EXHIBIT “A”, SCOPE OF SERVICES

AUTOMATED VEHICLE LOCATION (AVL) SYSTEM
AND SUPPORT SERVICES

ITB-DOT-11/12-6123DS

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EXHIBIT A

INVITATION TO BID

SCOPE OF SERVICES FOR PROCUREMENT OF AN
AUTOMATED VEHICLE LOCATION (AVL) SYSTEM

1. Objective

The Florida Department of Transportation (FDOT) District 6 Traffic Operations Intelligent Transportation Systems (ITS) Office (hereinafter known as the “Department”) is seeking a qualified Vendor to provide an Automated Vehicle Location (AVL) System. The Vendor shall provide an AVL system and supporting services as described in this Scope of Services document.

The term of the Invitation to Bid (ITB) Contract shall begin on the date the Notice to Proceed is given and may continue for a period of three (3) years. This agreement may be renewed, not to exceed three (3) one-year renewals or for a period no longer than the term of the original contract. If renewal is desired by the Department, it must be executed by the Department and the Vendor prior to the expiration of the original Contract term or prior to the expiration of any subsequent renewal issued by the Department and as allowed by this agreement.

2. Introduction

The AVL system typically includes an in-vehicle Global Positioning System (GPS) based transponder unit, wireless communications services between transponder unit and the SunGuide Transportation Management Center (TMC), and the supporting software that provides a visual depiction of the real-time location of the vehicle on a map along with vehicle status reporting capabilities. The AVL system shall be integrated with the existing SunGuide software and shall show the real-time location and vehicle status on the SunGuide map, thereby allowing the SunGuide TMC Operations staff to verify the number of incident management vehicles operational at a given time along with their travel route. For the purpose of this document, 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 thirty-two (32) in-vehicle transponder units in the current incident management vehicles. There are currently two models of in-vehicle transponder units operational within the District.

**Table 1 – District 6 Existing AVL Transponder Models**

<table>
<thead>
<tr>
<th>Description</th>
<th>Location</th>
<th>Number of Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xirgo Technologies XT – 2000 – G IntelliMatics GPRS Modem with Integrated GPS</td>
<td>Road Ranger tow trucks, flatbed trucks and incident response vehicle (IRV)</td>
<td>17</td>
</tr>
<tr>
<td>Xirgo Technologies XT – 2000 – O IntelliPort OBD II/GPRS Modem with Integrated GPS</td>
<td>Road Ranger pickup trucks and tow trucks</td>
<td>15</td>
</tr>
</tbody>
</table>

Detailed manufacturer’s specifications cut sheets for both the in-vehicle transponder units are provided as Appendix A to this document.

The Department currently uses an AVL module within the SunGuide software to display the AVL system data. The SunGuide software is the ITS operations software used in the State of Florida to allow the TMC Operations staff to control roadway ITS devices as well as 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. The Vendor may obtain additional SunGuide related information from [http://sunguide.datasys.swri.edu/](http://sunguide.datasys.swri.edu/). Appendix A and Appendix B information are provided for reference only. The Vendor shall be responsible for verification of existing equipment, including research of any existing records and equipment, and/or meeting with the Department staff. The Vendor’s AVL system shall be capable of supporting and using the current Department-owned in-vehicle transponder units and SunGuide AVL module.

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 Bid 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. Upon review, the Department may either partially or wholly approve the Vendor’s request. The Department shall have
the right to deny the Vendor’s request for a SunGuide TMC visit. No additional 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, bid price proposal or other documentation required to complete their proposal.

4. **Vendor Responsibilities**

The Vendor shall be responsible for furnishing, installing and maintaining an AVL system as defined in this Scope of Services document. The Vendor’s furnish and install services shall include all necessary hardware and software for a fully functional and operational system, which includes but not limited to:

- In-vehicle equipment;
- Back-office/TMC equipment; and
- AVL software.

The Vendor’s maintenance services shall include, but are not limited to:

- Provide wireless communications between the in-vehicle equipment and TMC equipment; and
- Provide a Service Maintenance Plan for software support and in-vehicle equipment maintenance.

In addition, the Vendor shall:

- Provide services and equipment listed in Exhibit B – Contract Price Proposal. The Vendor shall submit a signed and completed Exhibit B – Contract Price Proposal along with the proposed costs to the Department.
- Provide equipment that is new and unused.
- In addition to providing the Xirgo technology transponder units per the Bid Price Proposal, 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. The unit price of these alternate units shall not be made part of the Bid Price Proposal Total, but may be considered by the Department in the future for deployment.

- For any discontinued equipment, the Department shall request the Vendor to provide an updated substitute equipment list as needed during the Contract period. The updated list shall include any new equipment that is a substitute for existing equipment currently installed in the incident management vehicles or is a substitute to the original Bid proposed equipment. All substitute equipment shall be new, and equal to or better than the discontinued equipment. The unit price for all substitute equipment shall be equal to the unit price included in the original Bid Price Proposal submitted to the Department. The Vendor’s software shall support and be one hundred percent (100%) compatible with the new equipment at no additional cost to the Department.

- For any new equipment or services (not included in this scope of services document) that are needed to support any new incident management fleet, the Department and Vendor shall reach an agreement on the unit cost for the new item and/or services to be provided.

- For any upgrades deemed necessary by the Department related to the hardware or wireless communications portions of the AVL system to support future SunGuide software upgrades, the Department shall update the equipment and/or service items listed in the Bid Price Proposal and renegotiate the prices for the new items.

- For any upgrades deemed necessary by the Department related to software portion of the AVL system, refer to Section 7.0 of this scope of services document.
- The Vendor shall furnish, install and maintain all hardware/equipment required for the operation of the Vendor’s AVL system software. The Vendor shall perform any firmware updates to the existing and new AVL system hardware components that become available during the term of the Contract at no additional cost to the Department. The cost of the firmware upgrades shall not be paid separately but shall be included in the “Annual SunGuide AVL Software Licenses, Installation, and Service Maintenance Fee” bid price proposal item.

- Deliver and install all parts upon receiving the Department’s Task Work Order / Letter of Authorization or Electronic Purchase Order at the FDOT SunGuide Transportation Management Center (TMC), located at 1001 NW 111 Avenue, Miami, Florida 33172.

- Furnish replacements for any equipment that is damaged during shipment at no cost to the Department.

No work activity under this Scope of Services shall start without a Task Work Order / Letter of Authorization or Electronic Purchase Order 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 related to the AVL system during the Contract period.

5. **System Requirements**

The Vendor-provided 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 support all future SunGuide software updates within the term of the Contract.

- The Vendor’s AVL system shall be compatible with and support the Department-owned existing in-vehicle transponder units listed in Table 1.
- The AVL system shall provide incident management vehicle location as longitude and latitude. The AVL system shall have vehicle location accuracy of +/- 16 feet.

- The AVL system shall provide vehicle speed. The vehicle speed shall be provided in miles/hour (MPH) format. All new hardware/equipment purchased 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 and travel direction. The vehicle heading shall be accurate within 5 degrees.

- The AVL system accuracy required for location, speed and heading shall be achieved within one minute of vehicle start from its cold status. Individual vehicle information shall be sent at least once per minute, even if nothing has changed.

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

- A Geofence is defined as a predefined set of virtual boundaries for a real world geographic area. The AVL system shall be capable of defining a Geofence for individual vehicle routes using the AVL vendor software. The AVL system shall have a feature to allow for configuration of the Geofence as required by the Department. The Geofence feature shall allow for a single or group of incident management vehicles to be referenced to a specific Geofence using a polygon shape frame and generate a report as well as a
real time alarm whenever an incident management vehicle enters or exits the limits of a zone defined by the Geofence.

- At the time of transmission, no 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) for timestamps.
- 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 needs to be stored for a minimum of 90 days.
- 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.

6. Software Requirements

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 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 via alerts based on the vehicle ID (allows different alerts for different incident management vehicles) using the AVL system software within a configurable threshold time (default 5 seconds, but should be configurable by the User) after detection of the condition:
  - Vehicle stopped for more than predefined amount of time as configured by the User;
  - Vehicle moving after reporting a stopped vehicle condition;
  - Vehicle engine on/off; and
  - Vehicle is traveling outside of a Geofenced area/zone for more than a predefined length of time as defined by the User.

- The AVL system shall be able to detect speeding (speed limit violation or speed over fixed threshold), where speed limits can be defined by Vendor geo-database. The speeding detection should require a configurable minimum amount over the speed limit, which should not be allowed to be set lower than the error in the speed calculation and should include a minimum time that the speed is over the threshold so that there are not false alarms.

- All threshold times shall be user-defined (configurable), thereby allowing the Department to modify these threshold times as needed to manage the incident management vehicles and at a minimum shall include:
  - Vehicle speed averaging period (in seconds)
  - Alert time after detection (in seconds)
  - Stopped time for software alert (in seconds)
  - Geofence violation duration (in seconds)
  - Stopped time for e-mail alert (in seconds)
• 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 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, e.g. green color for vehicles that are moving, blue color if vehicles are idle more than configurable minutes, yellow color for vehicles that are stopped with ignition “ON” mode and red color for vehicles with ignition “OFF” mode etc. Actual colors to be used may vary and shall be approved by the Department.
    ▪ Vehicle status shall be updated every one (1) minute and shown on the roadway map for vehicles ignition in “ON” mode and “OFF” mode. When the vehicle ignition status is in “OFF” mode, the status shall be updated every one (1) hour.
    ▪ Vehicle “ON” and “OFF” status shall be displayed in the GUI by a distinct color.
When selected on the map by the User, each vehicle, at a minimum, shall show the following information:

- ID number;
- Time at which the most current data was sent from the vehicle;
- Vehicle heading (travel direction); and
- Speed (MPH) at which vehicle is moving.

Allow the user to select a more detailed zoom-in aerial view of a vehicle's location.

- Email Alerts Function

The software shall be capable of providing e-mail alert notifications to a pre-selected e-mail distribution list. The e-mail distribution list shall be configurable, which allows the User to add and/or remove e-mail addresses. The User shall be able to configure which alerts are transmitted to each individual e-mail recipient. For each vehicle(s) selected, the software shall support the following minimum e-mail alert conditions:

- Transition in either direction between engine ignition “ON” mode and “OFF” modes;
- Vehicle stopped - the vehicle stopped 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;
- No contact (communication) with the vehicle for a 1 hour period;
- Geofence ; and
- Vehicle transponder device reconnected (to track system tampering).

  o **Reporting Capabilities:**

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

  ▪ **Stop time report shall:**

    - allow the User to select a time period and vehicle IDs (individual or multiple selection).
    - allow the User to select a stop time minimum and maximum.
    - provide details about time period of vehicle stops and be available in various formats e.g. word, excel, on-screen. The User shall be able to select the report format, and print and/or save the information.
    - show the location of the stopped vehicle on the GUI map. The map shall be printable.

  ▪ **Map trace/play-back shall:**

    - allow the User to select a time period and vehicle IDs (individual or multiple selection).
    - trace the vehicles’ movements throughout the specified time period and show map screen shots at every update along with speeds. User is able to pause, rewind, play, and fast-forward the vehicle trace map updates.

  ▪ **Events Report shall:**

    - allow the User to select a time period and vehicle IDs (individual or multiple selection).
• provide a report that lists every AVL update, including vehicle status (normal, ignition on, ignition off, and signal loss) and speed, along with the corresponding location map showing the selected time period. This report needs to be available in various formats i.e. word, excel, and on-screen. The User shall be able to select the report format and print and/or save the information.

- AVL statistics report shall:
  • allow the User to select a time period (date and time) and vehicle IDs (individual or multiple selection).
  • provide various AVL system related statistics for the selected period, including cellular signal quality (measured in percentage), GPS lock (measured in number of satellites), battery voltage (measured in volts), and over speed count (measured in number of events).
  • show the information in tables and charts. The User shall be able to print and/or save the report.
  • Over speed count criteria - shows the number of times a vehicle speed is in the range of following speed intervals for more than one (1) minute:
    - >= 70mph and <= 79 mph
    - >= 80mph
7. **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” bid price proposal item. The items covered, shall include at a minimum the following: Changes to the messages or XML schemas used to communicate with SunGuide. Arguments or elements may be added, removed or renamed and the structure may change. 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. The Vendor shall be responsible for changes required to be compatible with updates to platform software, such as operating systems and libraries. Updated software shall be available for testing with SunGuide software within 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 negotiate a scope and a price for the upgrade.

For any Vendor software related updates that become available during the term of the Contract, if approved by the Department, the Vendor shall provide the updates at no additional cost to the Department, but shall be included in the annual AVL Software Licenses, Installation, and Service Maintenance Fee price proposal bid item.

8. **Wireless Communications Services**

The Vendor shall provide the necessary wireless communications services between the in-vehicle transponder 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. All wireless communications service fee shall be paid on a per unit basis, using the “Annual wireless communications fee for each in-vehicle transponder unit” bid price proposal item.

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 in-vehicle transponder units and Vendor AVL system or between the Vendor AVL system and SunGuide software, the Vendor AVL system shall continue to record activities and 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.

9. **Service Maintenance Plan**

The Vendor shall provide a service maintenance plan for the AVL system for the term of the Contract. The Service Maintenance Plan shall not be paid for separately but shall be included in the “Annual AVL Software Licenses, Installation, and Service Maintenance Fee” lump sum bid price proposal item. This plan shall meet or exceed the following minimum requirements:

- The Vendor shall maintain, in its entirety, the AVL software and the new hardware/equipment purchased using this Contract with an uptime of 99 percent, twenty four hours per day, three hundred sixty-five (365) days a year, assessed on a monthly basis by the Department. Failure by the Vendor to meet the response time requirements shall result in the Vendor being assessed a Non-Performance invoice reduction of $500 per month, and/or may cause the Department to terminate the Contract.

- The Vendor shall provide repair services for all AVL system failures as relating to software related issues and wireless communications services within eight (8) hours of initial notification. 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 response time shall result in the Vendor being assessed a Non-Performance invoice reduction of $500 per occurrence, and/or may cause the Department to terminate the Contract.

- The Vendor shall provide a three year warranty for all new equipment purchased by the Department using this Contract. The
Vendor shall provide repair/replacement services for all new equipment within eight (8) hours of initial notification. The Vendor shall provide an acknowledgement within one (1) hour from time of initial notification by FDOT Project Manager (or designee) of a failure. The Vendor is required to maintain an inventory of spare equipment as necessary to support this requirement and to minimize service interruptions. The Vendor shall not be paid separately for the repair/replacement services, but these shall be included in the unit price of the bid item purchased using this Contract. Failure by the Vendor to meet this response time shall result in the Vendor being assessed a Non-Performance invoice reduction of $500 per occurrence, and/or may cause the Department to terminate the Contract.

- For all new equipment which fails two (2) or more times within a one-month time period, the Vendor shall provide new substitute equipment to replace the failed equipment at no additional cost to the Department.

- 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 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. gasoline, vehicles, etc. Only manufacturer-trained technicians at the warranty depot shall repair the equipment.

- The Vendor shall provide a contact person(s) along with their telephone number(s), email address(es), and fax number(s) to report AVL system failures, repairs and/or replacements twenty-four (24) hours a day, seven (7) days per week, and three hundred and sixty five (365) days a year, for the entire duration of the Contract, including holidays. All Vendor acknowledgements to the Department’s requests shall be via email. The Vendor is
responsible for updating the contact information with the Department in writing, as needed during the term of the Contract to ensure that the Department has the latest and most accurate contact information.

- All new AVL system equipment that is replaced shall be replaced by equal or better equipment. All equipment that is replaced or repaired shall be reprogrammed (if applicable) and reinstalled 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 developer 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 the existing and new AVL system hardware components, and any software upgrades that become available during the term of the Contract at no additional cost to the Department.

- 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.
10. **Penalties/Invoice Reductions**

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Threshold</th>
<th>Penalty</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVL System - New equipment and AVL software uptime requirement (in its entirety) assessed on a monthly basis</td>
<td>99%</td>
<td>$500 per month</td>
</tr>
<tr>
<td>Repair response time for software and wireless communications services</td>
<td>8 hours</td>
<td>$500 per occurrence</td>
</tr>
<tr>
<td>Repair/replacement response time for new components</td>
<td>8 hours</td>
<td>$500 per occurrence</td>
</tr>
</tbody>
</table>

On occurrences on which the Vendor does not meet or exceed the performance standards established in this scope of services document, the Department shall reserve the right to assess the Vendor penalties documented in this Scope of Services that shall be deducted from the monthly Vendor invoice.

11. **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-2000-G
IntelliMatics
GPRS Modem with Integrated GPS
IntelliMatics is a technology platform that allows Xirgo to rapidly develop customized tracking devices which can communicate vehicle location information to owners via the ubiquitous GSM/GPRS network. With an integrated GPS engine and cellular modem, and embedded PCS and GPS antennas, IntelliMatics is the basis for a compact, cost effective solution for vehicle and fleet owners to monitor the location, speed and the travel direction of their vehicles. IntelliMatics has optional digital inputs to monitor external events such as ignition status and an internal analog input used to monitor battery voltage. In addition to multiple inputs, IntelliMatics also provides an optional digital output that can drive ignition relays. For installation in GPS challenged environments, IntelliMatics also has an optional external GPS antenna connector.

IntelliMatics incorporates a quad band GSM/GPRS modem which can be used in virtually any country where a GSM network is available. With its highly mature firmware, the device can support TCP, UDP & FTP and is capable of firmware update and configuration over-the-air.

IntelliMatics is another example of Xirgo Technologies' dedication to a flexible design-to-manufacture model that reduces time-to-market for customized products.

**XT-2000-G Summary**

- GPRS class B multi-slot class 10
- Supports 850/900/1800/1900 MHz
- LED status indicators for GPS lock and GSM registration
- Over-the-air firmware upgrade
- Supports TCP, UDP, FTP
- Integrated GPS engine and GPS antenna
- Supports SMS connectivity
- Optional external GPS antennas for improved GPS sensitivity
### Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency Band</strong></td>
<td>850/1900 MHz, 900/1800 MHz</td>
</tr>
<tr>
<td><strong>Transmit Power</strong></td>
<td>33 dBm @ 850-900 MHz, 30 dBm @ 1800-1900 MHz</td>
</tr>
<tr>
<td><strong>Status Indicators</strong></td>
<td>Network registration/GPRS</td>
</tr>
<tr>
<td></td>
<td>GPS position acquisition status</td>
</tr>
</tbody>
</table>

#### GPS specification
- Receiver: 16 channel
- Receiver Sensitivity: -158 dBm
- Accuracy: +/- 2.5m CEP
- Cold Start: <38 sec (@ 45 dB C/N)
- Hot Start: < 3 sec (@45 dB C/N)

#### 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

#### Power Requirement
- D.C Power: 10-16V
- GSM 850: 23 mA average @12V
- GSM 1900: 20mA average @12V

#### Physical Connection
- Power and input/output: 14 pin Micro Fit Connector
- Optional GPS Antenna: SMA female

#### Mechanical
- Case Material: ABS plastic
- Dimensions: 2.0” X 1.8” X 1”
- Weight: <2 oz.
- Operating Temperature: -30°C to +75°C
XT-2000-O
IntelliPort
OBD II/GPRS Modem with Integrated GPS
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
Appendix B - Existing SunGuide Software AVL Module Documentation
SunGuide®:

AVLRR System Interface Control Document

SunGuide-AVLRR-ICD-5.0.1

Prepared for:

Florida Department of Transportation
Traffic Engineering and Operations Office
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June 11, 2010
### Document Control Panel

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<td>09/13/2007</td>
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<tr>
<td>Steven W. Dellenback, SwRI</td>
<td>SWD</td>
<td>10/16/07</td>
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<td>Steve Dellenback, SwRI</td>
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<tr>
<td>Robert W. Heller</td>
<td>RWH</td>
<td>06/11/10</td>
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<tr>
<td>Meredith Moczygemma, SwRI</td>
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<th>Description</th>
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<tbody>
<tr>
<td>ATMS</td>
<td>Advanced Traffic Management System</td>
</tr>
<tr>
<td>AVLRR</td>
<td>Automatic Vehicle Location / Road Ranger</td>
</tr>
<tr>
<td>DOT</td>
<td>Department of Transportation</td>
</tr>
<tr>
<td>FDOT</td>
<td>Florida Department of Transportation</td>
</tr>
<tr>
<td>ITS</td>
<td>Intelligent Transportation Systems</td>
</tr>
<tr>
<td>ITN</td>
<td>Invitation to Negotiate</td>
</tr>
<tr>
<td>SwRI</td>
<td>Southwest Research Institute</td>
</tr>
<tr>
<td>TMC</td>
<td>Traffic Management Center</td>
</tr>
<tr>
<td>XML</td>
<td>Extensible Markup Language</td>
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REVISION HISTORY

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<td>Initial Release</td>
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<td>3.0.1</td>
<td>November 14, 2007</td>
<td>Added “how to use this document” section</td>
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<td>5.0.1</td>
<td>June 11, 2010</td>
<td>Updated for Release 5.0.1</td>
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1. Scope

1.1 Document Identification

This Interface Control Document (ICD) describes the interface between individual SunGuide™ 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:

![High-Level Architectural Concept](image-url)
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.

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:
AVLRR Interface Control Document

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

### 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
- addRadioReq.xsd
- addTelephoneReq.xsd
- addVehicleReq.xsd
- approveGeofenceViolationReq.xsd
- changeVehicleServiceReq.xsd
- changeVehicleStateReq.xsd
- deleteAvailabilityStatusReq.xsd
- deleteBeatReq.xsd
- deleteGeofenceReq.xsd
- deleteOperatorReq.xsd
- deleteRadioReq.xsd
- deleteTelephoneReq.xsd
- deleteVehicleReq.xsd
- initializeAvlCacheReq.xsd
- initializeEmCacheReq.xsd
- modifyAvailabilityStatusReq.xsd
- modifyBeatReq.xsd
- modifyGeofenceReq.xsd
- modifyOperatorReq.xsd
- modifyRadioReq.xsd
- modifyVehicleAgencyReq.xsd
- modifyVehicleReq.xsd
- retrieveDataReq.xsd
- setOpStatusReq.xsd
- subscribeReq.xsd
- vehicleHistoryReq.xsd

- responses
  - addAvailabilityStatusResp.xsd
  - addBeatResp.xsd
  - addGeofenceResp.xsd
  - addOperatorResp.xsd
  - addRadioResp.xsd
  - addTelephoneResp.xsd
  - addVehicleResp.xsd
  - approveGeofenceViolationResp.xsd
  - changeVehicleServiceResp.xsd
  - changeVehicleStateResp.xsd
  - deleteAvailabilityStatusResp.xsd
  - deleteBeatResp.xsd
  - deleteGeofenceResp.xsd
  - deleteOperatorResp.xsd
  - deleteRadioResp.xsd
  - deleteTelephoneResp.xsd
  - deleteVehicleResp.xsd
  - initializeAvlCacheResp.xsd
  - initializeEmCacheResp.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.

<table>
<thead>
<tr>
<th>Subscription</th>
<th>Description</th>
<th>Updates Received</th>
</tr>
</thead>
<tbody>
<tr>
<td>geofenceData</td>
<td>Receive notification of changes to the geofence configuration</td>
<td>addGeofenceResp</td>
</tr>
<tr>
<td></td>
<td></td>
<td>modifyGeofenceResp</td>
</tr>
<tr>
<td></td>
<td></td>
<td>deleteGeofenceResp</td>
</tr>
</tbody>
</table>
### Subscription Table

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

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)*

<table>
<thead>
<tr>
<th>Usage Description</th>
<th>Requests</th>
<th>FC</th>
<th>TD</th>
<th>Responses</th>
<th>FD</th>
<th>TC</th>
<th>Messages</th>
<th>TD</th>
<th>FD</th>
<th>TC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Used for a client to add a new availability status to the subsystem.</td>
<td>addAvailabilityStatus Req</td>
<td>X</td>
<td>X</td>
<td>addAvailabilityStatus Resp</td>
<td>X</td>
<td>X</td>
<td>addAvailabilityStatus Msg</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used for a client to add a new beat to the subsystem.</td>
<td>addBeatReq</td>
<td>X</td>
<td>X</td>
<td>addBeatResp</td>
<td>X</td>
<td>X</td>
<td>addBeatMsg</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used for a client to add a new geofence to the subsystem.</td>
<td>addGeofenceReq</td>
<td>X</td>
<td></td>
<td>addGeofenceResp</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used for a client to add a new operator to the subsystem.</td>
<td>addOperatorReq</td>
<td>X</td>
<td>X</td>
<td>addOperatorResp</td>
<td>X</td>
<td>X</td>
<td>addOperatorMsg</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used for a client to add a new radio to the subsystem.</td>
<td>addRadioReq</td>
<td>X</td>
<td>X</td>
<td>addRadioResp</td>
<td>X</td>
<td>X</td>
<td>addRadioMsg</td>
<td>X</td>
<td></td>
<td></td>
</tr>
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<td>Used for a client to add a new telephone to the subsystem.</td>
<td>addTelephoneReq</td>
<td>X</td>
<td>X</td>
<td>addTelephoneResp</td>
<td>X</td>
<td>X</td>
<td>addTelephoneMsg</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used for a client to add a new vehicle to the subsystem.</td>
<td>addVehicleReq</td>
<td>X</td>
<td>X</td>
<td>addVehicleResp</td>
<td>X</td>
<td>X</td>
<td>addVehicleMsg</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Usage Description</td>
<td>Requests</td>
<td>FC</td>
<td>TD</td>
<td>Responses</td>
<td>FD</td>
<td>TC</td>
<td>Messages</td>
<td>TD</td>
<td>FD</td>
<td>TC</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------------</td>
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<td>----</td>
<td>----</td>
<td>-----------------------------------------------</td>
<td>----</td>
<td>----</td>
<td>-----------------------------------------------</td>
<td>----</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>Used for a client to approve geofence violations.</td>
<td>approveGeofenceViolationReq</td>
<td>X</td>
<td>X</td>
<td>approveGeofenceViolationResp</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used for a client to remove an existing availability status from the subsystem.</td>
<td>deleteAvailabilityStatusReq</td>
<td>X</td>
<td>X</td>
<td>deleteAvailabilityStatusResp</td>
<td>X</td>
<td>X</td>
<td>deleteAvailabilityStatusMsg</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used for a client to remove an existing beat from the subsystem.</td>
<td>deleteBeatReq</td>
<td>X</td>
<td>X</td>
<td>deleteBeatResp</td>
<td>X</td>
<td>X</td>
<td>deleteBeatMsg</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used for a client to remove an existing geofence from the subsystem.</td>
<td>deleteGeofenceReq</td>
<td>X</td>
<td></td>
<td>deleteGeofenceResp</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used for a client to remove an existing operator from the subsystem.</td>
<td>deleteOperatorReq</td>
<td>X</td>
<td>X</td>
<td>deleteOperatorResp</td>
<td>X</td>
<td>X</td>
<td>deleteOperatorMsg</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used for a client to remove an existing radio from the subsystem.</td>
<td>deleteRadioReq</td>
<td>X</td>
<td>X</td>
<td>deleteRadioResp</td>
<td>X</td>
<td>X</td>
<td>deleteRadioMsg</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Usage Description

<table>
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<tr>
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<th>FC</th>
<th>TD</th>
<th>Responses</th>
<th>FD</th>
<th>TC</th>
<th>Messages</th>
<th>TD</th>
<th>FD</th>
<th>TC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Used for a client to remove an existing telephone from the subsystem.</td>
<td></td>
<td></td>
<td>deleteTelephoneReq</td>
<td>X</td>
<td>X</td>
<td>deleteTelephoneResp</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>deleteVehicleReq</td>
<td>X</td>
<td>X</td>
<td>deleteVehicleResp</td>
<td>X</td>
<td>X</td>
<td>deleteVehicleMsg</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used for the subsystem to send all AVL data to driver.</td>
<td></td>
<td></td>
<td>initializeAvlCacheReq</td>
<td>X</td>
<td></td>
<td>initializeAvlCacheResp</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Used for the subsystem to send all EM data to driver.</td>
<td></td>
<td></td>
<td>initializeEmCacheReq</td>
<td>X</td>
<td></td>
<td>initializeEmCacheResp</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Used for a client to modify an existing availability status in the subsystem.</td>
<td></td>
<td></td>
<td>modifyAvailabilityStatusReq</td>
<td>X</td>
<td>X</td>
<td>modifyAvailabilityStatusResp</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Used for a client to modify an existing beat in the subsystem.</td>
<td></td>
<td></td>
<td>modifyBeatReq</td>
<td>X</td>
<td>X</td>
<td>modifyBeatResp</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Used for a client to modify an existing geofence in the subsystem.</td>
<td></td>
<td></td>
<td>modifyGeofenceReq</td>
<td>X</td>
<td></td>
<td>modifyGeofenceResp</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Usage Description</td>
<td>Requests</td>
<td>Requests</td>
<td>Responses</td>
<td>Responses</td>
<td>Messages</td>
<td>Requests</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>-----------</td>
<td>----------</td>
<td>----------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used for a client to modify vehicle agency in the subsystem.</td>
<td>modifyVehicleAgencyReq</td>
<td>X</td>
<td>X</td>
<td>modifyVehicleAgencyResp</td>
<td>X</td>
<td>X</td>
<td>modifyVehicleAgencyMsg</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Used for a client to modify an existing operator in the subsystem.</td>
<td>modifyOperatorReq</td>
<td>X</td>
<td>X</td>
<td>modifyOperatorResp</td>
<td>X</td>
<td>X</td>
<td>modifyOperatorMsg</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Used for a client to modify an existing radio in the subsystem.</td>
<td>modifyRadioReq</td>
<td>X</td>
<td>X</td>
<td>modifyRadioResp</td>
<td>X</td>
<td>X</td>
<td>modifyRadioMsg</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Used for a client to modify an existing vehicle in the subsystem.</td>
<td>modifyVehicleReq</td>
<td>X</td>
<td>X</td>
<td>modifyVehicleResp</td>
<td>X</td>
<td>X</td>
<td>modifyVehicleMsg</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Used to retrieve data from AVLRR, data includes geofences, vehicles, vehicle agencies, availability statuses, operators, beats, radios, telephones, and users.</td>
<td>retrieveDataReq</td>
<td>X</td>
<td></td>
<td>retrieveDataResp</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used for a client to set the operational status of a particular vehicle in the system.</td>
<td>setOpStatusReq</td>
<td>X</td>
<td></td>
<td>setOnlineStatusResp</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Usage Description</td>
<td>Requests</td>
<td>FC</td>
<td>TD</td>
<td>Responses</td>
<td>FD</td>
<td>TC</td>
<td>Messages</td>
<td>TD</td>
<td>FD</td>
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</tr>
<tr>
<td>Used to subscribe to updates from the system. Data includes geofences, vehicles, vehicle agencies, availability statuses, operators, beats, radios, telephones, and users.</td>
<td>subscribeReq</td>
<td></td>
<td>X</td>
<td>subscribeResp</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used for a client to view the vehicle history for a particular vehicle in the system.</td>
<td>vehicleHistoryReq</td>
<td>X</td>
<td></td>
<td>vehicleHistoryResp</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used for a driver to send status updates to the subsystem.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>statusMsg</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Used for a subsystem to send vehicle updates to clients.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>vehicleUpdateMsg</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
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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
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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 its 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
Road Ranger AVL System

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.

March 12, 2008
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”.

March 12, 2008
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.
## Road Ranger AVL System

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>CENTRAL OFFICE</th>
<th>D4</th>
<th>D7</th>
<th>REQUIRED CHANGE/ADDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>The AVL subsystem shall acquire vehicle information containing position coordinates in XML format originated external to SunGuide.</td>
<td>AV001</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>The AVL subsystem shall display vehicle position using icons on the SunGuide Map.</td>
<td>AV002</td>
<td>X</td>
<td>X</td>
<td>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).</td>
</tr>
<tr>
<td>The AVL subsystem shall store vehicle position data by vehicle so that the vehicle’s track can be replayed on the SunGuide map.</td>
<td>AV004</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>AV005</td>
<td>X</td>
<td>X</td>
<td>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).</td>
</tr>
<tr>
<td>The AVL subsystem shall update the vehicle position each time a new position is reported for the vehicle.</td>
<td>AV006</td>
<td>X</td>
<td>X</td>
<td>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.</td>
</tr>
<tr>
<td>The operator shall be able to turn off the display of vehicle position information on the SunGuide map.</td>
<td>AV007</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>AV001L</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
## Road Ranger AVL System

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<th>D7</th>
<th>REQUIRED CHANGE/ADDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td>AV002L</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>If necessary, the acquisition component shall format the received data in accordance with the AVL Data Interface Specification.</td>
<td>AV003L</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>AV004L</td>
<td>X</td>
<td>X</td>
<td>The XML data file name should contain the truck number and date/time stamp in its name.</td>
</tr>
<tr>
<td>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.</td>
<td>AV004L1</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Position reports that are corrected by SunGuide shall be flagged in the data log and indicated to the operator.</td>
<td>AV004L2</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Event data and event type codes shall use the Florida Highway Patrol codes.</td>
<td>AV004L3</td>
<td>X</td>
<td>X</td>
<td>We should be using the list of event types defined by Central Office.</td>
</tr>
<tr>
<td>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.</td>
<td>AV004L4</td>
<td>X</td>
<td>X</td>
<td>D7 utilizes the FHP Codes in the display to save space – full translation may not fit.</td>
</tr>
<tr>
<td>The frequency that the AVL data is asked for by SunGuide shall be configurable in seconds.</td>
<td>AV005L1</td>
<td>X</td>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>Default frequency for the data acquisition request by SunGuide shall be 30 seconds.</td>
<td>AV005L1</td>
<td>X</td>
<td></td>
<td>See AVL005L1</td>
</tr>
</tbody>
</table>

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<tr>
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<th>D7</th>
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</tr>
</thead>
<tbody>
<tr>
<td>The source location of the AVL data source shall be configurable using the SunGuide Administration function.</td>
<td>AV006L</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>The icon symbol shall be able to be selected by an operator with administration rights on SunGuide and with appropriate permission for the subsystem.</td>
<td>AV002V</td>
<td>X</td>
<td>X</td>
<td>Icon symbol (image) would need to be selectable on a per RR (vehicle) basis. This is required to satisfy requirement D4-19.</td>
</tr>
<tr>
<td>The icon used on the SunGuide map shall be an SVG icon.</td>
<td>AV002V1</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The icon selected by the administrator shall be used to represent vehicles for which position reports are received.</td>
<td>AV003V</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>AV004V</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Vehicle icon color shall be configurable.</td>
<td>AV005V</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>The text popup shall appear on the SunGuide GUI map when the operator right clicks the vehicle icon and selects &quot;show status&quot;.</td>
<td>AV006V</td>
<td>X</td>
<td>X</td>
<td>D7 System utilizes “Hover” to obtain status instead of “click”</td>
</tr>
<tr>
<td>The operator shall be able to view the vehicle status via the SunGuide GUI Map.</td>
<td>AV006V1</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>The popup text boxes shall use the same tinted background color as used by the vehicle icon.</td>
<td>AV006V2</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>The popup text box shall move relative to the icon until &quot;Hide Status&quot; is selected.</td>
<td>AV006V3</td>
<td>X</td>
<td></td>
<td>This is not necessary if we use mouse-over functionality. In this setup, the user would have to &quot;toggle&quot; the summary mouse-over window using the menu.</td>
</tr>
<tr>
<td>DESCRIPTION</td>
<td>CENTRAL OFFICE</td>
<td>D4</td>
<td>D7</td>
<td>REQUIRED CHANGE/ADDITION</td>
</tr>
<tr>
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<td>----</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>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.</td>
<td>AV007V</td>
<td>X</td>
<td>X</td>
<td>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.</td>
</tr>
<tr>
<td>The SunGuide display of vehicles shall be refreshed whenever a new position report is available for display.</td>
<td>AV008V</td>
<td>X</td>
<td>X</td>
<td>D7 uses an update rate of once per minute.</td>
</tr>
<tr>
<td>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.</td>
<td>AV008V1</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chronological position data shall be maintained for each vehicle reporting position for a configurable deletion period.</td>
<td>AV001T1</td>
<td>X</td>
<td>X</td>
<td>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.</td>
</tr>
<tr>
<td>After 180 days, the oldest vehicle position data will be deleted as new position reports are received.</td>
<td>AV001T2</td>
<td>X</td>
<td>X</td>
<td>D7 does not delete any old data.</td>
</tr>
<tr>
<td>The operator shall be able to right click on a vehicle icon and select &quot;track display&quot; 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.</td>
<td>AV002T</td>
<td>X</td>
<td>X</td>
<td>Should be based on time.</td>
</tr>
<tr>
<td>Historical vehicle positions (tracks) shall be indicated by &quot;+&quot; symbols or similar leading away from the current vehicle position.</td>
<td>AV002T1</td>
<td>X</td>
<td>X</td>
<td>This can get cluttered quickly. Should be an option to turn this off.</td>
</tr>
<tr>
<td>There shall be an option to hide track display that applies to the track of the vehicle.</td>
<td>AV002T2</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DESCRIPTION</td>
<td>CENTRAL OFFICE</td>
<td>D4</td>
<td>D7</td>
<td>REQUIRED CHANGE/ADDITION</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>If the operator leaves &quot;display track&quot; 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.</td>
<td>AV002T3</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>If a vehicle speed is &quot;stopped&quot; or &quot;0&quot;, no more than one track icon shall be displayed.</td>
<td>AV002T4</td>
<td>X</td>
<td>X</td>
<td>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.</td>
</tr>
<tr>
<td>The operator shall be able to right click on the SunGuide map in an area without any symbols and get a menu of &quot;AVL Replay&quot; options to generate a historical track of a selected vehicle.</td>
<td>AV003T</td>
<td>X</td>
<td>X</td>
<td>(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).</td>
</tr>
<tr>
<td>The operator may designate a vehicle ID, a span of time in date and time, and a replay rate when replaying vehicle track information.</td>
<td>AV003T1</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>AV003T2</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>The operator shall have the ability to delete from the display all of the historical tracks for a particular vehicle.</td>
<td>AV003T3</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>The operator shall have the ability to globally delete all vehicles displaying a historical track.</td>
<td>AV003T4</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>AV004T</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>AV004T1</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

March 12, 2008
### DESCRIPTION

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>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.</td>
<td>AV004T2</td>
<td>X</td>
<td>X</td>
<td>Reports should not be external to SunGuide. SunGuide should provide all required reports.</td>
</tr>
<tr>
<td>Position reports shall be displayed on the SunGuide workstation when requested by the operator.</td>
<td>AV005T</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>AV005T1</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>The operator shall have the option to save or delete a report.</td>
<td>AV005T2</td>
<td>X</td>
<td>X</td>
<td>Reports should be exportable</td>
</tr>
<tr>
<td>A &quot;more noticeable&quot; 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).</td>
<td>AV005T2</td>
<td>X</td>
<td>D4-1</td>
<td></td>
</tr>
<tr>
<td>If a vehicle leaves the geo-fenced area without justification, the system shall alert the operator with a popup notification and an audible alarm.</td>
<td>X</td>
<td>D4-2</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>X</td>
<td>D4-3</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td>The AVL system shall provide a graphical user interface to define the geo-fences, both system wide geo-fences and beat specific geo-fences.</td>
<td>X</td>
<td>D4-5</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>X</td>
<td>D4-6</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>X</td>
<td>D4-7</td>
<td>X</td>
<td></td>
</tr>
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</tr>
<tr>
<td>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.</td>
<td>X</td>
<td>D4-8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The AVL system shall be compatible with the PC tablet devices used by the District 4 Road Ranger tablet application.</td>
<td>X</td>
<td>D4-9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The AVL system shall operate over the communications network designed for the Road Ranger tablet application by District 4.</td>
<td>X</td>
<td>D4-10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The AVL central software shall be distributed as part of a SunGuide software release.</td>
<td>X</td>
<td>D4-11</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>The AVL central software shall use the SunGuide oracle database to store and record vehicle location and speed history.</td>
<td>X</td>
<td>D4-12</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>The AVL software shall implement operator notifications within the SunGuide software.</td>
<td>X</td>
<td>D4-13</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>The AVL software shall provide summary data when an operator &quot;mouses-over&quot; 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).</td>
<td>X</td>
<td>D4-14</td>
<td>X</td>
<td>(D7) – Might be too much for a mouse over window. There should be a separate display for status</td>
</tr>
<tr>
<td>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).</td>
<td>X</td>
<td>D4-15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### DESCRIPTION

<table>
<thead>
<tr>
<th>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.</th>
<th>X</th>
<th>D4-16</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>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 &quot;Find on map&quot; option will be provided from the list, which will 'zoom' the SunGuide map to the current position of the vehicle icon.</td>
<td>X</td>
<td>D4-17</td>
<td>X</td>
</tr>
<tr>
<td>(D7) Clicking on the unit id number in the list shall zoom the map to the truck location.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Admin Editor functions will be provided to allow administrators to add and remove vehicles from the RR/AVL tracking system.</td>
<td>X</td>
<td>D4-18</td>
<td>X</td>
</tr>
<tr>
<td>(D7) Vehicles that are not “logged on” are not displayed.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The SunGuide GUI Map RR Icon shall indicate the relevant truck number.</td>
<td>X</td>
<td>D4-19</td>
<td>X</td>
</tr>
<tr>
<td>The SunGuide GUI Map shall enable the user to switch from map view to a satellite 'image' view.</td>
<td>X</td>
<td>D4-20</td>
<td>X</td>
</tr>
<tr>
<td>Satellite view shall be zoomable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>X</td>
<td>D4-21</td>
<td></td>
</tr>
<tr>
<td>A list of currently logged on trucks and their current dispatch status shall be displayed.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>D7-01</td>
<td>D7-02</td>
<td></td>
</tr>
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</tr>
<tr>
<td>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, &amp; Driver ID.</td>
<td></td>
<td></td>
<td>D7-03</td>
</tr>
<tr>
<td>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.</td>
<td></td>
<td></td>
<td>D7-04</td>
</tr>
<tr>
<td>TMC Operators shall be able to change unit status in the event of mobile electronics or communications malfunction.</td>
<td></td>
<td></td>
<td>D7-05</td>
</tr>
<tr>
<td>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.</td>
<td></td>
<td></td>
<td>D7-06</td>
</tr>
<tr>
<td>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.</td>
<td></td>
<td></td>
<td>D7-07</td>
</tr>
<tr>
<td>System shall be able to determine likely duplicated data during audit which was caused by communications loss, then recovery.</td>
<td></td>
<td></td>
<td>D7-08 (R2)</td>
</tr>
<tr>
<td>DESCRIPTION</td>
<td>CENTRAL OFFICE</td>
<td>D4</td>
<td>D7</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>Mobile operator shall be able to initiate incident</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobile operator shall be able to close incident which was initiated by that unit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobile operator shall be able to depart incident and leave it unresolved in SunGuide (i.e., abandoned vehicles)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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