mouses-over" the vehicle icon. The summary data shall consist of truck number, beat, driver, radio/telephone number, truck position (roadway, direction, reference location, proximity to reference location), speed and status (availability).	X	D4-14	X	(D7) – Might be too much for a mouse over window. There should be a separate display for status
The AVL software shall provide a right-click menu with all options available for the operator. A default action shall be configurable, which will be launched on left-click (or double-click).	X	D4-15		

DESCRIPTION	CENTRAL OFFICE	D4	D7	REQUIRED CHANGE/ADDITION
An operator shall be able to right-click on a vehicle to dispatch it to a new or existing event. In the case of new events, the operator will be prompted to enter the required information for the new event.	X	D4-16	X	
The list of Road Rangers, part of the EM GUI, shall be augmented to include current truck position (roadway, direction, reference location, proximity to reference location), speed and status (availability) from the AVL software. A "Find on map" option will be provided from the list, which will 'zoom' the SunGuide map to the current position of the vehicle icon.	X	D4-17	X	(D7) Clicking on the unit id number in the list shall zoom the map to the truck location.
Admin Editor functions will be provided to allow administrators to add and remove vehicles from the RR/AVL tracking system.	X	D4-18	X	(D7) Vehicles that are not "logged on" are not displayed.
The SunGuide GUI Map RR Icon shall indicate the relevant truck number.	X	D4-19	X	
The SunGuide GUI Map shall enable the user to switch from map view to a satellite 'image' view.	X	D4-20	X	Satellite view shall be zoomable
Each road type (interstate, state road, arterial, residential) shall be stored in a different map layer. Which map layers are displayed shall be linked to zoom levels, and this linking shall be configurable. Map layers shall contain road names.	X	D4-21		
A list of currently logged on trucks and their current dispatch status shall be displayed.			D7-01	
A Truck Activity report shall be available. This report shall list all activity for a truck for a given date and time range. The report shall be filterable by truck number (or all), event types, event dispositions, and Driver ID.			D7-02	

DESCRIPTION	CENTRAL OFFICE	D4	D7	REQUIRED CHANGE/ADDITION
An Activity Summary Report shall be available. This report shall summarize all activity for a given date and time range. The report shall be filterable by truck number (or all), event types, event dispositions, & Driver ID.			D7-03	
A Location report shall be available. This report shall list each GPS update for a given date and time, and the geo-referenced location for that report. It shall be filterable by truck (or all), and Driver ID.			D7-04	
TMC Operators shall be able to change unit status in the event of mobile electronics or communications malfunction.			D7-05	
Event data from mobile units shall be received and automatically stored in the database. Event data shall be items such as Enroute, At Scene, Cleared Scene, On Break, Assisting Others, etc.			D7-06	
Incident data shall be received from mobile units and entered into the database. Incident data shall include items such as types of vehicles involved, assistances rendered, Method notified, etc.			D7-07	
System shall be able to determine likely duplicated data during audit which was caused by communications loss, then recovery.			D7-08 (R2)	

DESCRIPTION	CENTRAL OFFICE	D4	D7	REQUIRED CHANGE/ADDITION
Mobile operator shall be able to initiate incident			D7-09 (R2)	
Mobile operator shall be able to close incident which was initiated by that unit			D7-10 (R2)	
Mobile operator shall be able to depart incident and leave it unresolved in SunGuide (i.e., abandoned vehicles)			D7-11 (R2)	

6. Operational Scenarios

Scenario 1 – TMC Dispatched Incident

1. FHP notifies TMC operator of incident at location.
2. TMC Operator consults AVL map to determine closest unit.
3. TMC Operator checks status display to ensure unit is not en-route to another incident.
4. TMC Operator dispatches unit by radio to incident.
5. Unit arrives at incident, and indicates at-scene status using mobile electronics. Map updates to indicate new status.
6. Unit completes incident. Data from incident is entered into mobile electronics and sent to TMC. Map indicates new status.
7. Unit indicates available by mobile electronics and voice.

Scenario 2 – RR Initiated Incident (R2)

1. Unit arrives at incident during patrol.
2. Unit enters arrival status and type of incident using mobile electronics. SunGuide creates incident in system.
3. For lane blocking incidents, Unit notifies TMC by radio of blockage and TMC operator updates incident.
4. For lane blocking incidents, Unit notifies TMC of event status changes via radio for duration of incident and TMC operator updates incident.
5. Unit completes incident. Data from incident is entered into mobile electronics and sent to TMC. Map indicates new status.
6. Unit indicates available by mobile electronics and voice.

Scenario 3 – Mobile Electronics Not Functional

1. FHP notifies TMC operator of incident at location.
2. TMC Operator broadcasts incident location to determine closest available unit.
3. TMC Operator dispatches unit by radio to incident.
4. TMC Operator updates status display manually.
5. Unit arrives at incident, and indicates at-scene status using radio. TMC operator updates status and location. Map updates to indicate new status.
6. Unit completes incident. Data from incident is provided via radio and operator updates at TMC. Map indicates new status.
7. Unit indicates availability by voice and operator updates system.

Scenario 4 – Operations Manager Researches Complaint.

1. Manager determines approximate date and time of complaint.

2. Manager uses truck location report for all trucks to determine possible involved unit.
3. Manager uses map replay to verify involved unit was at the location at the given date/time.
4. Manager uses truck status report to determine operator of vehicle at the complaint time.

Scenario 5 – Operations Manager Determines Contract Time Compliance

1. Manager uses truck report to determine start and end shift times.
2. Manager filters report by event LogOn and event LogOff for all trucks for date range.

7. Summary of Impacts

The RRAVLS should not impact Districts not currently using AVL software. For those that are, a period of re-training and operations modifications should be expected.

8. Analysis of the Proposed System

The proposed RRAVLS should provide a standardized approach to managing the Road Rangers throughout the State. Care must be taken to ensure that any and all functions that are currently being used by the Districts are maintained or replaced in an acceptable manner by the new system.

The RRAVLS should provide an enhanced capability to monitor Road Ranger activities, record information, and provide a superior reporting mechanism that can be utilized by all Districts across the state.

As the Districts are acquiring different mobile electronics at different times, one of the unique challenges of the system design will be to incorporate data from these diverse systems in a manner that is transparent to the end user. The use of XML files for the data transfer helps to accomplish this – but it still potentially leaves the work of receiving and formatting the data into the XML file to each District. Ultimately, a complete hardware/software approach should be taken to ensure the systems' longevity, expandability and utility.

9. Notes

10. Appendices

11. Glossary

This page is intentionally left blank.

Appendix C – AVL Work Completed Form

BDU15
AVL Technician
Work Completed

Date: _____   Contractor/Company: _____

Tech Name: _____   AVL Unit(s): _____

Contact Name	

Truck #	

AVL Operational?	

Description of Work: _____

_____

_____

_____

_____

_____

_____

_____

_____

Technician Signature: _____   Date: _____

Supervisor Signature: _____   Date: _____