myAvail

In-Vehicle Administrator Guide

Description of In-Vehicle Hardware and Software

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About this Document - myAvail In-Vehicle Administrator Guide

This document describes the components of the myAvail CAD\AVL in-vehicle system, both hardware and software, and provides information about the design, structure and configuration of these components. The guide covers the myAvail system at a level intended for system administrators and for providing management staff a system overview.

This document provides information about how data flows within and between in-vehicle hardware components and to the backend system. Additionally, this guide provides references to various other User Guides and Quick Reference materials for detailed information about system features and various daily and less frequent operational tasks. Step by step instructions for performing technical functions such as updating software and other responsibilities are provided in the AVL Service Guide provided when the fleet is installed.

This Guide is intended for use by the staff responsible for the technical administration of the overall myAvail System, for those responsible for the myAvail in-vehicle hardware and for management staff that require an overview of the complete product.

HINT: Clicking on the word **RETURN** will take the reader back to the Table of Contents.

Revision History

REVISION NUMBER	DATE	COMMENT
1.0	February, 2016	Initial Release
1.1	July, 2018	Resuming work towards first release.
1.2	December, 2018	Resuming work towards first release
1.3	April, 2019	Updated for myAvail 2.10.0.1
1.4	August, 2019	Updated for myAvail In-vehicle 3.2
1.5	September, 2020	Updated for In-Vehicle 3.3. Updates for GPS speed for dead-reckoning and secure GEMM.
1.6	March, 2022	Updated for In-Vehicle 3.6. **Updated**: What are the GPS & Dead Reckoning Components? **Added**: Appendix 1 - Installing and calibrating Ublox dead reckoning antenna.

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Introduction

This document has four major sections.

The first section, "What is the myAvail In-Vehicle Equipment?" covers the hardware installed in the vehicle and how the equipment ties to the vehicle. This section also describes various generations of supported equipment.

The next section, "What Are the myAvail In-Vehicle Components?" covers the various myAvail components applications, services, third party tools and how they exchange information.

The third section, "What Is the myAvail In-Vehicle System?" provides a general overview of all myAvail In-vehicle functions and workflow.

The final section, "Descriptions of Key Decision Processes" describes the processes followed in key situations, such as when ignition is turned on or off or how the system decides to change settings for the headsign or farebox.

This document covers all features, options, and equipment configurations available within the myAvail product line. Reading this document will help you understand why a particular solution might be to replace an apparently unrelated component. For example, a problem with a Mobile Data Terminal (MDT) rebooting might require replacing the IVU (In-Vehicle logic Unit). From this document, you will learn how the IVU is part of a "Watchdog" chain implemented to resolve Windows OS issues.

While this guide provides the overall scope of the product, it does not show you how to perform most tasks. To learn how to perform most daily tasks, please reference the *myAvail In-Vehicle User Guide*. For information about maintenance and in-vehicle equipment updates, refer to the AVL Service Manual.

What is the myAvail In-Vehicle Equipment?

Description of Vehicle Equipment

There are multiple generations of most in-vehicle components. This section focuses on the current generation of each device. However, a chart provides information about past generations and their compatibilities.

The equipment that the myAvail in-vehicle solution uses has evolved since its introduction in 1999. The in-vehicle system encompasses a variety of interconnected devices. This section covers the role of each device and how it interacts with the system. Several devices are optional and might not be included in your installation. Moreover, Avail has improved many of these devices over multiple generations. Most of the newer versions are backward compatible. Because of these changes over time, please reference the customer specific AVL Service manuals that Avail provides for the components in your vehicles.

The first-generation equipment centers on the control head, which is the Mobile Data Terminal (MDT). This device collected, processed, and reported all available vehicle data that it obtained from supporting Avail equipment, such as passenger counters and announcement systems. As functionality expanded, more input and outputs were needed. Avail added the Interface Expansion Box (IEB) to the system to support these new connections.

At about the same time, the MDT made its first generational leap to the Vector 530. Over the next several years, the control head went through two revisions (Vector 9000 and mSlate) while Avail modified the IEB to give it more processing power. The IEB became the In-Vehicle Unit (IVU). Avail planned this evolution to move all processing, data collection, and communications to the IVU, which led to the IVU 2. The culmination of these efforts is the layout shown in (Fig. 2) where all connections center on the IVU and the MDT is a display only device with no processing functions.

The following diagram is a full installation with the latest generation of equipment:
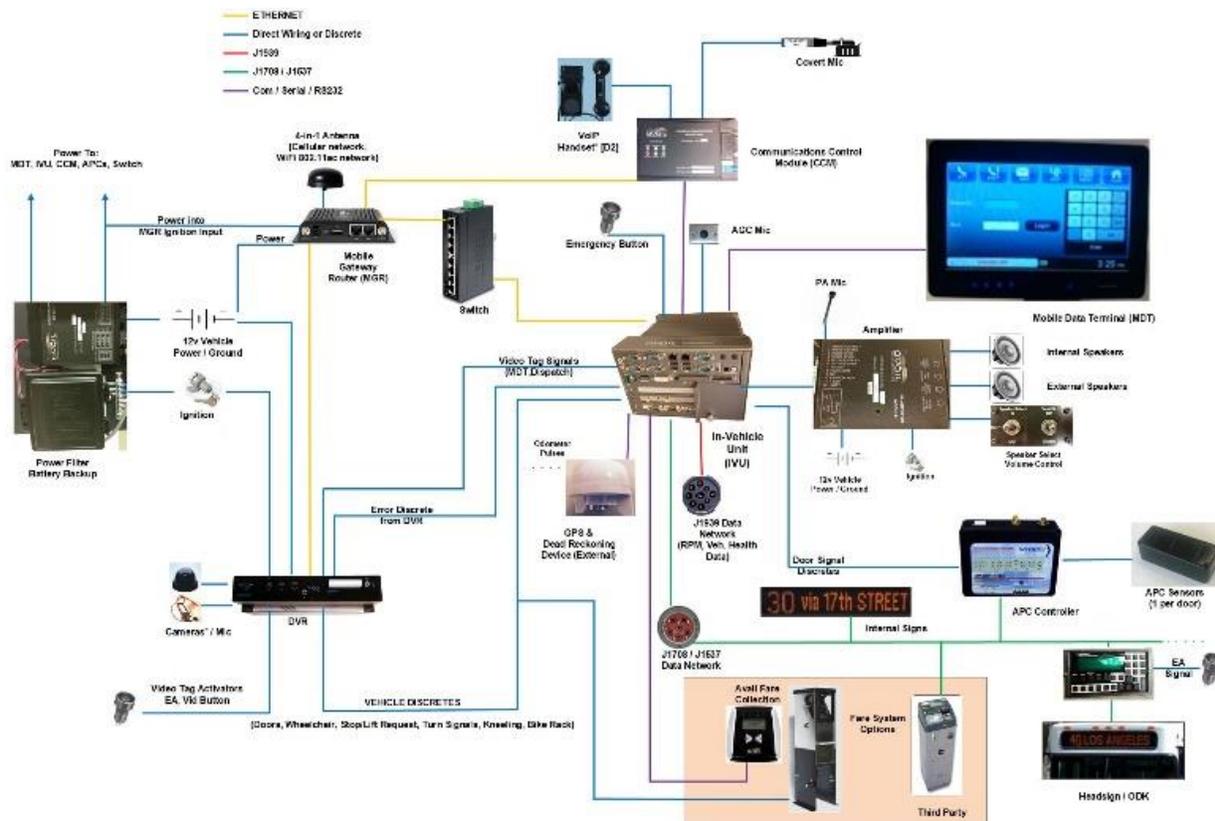
(Fig. 2)

- **Power Filter / Battery Backup** – This is the primary connection to the vehicle electrical system. Vehicle power generation tends to be "noisy" (dips and spikes in the voltage). The filter combined with the battery provides a steady "clean" power source to the Avail equipment. The back-up battery also provides power if the vehicle power is unexpectedly removed to allow the equipment to gracefully shutdown.
    - o **Connectivity –**This device provides vehicle power by direct wiring to MDT, IVU, CCM, APC, MGR, and Switch

NOTE: While the power filter provides power to all these devices it is the CCM that controls the power filter.

- **Mobile Gateway Router (MGR)** – This device provides the cellular connection and the Wi-Fi connection for all Avail devices. The device can also be connected to third party devices such as a Digital Video Recorder (DVR) where supported by the device.
    - o **Connectivity –**This device provides the bi-directional communications with the myAvail backend through a multi-function antenna supporting cellular and Wi-Fi communications. Internally the device provides bi-directional communication

via ethernet to the IVU and CCM, with optional connectivity to a switch and DVR.

- o This device was introduced in 2018. Prior to that time the cellular connection was integrated into the MDT or through a freestanding cellular modem connected to the MDT. The Wi-Fi connections was either through the MDT or the IVU.

- **Ethernet Switch –** This optional device allows multiple components to connect to the Mobile Gateway Router.
  - o This device was introduced with the MGR and is used where multiple devices connect to a shared cellular connection.

- **Communications Control Module (CCM) –** This device manages either private radio or VoIP communications. This device introduced in 2018 is the latest generation of the Radio Control Unit (RCU).
  - o **Connectivity –**This device connects to the MGR via ethernet, via a serial connection to the IVU and with direct wire connections to the Emergency Alarm button, Handset and covert mic.
  - o In a private radio system, this device handles radio channel steering and control of the speaker where the private radio system is integrated into an Avail managed closed mic system.
  - o In a VoIP communications system, this device manages the VoIP connections directly to the MGR.
  - o In all systems, this device monitors a "heartbeat" from multiple IVU processes. This heartbeat ensures these critical Windows services have not ceased to function without some other clear indicator. Failure to receive this signal will trigger the power to the IVU to be interrupted forcing a re-boot.
    - ▪ This device also provides the power executive and control. As part of this function the CCM also is the primary ignition sense detecting changes in ignition state (on / off or off / on).
  - o If an Emergency Alarm (a.k.a. covert alarm) is installed, it connects to the IVU. The emergency alarm button alerts dispatchers that an emergency, such as an armed passenger, is happening on the vehicle.
    - ▪ An emergency alarm is often paired with a covert microphone, which allows dispatchers to hear what is happening on the vehicle. This device connects to the CCM. The Covert Mic cannot be installed without the emergency alarm.

- **Handset / Speaker –** In either a VoIP or Avail managed closed mic environment a handset and speaker are provided as part of the installation.
  - o **Connectivity -** This device has a direct wire connection to the CCM.

- **Digital Video Recorder (DVR) –** This is a third-party device that might have been installed as part of the Avail project. Capabilities of these devices vary widely between manufacturers and with models for a single manufacturer. Depending on the device, the available connections can range from none to all the following connections:

- o **Connectivity –** This device might only receive power from the vehicle or have any or all the connections included. Check your specific AVL Service manual for details of your installation. However, this device might have an ethernet connection to the CCM and discrete connections to the IVU for indicating errors or receiving video timeline tag requests. (Dispatch and operators can mark timepoints for later review.) Connections to other devices are possible.
- **Emergency Alarm –** This is a single button that can be connected to the CCM, DVR and the Destination Sign (A.K.A. Headsign). This button is placed in a location where it can be inconspicuously pressed in an emergency, such as an armed violent passenger. The button makes no noise when pressed.
    - o **Connectivity –** This device has a direct wire connection to the CCM, DVR and Destination sign controller. NOTE: The connection to the CCM is normally an open circuit. Consequently, a disruption of the current in the circuit triggers the alarm. This arrangement prevents an undetected failure of the alarm.
    - o **Covert Microphone –** If the vehicle is properly equipped, dispatchers can listen through this microphone after the operator activates the emergency alarm. When a dispatcher is listening, the operator is given a subtle indication so they can verbally inform dispatch about the situation.
- **IVU 2 –** This is the core processing device in the system. This device does all the processing for display to and input from the operator through the MDT and for the GPS data and how they relate to the schedule and route. Furthermore, it stores and plays all announcements and provides connectivity to signals from the vehicle (i.e., Doors, Wheelchair lift, Stop / Lift Request, Bike Rack).
    - o **Connectivity –** This device has a serial connection to the CCM. There is an ethernet connection to the MGR and a wired connection to the DVR. All vehicle devices (i.e. Doors, Wheelchair lift, Stop / Lift Request, Bike Rack) are connected to the IVU. The IVU sends these signals to all other installed Avail devices as needed.

> **NOTE**: The remaining devices depend on the IVU for myAvail functions. They either respond to commands from the IVU or provide inputs to the IVU. The connectivity to the IVU is listed with the individual devices.

- o **Mobile Data Terminal –** This device is the interface to the vehicle operator. Past generations of the MDT (i.e. Vector 530, Vector 9000, mSlate) all performed much of the myAvail processing. It was late 2018 when all remaining processing was moved to the IVU, so the MDT could become a true Display Terminal that does no processing.
    - ▪ **Connectivity -** This device has a serial connection to the IVU.
- o **AGC Mic –** The Automatic Gain Control (AGC) microphone is connected to the IVU to provide the ability to adjust the volume of announcements based on the ambient noise on the vehicle.

- **Connectivity -** This device has a direct wire connection to the IVU.
  - **Amplifier –** This is a standard audio amplifier with a microphone input for the vehicle operator to make announcements and a line-in input from the IVU for automatic stop announcements, scheduled public announcements and operator trigger safety announcements. The amplifier can drive internal and external speakers and a speaker selector and volume control is provided for the PA microphone. These announcements provide ADA (Americans with Disabilities Act) compliance to the visually impaired.
    - **Connectivity -** This device has a direct wire connection to the IVU, to the control switch and to the internal and external speakers. This device also has a direct vehicle power connection so that it can continue to operate if the myAvail system fails.
    - **Mackenzie –** Prior to adding audio capabilities to the IVU Avail used third party equipment from Mackenzie Laboratories, Inc to provide announcement functionality.
  - **GPS & Dead Reckoning Device –** This is a global positioning satellite antenna with optional capabilities to calculate position based on dead reckoning from the last known position, which allows the vehicle to always have a known position.
    - **Connectivity -** This device has a serial connection to the IVU.
    - Past generations of equipment used a standard GPS antenna with an antenna cable connected to the MDT (i.e. mSlate, Vector 9000 or Vector 530) which did the signal processing.
  - **J1939 Network Card or Simma Adapter –** Avail accesses the J1939 network either through dedicated processor card in the IVU or through an adapter. Both devices provide the same functionality. This device allows Avail's in-vehicle equipment to interact with the vehicle's internal data network. This network is a standardized data network used by vehicle manufacturers and supporting parts suppliers (e.g. Engines, Transmissions, ...) to communicate diagnostics. Avail monitors this network to report vehicle health in real-time to dispatchers and maintenance staff.
    - **Connectivity -** This device provides myAvail's access to the SAE J1939 network, which is the standard implementation of the CAN bus (Controller Area Network) in transit vehicles.
  - **J1708 Network Card or Simma Adapter –** Avail accesses the J1708 network either through dedicated processor card in the IVU or through an adapter. Both devices provide the same functionality. This device allows Avail's in-vehicle equipment to interact with the vehicle's internal data network. This network is a standardized data network used by vehicle manufacturers and supporting parts suppliers (e.g. Fare Box, Destination Sign, ...) to provide controls. Avail uses this network to monitor the devices and to submit commands.
    - **Connectivity -** This card provides access to the SAE J1708/J1587 serial communications network. This is the legacy protocol, while still widely

used is being replaced by the J1939 standard. The following devices all use the J1708 network for connectivity.

- **Fare Box –** Avail can communicate with fare box provider GFI and other providers, such as Fare Logistics. Avail also provides its own fare solution with an RFID reader and non-validating fare collection box.
    - **NOTE:** If the IVU is not functional this device can still be manually controlled.
- **Internal Display –** This device is an internal sign that helps vehicles comply with the Americans with Disabilities Act (ADA) for the hearing impaired. NOTE: This device also has a direct connection to vehicle power.
- **APC Controller –** This device provides the processing for the automatic passenger counters.
    - **APC Sensor –** There is at least one sensor on each door, depending on door width, that provide counts of passengers boarding and alighting the vehicle
- **Destination Sign Controller –** This is the user interface between the operator and the destination sign (headsign). Avail interacts with the destination sign to automatically update it as needed, such for a trip change.
    - **NOTE:** If the IVU is not functional this device can still be manually controlled.
- If an Emergency Alarm (a.k.a. covert alarm) is installed, it is connected to this device. The emergency alarm is a button that when pressed alerts the Dispatchers that an emergency, such as an armed disruptive passenger, is happening on the vehicle.
    - An emergency alarm is often paired with a covert microphone, which when triggered allows the dispatchers to hear what is happening on the vehicle. This device is connected to the CCM.

NOTE: The IVU 2 is the latest in multiple generations of devices. The first generation was the IEB (Interface Expansion Box) who's primary function was to provide additional I/O capabilities to the MDT. The next generation was the IVU (In-Vehicle Unit), which provided the I/O capabilities and provided additional processing capabilities. The IVU 2 continued to expand the processing capabilities.

There are important concepts to understand about the in-vehicle equipment.
- The system requires power and ignition sense to start up, if either is disrupted, the system will fail to power up.
- The system power up / power down procedure.

- o Powering up is initiated when the CCM (Communications Control Module) detects ignition. It is the CCM that signals the power filter to provide power to the other devices.
  - o Powering down is also initiated by the CCM by way of the IVU. The CCM signals the IVU that ignition is lost, IVU manages its own shutdown. When the IVU shuts down the CCM "watchdog" is tripped and without ignition it causes the rest of the myAvail equipment to shut down.
  - o For more information see: [What Happens on Ignition State Change?](#)
- The IVU and the MDT services must be synchronized. Therefore, if one is re-started, they both must be re-started. Using the re-boot feature in the MDT ensures this happens correctly.
- There is a software "watchdog" feature built into the system that uses a "heartbeat" signal sent from separate components in the IVU and another is sent to the CCM. If either signal is missing, the CCM will shut down power to force a re-boot of BOTH the IVU and the MDT. Consequently, an MDT that constantly re-boots can indicate a problem with the IVU.
  - o When there are no interactions between the Avail system and the radio systems and VoIP communications are not used. The CCM does perform the "Watchdog" function, so it is included with all installations.

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Mapping of myAvail In-Vehicle Components Compatibility

Avail is committed to ensuring our customers get the maximum value from their investment in hardware. We are also committed to providing our customers with the state-of-the-art equipment. To meet both commitments, backward compatibility is a core priority for our systems. The key to providing this backward compatibility is in the messaging between the vehicle and the backend system. Our messaging scheme is continually additive, meaning we always add new messages when an enhancement requires changes to messaging. The backend tracks the in-vehicle equipment and software versioning to ensure the correct messaging is sent to each vehicle. This allows a property to have multiple generations and configurations of in-vehicle equipment, and their vehicles can use a mix of different software versions.

There are limitations to compatibility. The cabling installed in a vehicle is custom designed to the equipment selected for that vehicle. Because each piece of equipment has different connectors and other cable needs, equipment generations cannot be easily swapped within a specific vehicle. While either a mSlate or a Vector 9000 can function with an IVU, there are differences in the cables that connect the devices. Consequently, after installation, you cannot replace a failed Vector 9000 with an mSlate. Appropriate levels of spares should be kept for each type of equipment.

	IVU 2	IVU	IEB	MDT	mSlate	Vector 9000	Vector 530	CCM	RCU	Mackenzie
IVU 2				C	C			C	C	
IVU					C	C			C	
IEB					C	C	C			C
MDT	C							C		
mSlate	C	C	C						C	C
Vector 9000		C	C						C	C
Vector 530			C						C	C
CCM	C			C	C					
RCU		C	C		C	C	C			
Mackenzie			C		C	C	C			

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myAvail In-Vehicle Networking History

Providing network access for the in-vehicle system has been a challenge. Avail is committed to ensuring our customers get the maximum value from their investment in hardware. To provide this access, the in-vehicle equipment uses cellular and Wi-Fi connections.

Avail first added separate dedicated devices for Wi-Fi (MOXA) and cellular (RAVEN modems) to the earlier Vector 530 MDT units. The next generation of MDT, the v9000 and mSlate, had built-in Wi-Fi and cellular capabilities. During this generation of equipment, Avail also upgraded the IEB to the IVU. The IVU, which used a full Microsoft Windows operating system, provided an improved Wi-Fi capability compared to the embedded capabilities of the v9000 and mSlate. Consequently, the IVU prompted Avail to move away from the embedded systems and transition to using the MDT as a display only device.

The Radio Control Unit (RCU), which controls the interaction between Avail's in-vehicle system and the private radio systems in the vehicle, became the Communications Control Module (CCM). The CCM provides the same functionality as the RCU and adds the ability to support Voice Over IP (VOIP). The RCU and CCM, provide power management for the in-vehicle system, which is why systems with no radio interface or VoIP still have an RCU or CCM.

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What Are the myAvail In-Vehicle Components?
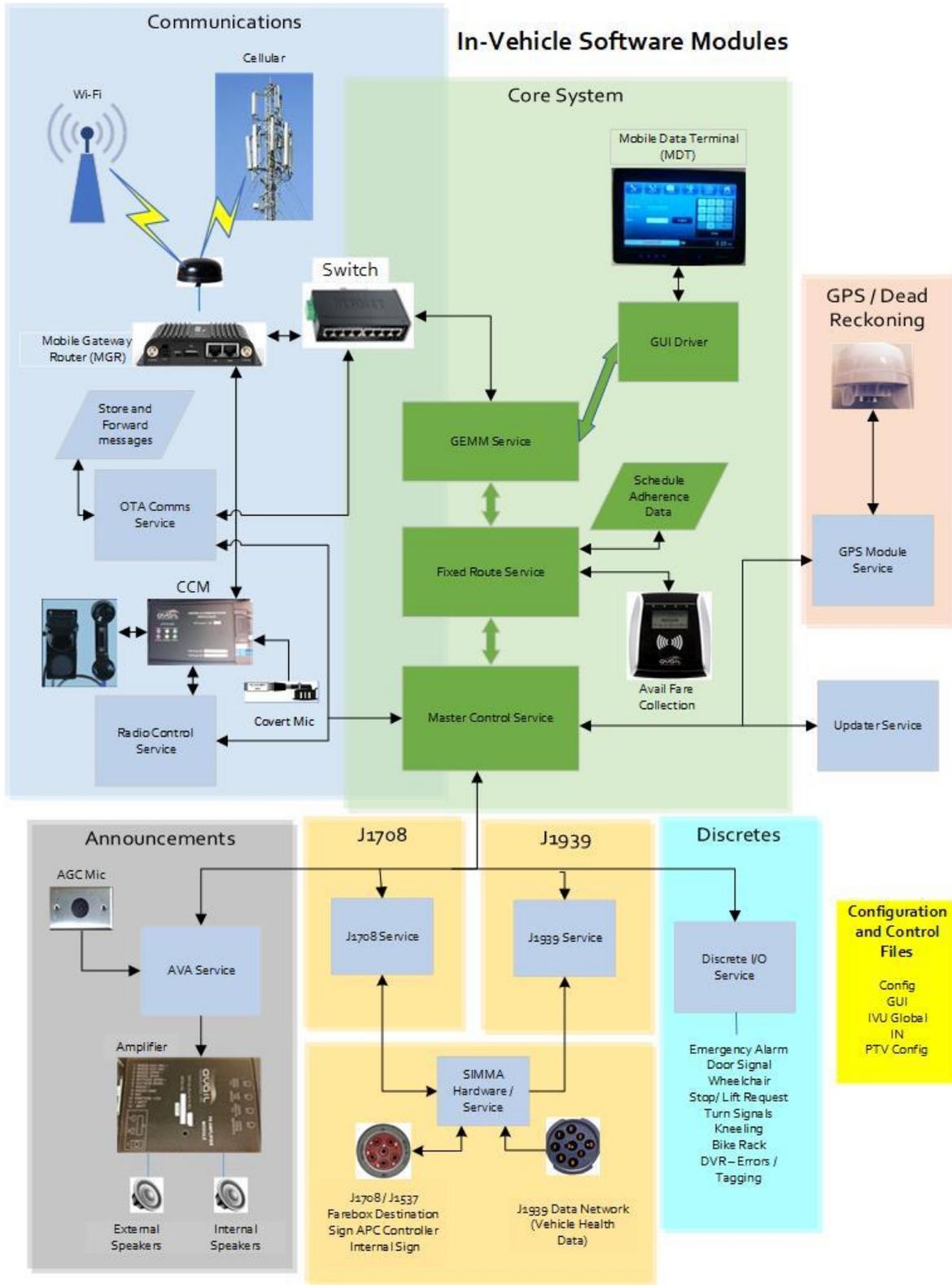
An Overview of myAvail In-Vehicle Components

The core of the myAvail in-vehicle system is the IVU (In-Vehicle Unit). This device is a ruggedized 64-bit Windows 10 PC with a solid-state drive and specialized components to interface with equipment that is specific to vehicles (e.g. J1939, J1708, …). There is a digital I/O capability to interface with vehicle discrete signals. These are typically simple indicators to inform myAvail if the door is open or closed, the stop request cord was pulled, or the wheelchair lift was deployed. The Avail software on this device is mostly Microsoft Services modules except for the GUI Driver which is a web application. The modular design with services handling individual components and communicating with each other and the core system through a Master Control Service allows Avail to add and update individual services with a minimum of change to the system.

What are the Core System Components?

GUI Driver

The touch screen monitor in the vehicle is a web browser display running in kiosk mode. The GUI Driver module prepares the information that is displayed on the monitor and receives inputs from the monitor. This web application receives data from and sends data to the GUI Event and Message Management (GEMM) Service. This service design and use of a browser for display allows flexibility in the display devices.

GEMM Service

GEMM stands for GUI Event and Message Management. This module handles messaging to and from the monitor and the in-vehicle network. This module provides a flexibility network capability for the Avail in-vehicle solution to partner with other third-party devices, such as the DVR and signage.

If your third-party vendor would benefit from access to the Avail in-vehicle solution contact your FAST representative.

Beginning with in-vehicle v3.3, GEMM supports connections through HTTPS using a self-signed security certificate. Consumers of the API must accept Avail's certificate if they desire HTTPS.

GEMM does the following:

- Accepts requests through a secure HTTPS port.
- Uses a self-signed certificate to avoid reliance on a third-party signing authority.
- Serves subscriptions via HTTP or HTTPS, based on the consumer who is subscribing.
  - For HTTPS publications, GEMM accepts self-signed security certificates.
  - GEMM *should not* include its own security certificate to verify its identity when it functions as the client.

GEMM *should not* require HTTP->HTTPS redirects over the unsecured port.

Fixed Route Service

The Fixed Route Service contains all the myAvail business logic. This service takes inputs from the various devices, including GPS data and the stored schedule data. The service determines what to display for the operator, whether any connected sub-systems, such as the destination sign, needs a value change, and what data needs to be transmitted to the back-end system.

In prior versions of the myAvail in-vehicle solution, this code resided in the MDT (mSlate, Vector 9000 or Vector 530). However, Avail has moved all code to a standard Windows platform device. Having all logic reside in the IVU reduces the complexity of the solution and increases the flexibility in the choice of display unit.

Master Control Service

The Master Control Service is a master control switch. The design of the in-vehicle solution revolves around this control switch. All services that interact with vehicle components need to send messages to only this master Control service. Services that need inputs from vehicle components register with this Master Control service. In this way, the devices sending data do not need to know which services they need to send data to. They just send all data to the Master Control service. Services that register for specific input will receive the data. This abstraction allows Avail to add services with a minimum of changes because the new module needs to request the data, but the service sending the data does not need to be modified.

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What are the Communications Components?

OTA Comms Service

"Over The Air" (OTA) Communications service manages all vehicle data communication to external systems. This module handles Wi-Fi, private radio and cellular data transmissions under normal processing. It also manages data storage when the vehicle is out of communication coverage. All messages have a 'time to live" value. The system attempts to send the message until this time expires. Critical data, such as stop and trip change records, do not expire in order to preserve these important data.

Radio Control Service

The Radio Control Service handles voice communications for private radio when using a closed microphone system and for VoIP (Voice over IP). In a private radio system, this service controls the speaker for the operator's handset and handles all necessary channel steering.

> **NOTE**: If the IVU fails and this service is unavailable, the CCM hardware can detect the failure and connect the handset with the MGR hardware to provide a voice fallback system. This fallback allows the vehicle operator to remain in communications.

What are the GPS & Dead Reckoning Components?

GPS Module Service

The Global Positioning System (GPS) Module accepts data from the GPS device in the National Marine Electronics Association (NMEA) format. The GPS Module reformats the data into a proprietary location message. Then, it sends the message to the master control service, which provides the message to all modules that require location information. This module does not perform any calculations with the location information. It sends only the vehicles current location.

Avail supports standard GPS devices that use satellite signals, which are subject to interference from urban canyons (narrow streets between tall buildings), overhangs, multiple level highway interchanges, or anything that can disrupt these very low power signals. This solution is sufficient for most properties. Avail has an optional upgrade that includes a "Dead Reckoning" capability. Dead Reckoning is the ability to calculate the vehicle's current position based on knowing how it has moved from a previously known position. The dead reckoning device upgrade requires a connection to the vehicle to determine speed and electronic components to determine the direction the vehicle is moving in 3 dimensions. When the GPS signal is lost or degraded, the dead reckoning capability kicks in to maintain an accurate vehicle location. If you are interested in adding this functionality, perhaps on new vehicles, please contact your FAST representative. This feature is available for in-vehicle software of 3.6 and above.

Beginning with in-vehicle version 3.3, speed is read from the J1939 and sent to GPS module. UBLOX GPS receiver achieves dead-reckoning calibration based on the J1939 wheel speed data. UBLOX GPS dead-reckoning calibration performs as well as the external discrete wheel-tick input. This process allows vehicles to utilize the dead-reckoning capabilities without having to wire an external wheel-tick input signal.

For more information on installing and calibrating Ublox dead reckoning antenna, please see Appendix 1 in this document.

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What are the Announcement Components?

AVA Service

The Automatic Voice Announcements (AVA) service module handles communications with the in-vehicle sound system hardware, including the AGC (Automatic Gain Control) microphone. The Fixed Route Service controls the announcements, their order, and determines whether one announcement can interrupt another. This module controls the low-level interface that processes sound files. When the Fixed Route service passes an announcement to the AVA module, the AVA service uses the AGC mic to assess the ambient noise level in the vehicle and adjusts the volume accordingly.

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Users manage announcements on the Announcements tab of the myAvail application and assign them at the stop / trigger box level. In addition to the announcements that are associated with specific trigger boxes, the system also provides safety announcements the operator can play as needed. These announcements provide instructions to riders without the need for a direct confrontation. Examples of common safety announcements include the following:

- Profanity Is Prohibited.
- Limit speaking to the operator.
- No eating or drinking.

Up to nine messages can be provided to the operator.

The in-vehicle equipment includes a text to speech component. This feature allows dispatchers and other office staff to type messages that the system reads over the PA system. The system can play these messages on anywhere from one to all vehicles.

What are the Simma / J1708 / J1939 Components?

Simma Hardware / Service

Simma is a third-party product designed to provide connection hardware for both the J1708 and J1939.networks. The service also provides initial processing of the J1708 and J1939 data That is done prior to the Avail business logic processing.

This **J1708** Device Driver provides an application program interface (API) for sending and receiving SAE J1708 messages. It is designed to work with our J1587 software and abstracts away the technical details and many complexities associated with message timing and interfacing to the physical layer. This increases the simplicity of the application software and improves reliability.

The service also provides an **SAE J1939 protocol stack** designed by Simma Software, a nationally recognized CAN bus expert, to meet the demanding needs of the high-speed Controller Area Network (CAN). The source code uses a high-performance modular design and has a simple API.

J1708 / J1587

J1708 refers to a Society of Automotive Engineers (SAE) serial communications hardware standard and J1587 is the communications protocol. These components form a communications network that transit vehicles use to connect various components. The non-proprietary standard allows different components produced by various manufacturers to communicate. Typically, there are the following two separate networks:

- Drivetrain J1708 network for engine and transmission communications.
- Transit J1708 allows other devices to communicate.

Avail uses only the Transit J1708 network, which connects components such as the farebox, internal signage, APC controller, and the destination sign. Avail uses the Simma product to provide the physical connection.

> **NOTE**: While SAE J1708 is still widely used, it is being replaced by the SAE J1939 protocol.

J1939

J1939 refers to a Society of Automotive Engineers (SAE) communications standard. The J1939 service module provides the interface to the in-vehicle J1939 network, which supports communications and diagnostics between vehicle components. This module acts as a filter for the J1939 network. This network, which is slowly replacing the J1708 in-vehicle network, has a significantly larger amount of data flowing across it. The J1939 network used with diesel engines includes detailed sensor data about displays and the Electronic Control Units (ECU) that control engine operations. Because of the large amount of data, the module filters the data to include only the vehicle health alerts. myAvail has a Vehicle Health Monitoring (VHM) option that provides real-time alerts to Dispatch and/or Maintenance for maintenance issues, such as a "check engine" light and why it turned on. This service formats the selected messages and passes them to the Master Control service for distribution.

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Discrete IO Service

Not all vehicle components connect to either the J1708 or J1939 networks. For example, the passenger doors and wheelchair lift use a simpler method to communicate their statuses. This method is referred to as a discrete signal. These signals are binary (on or off) and run through a wire that physically connects the device to the Avail system. For instance, the door sends a signal to the Avail system that indicates whether the door is open or closed.

The Discrete IO Service monitors these physical connections while understanding which connection belongs to which component. For example, when the door changes from closed to open, the discrete signal changes. When this service detects the change, it prepares a message for the Master Control Service that the door is now open. The Master Control Service, in turn, passes the message to the Fixed Route service for processing. myAvail supports the following discrete signals:

- Door Signal
- Wheelchair lift

- Stop / Lift Request
- Vehicle Kneeling
- Bike Rack (requires optional hardware)
- DVR – Errors / Tagging (when supported by the device)

Updater Service

As the name implies, this service handles all scheduled updates. Scheduled updates fall into the following two broad categories:

- Schedule Data (a.k.a. Run files).
- Program Files / Configuration Files.

Deploying revised schedule data is the most common type of update event. When a property changes its service, it must publish those changes. Part of that process involves deploying the new schedule to all vehicles.

The deployment process places the files for download in a designated server location. When a vehicle is in range of the Wi-Fi system, the service checks for files to download. The vehicle obtains schedule update files from the server and places the files in the correct location in the vehicle and waits for the activation date. Typically, the system deploys schedule data days before its usage to ensure all vehicles have time to receive the files. At the first log on success on or after the publish activation date, the update service replaces the previous schedule with the new schedule.

> **NOTE**: If the schedule data is not deployed to the vehicle before the start of the new schedule, the new schedule data for the block / run that is being logged into will be downloaded over the air (via radio or cellular data) by the OTA and Fixed Route services.

Program and configuration files are provided and downloaded only at the direction of Avail personnel. The Vehicles File tab in myAvail controls the server side of the download process. That side of the process is described in the myAvail Administrator User Guide.

The Updater Service handles the vehicle side of the update process automatically. The service detects when program files or configuration files are ready for download and obtains them. These files have an activation date. The service activates the files when the system boots up for the first time after the activation date. To active updated programs, the updater service forces a system re-boot. When only configuration files are downloaded to the vehicle, the system places the files in the activation folder on the activation date, but those files will not be used until the next re-boot.

Avail uses the term "Configuration Files" to refer broadly to files that in-vehicle software uses during run time. These files activate and control optional features and define which specific equipment are installed in a vehicle. Vehicle equipment definitions are complex because there

are many possible vehicle set-ups (e.g. different headsign manufacturers, radio or cellular communications, APC units, etc.).

All these various files are collected into five groups. Three groups relate to software setup - Config Files, GUI Files and IVU Global Files. Two groups are for the vehicle equipment - PTV Config Files and INI Files.

If you have any questions about vehicle configuration, please contact your FAST representative.

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What is the myAvail In-Vehicle System?
An Overview of myAvail In-Vehicle Capabilities

The myAvail In-Vehicle system provides capabilities in three broad areas:

- The system removes distractions from the operator by handling passenger information tasks
- The system determines and reports schedule adherence and ridership information.
- The system informs Operations and Maintenance of the vehicle's location and mechanical status.

myAvail begins Operator support by providing a single point of operator logon through the Mobile Data Terminal (MDT). The operator enters their operator ID and block or run number, which allows the system to do the following:

- Display the correct value on the destination sign and update as needed.
- Play announcements with the Automated Announcement system and display them on the internal signs for Americans with Disabilities Act (ADA) compliance.
- Set farebox values based on driver ID, run, route, direction, and trip, and update as needed.

Calculating schedule adherence and performing operator support tasks begins with the block or run number that the operator enters during log on. The block number defines a vehicle's work for the day. The run number is an operator's work for the day, which can be spread over more than one vehicle (block). If the system is configured for the operator to enter run numbers, the system uses the time of day to determine which block it should load.

myAvail calculates schedule adherence at scheduled stops. The system uses trigger boxes to determines when a vehicle is at a stop. A trigger box is a geofence, or virtual boundary, that surrounds around each stop. Transit property users define trigger box areas by using the Geographic Tools tab in myAvail.

The system uses live GPS data to determine when a vehicle enters a trigger box. However, it must also determine whether the trigger box is valid for the active block of work. To make this determination, it assesses the previous stops that the vehicle completed for the current trip

and the remaining stops for the current trip. The system can also use direction of travel when a vehicle passes through a stop more than once on a trip. During this validation process, the system accounts for missed stops, detours, and the vehicle being off schedule.

After the system confirms that the vehicle enters a trigger box for a valid stop, it performs several operator support actions, such as making ADA announcements, informing the operator if they are ahead or behind schedule, and changing the destination sign and farebox if needed. Upon exiting the trigger box, myAvail performs additional actions, such as relaying passenger boards and alights and schedule adherence information to the myAvail backend.

This process occurs all day long and relieves the operator of that task and allows them to focus on driving.

HINT: The last stop of a trip is usually the first stop of the next. myAvail considers the actions needed for everything from changing the destination sign on approach to the stop and adjusting internal signage, even when the next trip is to deadhead to a new trip. For an explanation of how ridership is assigned see: myAvail System Administrator Guide section 'An Overview of How Ridership is Attributed to Block/ Run/ Route/Trips/Stops'.

Automatic Vehicle Location (AVL) tracking and optionally Vehicle Health Monitoring (VHM) occur whenever the vehicle ignition is on. The operator does not need to be logged on for the system to report its location and to monitor the J1939 'CAN' internal network for issues. VHM is dependent on the vehicle having a J1939 network and the equipment that provides standard messaging across the network. myAvail can be configured to alert Dispatchers if a vehicle moves off the yard without being logged in.

When Avail provides the in-vehicle solution for both paratransit and fixed route systems, operators of both systems enter run numbers at login. myAvail uses unique run numbers for paratransit and fixed route runs. Paratransit logins are forwarded to the properties paratransit system.

In the Paratransit applications, the MDT handles a slightly different set of functions than for fixed route use, but it still provides AVL reports in the same way that a Fixed Route vehicle does. On Paratransit vehicles, the MDT tracks the vehicle location, uses GPS to determine the mileage that the vehicle has traveled, and delivers that information to the central system when certain events occur. These events include arrivals, performs, and no-shows, which are submitted to the central system by operator interaction with the MDT. Just like Fixed Route vehicles, when any of these events occur, the system sends AVL data to the central system.

NOTE: Support by Avail for an in-vehicle Paratransit interface through the MDT is a legacy feature. Currently this feature is unavailable on our latest display units.

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Description of Operator interactions with the myAvail In-Vehicle System

This section provides an overview of operator interactions with myAvail's features and capabilities. The precise operating procedures of your property can vary from those in this overview.

- **When the Operator turns on the ignition**
  - All in-vehicle myAvail equipment powers up automatically.
  - The MDT begins an equipment status check of the following:
    - VLU Data Store
    - Flash Disk
    - IEB / IVU
    - Silent Alarm
    - APC
    - Farebox
    - Annunciator
    - Destination Sign
  - These internal tests are checking that all the configured devices can respond to a status request.

NOTE: In software version 6.09 and higher, the in-vehicle system performs these tests in the background and displays only the results for the operator.

  - The MDT presents the operator Log On screen.
    - The log on process requires connection to the central system.
      - See Description of Vehicle Communications for a description of how connections are established.

NOTE: The Avail system is time synced via GPS to ensure accurate schedule adherence calculations.

    - The log on process does not require GPS lock.
    - The operator is required to enter their Operator ID and run or block number (as configured) into the MDT
      - The in-vehicle system sends the Operator ID and run number to the central system for validation and storage.
        - The system allows operator to log on only within a configurable number of minutes prior to the start time of

the run, which the server validates. Attempting to log on prior to that window will produce an "Invalid Run ID" message.

- o Invalid operator IDs or run numbers produce a login error on the MDT, and the operator will need to try again.
- o There is an option that will validate the operator is assigned to that run and the vehicle is assigned to that run. The system will prevent log on unless all three are correct.

- There is an option to require a password at log on.
- The operator log on information is automatically sent to the farebox at the time of logon, if enabled.

NOTE: In-vehicle system software version 6.09 and higher, myAvail validates the operator ID and the Block or Run number in the background, which allows the operator to continue with the log on process.

- o The system logs the Operator on to the farebox, finds the correct trip, and sets the destination sign. This process completes the single point of logon for the system.
- o Failure to log on during the acceptable window of time before the scheduled start of a run displays an event for the dispatcher. See *Description of Fixed Route's Operational Processes* in the **myAvail Users Guide**.
- o Pre-Trip Option
  - Operators can record vehicle pre-trip inspection values using an optional set of screens. These screens are customer configurable. See *Inspection Settings* in the **myAvail User Guide**.
  - If a property uses these pre-trip screens, operators are required to complete them during the initial vehicle startup for the day.
  - Required actions for relief operators is configurable and set up in the initial installation. Consult Avail Support if you wish to change these actions.
  - The system sends all failed checks to the backend system for reporting and displays an event for dispatch in real-time.
- o Required Pre-Trip Checks
  - As part of the login process, several pre-checks are provided for the operator to confirm the proper operation of the announcement system,

the APC unit (if on the vehicle), and the wheelchair lift. If the wheelchair lift must be deployed during the login process, dispatch receives an event if the operator doesn't perform this task.

- o The in-vehicle system sends logon messages to the CAD/AVL dispatch system. For paratransit vehicles, the logon/logoff messages are forwarded to the paratransit system.
- o Destination Sign Updated at Log On
  - Route and destination codes are sent from the system to destination sign as required
  - The codes are sent to the front destination headsign and, if the vehicle is equipped with a side or rear sign, the destination sign is responsible for relaying that information to those signs. Schedule data includes headsign codes for patterns for all trips including "deadhead" trips.
  - The existing manual headsign controller interface can continue to be used by the operator
- o Farebox is Updated at Log On

NOTE: The fareboxes in use must support a physical J1708 interface, which is the interface between the CAD/AVL in-vehicle system and the farebox. License and support service fees for the J1708 interface are required, and Avail will work with the farebox provider to ensure the fareboxes are properly configured to support the J1708 interface.

  - Operator, Route and associated fare information is provided to the farebox upon myAvail log on
  - If farebox alarms are activated by the GFI system, myAvail will detect the issuance of such events from the farebox and send indicators to the CAD/AVL system that results in a dispatch event
  - The GFI farebox manual user interface can continue to be used to override any settings made during the log on process
- **What happens when the vehicle starts moving?**
  - o The optional Automated MDT Screen Lockout Functionality is engaged
    - When the vehicle is above a configurable speed, certain buttons and the six softkeys can be disabled on an individual basis. These functions are:
      - Full Screen
      - RTT/PRTT
      - Public Safety Messages

- Audible alerts
- Pop-up Messages
  - The following can be set independently for Fixed Route and paratransit vehicles:
    - Speed Limit at which to lockout or enable functions
    - Number of seconds at or above speed limit to activate lockout
    - Number of seconds below speed limit to deactivate lockout
  - The following are paratransit-only settings that can be configured:
    - The 'Map To' button can be either enabled or locked out while in the Lockout mode
    - The distance (in feet) to the location of the trip within which the number of seconds to deactivate (based on speed) will be ignored.

- o The fixed route vehicle reports location
  - The reporting of vehicle location is a triggered event.
  - AVL reports include location, date time, direction of travel, speed, vehicle ID, operator ID, route, run and trip information.
  - AVL reports occur after the following events:
    - Vehicle ignition changes state (on to off or off to on)
    - The operator logs on to a specific run or block
    - A maximum time interval has elapsed since the last communication (default 60 seconds)
      - o NOTE: The time interval is to provide periodic reports while the bus is stationary. While on route the other events occur frequently enough to provide accurate location information.
    - The vehicle has traveled a maximum distance since the last communication (default ¼ mile)
    - The vehicle has exited a stop trigger box
    - The operator sends a message to Dispatch
    - The operator puts the vehicle in "Manual Announcement mode", "Out of Service" or "Driver Off" state
    - The operator logs off
  - If cellular communications are temporarily lost, the AVL reports will be stored as per the configurable keep alive time until a network cellular connection is re-established with the CAD/AVL system, at which time any such stored messages are transmitted.
- o The internal sign will display

- Date/Time
- Destination
- Optional – Operator name
  - When the stop cord or wheelchair stop/lift request button is activated, the announcement system will play the defined 'stop requested' announcement and display the appropriate text on the internal sign.
- **What happens as the vehicle approaches a stop?**
  - The system detects when the vehicle enters a predetermined area or Trigger Box (TB) around a given stop.
    - A specific angle of entry can be assigned to the TB to prevent announcements when the vehicle passes through the TB more than once on the same trip. The myAvail Administrator User Guide includes detailed recommendations on creating trigger boxes.
    - See "Description of Fixed Route Schedule Data Input / Modification Process" in the myAvail System Administrator Guide for an overview of schedule data entry.
  - When an announcement action has been assigned to the TB, the system will send a code to the announcement system within the IVU to play a specific pre-recorded message and display any defined text on the internal sign.
    - The base volume level of announcements is set by global configuration parameters per vehicle type defined during the system installation. These values can be changed by contacting Avail Support.
      - An Automatic Gain Control (AGC) microphone is also installed midway inside the fixed route vehicles to monitor the ambient noise level inside the vehicle at any time.
      - The AGC microphone will allow the annunciator to automatically alter the volume level, if necessary, based on the ambient noise inside the vehicle.
      - Exterior announcement has two volume settings one for daytime volume level, and one for nighttime volume level, and a setting for the time of transition.
    - The announcement system also serves as the PA microphone amplifier
    - The operator also has the option on the MDT to select a public safety message to play, and can also use the microphone to make verbal announcements

- The announcement system adheres to an order of precedence for the various announcements that can occur on a given vehicle. The order is listed below:
  - Operator PA Microphone
  - Stop Requested
  - Automated Stop Announcements (will repeat if interrupted by a stop request)
  - Public Service Announcements
- The operator can use the PA microphone to interrupt any announcement
- Route and destination codes are sent by the system to destination signs as required
  - The codes are sent to the front destination (headsign) and, if the vehicle is equipped with a side or rear sign, the destination sign is responsible for relaying that information to those signs.
  - The existing Destination controller interface can continue to be used by the operator to override if needed the automatic setting.
- Operator, Route and associated fare information is provided to the farebox upon the system detecting a trip change.
  - If the route changes during the run, the updated route is sent to the farebox
    - There is an option to send location data to the farebox upon door open events
  - If farebox alarms are activated by the GFI system, the system will detect the issuance of such events from the farebox and send indicators to the CAD/AVL system that result in a dispatch event
  - The GFI farebox user interface can continue to be used to override any settings made during the log on or trip change process
- Schedule status provided to operator
  - At stops where the departure time is published to the public and the departure of the trigger box (TB) is in the future x minutes from the current time, the status line on the MDT will indicate 'Wait -x min' with a countdown to time to depart. When the time for departure is reached, a notification with audible alarm pop-up will tell the operator 'Time to Depart'.

- If the scheduled departure is already past x minutes, the status line will indicate 'Late x min' indicating the operator should depart as soon as possible.
    - The amount of time the operator is late is cleared after leaving the trigger box and their schedule status is displayed again when the vehicle reaches the next published stop on the trip.
- The system is configurable to establish the On-Time range
- The On-Time range is set with two separate parameters. For example:
    - A vehicle that is more than zero minute ahead of schedule is declared EARLY (e.g. 10 seconds early is early). The number of minutes is configurable.
    - A vehicle that is more than 5 minutes behind schedule is declared LATE (e.g. a vehicle 4 minutes and 45 seconds late arriving at the stop is "On Time"). The number of minutes is configurable.

NOTE: When a vehicle is off-route, the trigger boxes cannot be entered therefore all the proceeding actions will not occur. The system will automatically detect when the vehicle returns to on-route status.

- **Various On Request in-vehicle functions**
    - Request to Talk (RTT), and Priority Request to Talk (PRTT)
        - Are buttons available on the MDT, which send a message to the dispatcher, indicating a need to communicate with Dispatch. This option is configurable but can be used on an open-mic system, this can help reduce radio traffic and allows some prioritization of talk requests.
    - Text Messaging
        - The text messaging feature can be accessed by the operator from the MDT's home screen, but there are several ways in which an operator can access the different features of the text messaging function. An audible tone is generated when a text message is received by the system. Up to ten text messages are stored in the system at a time, with the oldest message removed when an eleventh message is received.
            - The 'MSG' soft key (Touch screen button) presents options to send or read text messages
            - To Send a text message, the operator selects from a prepared list of messages

- Existence of un-read, or read but not deleted, text messages is indicated on the MDT's home screen
- An 'INBOX' soft key (Touch screen button) is also available on the MDT's home screen, and provides quick access to messages received from dispatch
- The dispatcher has the option to request either an acknowledgement or a yes/no answer from an operator when sending a text message; the operator is shown buttons to provide this response when reading the message
- Indicates that there are new messages in the message list (Inbox)
- Indicates that there are new messages in the message list, and the operator has looked at the Inbox, but has messages that have not been opened and read (by selecting the message)
- Indicates that all messages have been read by the operator

- How to Alert dispatch of an emergency
  - Each vehicle can be equipped with an emergency alarm button used to covertly alert the dispatcher to serious situations that might occur on the vehicle
  - When the button is depressed for > .5 seconds, the dispatcher is notified via a large 'Emergency' icon, along with an audio alarm
  - The emergency signal can also activate an emergency setting on radio or cellular voice communication system. If the radio and cellular system is configured for this capability.
  - AVL reports for the affected vehicle are sent to the fixed-end with a higher frequency
  - Vehicle Operators are discreetly informed of the Dispatcher's acknowledgement action
  - The dispatcher can activate a covert microphone on the vehicle and listen to audio on the vehicle if the vehicle is so equipped
    - The covert microphone can only be activated after the operator has pressed the emergency alarm
  - The dispatcher can close the Emergency Alarm event, which will disable the covert microphone

- The Emergency Alarm button can also send a signal to the headsign that causes it to display its emergency mode message (e.g., 'Call 911')
- Automatic vehicle announcements continue to occur normally when the EA button is activated
- The receipt of voice communications and text messages is disabled

o Transfer Connection Protection Feature

- This provides the option for an operator on one vehicle to indicate a passenger desires a transfer to another route. The system will send the transfer request, and the central system will determine if the transfer can be supported and send a message to the receiving route's vehicle if it can. Further details of this process are in the fixed route operator user guide.

- **Paratransit Specific Features**

NOTE: Support by Avail for an in-vehicle Paratransit interface through the MDT is a legacy feature. Currently this feature is unavailable on our latest display units.

o The paratransit functionality of the MDT includes the ability to launch a navigation application for automatic directional guidance with speech functionality. For each manifest entry, the user can select a 'Map To' button that will automatically launch the navigation application and start route calculation and guidance, including audio turn cues. The operator can choose to exit the navigation application at any time, and the user will be returned to the screen from which the navigation application was launched. The audio cues are a configurable option that can be activated or de-activated by the operator.

o Manifest information is provided from the paratransit system to the CAD/AVL system, which is transmitted to the appropriate paratransit vehicle. Configuration settings control how many manifest entries are provided to the MDT at a given time. Updates to the existing manifest entries are sent to the MDTs, with changes to existing manifest entries highlighted with an asterisk character. The vehicle operator is provided options for performing and arriving the trip entries on the manifest, as well as pull-out, pull-in, and no-show options. The system can be configured to allow grouping of trips, such that a single drop off action can be done for multiple trips. The system can be configured to allow the operator to update the odometer value prior to sending a pickup, drop off, and cancel at door or no-show message.

- A configurable radius can be defined that will prevent an arrival event from being performed by the operator unless within the specified radius value of the manifest entry address.
- The AVL reporting rate is generally set the same as fixed route but can be set independently. AVL reports can also be sent after a configurable amount of distance has been traveled since the last issuance of a report.
- AVL reports are also included when any event occurs that requires an inbound message to be sent from the vehicle to the CAD. The following are some examples of Paratransit events:
  - Logon / Logoff
  - Pull-Out / Pull-In
  - Arrives/Performs/No Shows
  - Canned data message
- If cellular communications are temporarily lost, the AVL reports will be stored on the MDT until a network connection is re-established with the CAD/AVL system, at which time any such stored messages are transmitted.

- **MDT shut down process**
  - The system power-off sequence is initiated by ignition off. A backup battery is included to allow the Avail system to have a normal shutdown if the vehicle main batteries are disconnected. This provides time for Bulk Download data transfers to occur after a vehicle is powered off, and to allow operators to turn off a vehicle for a brief period while keeping the system powered on. Configuration parameters exist to control how long the in-vehicle system remains on after the vehicle is powered off. Two parameters exist – one controls how long the system remains on when an operator is logged in, and the other controls the on duration when there is not an operator logged in. For a detailed discussion of what happens when the ignition state is changed See: What happens on ignition state change.

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Description of the Operator's Part in Firmware Updates

Short answer is NONE.

Updating myAvail software and configuration files is performed only at the direction of Avail Support. The software and configuration of the IVU and in systems with a mSlate, Vector 9000 or Vector 530 is normally updated via Wi-Fi using the Bulk Download feature. If that feature is not implemented, the programable MDT units can be updated directly via a USB drive and the IVU with a laptop. The Vehicle Files tab in myAvail is used to schedule such updates, and when

the vehicle is in range of the Access Point, the code and/or configuration updates are transferred to the vehicle automatically.

Description of Vehicle Communications

Operators do not need to know or understand how a vehicle communicates with the backend system. Operator procedures do not change based on the communication methods.

While in service, vehicles communicate in real time with the system using several methods. Avail supports either cellular data service or data over a private radio network for reporting real time status data to the backend system, sending / receiving communications from dispatch, and as a backup for receiving schedule update files.

Most vehicles also have a Wireless Local Area Network (WLAN or Wi-Fi) capability. The system uses this communications channel primarily for the bulk transfer of schedule data, software updates, configuration files, and log data. As a backup system, the Wi-Fi system can establish a connection to allow operators to log on to myAvail and allow vehicles to send accumulated stop information that they were unable to send over the primary real time communication method. This capability depends on the vehicle equipment and the capabilities of your network.

As described in Mapping of myAvail In-Vehicle Components Compatibility, myAvail makes every effort to extend the life of your vehicle equipment. Consequently, Avail supports seven hardware implementations for Wi-Fi connections and several software versions. Additionally, the vehicles might have their own restrictions on allowed connection methods. The combination of equipment and vehicle variables can affect the potential communication methods. To determine your exact communication capabilities, please contact Avail Support.

A Description of Vehicles Communications While On the Road

All vehicles, paratransit or fixed route, communicate in real-time to the backend server equipment. Event triggers cause the vehicle to report its Global Positioning System (GPS) location and other information to the back-end system. Regardless of the method of communications, event triggers prompt the system to transfer the same data between the vehicles and the "COMMS" server. The following list contains the most common events:

- Vehicle ignition changes state (on to off or off to on)
- The operator logs on to a specific run or block
- A maximum time interval has elapsed since the last communication
- The vehicle has traveled a maximum distance since the last communication
- The vehicle has exited a stop trigger box
- The operator sends a message to Dispatch
- The operator puts the vehicle in "Out of Service" or "Driver Off" state
- The operator logs off

GPS is a satellite-based system. Consequently, vehicles can lose contact with the satellites in areas where the view of the sky is restricted, such as in garages. When vehicles lose GPS contact, the system reports its last known good location until it sends another good location.

Vehicles must be connected to the "COMMS" server to allow operators to log on and log off. If connectivity is lost after operator log on is complete, the system alerts the dispatcher about the vehicle's status change. A warning icon on the MDT notifies the operator. However, the vehicle continues with most normal operations.

Fixed route vehicles, if equipped, will continue to update the farebox, destination sign, and make ADA announcements. The system will also collect schedule adherence data and passenger counts. These data are held until connectivity is restored. Paratransit vehicles will provide driving directions and display manifest data that is on the vehicle. The paratransit manifest, as configured for your property, is downloaded upon vehicle log on. Vehicle communications is required to receive manifest updates.

myAvail supports the following two methods of data communications:

1. Using a cellular data plan from any major provider (e.g. Verizon or AT&T).
2. An FCC licensed private radio data channel.

These two data communications methods interact differently with voice communications, as summarized below:

- Cellular data is a direct Internet Protocol connection between the vehicle and the "COMMS" server. There is no interaction with the operator's voice communications.
- Cellular data with "Voice over Internet Protocol" (VoIP) blends vehicle data communications with operator voice communications over the same cellular internet connection as the vehicle data. However, voice communications can be separate from the rest of myAvail.
- Private radio data with separate data frequency and physical radios is similar to a cellular connection because there is no interface with voice communications. The data channel is in constant operation.
- Private radio data with separate data and voice frequencies that share a common physical radio requires the myAvail system to control whether the voice channel or data channel is active at any given moment. The default setting for the radio is voice mode, which allows for voice communications if myAvail fails. In general, when a vehicle uses a single physical radio, it is in data mode. For the operator and dispatcher to communicate via voice, the vehicle radio needs to be switched to voice mode. When dispatchers need to talk to a specific vehicle, or a group of vehicles, they set up the voice call using myAvail, which switches the appropriate radios to voice mode. At that point, dispatchers can use the radio console normally to communicate with the operators. At the end of the call, the vehicles return to data mode.

  For calls that operators initiate, operators must first submit a request to talk through the MDT. This request is a data command that the system sends over the radio network

and displays on the dispatcher's workstation. Upon seeing the request, the dispatcher can set up a voice call to the correct vehicle. This arrangement is a "closed-mic" system. Operators must request permission before they pick up their handset and start talking to the dispatcher or to other operators. Operators cannot talk directly to each other without actions by the dispatcher. Also, operators will hear only calls that the dispatcher has specifically set up for their vehicle. They will not hear calls to other vehicles. This type of system reduces chatter that operators hear on their radios.

> **NOTE**: Support by Avail for an in-vehicle Paratransit interface through the MDT is a legacy feature. Currently this feature is unavailable on our latest display units.

A Description of How Vehicles Communicate at Your Facilities?

myAvail can communicate wirelessly with the In-Vehicle-logic Unit (IVU) to transfer information between the backend system and the vehicles.

Using myAvail's Vehicle Files tab, administrators can schedule transfers for the following types of information: software updates, configuration files, and debug reporting uploads.

Additionally, transit personnel can use myAvail's Build & Deploy tab to transfer the following types of information: route/trip/timepoint schedule data downloads, announcement downloads, Avail Fare Screens, and Pre-Trip Inspection configurations.

After the administrators schedule these transfers, the Bulk Download Server automatically handles them.

When vehicles enter the coverage area of an Avail wireless access point, they establish a Wi-Fi network connection, which alerts the Bulk Download Server. If this server determines that an upload or download is required, it automatically starts the transfer.

When a transit property publishes a schedule change that a vehicle does not receive before the activation date, myAvail sends these changes to the vehicle using the real-time data channel (either cellular or private data radio). This situation can occur when a property does not use the Build & Deploy tab to schedule the transfer or some other reason prevents the vehicle from receiving it by a Wi-Fi connection.

Data that are normally transmitted in real-time, which is retained on the vehicle due to a failure of the real-time system, might be transferred over the Wi-Fi connection. See Description of Vehicle Communications for more details.

NOTE: The download does not require an MDT login to occur. The Build & Deploy tab and the Vehicle Files tab in myAvail indicate success or failure of their downloads. Please reference the myAvail User Guide for details about how to use these tools. There are also references available in the myAvail Schedule Publish Quick Reference document for setting up the download process.

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Descriptions of Key Decision Processes

This section explains the process followed in key situations such as when ignition is turned on or off or how the system decides to change settings for the headsign or farebox.

What happens on ignition state change?

Avail's in-vehicle system intentionally minimizes interactions with operators so they can focus on driving. This process starts when the operator turns the vehicle on, and the in-vehicle system begins its power up cycle automatically. When the operator turns the ignition off, the system shuts down automatically.

Avail's in-vehicle power management system involves several components. The Communications Control Module (CCM) is Avail's power executive. The CCM physically connects to the vehicle and monitors the ignition state and, in conjunction with the Avail's power filter, controls the power supply for components of the in-vehicle suite.

Additionally, the CCM monitors the "Watchdog." Avail's system Watchdog is a message that passes between the key components of our in-vehicle suite: MDT, IVU, and CCM. If any of these components cannot pass the message to the next in line due to a hardware or software fault, it breaks the watchdog chain. If the fault persists, the CCM shuts off the power and restarts Avail's in-vehicle suite. If ignition is off at the time of the fault, the CCM keeps the suite off.

NOTE: The "Watchdog" has an initial message interval of 3 minutes to allow all the components time to boot up and start normal operations. After this initial interval, the subsequent watchdog intervals are 90 seconds.

The power filter and back-up battery work together to ensure power supplied to the Avail components stays in an acceptable voltage range, by filtering out voltage spikes and assisting during vehicle power drops, such as starting the engine or disconnecting the battery.

NOTE: The back-up battery and its charging circuit are not intended to support extended operations. If there is a 30 second continuous draw on the back-up battery, the system will shut itself down.

The In-Vehicle Unit (IVU), which is an embedded PC with a Microsoft Windows operating system, is in control of the system shutdown process. It is the CCM that detects ignition state changes, when the ignition state changes from on to off, the CCM messages the IVU. When the IVU receives the ignition off message it begins a shutdown timer. The length of time before shutdown begins has separate settings depending on whether the operator is logged on or not.

This interval reduces the startup time after a short break in service. If the CCM detects that ignition is restored during the shutdown countdown, it sends a message to the IVU to abort the shutdown. If the shutdown timer expires, then the IVU initiates a shutdown of the in-vehicle suite. In the first stage, the IVU sends a shutdown command to other components. In the second stage, the IVU submits an Operating System (OS) shutdown command to itself – note that it is at this point the IVU stops sending System Watchdog messages.

For the IVU, these two stages can take up to a minute to complete. After the shutdown has begun, it is irreversible and any new ignition state changes will be ignored. The final stage of the shutdown process is that the CCM turns off power to externally controlled devices and

NOTE: The In-Vehicle Unit (IVU) uses a Windows operating system. As with any Microsoft Windows PC, an unplanned hard shutdown can cause file system corruption. Therefore, it is critical to allow the system to follow its normal shutdown procedure and to perform the schedule checks on the Avail system back-up battery.

enters its fully powered-off state.

When the vehicle ignition state changes (on to off or off to on), Avail's in-vehicle system can be in one of four states: Active, Shutdown, Start-up is in progress, or Shutdown is in progress.

The following outlines a few common cases.

Scenario 1: The morning start-up or after a long mid-day break. The vehicle and the myAvail system are both completely off.

1. The operator starts the vehicle

2. The CCM detects ignition on and the Watchdog is in a shutdown state.
3. The CCM signals the power filter to provide power to all Avail equipment.
   3.1. The PA amplifier and the interior sign are powered independently.
   3.2. The CCM puts the watchdog into the initial start-up state.
4. The IVU goes through the boot process to launch Windows
   4.1. The Windows boot process starts the myAvail applications including the system Watchdog.

Scenario 2: The operator is taking a mid-day break. The vehicle is turned off, the remains logged on to the myAvail.

1. The operator shuts off the vehicle
2. The CCM detects ignition off and the Watchdog is in an active state.
3. The CCM signals the IVU to begin the logged-on shutdown timer, which has a default of 30 minutes.
4. The IVU continues normal processing for 30 minutes
5. The operator returns after 20 minutes and starts the vehicle
6. The CCM detect the ignition on and sends a message to the IVU
7. The IVU receives the ignition start message and aborts the shutdown timer
8. Normal operation continues.

Scenario 3: The operator is at the end of the run, log offs, and shuts the vehicle off while waiting for the relief operator. The vehicle is turned off and is at the log on screen.

1. The operator shuts off the vehicle
2. When the CCM detects ignition off; the Watchdog is set to an inactive state.
3. The CCM signals the IVU to begin the logged-off shutdown timer, which has a default of 10 minutes since the operator has logged out.
4. The IVU continues normal processing for 10 minutes
5. The relief operator arrives after 11 minutes and starts the vehicle
6. The CCM detect the ignition on and sends a message to the IVU
   6.1. When the ignition was turned on the CCM reset the watchdog to an active state and begins the timer to receive the watchdog signal
7. The IVU receives the ignition start message however the shutdown has already started so the ignition on message is ignored.
8. The Avail system shutdown completes
   8.1. The IVU shutdown stopped the expected watchdog message, from the IVU to the CCM
9. After 90 seconds without a watchdog message the CCM but with the CCM is in an active state (with ignition on), the CCM will initiate the myAvail system power up process.
10. The Avail system boots up and presents the operator with a log on screen.

Scenario 4: The operator has returned to the garage at the end of the service day. The vehicle is to be shut down for the day.

1. The operator logs off and shuts off the vehicle
2. The CCM detects ignition off.
3. The CCM signals the IVU to begin the logged-off shutdown timer, which has a default of 10 minutes.
4. The IVU continues normal processing for 10 minutes
5. At the end of the 10 minutes the IVU sends a shutdown command to the other Avail components
6. The IVU gives itself an operating system shut down command
7. When the IVU shutdown is complete the CCM turns off power to all Avail components and enters its powered-off state.

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How is mileage tracked?

Vehicle mileage are critical data to report. Revenue vs. non-revenue mileage must be reported to several governmental agencies. Collecting the actual mileage for the vehicle is desired but optional. myAvail can estimate the mileage using the calculated distance of the vehicle's scheduled service and adjusting that value for any missed or added service.

Actual mileage is determined by one of the following methods.

Wheel rotation counter

A wheel sensor detects the number of rotations and transfers the count to the in-vehicle system using a physical connection. A system parameter defines the number of rotations per mile. Consequently, the system can use the number of wheel rotations to calculate mileage. The accuracy of the resulting mileage is limited and, therefore, operators need to make daily corrections.

GPS Calculation

To avoid the need for a physical connection to the wheel sensor and to improve accuracy, Avail added a software option that calculates mileage from GPS data. GPS data is pulled once per second. The system sums the distances between data points to calculate mileage. GPS mileage calculations have always been more accurate than counting wheel rotations, and they are improving over time. However, this method is imperfect. Problems include the loss of GPS signal and the fact that turns and elevation changes introduce small errors that add up over time. Consequently, operators need to make corrections.

Vehicle Manufacturer J1939 Value:

Accessing the J1939 network allows Avail to access the same mileage value that the vehicle displays to the operator. These are the most accurate data available. The system looks for two PGN's in the J1939 data: PGN 65248 Vehicle Distance (VD), and PGN 65217 High-Resolution Vehicle Distance (VDHR). These two values provide myAvail with current distance traveled,

and a vehicle odometer value that matches the dashboard. We cannot guarantee these PGN values exist in the J1939 data stream, but either value updates the odometer automatically.

PGN 65248 has a 1/8 km resolution and PGN 65217 has a 5-meter resolution. If both PGN 65248 and 65217 are available, the system gives preference to the high-resolution data and distributes those data to the IVU system. If needed, J1939 odometer processing can be disabled.

No configuration is required to enable the J1939 odometer. If the correct PGN values are in the data, these data have precedence over all other mileage data sources, including GPS calculations. The switch-over occurs automatically. The existing behavior of GPS calculated mileage is unchanged and, if J1939 is not available, the system will use the GPS data.

There are several items to note about the MDT display:

- The value the MDT displays in the Odometer field on the logon/logoff screen does not update. It is valid for the moment when the system first displays the value. However, if the vehicle moves before the operator logs on, the MDT display does not update the mileage. However, the value the system records "under the hood" does update and will be correct when logon occurs.
- The odometer value is only saved at shutdown. J1939 (if available) data from the vehicle will be available by the time the MDT displays the logon screen.

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GPS Considerations

The Global Positioning System (GPS) is a satellite-based radio navigation system operated by the United States Air Force. It is a global navigation satellite system (GNSS) that provides geolocation and time information to a GPS receiver anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites. Obstacles such as mountains and buildings block the relatively weak GPS signals. These types of obstacles can also cause reflections that generate interference that degrades the signal.

The GPS does not require the user to transmit any data, and it operates independently of cell phone and internet reception. The United States government created the system, maintains it, and makes it freely accessible to anyone with a GPS receiver.

Avail's current GPS implementation uses an antenna that contains all the necessary processing circuitry to convert the radio signal into the standard GPS NMEA (National Marine Electronics Association). The antenna sends the GPS data to the IVU using a serial connection. Past implementations used a simple antenna connected to a GPS processor imbedded in the MDT

(v900 or mSlate). Reference your AVL Manual to determine which installation type your property has in which vehicles.

In the vehicle, the system processes the GPS signal once a second. The following data are provided:
- Location – as latitude / longitude to a precision of 3 meters 90% of the time
- Speed (mph)
- Heading (degrees 0 – 360 with both 0 and 360 being North)
- Time to a precision of a small fraction of a second
- GPS status
    - Number of Satellites received
    - Quality of signals, signal lock status

While the vehicle reports its location in response to specific events, the in-vehicle system uses the data once a second. See the *myAvail Administrator User Guide* for details about when the in-vehicle system sends Automatic Vehicle Location (AVL) data to the backend system.

NOTE: The system determines whether the vehicle enters a trigger box once a second.

In addition to standard GPS tracking, Avail offers an option for dead reckoning (inertial navigation). Dead Reckoning requires an upgraded GPS receiver with embedded dead reckoning capability and a connection to the wheel rotation sensor. This additional capability tracks changes in heading and tracks time without a GPS signal. The wheel ticks provide the vehicle's speed. Dead reckoning can calculate the vehicle's new position by knowing its starting position and then using speed, time and direction. This process has a limited precision, which decreases over time. The impact is that the vehicle could not function all day on dead reckoning, but it works well for filling in gaps when GPS signals are lost for a short time.

Things to know about GPS:

- GPS signals are extremely weak (low power).
    - Do not place a transmitting antenna near the GPS antenna. Avail will ensure this does not happen during installation but if an antenna is added after the Avail equipment installation verify the placement of any new antenna.
    - Objects above the vehicle can block the signal, such as the following examples.
        - Vehicles starting in a barn
        - Stops that are inside a structure, such as a parking garage, or have an awning over it.
        - Tunnels, multi-deck bridges, highway underpasses, and even trees overhanging the street can block the signal.

- Urban Canyon (Multi-Path).
  - Places with tall structures on both sides of the street generate interference because GPS signals reflect off the structures. The reflected signals interfere with the direct signals, which greatly reduces accuracy or causes complete loss of signal lock.
  - This problem can happen in mountain canyons as well.
- GPS Wander / Drift.
  - GPS accuracy is not perfect. Repeated position calculations on a stationary vehicle display a scatter pattern around the vehicle's location.
    - Use the myAvail Replay function on a vehicle that was stationary with the Avail system on for 30 minutes or more to see an example. You will need to zoom in closely.
  - Make sure vehicles do not park for layovers near the edge of a trigger box or this drift can cause the system to trip the trigger box exit function.
  - Overhangs and urban canyon situations can reduce accuracy, which will enhance wander without causing signal loss. Normal amounts of drift can greatly increase where there is interference or partial signal blockage.

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Trigger Box Considerations

Trigger boxes are geofences, or virtual boundaries, around stops that the property defines using a graphical tool in myAvail. myAvail distributes trigger box information to vehicles with the schedule data.

Trigger boxes are important because entering and leaving them "triggers" myAvail to take most actions in the vehicle. All these actions are automatic and do not require operator actions. Consequently, the system does not provide operators with indicators for when the vehicle enters or exits a trigger box. Under normal operating conditions, operators do not need to think about trigger boxes.

However, understanding how trigger boxes interact with the vehicle software will occasionally help users understand how to correct a problem.

The possible triggered actions include the following:

- Sending stop entry messages to the backend (always on entry).
- Making an announcement (usually on entry, can be on exit).
- If the stop is a timepoint, the system informs the operator of their schedule adherence status.
  - How long the operator needs to wait if ahead of schedule.
  - How far behind schedule they are.

- If set for the stop, the system changes the destination sign value (usually on entry of last stop of trip but can be set to any stop on entry or exit).
- For a stop at the end of a trip, the in-vehicle system downloads the next list of stops for the trigger box search.
- Sending the stop departure message to the backend (always on exit).
  - This includes schedule adherence information.
  - The dwell time at the stop.
  - The number of passenger boards and alights.

Trigger boxes trigger actions only when the operator is logged on and the vehicle is in normal operations mode. By default, the vehicle is in normal mode when operators log on. However, operators can change modes by pressing Out of Service or Manual Mode (manual public stop announcements).

After the operator logs on and the backend system registers the vehicle, the in-vehicle system checks every second to determine whether the vehicle enters or exits a trigger box. Trigger boxes can overlap, which causes the vehicle to track multiple trigger boxes at a time. To be valid, overlapping triggers boxes must be arranged in a manner such that vehicles exit the trigger boxes in the same order they entered them. See the *myAvail Users Guide* for more information about defining trigger boxes correctly.

Entering a trigger box has two criteria:

- The trigger box is around a stop in the current trip and it is later in the stop order than the last stop the vehicle entered. For example, if a trip has 10 stops and the vehicle has already serviced stop 1 and 2, the system only checks to see if the vehicle enters stops 3 to 10. If the vehicle next enters stop 5, the system removes stops 3, 4, and 5 from the search list.
- If transit personnel have assigned an angle of entry to a trigger box, the heading of the vehicle must fall within the range of that value plus or minus 13.5 degrees. The system does not record a vehicle as entering a trigger box until both its position is within the trigger box and its heading falls within the angle of entry range.

Suppose a trigger box has an angle of entry of due South and the vehicle enters the box heading West. Initially, the system does not consider the vehicle to be in the trigger box because the heading is incorrect. However, if the vehicle turns to the correct heading later in the trigger box, the system records the vehicle entering the trigger box at that point. For this example, trigger box entry does not occur at the boundary of the trigger box but at the point where the vehicle turns to the correct heading.

Assigning an angle of entry is optional. Generally, Avail recommends assigning an angle of entry when the vehicle will pass through a stop more than once in a single trip, and it is the second time that the vehicle services the stop.

Identifying the Correct Trip

Vehicle logons can use either block or run numbers. However, the system uses only blocks. If log on is by run number, the system translates the run to a block number. The block information is translated into a list of trips and a list of stops.

The system uses logon time to determine which trip on the list of trips for the block the vehicle should be on. Additionally, the system uses the time to determine where the vehicle should be at in the list of stops for a trip.

The system uses the vehicle's GPS location to determine if it is inside the trigger box for any stop on this trip. If not, the system keeps checking every second until the vehicle enters a trigger box for a stop on the current trip.

At this point in the process, it is important to note certain possibilities:

- If the operator logs on very early or late, the system might not select the correct trip. When the MDT displays the wrong trip, operators must use the Trip Select function to choose the correct trip. The vehicle will not make announcements or provide schedule adherence information until the vehicle is on the correct trip.
- After logon and while the vehicle is stationary, the system does not consider angle of entry for trigger boxes. Consequently, if the log on occurs while in a trigger box, the system recognizes the trigger box regardless of vehicle heading.

The end of one trip and the start of the next trip are always simultaneous events. If for any reason one revenue trip ends and the vehicle must move elsewhere to begin the next revenue trip, there must be a deadhead or non-revenue trip to connect the two revenue trips. Avail also recommends that you do not assign an angle of entry for these transition stops.

The system loads the new stop list for the trigger box search algorithm at these transition stops. If the vehicle misses the last stop of a trip (e.g., detour or short turning due to running late), the operator must use the Trip Select function to force the system to load the next trip.

How and when is the Headsign display updated?

myAvail uses the same codes as the operator. Avail's in-vehicle system connects to the headsign using a J1708 connection. The system determines the code to send the headsign using the following two methods:

Method 1: While in schedule adherence mode, meaning the operator has logged onto the vehicle with a specific run or block number, the system uses a code provided with the schedule data for the trip. This code was originally entered either through the scheduling package or at the stop level on the myAvail system in the Geographic Tools tab. See the myAvail User Guide for instructions on how to enter headsign codes.

Using this method, the schedule data downloaded from the backend system provides the headsign value. The system checks the schedule data when the vehicle enters and exits trigger boxes. Normally the headsign only changes at the start of a new trip, but it can change at any stop if transit personnel specify those changes in myAvail's Geographic Tool Trigger Box setup.

There are several exceptions for using schedule data to provide the headsign code. For example, showing the next trip value after the penultimate stop of the previous trip and the value to display for deadhead trips. Configuration parameters can handle these exceptions.

Method 2: When not in schedule adherence mode, such as before logging on or when the operator changes the mode (i.e. Out of Service, Manual or Off Vehicle), the system uses a set of parameters to determine the headsign value.

 NOTE: The assignment of headsign codes through parameters in place of having to manually assign a code for each deadhead trip depends on the existence of a common rule for all deadhead trips that is supported by available configuration parameters. Your assigned System Engineer will work with you to configure this setup during your initial installation. If you later wish to change these or the Method 2 settings, please contact your FAST representative.

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When does myAvail update the farebox?

Avail supports single sign on integration with several farebox manufacturers. Farebox integration requires a physical J1708 connection and might require additional license agreements with your farebox provider.

Avail uses the SAE J1587 protocol to communicate with the farebox over the J1708 connection. Various message types are implemented to support the following:

- Request the status of the farebox
- Provide an Operator ID
- Provide fare identification information:
    - Run
    - Block
    - Route
    - Trip
    - Fareset
    - Direction
- Provide Location in Latitude / Longitude

- Provide Door Open Status
- Receive Farebox Alarms

When the operator logs on to the MDT, the in-vehicle system also logs the operator on to the farebox and sets it with the current fare identification information. All fare identification information, including the fareset value, is provided in the schedule data file (A.K.A Run File). At the end of each trip, the system updates the fare information to the values for the next trip. The farebox logs off when the operator either logs off myAvail or puts myAvail in Out of Service mode. Optionally, the system can be set to log off the operator from the farebox when the operator presses Driver Off on the MDT. The system will automatically log the operator back on to the farebox upon return to regular service.

If you need to add farebox integration to an existing system or obtain the technical details about the J1587 protocol implementation, contact your Avail FAST representative to discuss the details.

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Why and How to do a "Cold Boot"?

Transit personnel should only start a "Cold Boot" at the request of Avail Support. Under most circumstances, Avail Support can initiate a cold boot remotely. Consequently, it is rarely necessary for a transit agency to perform this function.

A cold boot resets Avail's in-vehicle system to factory defaults. After the Avail equipment is installed and the installers perform their initial acceptance testing in the vehicle, all subsequent system restarts are "Warm Boots," which is when the system uses the following resources:

- Configuration parameters stored in battery backed up RAM.
- Existing Windows Registry settings.
- Current Configuration files (referred to as PTV Configs) based on a CRC value.

When investigating a vehicle issue, Support might suspect corruption in these any of these warm boot resources, or at least they might want to eliminate that possibility. The cold boot clears and re-loads the memory stored configuration parameters, rewrites the myAvail Windows registry entries, and clears the CRC entry for the downloaded configuration files, which forces a new download of the latest files.

NOTE: A cyclic redundancy check (CRC) is an error-detecting code commonly used in digital networks and storage devices to detect accidental changes to raw data. As part of the handshake between the vehicle and back-end system, a CRC compares the configuration files on the vehicle with those stored on the server. If a difference exists, new files are downloaded to the vehicle.

If your vehicle software version is 6.17 or greater, access the Coldboot button by following these steps:

1. Go to **Menu.**
2. Select **Maintenance.**
3. Go to **Admin.**
4. Enter the password (Your Maintenance Manager should have this value).
5. Select **Next.**
6. Press the **Coldboot** Button. A popup indicates that a cold boot will occur on next reboot.
7. Press the **Reboot** button.

On vehicles with older software the process requires two reboots
1. Go to **Menu.**
2. Select **Maintenance.**
3. Go to **Admin.**
4. Enter the password (Your Maintenance Manager should have this value).
5. Select **MDC ID.**
6. Record the current MDC ID value for this vehicle.
7. Set the MDC ID value to zero (0).
8. Press the **Save** button.
9. Press the **Reboot** button.
10. After reboot is complete, Repeat steps 1 through 5.
11. Set MDC ID value back to the original value.
12. Press the **Reboot** button.

NOTE: Entering an invalid MDC ID value prevents users from being able to log on to this vehicle. Entering a duplicate MDC ID will corrupt the data.

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What are the configuration options for MDT Lockout?

myAvail includes the MDT Lockout feature to support your efforts to prevent distracted driving. This feature allows the property to determine how much, if any, of the MDT screen is viewable by the operator while the vehicle is in motion.

Screen Lockout can be enabled or disabled globally by a parameter setting. When enabled, the system activates the screen lockout when the vehicle is moving above a speed threshold for a specified duration. The default lock out speed is 10 MPH and the duration default is 10 seconds. After screen lockout is active, the vehicle must be stationary for a specified duration to release the lockout.

When screen lockout is enabled, the next choice is to select partial or full screen lockout.

- If you enable full screen lockout, all areas of the screen including the fixed route main area are fully obscured by screen lockout.
- If you enable partial screen lockout, the fixed route main screen will still display the right-hand information panel during screen lockout.

In either configuration, the top menu button and bottom status bar areas of the screen are not obscured.

While lockout is active, most or all interactions with the operator are disabled by default, and operators cannot enable those features. Optionally, system configuration can enable some of the interactions. The following functions can be enabled during screen lockout via configuration parameters:

- RTT / PRTT: The ability to request contact with Dispatch.
- Public Safety Announcements: The ability to play the safety announcements inside the vehicle.
- Canned messages and message inbox: The ability to send and receive text messages.
- Popups and audio indicators can be enabled or disabled. When these are not globally disabled, popups and audio alerts specifically for incoming voice calls can be independently disabled via configuration parameters.

If screen lockout is active and the GPS signal has been lost for three consecutive GPS points, the system will deactivate the screen lockout.

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What is available in Vehicle Health Monitoring?

The operator has no need to interact with the Vehicle Health Monitoring (VHM) processes. Avail's system monitors all Avail equipment and, using the J1939 system, specific vehicle components. As of March 2019, Avail monitors the following vehicle components:

- Cummins Engines
- Allison Transmissions
- WABCO Brakes
- Thermo King HVAC

NOTE: For Avail to add additional vehicle components for VHM, please verify that the components put DTC (Data Trouble Codes) on the J1939 network. Additionally, Avail needs a contact person for the component manufacturer who can furnish the component's SPN (Suspect Parameter Number) codes and FMI (Failure Mode Identifier) codes.

What are the capabilities of in-vehicle public messaging?

Providing information to your ridership is crucial. In addition to the public information services provided by the back-end system, which are described in the *myAvail Administrator User Guide*, the in-vehicle system has the following public information capabilities:

- ADA Announcements.
- Headsign Updates.
- Stop Requests.
- Basic Information.
- Exterior Route Announcements.
- Safety Announcements.

ADA Announcements: The Americans with Disabilities Act (ADA) requires the ridership, including those that are visually or hearing impaired, to be informed of the vehicle's progress during service. Without requiring operator actions, the system automatically makes these announcements.

For the system to be able to make the ADA announcements, the operator must log into their scheduled service and the planning staff must assign the correct announcements. The system displays these announcements on interior signs and plays them over the public address system. Transit personnel can add announcements to any stop or locations defined as non-public stops.

Headsign Updates: The system sets the appropriate headsign value (a.k.a., Destination Sign) and updates it as needed without involving the operator. For the system to be able to perform this task, the operator must log into their scheduled service and the planning staff must assign the correct sign values.

Additionally, the operator retains manual control, which can be used to override the system or to add a public relations message (e.g. Happy Holidays, Go Nittany Lions, …). For more details about the headsign display, see How and when is the Headsign display updated?

Stop Request: When a rider pulls the stop request cord, the system plays a 'Stop Request' announcement and displays a visual confirmation, which displays until the door is opened. Repeated pulls to the stop request cord are ignored until the door is opened and closed.

Basic Information: When the interior sign is not showing ADA information or stop requests, the sign displays the current date, time, and the route name or destination as configured. Optionally, the sign can display the operator's name.

Exterior Route Announcements: When either door is opened and the exterior speakers are functional, the system announces the route name to help riders verify they are boarding the correct vehicle. The system can adjust the volume of the announcement based on time of day and route. The operator is not involved in making these announcements at all.

Safety Announcements: The transit property configures these announcements, which operators can play as needed. The announcements, such as "No Profanity" or "No Eating and Drinking," allows the operator to remind riders of the rules without a direct confrontation.

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Description of Debug Data

In-vehicle debug information is for the use by Avail staff only. Each of the system modules defined in What are the core system components? can produce up to three levels of detail. The following is the list of options and the level of detail can be set for each one. The Vehicle Files tab in myAvail application manages the collection and downloading of the debug data. Operators and property staff are not involved with this process at all.

- Vector State Dump
- Master Control
- Main Message Switch
- IEB
- PTV Diagnostics
- OTA Comms
- Debug
- GPS
- Schedule Adherence
- Annunciator
- APC
- Head Sign
- Internal Sign
- Fare Box
- Other

NOTE: This 'debug' feature is limited to Avail staff because requesting too much debug data can overload the system and cause it to shut down.

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Appendix 1

This section walks you through some troubleshooting steps for installing and calibrating of Ublox dead reckoning antenna. Once you have completed this section, the Ublox dead reckoning antenna should be receiving the vehicle's speed and be ready to use dead reckoning. Make sure you are at least using version 3.3.

Verify Equipment Is Properly Installed

To verify that the J1939 interface and Ublox Dead Reckoning antenna are properly installed, boot up the IVU and navigate to Menu > Maintenance > Admin > Password & Enter > GPS > Page Down. You should see a screen that looks like the following (without the notations):
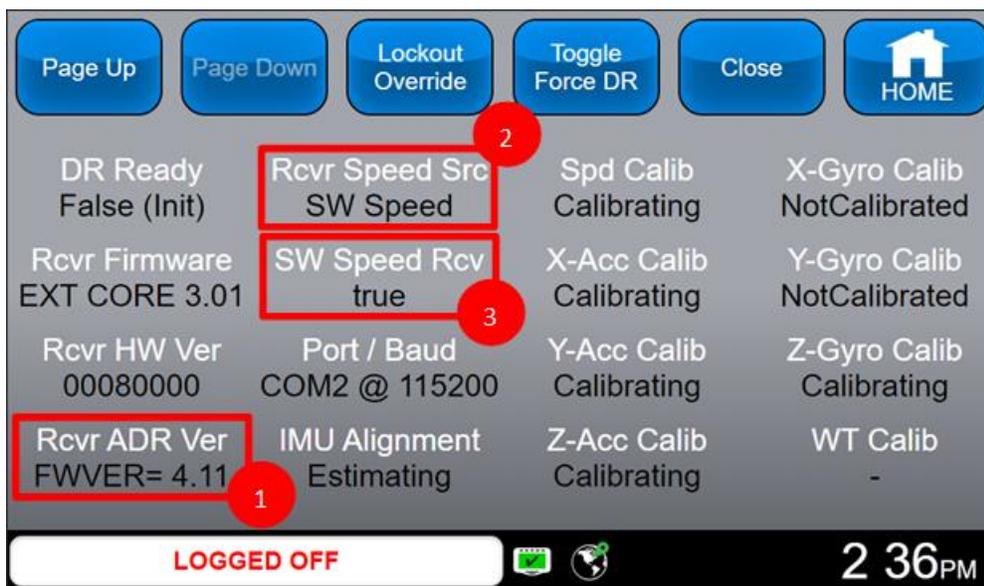
1. This is the dead reckoning version number that is being reported by the Ublox dead reckoning antenna. If you see a valid version here, that means that the IVU has successfully detected that it is interfacing with a Ublox dead reckoning antenna. This means that the comm interface and baud rate is correct in the IVU_GpsModule.exe.config.

2. This field indicates whether the Ublox dead reckoning antenna is configured to use software speed (from the J1939 interface) or the hardware tick discrete. We want to make sure the antenna is configured to use software speed. If you see "SW Speed" here, the antenna is configured correctly.

3. This field indicates whether the IVU GPS module is receiving the vehicle's speed from the IVU J1939 module. This field is helpful to figure out if the IVU is properly interfacing with the vehicle's J1939 interface. If you see "true" here, that means that the GPS module is successfully receiving the vehicle's speed from the J1939 interface.

NOTE: If the IVU is interfacing with a non-dead reckoning antenna, the "SW Speed Rcv" field will always be false regardless of whether the IVU is interfacing with the vehicle's J1939 network. To save processing power, the IVU GPS module does not request the IVU J1939 module to send it J1939 software speed if the GPS module detects that it is interfacing with a non-dead reckoning antenna. This is important to keep in mind especially if the IVUs are being updated with 3.3.0.0 before a dead reckoning antenna is installed.

Calibrate The Ublox Antenna To Enter Fusion

Calibrating the Ublox dead reckoning antenna takes the longest during its first use since it has never been calibrated before. There are ways to accelerate the initialization and calibration process. Here is a paragraph from the Ublox manual that explains how to accelerate this process:

"The duration of the initialization phase mostly depends on the quality of the GNSS signals and the dynamics encountered by the vehicle. Therefore, the vehicle should be driven to an open and flat area like an empty open-sky parking area for example. The initialization and calibration drive should contain phases where the vehicle is stopped during a few minutes (with engine turned-on), phases where the vehicle is doing normal left and right turns and phases where speed is above 30 km/h (18.64 mph) under good GNSS reception conditions."

Based on previous testing experience, it's best to try to drive the vehicle in a figure eight pattern. Although this will be difficult with a vehicle as large as a bus.

You can see the state of the calibration process by navigating to Menu > Maintenance > Admin > Password & Enter > GPS > Page Down. Once the antenna has become calibrated and entered Fusion, you should see the following on the GPS maintenance screen (without the notations):

Confidential & Proprietary
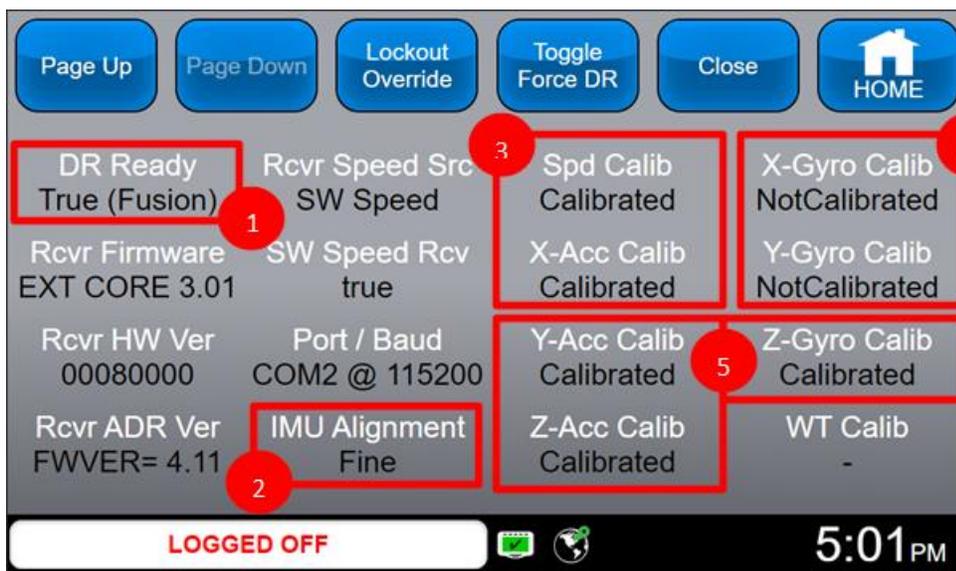
1. This field indicates the fusion state of the Ublox dead reckoning antenna. If you see "True (Fusion)" here, that means the antenna has successfully entered a Fusion state and is ready to use dead reckoning.

2. This field indicates how confident the Ublox dead reckoning antenna is on where it is mounted on the vehicle's frame. You may see "course" or "fine" here once the antenna has entered Fusion. "Course" just means it has a rough idea of where it is mounted on the vehicle, and this is fine. Overtime, the antenna is going to continuously get a better idea of where it is mounted on the vehicle until it says the alignment is "fine". If you see "estimating" here, that means the antenna is still in the initialization process. If you see "error" here, there could be a problem. Typically, this error resolves itself after the vehicle has been driven for a long enough period. If it does not resolve itself, try knifing the vehicle so power is cut to the antenna and reset. If that still does not resolve the problem, you may need to reset the alignment of the antenna. There are two ways to do this. One way is to use u-center.

   Once you have connected the Ublox antenna to u-center, navigate to View > Messages View > Expand UBX > Expand ESF (External Sensor Fusion) > Select RESETALG (Reset IMU-mount alignment). Then press the Send button on the bottom left of the window.
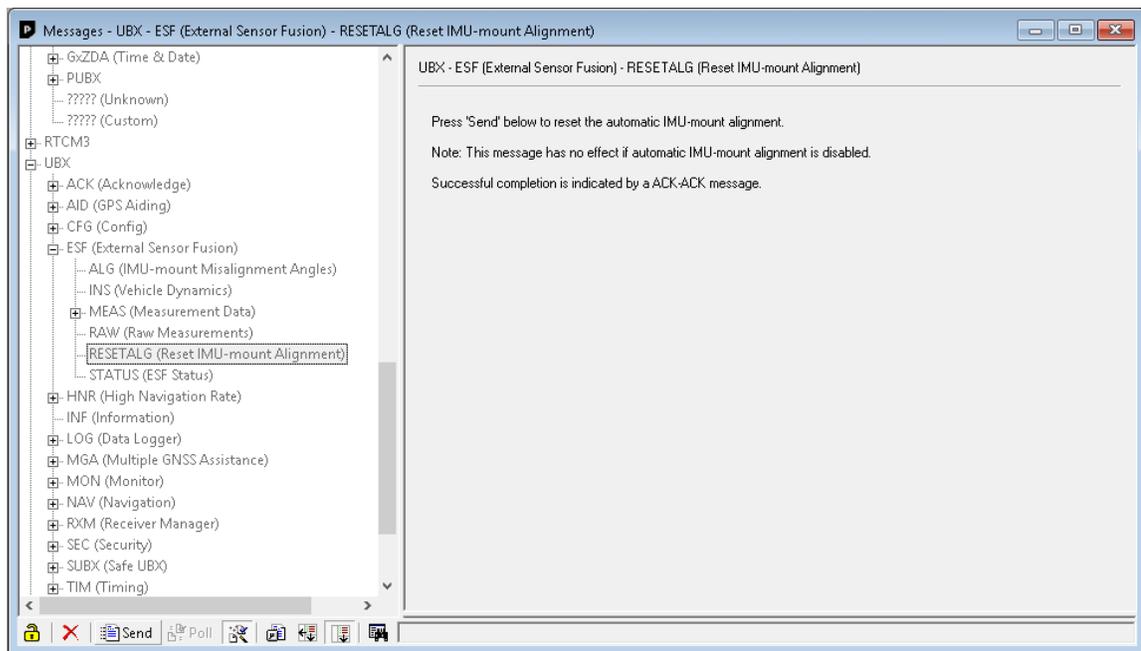
   The second way to reset the alignment of the antenna is to use the GPS maintenance screen. Starting with IVU and GUI version 3.4.0.0, there is a Reset Alignment button on the third page of the GPS maintenance screen. You can press this button to reset the alignment.

Page Up	Page Down	Lockout Override	Toggle Force DR	Close	HOME

Reset Alignment

REG ATTEMPT

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3. These fields are the most critical to be in the "calibrated" state. The Ublox dead reckoning antenna cannot enter Fusion and use dead reckoning if it cannot calibrate with the J1939 speed the IVU is sending it. If these fields say "calibrating" or "calibrated" you have successfully set up the Ublox dead reckoning antenna. These fields may switch between "calibrating" and "calibrated" depending on the motion of the vehicle, and this is fine and expected. If you see "error" next to the speed field, there may be an issue with the J1939 speed being sent to the Ublox antenna from the IVU. This should not happen anymore with 3.3.0.0, but if it does consult an in-vehicle engineer.

4. These fields will never be calibrated and will always stay in the "not calibrated" state. This is a limitation on Ublox's part and nothing to worry about.

5. These fields are calibrated last and are not necessary for dead reckoning functionality. As long as these fields do not say "error" then they are fine.

Dead reckoning should now be functional. If you are still having issues, please consult an in-vehicle engineer.