3. Level 2 Requirements

3.A. Level 2 Technical Requirements

3.A.1. Level 2 Overview

In Level 2 of the OBS/CCS Project, the Contractor shall deliver and implement the Communications Center System, consisting of fixed-end CAD/AVL and related systems, at the new Communications Center facility. Level 2 OBS services shall include modifications to the OBS functionality delivered for Level 1 to support implementation of the KCM 700 MHz radio system provided by the Transit Radio System (TRS) project. The Contractor shall integrate the Level 2 OBS/CCS with the TRS in collaboration with the selected TRS contractor.

3.A.2. Procurement Process Description: (Upgrade vs. Replacement)

Level 2 responses will be evaluated in Evaluation Phase III from proposals that remain in the competitive range. Proposers must address in their proposals their proposed approach to Level 2, including one CCS Alternative: a CCS Replacement (Alternative A) or a CCS Upgrade (Alternative B). For the CCS Replacement (Alternative A), Proposers shall describe their approach to a full system replacement of the legacy CAD/AVL system to meet the requirements described in Subsection **3.A, Level 2 Technical Requirements** and Subsection **3.B, Level 2 Functional Requirements.** For the CCS Upgrade (Alternative B), Proposers shall describe their approach to upgrading the legacy CAD/AVL system to meet the requirements described in Subsection **3.A, Level 2 Technical Requirements,** and Subsection **3.B, Level 2 Functional Requirements.** Detailed descriptions of the CCS Alternatives may be found in Subsection **3.A.4, CCS Replacement (Alternative A)** and Subsection **3.A.5, CCS Upgrade (Alternative B)**

A detailed description of the Level 2 procurement and proposal evaluation process may be found in Part A, Section **2, Proposal Evaluation and Contract Award**.

3.A.2.1. OBS/CCS Level 2 Proposal Evaluations: Phase III Activities

In Evaluation Phase III, Proposers who are in the competitive range shall participate in the following evaluation activities:

a. CCS Replacement Proposal Evaluation CAD/AVL simulation:

   CCS Replacement finalists shall provide a simulated benchmark testing environment for KCM user evaluations of the Proposer's CAD/AVL product at King County Metro.

b. CCS Upgrade Proposal Evaluation:

   CCS Upgrade finalists shall provide members of their proposed CCS Upgrade project team to conduct an assessment and analysis of the legacy CAD/AVL system at King County Metro. Upon reviewing the KCM legacy system and code, Proposers shall provide a technical assessment of the CCS upgrade, and provide detailed proposed CCS Upgrade Project schedule and costs.

   See Part A, Section **2, Proposal Evaluation and Contract Award**, for more details.

3.A.3. Communications Center System Statement Of Work

3.A.3.1. CCS Scope Overview

The existing KCM CAD/AVL system provides Communications Center staff with radio call management, automated vehicle location, transit schedule and service information, and incident management forms used in managing communications with KCM Revenue Vehicles. The purpose of the Communications Center System (CCS) project is to replace or upgrade the CAD/AVL functions used by Service Communications staff and other related fixed-end system functions, including:

a. Computer-aided dispatch: call prioritization and radio call management, transit schedule information, incident management forms.

b. Automatic vehicle location: dynamic display of current Revenue Vehicle location and status information.

c. Emergency Alarm processing.

d. Revenue Vehicle fleet polling.

e. System databases.

f. Reporting functions.

3.A.3.1.1. Continuity in Existing Level of System Functionality

As a second-generation CAD/AVL system, the CCS will continue to provide the existing system functions, including:

a. The Coordinator Service Record (CSR) as the Communications Center staff's tool for documenting the agency's response to service disruptions and incidents.

b. King County Metro's Geographic Information System (GIS) as the AVL user-interface base map and geographic data source.

c. The high level of core CAD/AVL functionality and systems integration among the call processing, automated vehicle location, CSR, and schedule information software modules.

d. Frequent status updates from Revenue Vehicles.

e. The high level of integration and interoperability of user functions. Coordinators utilize function keys and context (right-click) menus to select key functions from within any of the modules: call processing, vehicle location, CSR, schedule information.

f. The "Strategies" process which manages Communications Coordinator work flow by assigning service routes to call groups and Coordinator assignments. This process routes radio calls and assigns CSR ownership to the appropriate Coordinator assignment.

In addition, the CCS will continue to distribute data to users outside of the Communications Center, including:

a. Real-time Web reporting of CSR data to internal King County Metro users.

b. Real-time AVL data to the existing My Bus and Bus View software applications, which provide vehicle location and other transit information to the transit riding public via the Internet.

3.A.3.1.2. Expected Changes in Next System Functionality

The following fundamental changes in the Communications Center systems are required for the implementation of Level 2 and the TRS:

a. The OBS AVL will determine the vehicle location and transmit the data to the Communications Center. The legacy CAD/AVL system currently calculates vehicle location at the fixed end, based on transmitted signpost encounters and odometer readings.

b. Revenue Vehicle schedule and route adherence will be determined by the OBS, and transmitted to the Communications Center.

c. A new OBS AVL methodology and new TRS will necessitate new communications protocols and data messages.

3.A.3.1.3. User Function Enhancements

The CCS CAD/AVL module is expected to provide enhancements to the existing level of functionality in these areas:

a. Continuous display of the location of an off-route Revenue Vehicle, and differentiation between on-route and off-route coaches on the CAD/AVL user display.

b. Vehicle location playback.

c. The flexibility to better manage Coordinator radio-call queue overloads and workflow, for example the ability to select and forward calls in a Coordinator's queue.

d. Pre-defined text messaging between Transit Operators and Communications Coordinators, with the ability to send custom text messages available to Communications Coordinators.

More detailed scope information is provided in the subsequent Subsection **3.A.4.1, CCS Replacement Scope** and Subsection **3.A.5.1, CCS Upgrade Scope** of this document. CCS functional requirements, including descriptions of new and existing required functionality, may be found in Subsection **3.B, Level 2 Functional Requirements**.

3.A.3.2. CCS and Transit Radio System Project Boundaries

In general, the CCS scope involves the processing and management of data communications to support the CAD/AVL functions utilized by Service Communications staff. Voice radio communications functions are within the scope of the TRS and will be provided by the new radio system. The following table summarizes the functional areas within the CCS and Transit Radio System Project scopes:

Table C.3.A.3.2. CCS and Transit Radio System Project Scopes

Communications Center System (CCS) Project scope	**Transit Radio System (TRS) Project scope**
Computer-aided Dispatch (CAD): • Radio call management • Schedule information • Coordinator Service Record Automated Vehicle Location (AVL) Display	Radio system infrastructure sites, transmitters, receivers Revenue Vehicle mobile radios Non-revenue vehicle mobile radios Non-revenue vehicle portable radios
CCS system database functions Real-time data radio communications processing	Revenue Vehicle and non-revenue vehicle voice radio communications functions Communications Center voice radio user functions and consoles
Revenue Vehicle polling/status updates	RF Encoders/decoders (fixed-end and On-Board Radio) if required
Data message voting	Voice message voting
CCS system administration, troubleshooting functions	Radio system maintenance, troubleshooting, system admin functions
CCS reporting	Radio system reporting

Data communications with the non-revenue fleet, such as vehicles operated by Service Supervisors (field supervisors) and maintenance staff, are not within the scope of either project.

3.A.3.2.1. Project Dependencies

As a Level 2 activity, the CCS is dependent upon the schedule, design, and implementation of the following:

a. Transit Radio System Project, which will provide the infrastructure for the transport of voice and data communications between the Revenue Vehicle fleet and the CCS.

b. Level 1 OBS, which will deliver the new on-board hardware and software that supports required on-board functions. Level 2 OBS modifications will support Revenue Vehicle communication with the CCS.

c. The KCM Communications Center Relocation Project, which will build the new Communications Center facility where the CCS will be installed, tested, and deployed.

3.A.3.3. Communications Center System Interfaces

The CCS will support two real-time system interfaces, and utilize a service- and GIS-data-import process.

Table C.3.A.3.3, Communications Center System Interfaces

CCS Interface	Description
KCM Transit Enterprise Database (TED) and other KCM production databases	Periodic import of KCM service and GIS map data for CAD/AVL.
Radio System	Real-time exchange of data messages between the OBS and CCS transmitted via the radio system interface.
My Bus/Bus View	The CCS will provide real-time AVL data to these applications, as is provided currently by the existing AVL system.

3.A.3.4. Level 2 Project Phases

The selected Contractor shall implement the following Level 2 phases, in conjunction with the Level 1 project phases and work plan. Proposers shall describe in their proposals the proposed coordination and timing of the Level 1 and Level 2 OBS and CCS tasks. A detailed listing of Level 2 deliverables organized by project phase and milestone may be found at Subsection **3.A.7.6, Deliverables**.

3.A.3.4.1. Design and Development

Upon notice to proceed, the Contractor and KCM staff shall conduct a requirements walk-through session to jointly review the Level 2 scope of work and requirements, and proposed project schedule and plan. The Contractor shall provide project Pre-Design Phase deliverables described in Subsection **3.A.7.6, Deliverables.**

The Level 2 design effort shall be organized to clearly identify the work and decisions needed to meet King County Metro's stated requirements. Detailed Design Review requirements are described in Subsection **3.A.7.6, Deliverables**.

This phase includes the Levels 1 and 2 joint Preliminary Design Review (PDR), constituting 50% completion of the Level 2 design effort.

Work to begin Critical Design shall commence upon notice to proceed from the KCM project manager.

Critical Design Review (CDR): Shall provide a comprehensive review of the design effort, constituting 75% of design completion.

Final Design Review (FDR): The detailed technical design and associated documents shall be reviewed, finalized, and approved.

The Level 2 development activities shall include development and customization of the CCS and development of Level 2 OBS modifications, Factory Acceptance Testing, and CCS User Bench Testing of the developed CCS prior to installation. Issuance of User Bench Testing Acceptance by KCM shall conclude this project phase.

3.A.3.4.2. Installation and Test

This phase shall include preparing the developed CCS for installation at the new Communications Center facility, and installing the CCS. Upon receipt and acceptance by KCM of deliverables required for Installation Readiness, Level 2 installation shall begin, subject to KCM Project Manager approval. The Contractor shall install the Level 2 OBS on up to 10 coaches in preparation for an OBS/CCS Field Test. Once installed, the Field Test of the integrated CCS, OBS, and TRS will be conducted.

This phase shall conclude with issuance of Field Test Acceptance by KCM.

3.A.3.4.3. Implementation

Following successful Field Testing, a Pilot Test of the OBS/CCS shall be conducted. The Level 2 OBS shall be installed and tested in revenue service, in conjunction with the CCS and TRS. Following successful completion of the Pilot Test, Level 2 OBS and CCS implementation and testing shall continue as the revenue fleet is installed with the Level 2 OBS and 700 MHz mobile radios. A Mid-Implementation Test shall be conducted, and Conditional Acceptance Test of the OBS/CCS shall be conducted on the fully implemented revenue fleet. The phase shall conclude upon issuance of Level 2 Conditional Acceptance by KCM.

3.A.3.5. Full System Acceptance

Upon issuance of Level 1 Conditional Acceptance Notice of Apparent Completion (NAC), and Level 2 Conditional Acceptance Notice of Apparent Completion (NAC), the performance of the fully implemented OBS/CCS will be monitored. The Contractor will resolve any outstanding performance issues, and the system will meet performance criteria for achieving Full System Acceptance. Full System Acceptance Testing shall be conducted for a minimum of one service change period of approximately 4-5 months, according to the requirements stated in Subsection **3.A.7.5.2.10, Full System Acceptance Testing**. This phase shall conclude with the issuance of Full System Acceptance Notice of Apparent Completion (NAC) by KCM.

3.A.4. Communications Center Systems Replacement (Alternative A)

3.A.4.1. CCS Replacement Scope

In this Alternative, the Contractor shall design, build, and implement a replacement system for the following legacy CAD/AVL system fixed-end functions. Detailed functional requirements for these and other CCS functions may be found in Subsection **3.B, Level 2 Functional Requirements** of this document. All requirements stated in Subsection **3.A, Level 2 Technical Requirements** (except Subsection **3.A.5, CCS Upgrade Alternative B)**, and Subsection **3.B, Level 2 Functional Requirements** shall apply to the CCS Replacement.

Activities for the CCS Replacement Alternative include, but are not limited to:

3.A.4.1.1. Replace the Existing CAD Module

Replacement of the existing CAD module shall consist of the following:

a. Replace the Computer-Aided Dispatch function utilized by Communication Coordinators to initiate and respond to Revenue Vehicle radio communications.

b. Replace the Schedule Data Reports function utilized by Coordinators to access various views of expected Revenue Vehicle schedules. The CCS shall utilize King County Metro service data originating from the KCM Transit Enterprise Database (TED).

c. Incorporate the existing CSR functions into the CCS CAD module. The CCS will provide existing CSR functions and support continuation of existing real-time CSR Web reports to internal King County Metro staff. Proposals may include a replacement of CSR functions with another product, and/or incorporate KCM's CSR module into the CCS design. (See Table ***3.A.4.2, CCS Replacement Tasks***, Task 2.3.1, below.)

3.A.4.1.2. Replace the Existing AVL Display Function

Replace the existing AVL function utilized by Coordinators to view Revenue Vehicle locations as transmitted from the OBS. The AVL function also provides supporting KCM transit information, such as King County Metro service routes, bus stop locations, and landmarks.

The CCS AVL function shall utilize the King County Metro Geographic Information System (GIS) base map and transit data for the CCS AVL map display and related functions.

3.A.4.1.3. Replace Data Communications, Database, and Associated System Functions

Provide CCS radio call management, data communications, and database functions that support the CAD/AVL system.

3.A.4.1.4. Provide Revenue Vehicle Polling Function

Design and replace the legacy KCM Radio/AVL polling function with a process for obtaining regular Revenue Vehicle status updates from the OBS. The existing system polling function utilizes a poll/poll-response scheme.

3.A.4.1.5. Provide OBS/CCS Data Communications

In consultation with the TRS contractor, the Contractor shall design, build, and implement OBS/CCS communications protocols, processes, and the OBS/CCS polling function.

3.A.4.1.6. Provide CCS Reports

The CCS shall provide real-time, static, and historical reports of CCS data as described in the CCS functional requirements.

The CCS shall provide existing real-time CSR reporting functions to Communications Coordinators utilizing the CCS CAD/AVL functions.

New CCS CAD/AVL functionality shall include providing a vehicle playback function.

3.A.4.1.7. Provide CSR Web Reports

Design and implementation of the CCS CSR function shall support continued operation of the real-time CSR Web report function utilized by internal King County Metro staff.

3.A.4.1.8. Provide Real-Time AVL Data to My Bus/Bus View

The CCS shall provide real-time Revenue Vehicle location and other data to downstream systems for the My Bus and Bus View Web applications.

3.A.4.1.9. Provide CCS System Administration, Troubleshooting, and Other Tools

The Contractor shall provide system administration, maintenance, diagnostic, and troubleshooting tools for use by King County Metro CCS administration staff.

Detailed functional requirements for the CCS Replacement may be found in Subsection **3.B, Level 2 Functional Requirements.**

3.A.4.2. Communications Center System Replacement Tasks

Proposers shall describe their proposed approach to the CCS Replacement Tasks below, including the proposed sequence of the Tasks. Proposers are expected to elaborate on the tasks outlined below, as proposals will be assessed by the quality and completeness of the responses received. Additional tasks may be included to fully describe the activities required to accomplish the proposed body of work.

Table 3.A.4.2. CCS Replacement Tasks

Task ID	Description
1.0	**Pre-Design**
1.1	Requirements walk-through: Upon notice to proceed, the Contractor and KCM staff shall jointly review the CCS Replacement scope of work and requirements.
1.2	Review project plan and schedule: The Contractor and the KCM Project Manager shall meet to review the detailed project plan and schedule. The Contractor shall be responsible for providing and implementing the detailed CCS project plan and schedule, including project milestones, work plans, and deliverables for the CCS Replacement. Proposers shall provide a draft of this plan with their proposals, as described in Part A, Subsection **1.T.3, Response Content Requirements**.
1.3	Deliverables include: Project plan and schedule
2.0	**Design and Development**

Task ID	Description
2.1	The Contractor shall design the CCS to meet requirements as described in Subsection **3.A., Level 2 Technical Requirements** and Subsection **3.B, Level 2 Functional Requirements.**
2.2	The Contractor shall design OBS/CCS communications protocols and data messages: As part of the Level 2 design effort, design the OBS/CCS communications protocols and data messages in conjunction with the TRS design and technical specifications.
2.3	The Contractor shall design the CCS/OBS polling scheme: Design the Revenue Vehicle polling process in conjunction with the TRS design and technical specifications, and CCS polling function requirements. See ***CC3-Manage Revenue Vehicle Polling***.
2.4	The Contractor shall incorporate the existing Coordinator Service Record functions as described in the Level 2 Functional Requirements (See **CC8-Manage Incidents**). Proposals may include one or both of the following approaches to providing CSR functionality: 1. Modify the Proposer's incident-management module. Proposers may recommend modifications of their incident-management module to provide KCM CSR functions. 2. Incorporate existing KCM CSR code into the Proposer's CAD module. Alternatively, Proposers may include in their recommended approach incorporation of KCM CSR module code into the vendor CAD module as a means of providing CSR functionality. • KCM owns the intellectual property rights to the CAD/AVL module that includes CSR functions. The CAD/AVL was completely rewritten in Visual Basic 6.0 in 1998. • DACS, the Data Acquisition & Control System, provides the server and database functions supporting the CAD/AVL functions including CSR. Provided by Harris with the original system in the early 1990s, DACS has been rewritten by KCM. KCM intellectual property rights to DACS include the right to modify the software. • DACS is written in "C" and utilizes an IBM/Informix database.
2.4.1	CSR Web Reports: The CCS shall provide the existing CSR Web reporting function. The CSR Web reports were developed in house using PHP. The legacy system data resides on an IBM/Informix database. A rewrite of the reports may be proposed, depending on the best fit with the proposed system architecture.
2.5	**Design the CCS Databases**
	In collaboration with KCM staff, the Contractor shall design databases based on CCS system requirements.
2.6	**Incorporate the Strategies functions**

Task ID	Description
	The Contractor shall incorporate the Strategies functions into the CCS system design to meet CCS requirements. Proposers may consider a redesign of the existing Strategies tool from Visual Basic 6.0 to a recommended and supported software language.
2.7	**CCS Integration Design**
2.7.1	Radio/CCS/OBS Integration: The Contractor shall design CCS/radio and OBS/radio system interfaces in conjunction with the selected Transit Radio System contractor.
2.7.2	TED Service and GIS data integration: CCS processing shall receive service and GIS data from the Transit Enterprise Database (TED) and/or other KCM production databases. See ***CC7-Manage Transit Service & Geographic Data***.
2.7.3	My Bus/Bus View interface integration: The CCS replacement shall continue to provide real-time AVL data to My Bus/Bus View. Provide My Bus/Bus View with an ICD and data requirements.
2.7.4	CCS module integration: Integrate processing among the CCS modules and components including the CAD/AVL.
2.8	**Development**
2.8.1	Develop or customize individual modules, as required.
2.8.1.1	Develop code for new or revised data messages, message processing, data flow, and outputs.
2.8.2	Develop System Interfaces
	The Contractor shall develop the following CCS interfaces:
2.8.2.1	Develop the CCS/radio and OBS/radio interfaces in conjunction with the selected Transit Radio System contractor.
2.8.2.2	Integrate KCM schedule data and GIS data: CCS processing shall accommodate schedule and GIS data imported via a new process from TED and/or other KCM production databases. See ***CC7-Manage Transit Service & Geographic Data***.
2.8.2.3	The CCS shall continue to provide real-time AVL data to My Bus/Bus View.

3.A.5. Communications Center Systems Upgrade (Alternative B)

3.A.5.1. CCS Upgrade Scope

3.A.5.1.1. Overview

The existing King County Metro CAD/AVL module has been subject to significant improvements to reach the current high level of user satisfaction. The CCS Upgrade (Alternative B) provides King County Metro with the means of leveraging the existing CAD/AVL functionality for the next generation of systems. In this alternative, the Contractor shall upgrade the existing CAD/AVL module and associated systems to operate with the new OBS/CCS communications protocols, data messages, and functions along with the new TRS. The legacy systems will be upgraded to meet the technical and functional requirements described in this document, excluding those only applying to the CCS Replacement. All requirements stated in Subsection **3.A, Level 2 Technical Requirements** (except Subsection **3.A.4, CCS Replacement (Alternative A)**), and Subsection **3.B, Level 2 Functional Requirements** shall apply to the CCS Upgrade.

The legacy system AVL processing, based on signpost and odometer data, will require revision to process OBS-generated AVL data, and to accommodate other new functions expected with OBS implementation, such as on-board route- and schedule-adherence processing.

Data messages currently transmitted between the legacy systems at the Communications Center and Revenue Vehicles (for example poll, poll-response, Request to Talk, or Emergency Alarm messages) consist of 84 bits of application data along with 60 bits of Reed Solomon error-correction data. With the advent of OBS and an on-board vehicle location mechanism that includes GPS, the size and composition of data messages are expected to change.

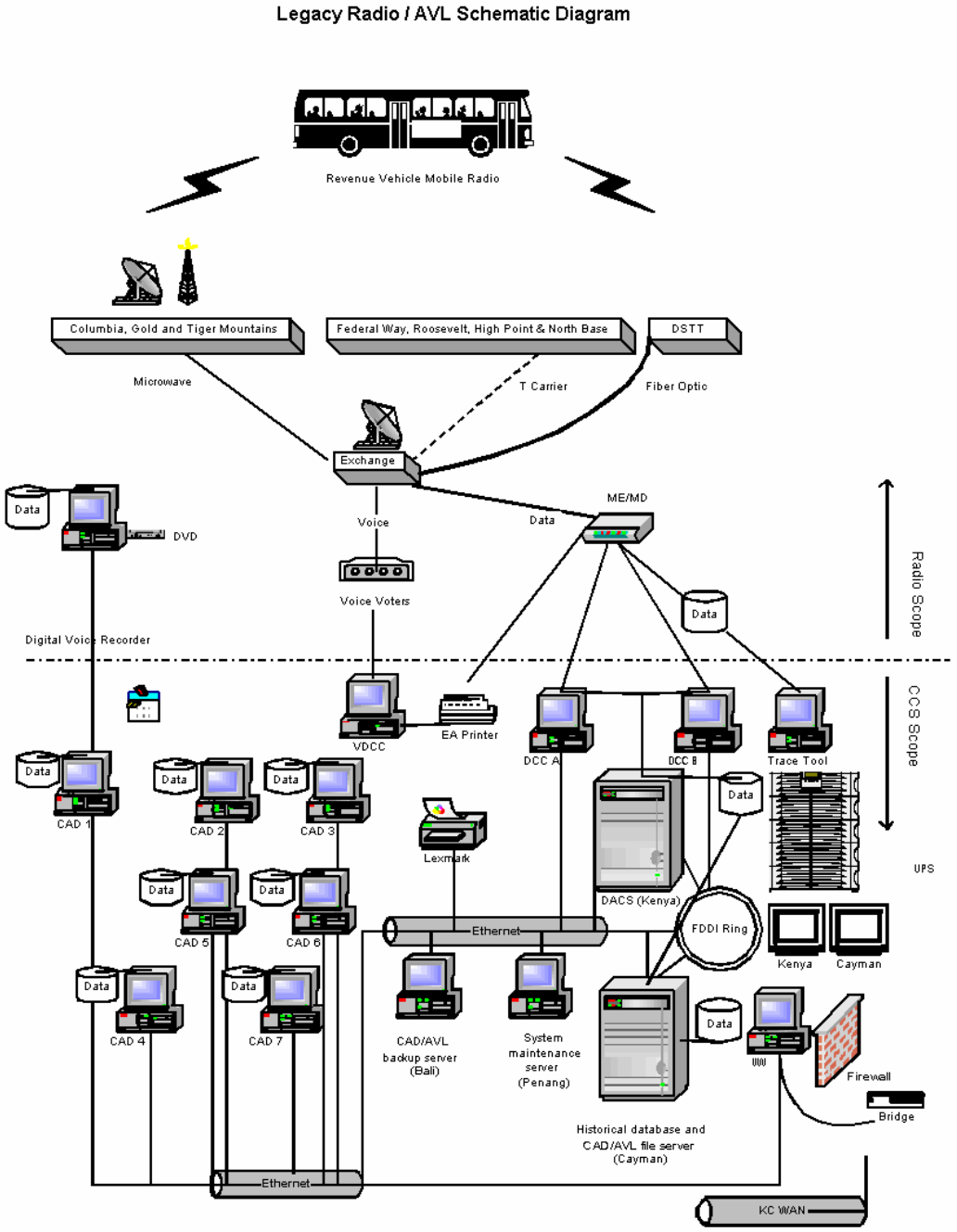
A summary description of the existing fixed-end legacy Radio/AVL system at the Communications Center follows, as well as an overview of expected CCS upgrade tasks.

3.A.5.1.2. Current System and Upgrade Tasks Overview

3.A.5.1.2.1. Existing CAD/AVL System

The Legacy Radio/AVL Schematic Diagram below illustrates the existing CAD/AVL system equipment installation at the KCM Communications Center. Individual components within the scope of the CCS are described in the following section.

Figure C.3.A.5.1.2.1, Existing CAD/AVL System



3.A.5.1.2.2. CAD/AVL

Description: the legacy CAD/AVL module provides the Coordinators' user interface to the computer-aided dispatch, automated vehicle location, schedule data, and Coordinator Service Record (CSR) functions. KCM owns the intellectual property rights to this module, which was completely rewritten in 1998.

Software: Completely rewritten using Visual Basic 6.0. A key strategic decision for the CCS upgrade is selection and implementation of a migration path from VB 6.0. (Microsoft has announced its intention to end VB 6.0 support.)

The AVL display utilizes the KCM GIS map and was recently upgraded to Map Objects 2.0 KCM GIS will remain the source of GIS data for KCM.

The CAD/AVL program contains 49,449 lines of code, and a total of 40 forms (32 CAD/MMI forms and eight AVL forms).

Hardware: The CAD/AVL application currently runs on PCs operating Windows Professional. New user terminals are assumed for the upgrade, to be provided by King County Metro, based on the Contractor’s specifications.

Upgrade Tasks will include:

a. Alternatives analysis and recommendation of a migration path from Visual Basic 6.0.

b. If recommended by the Contractor and approved by KCM, porting the application to another software language.

c. Revising and developing data messages and system processing based on changes in OBS/CCS communication protocols.

d. Providing new user functions, such as text messaging and vehicle playback.

3.A.5.1.2.3. DACS

Description: The DACS (Data Acquisition & Control System) provides the server and database functions supporting the fixed-end data radio call management, vehicle-location tracking, schedule-adherence calculation, and CSR functions. In addition, DACS currently provides radio-channel switching functions that are expected to change with the next radio system. Provided by Harris with the original system in the early '90s, DACS has been rewritten by KCM, with the exception of the call-management module. The module will be rewritten as part of the CCS Upgrade.

Software: Written in “C,” DACS utilizes an IBM/Informix database. KCM possesses intellectual property rights to use and modify the DACS code.

The program contains 59,565 lines of code (11,299 of which are 4gl reporting code) and 38 reports.

The DACS database is 500 MB, and consists of 83 tables and 121 stored procedures. The database size remains fairly constant.

Hardware: DACS currently runs on a DEC Alpha 2100.

System Administrator Tools: The Mobile Data Structure Analyzer (MDSA), written in C, provides a view of DACS internal processing, and includes two bus simulators.

Upgrade Tasks will include:

a. Alternatives analysis and recommendation of a migration path from IBM/Informix.

b. If recommended by the Contractor and approved by KCM, converting the database to another product, and porting or rewriting all stored procedures as required.

c. Revising DACS code as needed to migrate from the Tru64 UNIX OS to another OS, subject to KCM approval, and another hardware platform.

d. Revising DACS logic and processing to incorporate OBS/CCS changes in vehicle location and schedule adherence processing, formerly conducted by DACS.

e. Revising DACS functions to reflect the new radio-system radio channel switching functions.

f. Revising data messages and system processing based on changes in OBS/CCS communication protocols.

g. Providing new user functions, such as text messaging and AVL playback.

h. The MDSA will require upgrading to accommodate new data-message structures and communications protocols. To the extent possible, provide new troubleshooting and system-administration functions.

3.A.5.1.2.4. DCC (Data Communications Controller)

Description: The DCC manages data-message timing and traffic between the fixed end and the fleet. In addition the DCC:

a. Controls the timing and sequence of the Revenue Fleet polling function. Based on a poll/poll-response scheme, the DCC polls each in-service Revenue Vehicle every one to two minutes.

b. Performs the inbound data-message voting function when the same data message is received from multiple radio sites.

c. As the radio command router from DACS to the bus, the DCC controls the timing of group and other calls to the fleet.

d. Provides message receipts (acknowledgment messages) in response to a message received from a Revenue Vehicle.

Software: Written in “C,” and resides on an MS-DOS operating system. KCM is implementing a rewritten DCC, and possesses intellectual property rights to use and modify the DCC code.

The program contains 33,678 lines of code, and uses 7 screens.

Hardware: Operating on a Pentium PC, there are two DCCs, a primary and a backup.

System Administrator Tools: The DCC environment includes a Trace Tool for viewing the inputs and outputs of the DCC, as well as a DCC simulator and bus simulator. The Tools are written in C and are PC-based.

Upgrade tasks will include:

a. Revising data messages and system processing based on changes in OBS/CCS communication protocols and new radio-system requirements.

b. Revising the inbound data-message voting function for data messages received from multiple radio sites to include the number of sites required by the new radio system.

c. Revising the polling function to meet CCS polling requirements.

d. The DCC Trace Tool will require upgrading to accommodate new data-message structures and communications protocols. To the extent possible, provide new troubleshooting and system-administration functions.

3.A.5.1.2.5. Historical Database

Description: Provides historical AVL and CSR data and reporting. Created in house in 1998.

Software: IBM/Informix database.

The database is 16 GB, and grows approximately 5 GB annually. The database consists of 48 tables and 88 stored procedures.

Hardware: DEC Alpha 2100. A hardware replacement is expected as part of the upgrade.

Upgrade tasks will include:

a. Alternatives analysis and recommendation of a migration path from IBM/Informix.

b. If recommended by the Contractor and approved by KCM, converting the database to another product.

c. Revising the historical database, in collaboration with KCM staff, to support CCS requirements. It is anticipated that the existing database will no longer be the source of the agency's historical on-time performance and AVL data.

3.A.5.1.2.6. VDCC (Voice Data Communications Controller)

Description: Tracks data messages that utilize voice channels; specifically, Emergency Alarm and push-to-talk (stuck microphone) messages. The VDCC provides a redundant path for incoming Emergency Alarm messages, which are transmitted in a sub-audible data burst on a voice radio channel, decoded by the VDCC, and printed on a dedicated line printer.

Software: KCM is currently rewriting the original Harris system, which is written in “C” and resides on an MS-DOS operating system. The program consists of 10,238 lines of code.

Hardware: Operates on a 486 PC.

Upgrade tasks will include:

Revising data messages and system processing based on changes in OBS/CCS communication protocols and new radio-system requirements.

3.A.5.1.2.7. Strategies Tool

Description: Written in house, this tool allows staff to associate KCM service routes with Coordinator assignments for DACS radio-call processing and other CAD/AVL functions. The tool provides operational staff with a user-friendly means of updating the Strategies table in the DACS database.

Software: written in Visual Basic 6.0.

Hardware: Runs in the CAD/AVL console PC environment.

Upgrade tasks will include:

a. Rewrite the Strategies tool in a recommended and supported software language.

b. Revise the current Strategies functions to reflect CCS requirements.

3.A.5.1.2.8. Schedule & GIS Data Import ("Schedule Build")

Description: Schedule and GIS data utilized by the current system are imported biweekly via a series of processes, known as the "Schedule Build" process.

Software: written in Visual Basic 6.0.

Hardware: Runs in a PC environment.

Upgrade tasks will include:

The upgraded CCS shall accommodate a revised service- and GIS-data-import process. (See ***CC7-Manage Transit Service & Geographic Data.***) KCM will provide a description of the current schedule- and GIS-data outputs from TED and other KCM production databases.

3.A.5.1.2.9. Interface to My Bus/Bus View

Description: Real-time AVL data are provided to the MyBus/Bus View applications developed by the University of Washington. The University of Washington sniffs the KCM AVL data packet broadcast by the CAD/AVL system, and parses the data for the MyBus/BusView servers.

Software: The interface software was written by the University of Washington.

Hardware: Runs on a University of Washington–supplied PC.

Upgrade tasks will include:

Consultation with the University of Washington regarding the content of the future CCS AVL data packet and an ICD.

3.A.5.1.2.10. CSR Web Reports

Description: Coordinator Service Record current-day and historical reports are provided to King County Metro users such as the Customer Assistance Office and others through the King County Intranet.

Software: Developed in house using PHP. The data reside on an IBM/Informix database.

Hardware: Alpha 2100.

Upgrade tasks will include:

Ensuring continued operation of the existing CSR web-report function.

3.A.5.2. CCS Upgrade Tasks

The CCS Upgrade effort shall include upgrading the existing system to provide the new functions identified in Subsection **3.B, Level 2 Functional Requirements**. The Communications Center System Upgrade tasks outlined below identify the major bodies of work and examples of the changes in system processes that the upgrade needs to accomplish. Should the County select the Upgrade alternative, the Contractor will conduct a detailed analysis in the Pre-Design phase of the effort to identify in detail the full extent of CCS Upgrade activities.

Proposers shall describe their proposed approach to the CCS Upgrade Tasks below, including the proposed sequence for the Tasks. Proposers are expected to elaborate on the tasks outlined below,

adding other tasks as needed to describe the activities required to accomplish the proposed body of work. Proposals will be assessed on the quality and completeness of the responses received.

The CCS Upgrade effort must allow for continued operation of the legacy Radio/AVL systems at the Communications Center located in the Exchange Building until full switchover of the upgraded CCS, the OBS, and TRS is achieved. Proposals shall include a recommended approach for conducting the CCS Upgrade without affecting the availability and reliability of the legacy Radio/AVL system (a mission-critical King County Metro system), including a description of the proposed development and test environment.

Table C.3.A.5.2. Communications Center System Upgrade Tasks

Task ID	Description
1.0	**Pre-Design**
1.1	Requirements walk-through: Upon notice to proceed, the Contractor and KCM staff shall jointly review the CCS Upgrade scope of work and requirements.
1.2	Review project plan and schedule: The Contractor and the KCM Project Manager shall meet to review the detailed project plan and schedule. The Contractor shall be responsible for providing and implementing the detailed CCS project plan and schedule, including project milestones, work plans, and deliverables for the CCS Upgrade. Proposals shall provide a draft of this plan, as described in Part A, Subsection **1.T.3, Response Content Requirements**.
1.3	Deliverables include: Project plan and schedule
1.4	**Review Existing System**
1.4.1	With KCM staff, the Contractor shall conduct a detailed technical review and orientation to the existing system.
1.4.2	Review available existing system documentation, existing modules, and code. KCM will provide the existing system documentation and code for Contractor review.
1.5	Conduct Visual Basic Alternatives Analysis: The Contractor shall conduct a VB alternatives analysis, describing options and a recommendation for an alternative to Visual Basic 6.0 as the CAD/AVL and Strategies software language. The analysis shall include assessment of alternative products and their key characteristics, technical advantages and disadvantages, suitability to CAD/AVL and Strategies technical requirements, and long-term product support.
1.5.1	Deliverable: Visual Basic Alternatives Analysis document

Task ID	Description
1.6	Conduct Upgrade Impact Analysis. For each existing system component, The Contractor shall identify the impact of system changes and new requirements, including the impacts on each data message utilized by the component. Document existing data messages, message processing, data flow, and outputs. Document changes to message content, message processing, message flow, and outputs.
1.6.1	Deliverable: Upgrade Impact Analysis document.
1.7	Conduct Informix Migration Alternatives Analysis. The Contractor shall conduct an alternatives analysis and provide a recommendation for converting DACS and the existing historical database from IBM/Informix to an alternative database product.
1.7.1	Deliverable: Informix Migration Alternatives Analysis document.
2.0	**Design and Development**
2.1	**Design the CCS** The Contractor shall design the CCS to meet requirements as described in Subsection **3.A, Level 2 Technical Requirements** and **Subsection 3.B, Level 2 Functional Requirements.**
2.1.1	Design OBS/CCS communications protocols and data messages: As part of the Level 2 design effort, the Contractor shall design the OBS/CCS communications protocols and data messages in conjunction with the TRS system design and technical specifications.
2.1.2	Design the CCS/OBS polling scheme: The Contractor shall design the Revenue Vehicle polling process in conjunction with the 700 MHz radio system design and technical specifications, and CCS polling-function requirements. See ***CC3-Manage Polling***.
2.1.3	CSR Web Reports: The CCS shall provide the existing CSR web-reporting function. The CSR Web reports were developed in house using PHP. The legacy system data resides on an IBM/Informix database. A rewrite of the reports may be proposed, depending on the best fit with the proposed system architecture.
2.2	**Redesign Existing Modules** The Contractor shall redesign the legacy system to meet CCS requirements.

Task ID	Description
2.2.1	**Redesign CAD/AVL:** The Contractor shall redesign the CAD/AVL modules. • Redesign CAD/AVL user interface to provide new user functions; for example playback and text messaging. • Redesign CAD/AVL processing to incorporate DACS data-message changes. • Redesign the CAD/AVL module to operate in the selected and approved alternative to Visual Basic 6.0.
2.2.2	**Redesign DACS:** The Contractor shall redesign DACS processing to accommodate new data messages and functions. Tasks shall include: • Redesign radio-call/communications processing based on new radio system functions; for example, the DACS call set up function. • Redesign DACS to provide new user functions; for example text messaging or playback. • Redesign DACS processing to accommodate OBS-derived vehicle-location data, rather than location derived from signpost and odometer data. Eliminate obsolete DACS functions, such as calculation of schedule adherence. • Redesign messages between DACS and the DCC. • Redesign messages between DACS and CAD/AVL, including call setup, fast polling, and tracking messages. • Redesign DACS to accommodate changes in schedule data due to OBS, such as stop announcement or signage change triggers, as required. • If approved, redesign DACS to utilize a database product other than IBM/Informix. • Redesign the MDSA to utilize new CCS communication protocols and messages. Provide new CCS system-administration functions.
2.2.3	**Redesign the DCC:** The Contractor shall redesign the DCC: • Redesign DCC communications processing and data messages. • Redesign poll and poll-response messages based on the CCS polling design. (Assumes retention of current polling scheme.) • Redesign the inbound data-message voting function for data messages received from multiple radio sites to include the number of sites required by the new TRS. • Redesign the system-administration tools to utilize new CCS communication protocols and messages. Provide new CCS system-administration functions.
2.2.4	**Redesign the historical database:** The Contractor shall redesign the historical database based on CCS system requirements. The existing historical database provides on-time performance historical data for the agency. This function will be provided by the OBS.

Task ID	Description
2.2.5	**Redesign the VDCC:** The Contractor shall redesign the VDCC to process a new Emergency-Alarm data message.
2.2.6	**Redesign the Strategies:** The Contractor shall redesign the Strategies tool to meet new CCS requirements. Redesign the Strategies tool from Visual Basic 6.0 to a recommended and supported software language, if approved.
2.2.7	**CCS Integration Design**
2.2.7.1	**Radio/CCS Interface:** The Contractor shall design the CCS/radio-system interface in conjunction with the selected TRS contractor. Redesign the DCC/radio-system interface to accommodate the TRS. Redesign the VDCC/radio-system interface.
2.2.7.2	**Schedule and GIS data integration:** The Contractor shall redesign CCS processing to accommodate schedule, GIS, and other service data imported via a new process from TED and other KCM production databases. See ***CC7-Manage Transit Service & Geographic Data***.
2.2.7.3	**My Bus/Bus View interface integration:** The CCS shall continue to provide real-time AVL data to the My Bus/Bus View application. Provide My Bus/Bus View with an ICD and data requirements.
2.2.7.4	**CCS module integration:** The Contractor shall integrate processing among the CCS modules and components including: • Redesign the CAD/AVL and DACS interface and processing. • Redesign the DACS and DCC interface and processing.
2.3	**Development**
2.3.1	**Revise Individual Modules:** The Contractor shall provide a test environment for development work and develop code for revised data messages, message processing, data flow and outputs.
2.3.1.1	Revise CAD/AVL.
2.3.1.2	Revise DACS.
2.3.1.3	Revise the DCC.
2.3.1.4	Revise the historical database.
2.3.1.5	Revise the VDCC.
2.3.1.6	Upgrade the Strategies tool.

Task ID	Description
2.3.2	**CCS module integration** The Contractor shall integrate processing among the CCS modules and components including: • Revise the CAD/AVL and DACS interface and processing. • Revise the DACS and DCC interface and processing.
2.3.3	**Revise System Interfaces** The Contractor shall revise the following interfaces:
	• Revise CCS processing to accommodate schedule, GIS, and other service data imported via a new process from TED and other KCM production databases. • Revise the My Bus/Bus View interface to continue to provide real-time AVL data to My Bus/Bus View. • Revise the CCS/radio-system interface in conjunction with the TRS contractor. Revise the DCC/radio-system interface. Revise the VDCC/radio-system interface.

3.A.5.3. Other CCS Upgrade Requirements

3.A.5.3.1. CCS Upgrade Software Maintenance

King County Metro envisions CCS Upgrade software maintenance as ongoing software maintenance provided by the CCS Upgrade Contractor at minimal or no cost to KCM, in exchange for certain intellectual property rights to the KCM CAD/AVL module software.

Proposers should address this scenario in their proposals.

3.A.6. Level 2 Technical Specifications

3.A.6.1. Level 2 OBS/CCS Technical Requirements

The following Level 1 Technical Requirements, as described in Subsection **2.A.1.4, OBS/CCS Technical Requirements**, shall apply to Level 2:

- Physical and Material Requirements
- Electrical Requirements
- Environmental Requirements
- General Software Requirements
- System Security Requirements

3.A.6.2. Hardware, Software, and Database Requirements

3.A.6.2.1. Operating Assumptions

The CCS shall be operated by KCM staff using technologies that are widely available, cost-effective, and standards-compliant, and if possible, available from a selection of vendors.

The hardware, software, and database requirements for the CCS are influenced and guided by several constraining factors. These factors include:

- Performance
- Reliability/Availability
- Standards
- Cost
- Knowledge, Skills, and Abilities of KCM staff.

The Contractor shall provide software and hardware that are proven products, widely accepted and widely in use within the software development industry, and that are also the latest, up-to-date versions of their types in general use. The CCS shall be designed to utilize standard hardware and software that is state-of-the-art technology at the time of installation.

3.A.6.2.2. Server Hardware

The CCS server hardware shall possess the following characteristics:

a) **Scalability:** The CCS system shall scale (in terms of non-volatile storage, volatile storage, processing capacity, etc.) to a minimum of 200% of expected maximum system requirements over the life of the system.

b) **Availability:** The CCS system shall be designed as a mission-critical, “fire/life safety” system, and must be available on a 24/7/365 basis. The expectations for availability are “five nines,” meaning that the system must be available for use 99.999 percent per year of its service life. The system must also have sufficient redundancy to allow for routine and emergency maintenance of specific system components without affecting the overall availability of the system. The system should provide hardware to automate the backup process.

c) **Standard:** The CCS shall utilize hardware that is widely deployed and accepted within the software development industry and designed for mission-critical systems. This hardware configuration shall be available from multiple hardware vendors, and shall have the native ability to run the KCM-preferred operating systems and applications with little or no modifications to the software.

KCM will purchase and install CCS standard hardware based on the CCS Contractor's specifications, subject to KCM approval. The Contractor shall provide optimum server specifications for a five-year replacement cycle, based on KCM growth estimates. Selection of server hardware, subject to KCM approval, shall be governed by purchase and maintenance cost considerations according to established King County guidelines for hardware of this type. Contracts for hardware support must be available throughout the expected life of the system.

3.A.6.2.3. Computer Operating systems

CCS computer operating systems shall be Linux, Unix, or Microsoft Windows, unless technical justification is provided by the Contractor and approved by KCM.

CCS computer operating systems shall:

- Provide the latest, stable production versions available at the time of CCS system delivery.

- Be supportable through the life of the CCS, and/or provide an acceptable upgrade path to more recent supported versions.
- Support the CCS hardware environment through the system's life expectancy, and/or support a KCM-approved and affordable hardware-upgrade path.

3.A.6.2.4. Server Operating Systems

The CCS server operating systems shall possess the following characteristics:

a. Scale transparently to multiple system processors (SMP), or have the ability to join multiple hosts into a single production environment (Cluster). It shall also have the capacity to utilize all of the volatile and non-volatile storage specified in the "Server Hardware" section above.

b. Provide the functionality and stability to enable the CCS applications to meet the general system-availability requirements specified in the "Server Hardware" section above, with a minimum of administration.

c. Will be highly standards-compliant, utilizing standards-based technologies (such as TCP/IP, SCSI) wherever practical.

d. Will not impose excessive licensing requirements or costs. Per-seat or licensed user fees shall fall at or below the usual and customary fees paid by KCM for software of this type.

e. The CCS shall utilize Unix, Linux, or Microsoft Windows as the CCS operating platform.

3.A.6.2.5. Database Software

The CCS shall provide state-of-the-art database tools, appropriate to mission-critical systems. The CCS database software shall possess the following characteristics. The CCS shall:

a. Scale appropriately to the anticipated data requirements of the CCS system.

b. Include functionality to enable it to comply with the same availability requirements as the CSS server hardware as stated above. This functionality shall include hot backups, enterprise replication, and the ability to perform routine maintenance tasks with the database on line.

c. Include an ANSI standard SQL interface. It should be available on either of the CSS server preferred operating systems.

d. Include a stored-procedure language (e.g. Java, SPL, PL/SQL) and an interface for external programs to interact with the database.

e. Support transactions and transaction logging, along with a method for avoiding transactions if necessary.

f. Support triggers.

g. Support a bulk loading utility.

h. Have several interface tools, both GUI and CLI (command-line interface).

i. Have commercial support available.

j. Have a public bug list.

k. Provide utilities to check and repair the database.

KCM Communications Center systems-administration staff are highly competent with Unix versions of Informix On-line Server, less experienced with Unix versions of Oracle, and not experienced with either application on Windows or with SQL Server. Other KCM staff have wide experience with Oracle on both Unix and Windows, and experience with SQL Server.

3.A.6.2.6. CCS Development Environments

CCS development environments shall be in common use, widely available, and current at the time of CCS system delivery (e.g. Visual Studio, Eclipse). Supported development languages shall be ANSI standard languages (e.g. C/C++/SQL) or be in broad software-development-industry use and supportable by KCM staff (e.g. VB.NET, PLSQL, Java).

Development environments shall support the use of non-proprietary components and libraries (e.g. C/C++ standard libraries) unless they are in broad software-development-industry use and are supportable by KCM staff (e.g. .NET framework, ESRI Map Objects).

3.A.6.2.7. CCS Applications

The Contractor shall provide CCS applications with a long, useful life with viable, long-term support available.

a) CCS applications shall be built with widely available, mainstream tools that possess an identified long-term migration path.

b) CCS reporting tools shall be ANSI standard, Java, XML, or a SQL stored-procedure language provided by the CCS database product.

c) CCS Upgrade (Alternative B) custom (bespoke) applications shall be developed in the languages and environments specified above, and their development shall adhere to software-development-industry best practices and techniques.

d) KCM desires long-term CCS support through software maintenance and upgrades. See Part **B,** Exhibit **6, Software Maintenance**.

3.A.6.2.8. CCS Contractor Responsibilities

The Contractor shall provide detailed CCS server and Coordinator console hardware, operating system, and database software specifications to support the CCS, subject to KCM Project Manager approval.

CCS hardware and software specifications provided by the Contractor shall include, but not be limited to:

- CCS hardware specifications: CCS server, Coordinator console, and data-backup storage specifications.
- CCS software specifications: server operating system and database software final specifications.

KCM shall purchase the required hardware and software, based on the Contractor's specifications. Any custom or proprietary hardware provided under this contract shall be supplied by the Contractor.

Proposals shall include a proposed system architecture, and proposed CCS hardware and software solutions.

Proposals shall describe any proposed custom or proprietary hardware to be provided by the Contractor, including rationale for a custom or proprietary solution.

3.A.6.2.9. CCS Coordinator Consoles

The Contractor shall provide optimum hardware and operating-system specifications to operate the CCS Coordinator terminals, based on a five-year replacement cycle.

In addition to operating the CCS software, the CCS Coordinator consoles shall operate other KCM business software, such as Microsoft Office. The legacy Coordinator-console technical environment is described in Appendix **J, Current CAD/AVL Technical Environment**. The Contractor-provided hardware specifications shall take these requirements into account.

The CCS system design shall accommodate 11 Coordinator consoles. Each console shall include a CCS CAD/AVL and a Transit Radio System workstation. The Transit Radio System workstations shall be provided by the Transit Radio System project. The CCS CAD/AVL consoles shall include two 21-inch flat-screen monitors per workstation.

3.A.6.3. System Reliability and Availability Requirements

3.A.6.3.1. Equipment Reliability Requirements

Level 1 Equipment Reliability Requirements, as described in Subsection **2.A.1.4.6.1**, **Equipment Reliability Requirements**, shall apply to Level 2.

3.A.6.3.2. System Availability

The CCS shall provide system availability of at least 99.999% per year. Availability shall be defined as:

a. For a given time period, (total elapsed time minus downtime) divided by total elapsed time.

b. All CCS required functions shall be fully operational within stated performance requirements.

c. All CCS hardware components shall be fully operational, including all Coordinator consoles required for peak-hour operations, and one spare.

The CCS design shall support the system-availability requirements through system redundancies and health-status functions as described in Subsection **3.B, Level 2 Functional Requirements.**

The highest industry standards for data accuracy and completeness will be required. Any gaps in the data will need to be identified and logged by the software during processing. All gaps in data shall be tracked, and this information shall be made available upon demand for debugging and troubleshooting purposes.

3.A.6.3.3. System Downtime

Downtime shall be defined as when the CCS functions are not fully operational within stated requirements and/or any CCS hardware component fails to be fully operational. An individual component may fail and not impact availability, provided the system design provides redundancy and a backup component.

Downtime shall begin upon identification of the problem and shall end upon problem resolution and restoration of functionality.

If intermittent, multiple failures occur, downtime shall begin upon the first instance of problem identification and continue until all problems are resolved.

Lapses in system uptime due to catastrophic Acts of Nature, e.g. earthquakes, floods, and fires, which compromise the safe operation of the Communications Center facility, shall be considered exceptions to downtime.

3.A.6.3.4. Failure Review Team

Level 1 Failure Review Team requirements as described in Subsection **2.A.1.4.6.3, Failure Review Team**, shall apply to Level 2.

3.A.6.3.5. Corrective Action

Level 1 Corrective Action requirements as described in Subsection **2.A.1.4.6.4, Corrective Action**, shall apply to Level 2.

3.A.6.4. Data Backup, Archive, and Recovery

The Contractor shall provide a comprehensive Level 2 Data Backup, Archive, and Recovery Plan, describing these processes for Level 2 CCS and OBS.

3.A.6.5. GIS/Map Characteristics

Level 1 requirements for GIS/Map Characteristics as described in Subsection **2.A.1.7.4, Data Exchange Requirements (Software)**, shall apply to Level 2.

3.A.6.6. Communications Layers

Level 1 Communications Layer requirements as described in Subsection **2.A.1.6, Communications Layers**, shall apply to Level 2.

3.A.6.6.1. Level 2, 700 MHz Transit Radio System

In Level 2, the legacy 450 MHz radio system will be replaced by the 700 MHz Transit Radio System, requiring modifications to the OBS implemented in Level 1. The Level 2 OBS/CCS shall interface to the TRS. Level 2 modifications to the OBS primarily relate to the use of the new radio system and communication with the Level 2 CCS implementation in the Communications Center. Hardware and VAN configuration changes to support the new mobile radio will be required, producing a network architecture that places the Level 2 OBS in full control of the vehicle's new radio.

The selected TRS contractor will provide a mobile radio and design requirements early in the Level 2 design phase.

a. The next radio system will be digital and it is possible that the new system will be able to handle voice and data transmissions simultaneously. The VLU must be capable of processing both voice and data information separately and simultaneously.

b. The TRS expects to provide a data rate of 9600 bps per channel on two data channels. The OBS VLU component must be able to support high data-rate polling (9600 bps or higher) over-the-air link.

c. The OBS system should automate testing the radio on a vehicle. Once a technician logs in and starts the radio-testing procedure, an automated routine should begin to test the items below with fixed-end radio components. The results of the test will include the following and be displayed on the DDU screen for the technician and recorded in the VLU event log:

i. Transmit and receive frequency.

ii. Data speed and data errors.

iii. RTT, PRTT, and Emergency Alarm.

iv. Signal strength.

v. Modulation deviation

vi. VID data burst.

d. Digital Voting: The CCS shall provide a digital-voting function applied to data messages transmitted to the CCS for identifying and discarding duplicate versions of the same data message received from multiple simulcast radio sites.

Proposals shall include a detailed technical description of the functional, electrical, and physical interfaces required on OBS and CCS equipment necessary to complete a fully functional and compliant interface to the Transit Radio System. This description shall comply with the OSI Reference Model established by the International Organization for Standardization (Ref. Doc. Number ISO/IEC 10731:1994)

3.A.6.6.1.1. Radio-Data-Message Protocols

Protocols implemented in Level 2 shall apply consistent features, formatting, and performance requirements to all radio-data-message types. All radio-message events will be logged as detailed in the OBS/CCS use-case specifications and as determined in design.

The message protocols will be reflected in the radio-message-event logs which will be used to generate reports and analyze data-message events. The system shall provide time sequencing and traceability of message transmissions across systems (CCS, radio interface, and OBS) and between each system's major subsystems. Radio-data-message protocols shall provide an efficient, accurate, and orderly flow of data between the CCS and OBS via the TRS. Messages will include both planned messages (such as poll responses from the vehicle) and unplanned messages (such as request-to-talk or Emergency Alarm messages). The radio-message protocols shall deliver optimum communications reliability and performance with minimal error that result in the perception of seamless, instantaneous communications for users.

The TRS is expected to provide a maximum two-percent error rate. Specific accuracy and consistency requirements for OBS/CCS data-message communications, including the percentage of acceptable system errors for data-message transmission between the OBS, radio interfaces and the CCS, will depend upon the structure of the new radio system and the type(s) of error correction that are chosen in the radio-system design. Such Level 2 requirements will be determined and approved by the KCM Project Manager and the Contractor in the design phase.

3.A.6.6.1.2. Radio-Data-Message Elements

Proposals shall describe a recommended approach and mechanisms for providing reliable and accurate data-message communications.

3.A.6.6.1.2.1. Data-Message Content

Radio-data messages shall include, at a minimum, the following elements:

a. Common Content

All messages shall have, at a minimum, the following content in common:

i. Time stamp: the time of day the message was initiated.

ii. Sequence number: A number that is assigned to the radio message when it is generated for tracking purposes. Assuming the time stamp has adequate granularity, it may suffice as sequence number.

iii. Vehicle ID: a Vehicle ID field must be part of every message sent from a Revenue Vehicle to the CCS, and when appropriate, messages from the CCS to a Revenue Vehicle.

iv. Message-type identifier: All messages shall have an identifier that identifies the type of message, e.g. a Request to Talk, or EA acknowledgment. An acknowledgment of message receipt shall include the message-type identifier for the message being acknowledged.

b. Message Content Order

i. System design shall include a protocol for consistent ordering of message content common to all message types, such as Sequence Number, VID.

ii. System design shall provide a scheme for consistent ordering of message content specific to message type. Consistent ordering of message content will be established to aid KCM system administrators in troubleshooting.

c. Message Content requirements

Level 2 Functional Requirements describe data-message content requirements for Emergency Alarm, Operator login, poll, and poll-response message content, summarized in Table ***3.A.6.6.1.2.1, OBS/CCS Message Matrix*** below. More detailed data-message content requirements may be found in Subsection **3.B, Level 2 Functional Requirements**.

Table 3.A.6.6.1.2.1. OBS/CCS Message Matrix

	Message Type			
	Emergency Alarm	Operator Login	Poll Message	Poll Response
Message Content				
Sequence number	**x**	**x**	**x**	**x**
Message Type	**x**	**x**	**x**	**x**
Time Stamp	**x**	**x**	**x**	**x**
VID	**x**	**x**	**x**	**x**
Block ID	**x**	**x**		
OID	**d**	**x**		
Location Confidence Factor	**x**			**x**
Most Recent Serviced Stop				**d**
Time of Occurrence				**d**
Stop Event				**d**
Stop ID				**d**
Stop Sequence Number				**d**
Most Recent TP Encountered				**x**
TP Event				**x**
Unique ID				**x**
Sequence # of TP in trip				**x**
Trip ID				**x**
Schedule Adherence	**d**			**x**
Passenger Count	**d**			**d**
Route Adherence Flag	**d**			**x**
Service Route	**x**			**x**
Two Most Recent TP Events				**x**
Unreported TPs since last poll				**d**
Vehicle Location	**x**			**x**
x = required d = desired				

3.A.6.6.1.2.2. Message Requirements

The Level 2 communications protocol shall employ mechanisms for ensuring reliable message delivery.

a. Receipt Acknowledgments

The originating component or system shall expect to receive an acknowledgment of receipt from the destination component or system unless determined otherwise in design. All acknowledgment messages shall use a unique message identifier that

identifies it as an acknowledgment and identifies the message type it is acknowledging.

System design shall accommodate receipt acknowledgments for required message types without overwhelming system components. For example, when a radio call is sent out from the CCS to an Assigned Group or the fleet, the system design will include a way for the CCS to receive acknowledgments without compromising CCS system health, such as in a Revenue Vehicle's next poll response. If a poll/poll-response scheme is used, a poll-response message itself will serve as acknowledgment to a poll query.

b. Message retries

If an acknowledgment of message receipt is not received by the originating component/system within the reply window, the originating component/system shall send the message again. Whether a message type will be retransmitted, and the number of times it should be retransmitted before the attempt is abandoned, shall be configurable in the OBS and CCS.

Due to its critical nature, the OBS Emergency Alarm message protocol will have specific retry requirements if the originating OBS does not receive an acknowledgment from the CCS.

c. Notifications of non-receipt

The originating component/system shall retry the designated number of times. If an acknowledgment does not result from the last retry, then the originating component/system will send notification of non-receipt to the appropriate actor as configured in design. Automated notification shall be configurable and shall include types such as the following: the non-receipt being written to the originating component/system's database for reporting purposes, sending an automated e-mail to an Operator or Coordinator, or an automated page to a system administrator.

d. Promotion, demotion, and cancellation of radio data messages

The system design shall provide the ability for Operators to promote and/or cancel select message types while the messages are pending, as appropriate. For instance, a Request to Talk (RTT) could be promoted to a Priority Request to Talk (PRTT) or could be canceled. Emergency Alarm messages will not be demoted or canceled.

e. Duplicate-message prevention

The system design shall prevent the re-initiation of a message type from an individual OBS (VID) if the same message type was initiated from the same OBS within a standard and configurable number of seconds.

The OBS Emergency Alarm message protocol shall always allow the initiation of a PRTT as follow-up to an active EA, regardless of how much or how little time has passed since the initiation of a pre-EA PRTT and regardless of whether a pre-EA PRTT is pending.

3.A.6.6.1.3. Radio Data Message Audit-Trail Report

OBS/CCS design shall provide system administrators the ability to generate a Radio Data Message Audit-Trail Report. The report shall provide a clear time-sequenced audit trail of

message transmissions across systems (CCS, radio interface, and OBS) and between each system's major subsystems. The report will detail data-message communications across systems (CCS, radio interfaces, and OBS) and between each system's major components. Administrators will have the ability to query using multiple predefined and configurable parameters, e.g. by unique message identifier, within a specific time frame, by vehicle or subsystem ID. The report will draw from all available message content and will be filterable and sortable. Parameters, filters, and sorting categories will be configurable.

Proposals shall provide a detailed discussion of the proposed system's approach to joining, sequencing, querying, and generating the data to be contained in a Radio Data Message Audit-Trail Report.

3.A.6.6.1.4. Time Synchronization

Time synchronization between OBS and the CCS is critical to the task of real-time functions such as the data-message protocols listed above, including the polling scheme's role in AVL, and recording and reporting good data. OBS/CCS design shall include a consistent and reliable time source and method that ensures that OBS and CCS subsystems—including CCS Coordinator console clocks and databases and OBS databases and Operator interfaces—operate in, display, and log the same time, at all times, with an acceptable maximum variation of one second. Any variation will be tracked, logging the number of clock corrections and the magnitude of each correction so that device clocks that require frequent or large corrections can be investigated and repaired if necessary.

Time-synchronization methods in KCM's legacy systems have met with challenges that KCM wishes to avoid with Level 2 OBS/CCS functionality. Examples of these challenges have included low on-board battery power draining the charge from Operator-interface clocks and preventing their accurate update; urban canyons preventing accurate on-board updates; weather or other signal interference preventing the Coordinator's console clocks from receiving updates; and signal delays skewing the accuracy of updates to the Communications Center database.

The proposal shall include a discussion of the proposed time source and method of time synchronization explaining how the proposed system would handle future system challenges including those that may be similar to the legacy-system time-synchronization challenges mentioned above.

3.A.7. Other Level 2 Project Requirements

The following requirements shall be met by the Contractor for either the Replacement or Upgrade Alternative.

3.A.7.1. Communications Center Environment

The CCS shall be installed, tested, and implemented at the new King County Metro Communications Center, scheduled to be constructed at the KCM Central/Atlantic Base complex and available to the CCS project by August 2005. The Communications Center Relocation Project, managed by KCM Design and Construction staff, is in the process of determining the design of the facility, which will accommodate 11 Communication Coordinator consoles.

3.A.7.2. CCS Training Requirements

The Contractor shall provide a comprehensive CCS training program that prepares King County Metro staff to operate and maintain the CCS. The Contractor shall:

a. Provide personnel with the information and skills needed to operate, maintain, and support the CCS.

b. Offer at a minimum the System Administrator and Train the Trainer courses described below.

c. Provide required ongoing KCM personnel training after system implementation through the duration of the Contract.

General Training Requirements as described in Subsection **2.A.3.8.2** shall apply to Level 2.

The timing of the training, delivery of the specified training aids and equipment, and constitution of the groups to be trained will be specified by KCM. Materials, training schedule, instructors, and course outlines shall be approved by KCM.

3.A.7.2.1. Training Program Plans

The Contractor shall develop and submit to KCM for approval a CCS Training Program Plan. The plan shall be based on criteria identified in this specification, and at a minimum, provide the following for each course:

a. Brief course description.

b. Expected performance objectives and explanation of how the expected objectives will be measured.

c. Outline for the course content.

d. Type or method(s) of presentation that will be used.

e. Resources required (equipment, classroom/shop space, supplies).

f. An estimated time schedule to train (based on the required number of hours and/or sessions of instruction) employees.

g. Intended audience and the maximum class size.

h. A proposed training schedule, based on the training program requirements and CCS project schedule.

3.A.7.2.2. System Administrator Training

The Contractor shall provide CCS administrator training courses. The CCS administrator training courses shall be designed to provide KCM technical staff responsible for daily CCS operations, including system administrators, network administrators, database administrators and maintenance technicians, with the knowledge and skills required to troubleshoot, maintain, and configure the CCS. Courses shall include a combination of lecture and hands-on experience with CCS hardware and software. Training materials shall include system and user documentation, and system design documents.

3.A.7.2.2.1. System Overview Training

The Contractor shall provide a CCS Overview training course to provide CCS technical staff with a detailed technical overview and orientation to the CCS design and theory of operation. Course content shall include, but is not limited to, the following:

- System design
- Data flows

- Interface descriptions
- The OBS/CCS polling function
- Level 2 communications protocols
- Data messaging
- Data reporting
- Backup and archive processes
- User functions

3.A.7.2.2.2. Hardware Training

The Contractor shall provide hardware training for all CCS hardware provided by or specified by the Contractor as part of this contract. As a result of this training, KCM technical staff shall be proficient in the knowledge and operation of CCS hardware, including but not limited to:

a. Hardware installation and preventive maintenance.

b. Hardware interface connections between CCS components, CCS subsystems, and other KCM systems (e.g. the TRS interface).

c. Hardware diagnostic and testing tools.

d. Hardware troubleshooting and repair.

e. System expansion.

Hands-on experience shall be emphasized while training on diagnostic and testing software, system failures, and restoration.

3.A.7.2.2.3. Software Training

The software training courses shall prepare KCM technical staff to support the CCS applications, server, database, and diagnostic software. The software training courses shall include, but are not limited to, the following:

a. CCS Software Administration: This course shall provide the skills and knowledge for KCM technical staff to administer and maintain the CCS software. The training shall emphasize hands-on experience with the CCS software as installed at KCM. Course content shall include but is not limited to:

   i. Troubleshooting and use of CCS system health functions, including use of system and diagnostic messages.

   ii. Software backup and restoration.

   iii. Real-time data-message processing and data reporting.

   iv. Data management and archive process.

   v. Installing and testing software upgrades and updates.

   vi. Detailed instruction and hands-on experience in the use of the CCS Administrator's Toolkit as described in Appendix **K**.

   vii. System startup, shutdown, and Failover.

viii. System access and security functions.

b. CCS Systems Software: Courses shall train KCM technical staff to utilize each CCS operating system and other systems software. Topics shall include but are not limited to: performance monitoring software and utilities, networking software, and configuration utilities.

c. CCS Applications Software: Courses shall train KCM technical staff in the design, operation, and maintenance of all CCS application software. The courses shall include a detailed instruction in each application's design, architecture, and functionality; I/O, data flow, interfaces, algorithms, and the tools used to modify and extend the CCS software.

3.A.7.2.3. Train the Trainer Course

The Contractor shall provide a "Train the Trainer" course. This course shall be designed to train KCM personnel to deliver CCS Communications Coordinator training. This class shall be sufficiently detailed and shall identify the resources and number of instruction hours necessary to complete the program.

The course will prepare KCM-designated Trainers to train Communications Coordinators to be qualified in the fundamental capabilities of the CCS and in the operation of the CCS workstations and other relevant equipment. The training shall enable KCM Trainers to teach an eight-hour class to Communications Coordinators. This training shall provide a thorough understanding of the CCS workstation user interface, and shall also provide the trainees with an understanding of the CCS design concepts and features. It shall provide hands-on training using the actual CCS workstation hardware and software as implemented at KCM. This training shall include a detailed user manual.

The course shall be comprised of three separate eight-hour training sessions for a class size of 10 trainers and/or supervisory staff.

The Contractor shall provide a representative to attend a minimum of two training sessions conducted by KCM trainers who have attended the Train the Trainer course. The Contractor representative shall act as an information resource for the training sessions as needed.

3.A.7.2.4. Training Locations

All training shall occur at the KCM Communications Center, or KCM-approved alternative location.

3.A.7.2.5. Manuals and Equipment

Training manuals shall be developed and provided by the Contractor, subcontractors, third-party software suppliers, or OEMs. Training manuals shall be submitted to the KCM Project Manager for review and approval according to the process described in Subsection **3.A.7.6, Deliverables**. Training manuals shall be utilized as the primary training guides for CCS training courses. The training manuals may be supplemented by technical manuals and other CCS documentation as appropriate, subject to KCM Project Manager approval.

3.A.7.2.5.1. Training Materials

The Contractor shall provide a list of training materials required for each course discussed in the Training Program Plan. The following requirements apply to training materials:

a. The Contractor shall reflect all changes and revisions to the installed CCS in all training materials.

b. All Instructor and student books shall be loose-leaf-bound, camera-ready copies that are printed on 8½ x 11-inch paper, double-sided. The Contractor shall also be responsible for providing instructor and student books in electronic form on compact disk in the following formats:

   i. Text shall be provided in the latest version (current production version at deployment, as agreed to by the Project Manager) of Microsoft Word, Word Perfect, or equivalent commercially available word-processing program.

   ii. Drawings shall be provided in .eps or .dfx file formats.

   iii. Graphics files shall be provided in HTML and GIF and/or JPEG file formats.

c. All materials required for training classes shall be delivered to KCM at least 90 days prior to the scheduled start date of the class. All training materials shall use English text and shall become the property of KCM.

d. The Contractor shall be responsible for updating training materials to reflect current CCS parameters in the event that changes are made to the system or operational procedures. Such materials shall be updated and maintained by the Contractor throughout the life of the Contract.

e. At the end of the Contract, all such materials shall become property of KCM.

f. At a minimum, the Contractor shall provide the following training materials for each course:

   i. Instructor Guides: Contractor shall provide 25 copies of the Instructor guide for each class identified in the Training Program Plan, and this guide shall include:

      1. Course agenda and objectives.
      2. Resources and facilities required for the course.
      3. Detailed lesson plans or outlined presentations and discussion guides.
      4. Pre- and post-training assignments.
      5. Instructions for using any audio-visual support, mock-ups, and scale models.

   ii. Student Workbooks: The Contractor shall provide 50 copies of the student workbook for each course in the Training Program Plan. The student workbook shall contain all materials necessary to help the student understand the lessons being presented and serve as an on-the-job reference. The workbook shall include:

      1. Paper copies of all the transparencies.
      2. Lecture outlines.
      3. Lesson summaries
      4. Step-by-step instructions for the operation of each device in the CCS system.

5. Troubleshooting guides for Communications Coordinators and system administrators.
6. Other information that will help students understand the material and apply their knowledge in the field environment.

iii. Mock-Ups and Scale Models: The Contractor shall provide mock-ups and scale models to be used as instructional aids during the training courses. Mock-ups and scale models are to be constructed of secure, durable materials that will survive 10 years of use in a classroom environment.

iv. Overhead Transparencies: Overhead transparencies (view-graphs) used in training shall be supplied along with camera-ready copy. Master copies of slides and other audiovisual materials shall be provided to allow for reproduction as necessary.

v. Video and Interactive Computer Programs: These shall be provided, where applicable, as an instructional aid to the course material. These media shall also be available to permit KCM personnel to train, refresh, or update themselves at KCM facilities. Specific requirements follow.

1. Video materials shall be provided in DVD format.
2. Video materials shall thoroughly cover the topic discussed.
3. Video materials shall be identified according to subject.
4. Instructional video materials shall be of professional quality.
5. Protective cases shall be provided for all video materials.
6. All material must be supplied in either audio or video format, including but not limited to close-captioned for hearing impaired.
7. Contractor shall provide a master list of video materials, cross-referenced to the instructor's syllabus.
8. Interactive computer programs shall be furnished on compact disk (CD).

vi. CCS Simulator: CCS training equipment shall include a simulated CCS with simulated Revenue Vehicle communications: radio calls, alarms and text messages, and AVL tracking for the purpose of user training.

3.A.7.2.5.2. Training Program Approval and Instructor Qualification

The KCM Project Manager shall have the rights to review, approve, and accept all of the training materials and course work prior to the Contractor's use in execution of training. The Contractor shall warrant that all instructors are fully qualified to present the course material. The KCM Project Manager shall reserve the right to request replacement of instructors it deems to be unqualified or whose performance it deems unsatisfactory for any reason.

3.A.7.3. Installation

3.A.7.3.1. CCS Installation

The Level 2 Installation and Test phase shall commence following successful completion of User Bench Testing and issuance of User Bench Test Acceptance.

Installation of the CCS shall be contingent upon availability of the new Communications Center facility.

The Contractor shall plan and schedule the CCS installation with the KCM OBS/CCS and Transit Radio System Project Managers, and the selected Transit Radio System contractor, subject to KCM OBS/CCS Project Manager approval.

3.A.7.3.2. Responsibilities

Contractor and KCM responsibilities as outlined in Subsection **2.A.3.9.4, Installation Responsibilities** shall apply to the Level 2 Installation in addition to the following:

a. As described in Subsection **2.A.1.3.4.3, Installation Requirements**, KCM technical staff will install all equipment and software under the Contractor's supervision as necessary. The Contractor's installation requirements include, at a minimum, documentation for and training on the system requirements, installation procedures, and maintenance procedures, including but not limited to hands-on instruction with written step-by-step setup instructions. The Contractor shall provide personnel contacts for installation support for all software and hardware. All server and software specifications will be detailed in the provided documentation.

b. KCM staff shall install all CCS servers, Coordinator consoles, and CCS databases under the supervision and approval of the Contractor.

c. The Contractor shall train KCM staff to configure and install the CCS servers, databases, and Coordinator consoles, based on the Contractor's training and documentation.

d. The Contractor shall be responsible for installing any custom CCS hardware provided under this contract.

e. Any such installation shall be coordinated by the KCM Project Manager, and conducted with KCM staff participation.

f. Radio Interface Installation: The Contractor shall oversee and install the CCS interface to the TRS, in coordination with the TRS contractor.

3.A.7.3.3. Installation Readiness: Deliverables

The Contractor shall provide the deliverables required to install the CCS at the new Communications Center facility. The Deliverables required to satisfy installation readiness requirements are listed in Subsection **3.A.7.6, Deliverables**. Installation Readiness deliverables shall include but are not limited to:

a. System Documentation: All CCS system documentation, including but not limited to:

   i. Server and coordinator console and other hardware/firmware configuration documentation for each specified server or terminal.

   ii. CCS software installation and configuration documentation including operator, programmer, and user's manuals.

b. Training: KCM staff training for installing, maintaining, and operating the CCS, including the training plans, manuals, and equipment, and training classes, as described in Subsection **3.A.7.2, CCS Training Requirements**.

c. Software: Contractor-provided CCS software, including CCS administrator tools, CCS database administration tools, report generation tools, and Strategies administration tool.

d. Databases: CCS database documentation, schema, and data for all jointly or Contractor-designed databases.

e. Test Plans: Test plans for all phases of installation and configuration.

3.A.7.3.4. Installation Plan

The Contractor shall develop a plan describing the steps and procedures for Level 2 installation, subject to KCM Project Manager approval. The Installation Plan shall describe the process by which the CCS shall be installed at the new Communications Center, including installation schedule, work breakdown structure, Contractor and KCM staff roles, and key milestones. The plan shall provide detailed information concerning:

- The full scope of activities required to achieve a fully functional and complete Level 2 installation.
- Communications Center facility preparation, KCM staff preparation, and CCS equipment installation.
- All materials, documentation, KCM staff training, services, equipment, and tools required for installation.
- The process and procedures for enabling Level 2 OBS modifications.

The plan shall be developed in coordination with KCM staff and the TRS contractor, and shall reflect, at a minimum, the following information:

- The Communications Center facility layout, infrastructure, and other pertinent characteristics.
- Communications Center Relocation Project documentation and plans.
- KCM information system equipment and infrastructure.
- TRS project and installation plans, and TRS equipment.
- Communications Center operational environment.

3.A.7.3.5. Physical Installation Documentation

The Contractor shall specify the requirements for the physical installation of equipment and systems.

The Contractor shall provide CCS installation specifications, including but not limited to power requirements, network and conductivity requirements, installation drawings and schematics, physical interfaces and equipment layouts, subject to the KCM Project Manager approval.

The Contractor shall develop radio interface specifications, in conjunction with the TRS contractor, subject to KCM Project Manager approval.

The Contractor's installation documentation shall include the bolt-down of equipment, connection to power and data communication lines.

3.A.7.3.6. Installation Procedures

The Contractor shall supply detailed procedures for equipment-installation inspection, including installation checklists and instructions for each equipment type, installation configuration and testing, and other characteristics applicable to the installation process and parameters, and unique to equipment being installed.

The procedures shall provide step-by-step instructions to verify proper installation and interfacing of the equipment with other system components.

Installation procedures shall provide step-by-step instructions for installing and verifying that each software module, hardware component, or database is properly installed and fully functional.

Installation checklists and procedures shall be subject to the approval of the KCM Project Manager.

3.A.7.3.7. Implementation Plan

The Contractor shall develop a Level 2 Implementation Plan describing the process to guide and implement a trouble-free transition from operation of the legacy CAD/AVL system to the new CCS. The plan shall assume extended parallel operation of the legacy CAD/AVL and 450 MHz Radio systems, and the new CCS and TRS.

The Implementation Plan shall describe the system features, procedures, tasks, and activities required for a successful Level 2 Implementation Phase, and shall be developed in coordination with KCM staff and the TRS contractor. Implementation topics covered by the Plan shall include but are not limited to CCS testing, coordination with TRS implementation, and the transition of operation from the legacy CAD/AVL system to the CCS. The plan shall identify specific processes to ensure reliable communications between Revenue Vehicles and the Communications Center throughout system implementation.

3.A.7.3.8. Installation Testing and Certification

3.A.7.3.8.1. Installation Testing

Installation testing shall include testing of the installed CCS and Systems Integration Testing as described in Subsection **3.A.7.5, Testing.**

3.A.7.3.8.2. Installation Certification

Upon completion of the CCS installation, the Contractor shall inspect the installation and certify the installation meets the Contractor's specifications, and that the installed units are fully functional. The Contractor shall provide a list of any needed corrections and provide additional instruction to KCM if required, at no expense to KCM. Upon successful inspection, the Contractor shall issue an Installation Certification, certifying the installation meets the Contractor's requirements.

3.A.7.4. OBS Level 2 Modifications

In Level 2 of the project, the implementation of the TRS, the CCS, and modifications to Level 1 on-board functionality will enable enhanced communication between Operators and the CCS as well as the transmission of more data between the OBS and CCS. For the reader's reference, modifications to OBS functionality have been assembled in the matrix below, listing the Level 1 use case where the requirement resides, the Level 1 functionality described in that use case, and the modification to the functionality that will take place in Level 2.

Table 3.A.7.4, OBS Level 2 Modifications Identified in OBS Level 1 Use Cases

RV Domain Use Case	Level 1 Functionality	Functionality added in Level 2
Manage AVM	Full Level 1 OBS monitoring and data logging, and transfer of data and AVM alarms to base server.	• Real-time Critical AVM Alarms to CCS
Interface to DDU	Full Level 1 OBS functionality plus programming of Level 2 DDU key presses/menu items that will provide enhanced Operator controls to be enabled in Level 2.	• Enable Level 2 DDU menu/key presses (including pre-Operator-login RTT/PRTT) • Text messages • Joint Bus/Rail Tunnel operation • Option: Electronic Work Order form
Initiate Vehicle for Operation	Full Level 1 OBS functionality.	• Integration with 700 MHz radio system and the CCS. • Radio/AVL communications established at vehicle startup. • CCS ability to remotely log in either OID or the Block ID. • AVL tracking that considers and accurately adjusts its reporting of unscheduled changes such as adjusted trip times (e.g. a trip that runs at noon instead of 3 p.m. for early dismissal) or the addition of extra trips to a block of work.
Take Vehicle Out of Operation	Full on-board functionality and termination of radio/AVL communications.	• Keeps radio log for interface to 700 MHz radio system. • OBS sends Log Out Revenue Vehicle message to CCS and waits for Acknowledgment. • Ability for CCS to initiate a remote logout of OID and/or Block ID.
Monitor System Health	Monitoring of all on-board subsystems.	• Monitor the new on-board mobile radio and the hook switch on the Operator handset.
Manage Events	Manages full Level 1 OBS functionality.	• Add events to priority table: e.g., text messages and security microphone's real-time audio transmission. • Process Text Messages • Processing EA and Critical AVM Alarm events with new interface to 700 MHz radio.

RV Domain Use Case	Level 1 Functionality	Functionality added in Level 2
Determine Vehicle Location	Full Level 1 OBS functionality.	• Add Quality and Confidence factors reporting to poll response. • Report Lat/Long in poll response.
Monitor Route and Schedule Adherence	Full Level 1 OBS functionality.	• Add schedule and route adherence to poll response. • Add transmission of "late beyond recovery" signal to CCS. • Implement configuration method to handle poll response messages during system-wide extreme off-schedule operations.
Interface to 700 MHz Radio	(Not applicable)	• Manage mobile radio communications between the Revenue Vehicle and Communication Center System.

3.A.7.5. Testing

3.A.7.5.1. General Testing Requirements

The following Level 1 OBS Testing Requirements sections shall pertain to Level 2 Testing:

a. General Testing Requirements described in Subsection **2.A.2.1**.

b. Test Equipment requirements described in Subsection **2.A.2.2**.

c. General Testing Procedures and Definitions described in Subsection **2.A.2.4**.

In addition, Level 2 General Testing Procedures shall include the following:

3.A.7.5.1.1. Functional Testing

Functional testing of the Level 2 OBS/CCS shall be conducted as described in Subsection **2.A.2.5, Factory Acceptance Testing (FAT)**. Functional tests shall include but not be limited to functional testing of all developed CCS software modules for all CCS components, and shall demonstrate the system's ability to perform each step and supporting details in **Level 2 Functional Requirements, Section 3.B,** in sequence and in combination.

3.A.7.5.1.2. CCS Usability Testing

The Contractor shall conduct usability testing to verify that those features and operating characteristics that affect the Operator’s use of the system components are easy to understand, easy to use, and quick in response to Operator actions. The test may be conducted as an integral part of the functional test. The overall goal of this test is to ensure that the system software has been designed to fit user needs, tasks, and requirements as described in **Level 2 Functional Requirements, Subsection 3.B**.

3.A.7.5.1.2.1. Usability Problem Resolution

The Contractor shall participate with the Failure Review Team (see Subsection **2.A.2.4.6.1, Failure Review Team)** to analyze problems reported by CCS users that are attributed to "user error" to determine if the error is in fact attributable to a difficult or confusing user interface.

The Contractor shall monitor CCS testing, user training programs, and other user interactions with the system to identify any CCS functions that KCM personnel consistently have difficulty utilizing.

The Contractor shall participate with the Failure Review Team in analyzing complaints from KCM staff regarding the usability and ergonomics of the CCS.

The Contractor shall summarize the results of these activities and recommend a course of corrective action, such as modifications of the interface, additional user training, or adjustments of system component mounting.

3.A.7.5.1.3. Level 2 System Response Simulation

Verification of Level 2 functionality for both the CCS and modified OBS shall include simulation testing prior to installation. The Contractor shall provide appropriate input to simulate data transfers and voice messaging expected to occur on the installed systems. Simulation testing for each Level 2 system shall be conducted independently.

For CCS tests conducted prior to installation, test procedures shall include simulation of data- and voice-message traffic expected by the installed CCS. The Contractor shall execute simulated worst-case loading of data and voice messages to be accommodated by the CCS to demonstrate that the response time to process and display updated maps, tables, and other screens meets stated requirements. Simulated fleet size for these tests shall be in graduated increments, such as 500, 1000, 1500 vehicles, up to system's designed maximum, with actual numbers used in the test to be determined by the Contractor's test plan. Simulation assumptions and methodology shall be discussed in the test plan submittal, and approved by the KCM Project Manager.

For Level 2 OBS tests conducted prior to installation, test procedures shall include the use of simulated data to test all radio interface and control functionality. A mobile radio shall be used to provide simulated input, and loading levels shall be the same as those described above for the CCS simulation testing.

3.A.7.5.1.4. CCS Availability Testing

The availability of the CCS shall be monitored and measured with each CCS test. The Contractor shall provide a System Availability Measurement Plan describing the methods and procedures for measuring Level 2 System Availability throughout the project. Test acceptance shall be subject to meeting CCS availability requirements. Criteria for determining CCS availability are described in Subsection **3.A.6.3.2, System Availability**.

Following implementation of the system in revenue service, the CCS shall meet or exceed availability requirements of 99.999 % for any time period the system is scheduled to be operational and in service. CCS availability shall be maintained at 99.999% or better throughout the system implementation and performance monitoring period. Certification of Test Readiness by the Contractor, and Issuance of Test Acceptance by KCM, shall be subject to meeting the availability requirements.

3.A.7.5.1.5. Level 2 Overall Inspection and Testing Plan

The Contractor shall provide a Level 2 Overall Inspection and Testing Plan, describing the general testing strategy and criteria for test acceptance for each Level 2 test. The plan shall provide detailed narrative descriptions and proposed test methodology for each required and proposed Level 2 test.

3.A.7.5.2. Level 2 Test Stages

3.A.7.5.2.1. Factory Acceptance Testing (FAT)

The Contractor shall establish and maintain a Level 2 test environment sufficient to perform factory acceptance testing of all Level 2 functionality.

Level 1 OBS Factory Acceptance Testing requirements, as described in Subsection **2.A.2.5**, shall pertain to Level 2 Factory Acceptance Testing.

3.A.7.5.2.1.1. CCS Factory Acceptance Testing

Prior to CCS User Bench Testing, the Contractor shall conduct CCS Factory Acceptance Testing. CCS coding, module processes and interfaces, and system configurations shall be tested by the Contractor within the Contractor's test environment to ensure the CCS meets all functional and environmental requirements and specifications.

a. The CCS shall be tested at the Contractor's factory prior to shipment. These factory tests shall fully demonstrate that the developed CCS functionality meets stated requirements. Factory testing shall be intended to simulate as closely as practical the installed CCS environment.

b. Factory Acceptance Testing shall be performed in controlled laboratory conditions at the Contractor's facilities or KCM facility, subject to KCM Project Manager approval. The Communications Center System and radio network infrastructure shall be connected or simulated to the extent possible to demonstrate CCS functionality in final installation and implementation.

c. The Contractor shall provide all hardware, software, and other equipment required for the test and simulation of CCS implementation conditions.

d. Test equipment shall be that specified by the Contractor in the CCS software and hardware specifications and FAT Test plan. Any test equipment substitutions shall require KCM Project Manager approval.

e. Wireless communications via the voice and data radio shall be simulated at signal levels to resemble installed conditions. The complete set of Communications Center System components shall be factory-tested as a whole. A representative sample of Coordinator consoles may be utilized, provided sufficient network traffic is generated to simulate the full set of Coordinator consoles for loading and response-time testing. Interfaces shall be simulated for the purpose of verification of data transfer.

f. Testing shall verify the complete functionality of the CCS, including dispatcher consoles, CCS servers, alarm reporting, failure modes, interface to radio, and report generation. Functional performance testing shall utilize test cases with normal and exception data.

g. The FAT shall include functional testing of the CCS as described in Subsection **3.A.7.5.1.1, Functional Testing**. All requirements shall be tested and verified, including but not limited to:

- User-interface functions.
- Data transfers from other KCM systems, including GIS and transit service data.

- System failover and recovery from simulated hardware and CCS component failures.
- System health and performance monitoring functions.
- Confirmation that system documentation is correct and current.
- Required system capacity and sizing.
- Peak-activity load testing using simulated system events representing up to 150% of the expected quantity of system events as well as the system design maximum.

System restart capability testing through repeated shutdown and restart of all processes, using an automated script over a 24-hour period. The Contractor shall develop a CCS FAT Test Plan, describing in detail the FAT test methods, procedures, criteria, and reports.

3.A.7.5.2.1.2. OBS Factory Acceptance Testing

The Contractor shall conduct the Level 2 OBS FAT to demonstrate the following:

a. The successful operation of all functional requirements for the use and control of the 700 MHz radio system on board the Revenue Vehicle, using Contractor-provided simulations as described above. See Subsection **3.A.7.4, OBS Level 2 Modifications** for a summary description of required modifications.

b. The repetition of all possible Level 1 OBS functional testing performed for Level 1 Conditional Acceptance to ensure, as far as possible, that none of these operations has been adversely affected by the software and hardware modifications required to effect Level 2 OBS.

3.A.7.5.2.2. CCS User Bench Testing

Following successful factory acceptance testing by the Contractor's staff, and issuance of FAT Acceptance, the Contractor shall provide a test environment that simulates OBS and radio-system data messages for user bench testing by KCM staff of all CCS functions. This bench test may be conducted at the Contractor's site if necessary, subject to KCM Project Manager approval.

a. The test shall provide extensive Functional and Usability Tests, as described in Subsection **3.A.7.5.1**, including a test of all user-interface functions and all functional requirements to the extent possible within the test environment.

b. The User Bench Test shall include, but not be limited to, user testing of all CCS functional and special requirements by KCM staff including CCS response time with simulated voice, data, and traffic loads representative of worst-case peak-hour operation and interaction between the CAD and AVL map displays.

c. The test shall be conducted according to a User Bench Test Plan developed by the Contractor and subject to KCM Project Manager approval.

3.A.7.5.2.3. Installation Testing

The Contractor shall conduct Level 2 Installation Testing upon installation of the Level 2 OBS, in conjunction with the TRS mobile radio installations, and installation of the CCS at the new Communications Center facility.

3.A.7.5.2.3.1. CCS Installation Testing

Following installation of the CCS at the Communications Center, the Contractor shall perform testing to determine that the CCS equipment has been installed correctly and functions according to requirements and specifications.

a. A complete functional test shall be made of each system component to confirm that performance meets stated requirements. The test shall include but not be limited to:

- All functional requirements.
- CCS response time with simulated voice, data, and traffic loads representative of worst-case peak-hour operation.
- Interaction between CAD and AVL map displays.
- Report generation.
- Failure sensing and switchover.
- Recovery from simulated failures.

b. The test shall be conducted according to a CCS Installation Test Plan developed by the Contractor and subject to KCM Project Manager approval.

3.A.7.5.2.3.2. OBS Installation Testing

Level 2 OBS modifications shall be installed in coordination with the TRS mobile radios on no more than five Revenue Vehicles. The Contractor shall provide simulated data-transfer and voice-messaging input via the mobile radios to allow testing of the new system configuration including the following functionality:

a. All radio use and control functions.

b. Continued operation of all Level 1 OBS functionality within prescribed operating and performance parameters.

3.A.7.5.2.3.3. System Integration Testing

In coordination with CCS installation testing, the Contractor shall perform testing to verify that the interfaces between CCS components and CCS/Radio/OBS systems interfaces are functional and meet specifications.

3.A.7.5.2.4. Field Test

Following successful CCS User Bench Testing and successful CCS and OBS installation testing, the OBS/CCS Contractor shall conduct a Field Test of Level 2 functions, in coordination with the TRS contractor, on up to 10 KCM test coaches in simulated revenue service. The purpose of the Field Test is to conduct preliminary operational tests of the integrated OBS, CCS, and TRS within a controlled operational environment before deployment in revenue service, confirming that the installed OBS/CCS hardware and software meet all requirements.

a. The Field Test vehicles shall be operated on a selected subset of KCM service routes, comprising a representative sample of the KCM service area and service-route types.

b. To the extent possible, the Field Test shall emulate an extensive test of the Level 2 OBS and CCS in revenue service conditions, and shall encompass expected and

unexpected scenarios representative of the operational environment. The test shall include but not be limited to:

- Radio-call processing.
- Data-message processing, including polling.
- Automated vehicle location.
- Route and schedule adherence.
- System alarms.
- System failures, and switch to backup.
- CCS user testing.
- OBS testing (Level 1 and 2 functionality).
- OBS/CCS and TRS integration testing.

c. The Field Test shall be conducted according to a Field Test Plan, developed by the Contractor and subject to KCM Project Manager approval.

3.A.7.5.2.5. Ongoing System Performance Monitoring

Following Field Test Acceptance and implementation of the OBS/CCS in revenue service, the Contractor shall institute a process for ongoing OBS/CCS performance monitoring to identify and resolve system performance problems during Level 2 Implementation.

The process will be described in the Contractor's Level 2 Overall Inspection and Test Plan, developed in conjunction with the TRS contractor and KCM, and shall include, but not be limited to:

- The failure identification and resolution process as described in Subsection **2.A.2.4.6, Test Failure Resolution**.
- Establishing and monitoring system availability and reliability performance requirements, including targets for number of trouble-free days of operation for a given time period.
- Establishing and monitoring performance requirements for frequency of errors, including errors identified by the system and by KCM staff.
- Correction of any identified failures or unmet requirements.

3.A.7.5.2.6. Pilot Test

Following successful completion of the Field Test, the Contractor shall conduct a Pilot Test of the Level 2 installation in coordination with the TRS installations.

a. The Pilot Test shall be conducted on a minimum of 100 vehicles installed with the Level 2 OBS and TRS mobile radios in revenue service. The Pilot Test shall provide a comprehensive test of all Level 2 OBS/CCS requirements and functions under actual operational conditions.

b. The Pilot Test shall be conducted according to the Level 1 Pilot Testing requirements described in Subsection **2.A.2.8, Pilot Testing**.

c. As described in Section **2.A.2.8.5.1, Certification of Pilot Test Readiness**, the Contractor shall submit a Certification of Pilot Test Readiness prior to beginning the Pilot Test.

d. The Pilot Test shall be conducted according to a Level 2 Pilot Test Plan, developed by the Contractor and subject to KCM Project Manager approval. Pilot Test Plan requirements are described in Subsection **2.A.2.8.5, Pilot Test Plan**.

3.A.7.5.2.6.1. Pilot Test Acceptance

Pilot Test Acceptance shall be issued by the KCM Project Manager, subject to receipt of satisfactory test results, resolution of all identified problems, and trouble-free operation of the OBS and CCS for a pre-defined number of days, as described in the Level 2 Overall Inspection and Test Plan.

Subject to issuance of Pilot Test Acceptance, and correction of any identified problems by the Contractor, implementation of the CCS and Level 2 OBS shall continue as described in the Contractor's Implementation Plan.

3.A.7.5.2.7. Mid-Implementation Test

Upon installation and implementation of the Level 2 OBS on approximately 50% of the KCM fleet in revenue service, the Contractor shall certify the OBS/CCS readiness for Mid-Implementation Testing.

a. The Mid-Implementation Test shall include testing of the OBS/CCS at approximately 50% implementation, and shall include extensive, full functional and performance testing of the OBS/CCS, including but not limited to:

- The polling function.
- Peak-hour vehicle login and logout.
- Group radio calls.
- System failures (i.e. intentional failures as test scenarios for system recovery functions).

b. The Mid-Implementation Test shall be conducted in accordance with the Mid-Implementation Test Plan developed by the Contractor and subject to KCM Project Manager approval.

3.A.7.5.2.7.1. Mid-Implementation Test Acceptance

Issuance of Mid-Implementation Plan Test Acceptance shall be subject to receipt of satisfactory test results, documentation related to resolution of all identified problems, and a number of trouble-free days of OBS/CCS operation as defined by the Level 2 Overall Inspection and Test Plan.

Following issuance of Mid-Implementation Testing Acceptance, Level 2 OBS installation and testing shall continue until the full fleet has been installed with the OBS and TRS.

3.A.7.5.2.8. Conditional Acceptance Testing Settling-in Period

Following the completion of Level 2 OBS installation, a Conditional Acceptance Testing Settling-In Period of at least 30 days shall occur prior to Conditional Acceptance Testing. Level 1 Acceptance Testing Settling-in Period requirements described in Subsection

2.A.2.9.1, Acceptance Testing Settling-in Period, shall apply to the Level 2 Conditional Acceptance Testing Settling-in Period.

3.A.7.5.2.9. Conditional Acceptance Testing

Conditional Acceptance Testing shall begin following issuance of Certification of Conditional Acceptance Testing Readiness by the Contractor, subject to KCM Project Manager approval.

a. Conditional Acceptance Testing shall be conducted in revenue service with the Level 2 OBS and TRS installed on the full revenue fleet and CCS in full operation mode.

b. The purpose of the Conditional Acceptance Test is to demonstrate the full extent of the Contractor-delivered Level 2 functionality in full implementation. The test shall include but not be limited to:

- Demonstration of CCS performance under peak-hour and system-design maximum loads.
- CCS system reliability and availability.
- All functional requirements.
- Ability of the CCS to perform processor-intensive functions under peak and system-design maximum loads, including transitions to and from voice radio mode, vehicle tracking, radio-call processing, Revenue Vehicle polling, alarms and emergency operations.

c. The Conditional Acceptance Test shall be conducted in accordance with the Conditional Acceptance Test Plan developed by the Contractor and subject to KCM Project Manager approval.

3.A.7.5.2.9.1. Conditional Acceptance

Issuance of Conditional Acceptance shall be subject to receipt of satisfactory test results, documentation related to resolution of all identified problems, and a pre-defined number of continuous, trouble-free days of OBS/CCS operation as defined by the Level 2 Overall Inspection and Test Plan.

3.A.7.5.2.10. Full System Acceptance Testing

Full System Acceptance testing shall commence upon issuance of written Notice of Apparent Completion (NAC) for Level 2 Conditional Acceptance by KCM. Additionally, all outstanding technical issues that may arise after Conditional Acceptance shall be successfully resolved and approved by the KCM Project Manager. This Acceptance Testing shall consist of the ongoing, successful operation of all Level 1 and 2 functionality in conjunction with the TRS with no significant errors (i.e. Type II failures) for a minimum of one service-change period (approximately 4-5 months). Occurrence of a Type II failure during the test period will require resolution of the problem as described in Subsection **2.A.2.4.6.2.2**, Type II Failures, and will require restarting the clock at time zero after corrections are made by the Contractor.

Full System Acceptance shall occur upon determination by the KCM Project Manager that the Contractor has completed all work, including but not limited to:

- Implementation of a complete and fully operational OBS/CCS after successful completion of all tests and satisfaction of all functional and performance requirements.
- Correction of all variances.

- Provision of all required deliverables to KCM.
- Satisfactory completion of all contractual requirements.

3.A.7.6. Deliverables

3.A.7.6.1. Level 2 System Design and Design Reviews

Level 2 Design Reviews shall be conducted according to the requirements stated in Subsection **2 A.3.1.1.1, Design Phase and Design Reviews**. Level 2 Design reviews shall evaluate the progress and technical, functional, and programmatic adequacy of the CCS design in accordance with the performance requirements of the Contract during design and engineering.

3.A.7.6.1.1. Level 2 Preliminary Design Review (PDR):

The PDR shall address OBS/CCS Levels 1 and 2, and shall represent approximately 50% completion of the total Level 2 system-engineering and organizational-design phase.

At a minimum, the Level 2 PDR shall cover the following:

a. Review of schedule compliance and discussion of variances or delays.

b. Review of the implementation strategy for integration and installation in cooperation with other KCM contractors, including but not limited to the Transit Radio System project and Communications Center Relocation project contractors.

c. Review of mitigation strategies for identifying schedule slippage concerns including those related to dependencies created by integration with other KCM contractors.

d. Review of all PDR Deliverables, including but not limited to those listed in Design Review Deliverables in Subsection **3.A.7.6.2.5, Level 2 Deliverables by Project Phase and Milestone**.

e. Review of proposed modifications to Level 2 use-case specifications, including those required to respond to technical specifications, issues, and questions shown in each.

f. Review of identified system control and configuration functionality including CCS administrator tools, configurable parameters, system settings, and diagnostic, debugging, and troubleshooting utilities.

g. Identification of all interfaces between the major CCS subsystems, and identification of the information required to design the interfaces. Interfaces shall include the CCS/radio system interface, AVL data interface to My Bus/Bus View, the KCM service- and GIS-data-import process, and CCS component interfaces.

h. Confirmation that the Contractor is familiar with the intended CCS operations and maintenance environment. This shall include Contractor's completion of a tour of the Communications Center (may be fulfilled by attending all pre-bid conference activities) and a project-startup orientation session.

i. Identification of information needs and decisions required from KCM or other contractors.

CCS Upgrade PDR shall include the Visual Basic Alternatives Analysis, Upgrade Impact Analysis, and IBM/Informix Migration Alternatives Analysis final reports.

3.A.7.6.1.2. Level 2 Critical Design Review (CDR):

The objective of the CDR is to review the progress of the project and evaluate specification compliance of the completed work and/or work in progress.

The CDR shall represent approximately 75% completion of the total system-engineering and organizational design. The CDR shall provide deliverables that reflect more detail and completeness in the system design provided at the PDR. At a minimum, the CDR shall cover the following:

a. Schedule-compliance review and discussion of variances or delays.

b. Review of the implementation strategy for integration and installation in cooperation with other KCM contractors, including but not limited to the Transit Radio System project and Communications Center Relocation project contractors.

c. Review of mitigation strategies for identified schedule slippage concerns including those related to dependencies created by integration with other KCM contractors.

d. Review of all CDR Deliverables, including but not limited to those listed in Design Review Deliverables in Subsection **3.A.7.6.2.5, Level 2 Deliverables by Project Phase and Milestone**.

e. Revisions of drawings and documentation submitted for the PDR.

f. Complete user-interface information and drawings for all CCS components, including the CAD/AVL modules; system-administration tool and servers, including flow charts, display graphics, messages, and menus; accommodations of all operating-boundary and error conditions. User-interface information shall include at a minimum:

   i. User-interface description.

   ii. Field-level definitions.

   iii. Function key (or other control) definitions and processing logic.

   iv. Implemented business rules and/or special processing logic.

   v. CRUD (create, read, update, delete) functions.

   vi. Access and/or security restrictions.

g. Detailed OBS/CCS text-messaging function description and design.

h. Detailed technical specifications for all CCS equipment, including Coordinator workstations and CCS servers. Detailed technical descriptions, technical and user manuals, and documentation provided by original equipment manufacturers for any Contractor-provided equipment

i. Test plans for all required levels of testing (factory, bench, installation, CCS/radio integration, Field Test, Pilot Test, Mid-Implementation, Conditional Acceptance, Warranty) and functionality.

3.A.7.6.1.3. Level 2 Final Design Review (FDR)

The FDR shall represent 100% completion of the total Level 2 system engineering and design. The objective of the FDR is to determine whether the detailed design satisfies the design requirements established in the Contract documents. For the purposes of change control, the design baseline for all program elements shall be established at the FDR. After the conclusion

of the FDR Milestone, the Contractor shall submit any proposed changes that affect design characteristics to the Project Manager for approval.

The FDR shall be conducted when detailed design is complete.

All FDR documents shall be prepared in final form.

At a minimum, the FDR shall cover the following:

a. Schedule-compliance review and discussion of variances or delays.

b. Review of the implementation strategy for integration and installation in cooperation with other KCM contractors, including but not limited to the Transit Radio System project and Communications Center Relocation project contractors.

c. Review of mitigation strategies for identifying schedule-slippage concerns including those related to dependencies created by integration with other KCM contractors.

d. Review of all FDR Deliverables, including but not limited to those listed in Design Review Deliverables in Subsection **3.A.7.6.2.5, Level 2 Deliverables by Project Phase and Milestone**.

e. Latest revisions of the drawings and documentation submitted for the CDR.

f. Shutdown and startup sequences for the CCS, each CCS component, and each use-case specification including CCS transitional and voice-mode operation sequences.

g. Demonstration of compatibility with existing Agency equipment.

h. Documentation for replacement of damaged or flawed software modules and modular hardware.

i. Updated functional flow and block diagrams of the CCS software. Updated equipment block diagrams, layout for workstations and back-office systems.

j. Software documentation at the second level.

k. Design and appearance of CCS user interface and screens, CCS reports, CCS System Administration tools, CCS Database Administration tools, Strategies Administration tools.

The KCM Project Manager shall have on-site access to drawings and other design and manufacturing information related to manufacturing release of devices, including microprocessor source code and other proprietary technical data.

On-site access shall be provided at the Contractor's facility. The Contractor may establish suitable confidentiality agreements.

3.A.7.6.2. Deliverable Requirements by Project Phase

3.A.7.6.2.1. General Requirements for Deliverables

General Requirements for Deliverables as stated in Subsection **2.A.3.1.2.1** shall apply to Level 2.

3.A.7.6.2.2. Design Mockups and Prototype Equipment

Design mockups and prototype equipment requirements for Level 1 as described in Subsection **2.A.3.1.2.1, General Requirements for Deliverables**, shall pertain to Level 2.

3.A.7.6.2.3. Production Baseline

The Level 2 equipment and software production baseline shall be established after the completion of the User Bench Test.

Changes beyond the completion of the Acceptance Testing associated with the User Bench Test shall be documented in the form of change requests and submitted for approval.

3.A.7.6.2.4. Documentation Requirements

Level 2 technical and other required documentation for all project design phases shall be submitted in accordance with the Documentation requirements described in Subsection **2.A.3.2, Documentation**.

3.A.7.6.2.5. Level 2 Deliverables by Project Phase and Milestone

Level 2 CDRL delivery shall be coordinated with associated milestones. Technical and other required documentation shall be submitted in accordance with the Level 2 Deliverables, Tables ***3.A.7.6.2.5a*** through ***g,*** below. Note that the "Reference" column shown in this and all other tables of Phase Deliverables contains some but not necessarily all pertinent references contained within the RFP. The Contractor will be responsible for ensuring that each provided deliverable meets all RFP requirements.

Table 3.A.7.6.2.5.a, Level 2 Pre-Design-Phase Deliverables

The following Level 2 Pre-Design deliverables shall be provided prior to Preliminary Design Review. Provision of the Pre-Design-phase deliverables shall be required for successful completion of the Preliminary Design Review and PDR Acceptance. Pre-Design-phase deliverables pertaining to both Level 1 and Level 2 are listed in Subsection ***2.A.3.1.2.2, Pre-Design-Phase Deliverables****.*

Milestone No.	Deliverable No.	Category	Deliverable Description	Reference
L2.P1.M1	P.13	CCS Upgrade Alternative	Visual Basic Alternatives Analysis (CCS Upgrade only)	Subsection 3.A.5, CCS Upgrade (Alternative B)
L2.P1.M1	P.14	CCS Upgrade Alternative	Upgrade Impact Analysis (CCS Upgrade only)	Subsection 3.A.5, CCS Upgrade (Alternative B)
L2.P1.M1	P.15	CCS Upgrade Alternative	IBM/Informix migration Alternatives Analysis (CCS Upgrade only)	Subsection 3.A.5, CCS Upgrade (Alternative B)

Table 3.A.7.6.2.5.b, Level 2 Design and Development Phase Deliverables: Design Reviews

Design Review Deliverables for Level 2 Preliminary Design Review Acceptance, Critical Design Review Acceptance, Final Design Review Acceptance Milestones.

Milestone No.	*Category*	Deliverable Description	Required for Milestone Completion			Notes	Reference
			PDR	CDR	FDR		
L2.P1.M1 L2.P1.M2	Project Management	Project Timeline with Milestones (revised at CDR)	X	X			
L2.P1.M1 L2.P1.M2 L2.P1.M3	Project Management	Project plan (updates)	X	X	X	(1)	
L2.P1.M1 L2.P1.M2 L2.P1.M3	Project Management	Schedule-compliance report including discussion of variances or delays.	X	X	X	(1)	
L2.P1.M1 L2.P1.M2 L2.P1.M3	Project Management	"Project issues" report including recommended mitigation strategies report for schedule slippage, technical, project dependencies or other concerns.	X	X	X	(1)	
L2.P1.M1 L2.P1.M2 L2.P1.M3	Project Management	Outstanding information needs and decisions required from KC Metro, if any, including those related to other KCM contractors.	X	X	X	(1)	
L2.P1.M1 L2.P1.M2 L2.P1.M3	Design: SW, HW	Functional flow and block diagrams of the CCS software. Equipment block diagrams, layout for workstations and back-office systems.	X	X	X	(2)	
L2.P1.M1 L2.P1.M2 L2.P1.M3	Design: SW	Top-level data model illustrating the major logical and functional entities and relationships, showing each required CCS component, software component and database.	X	X	X	(2)	
L2.P1.M1 L2.P1.M2 L2.P1.M3	Design: SW	Detailed narrative descriptions of the subsystems proposed by the Contractor, including all CCS components and software modules.	X	X	X	(2)	
L2.P1.M1 L2.P1.M2 L2.P1.M3	Design: System	Proposed Physical System Architecture	X	X	X	(2)	Subsection 2.A.1.2.1.1

Milestone No.	*Category*	Deliverable Description	Required for Milestone Completion			Notes	Reference
			PDR	CDR	FDR		
L2.P1.M1 L2.P1.M2 L2.P1.M3	Design: Functional Requirements	Detailed narrative descriptions of all proposed modifications to Level 2 Functional Requirements including proposed solutions to technical specifications, issues and questions for each use case. Descriptions and diagrams should be organized by use case and provided as updates to KCM's existing documentation, using standard UML tools and methodology.	X	X	X	(2)	Subsection 3.B, Level 2 Functional Requirements
L2.P1.M1 L2.P1.M2 L2.P1.M3	Design: SW, HW	Identification and detailed description of all OBS modifications required to support Level 2 functionality.	X	X	X	(2)	
L2.P1.M1 L2.P1.M2 L2.P1.M3	Design: System Configuration	Detailed narrative descriptions of all system control and configuration functionality including CCS administrator tools, configurable parameters with identified defaults, system settings, and diagnostic, debugging, and troubleshooting utilities.	X	X	X	(2)	Appendix K. OBS and CCS Administrator Toolkits
L2.P1.M1 L2.P1.M2 L2.P1.M3	Design: Software Interfaces	Detailed software-interface descriptions for all CCS interfaces, including detailed Interface Control Documents (ICDs) for file and data exchanges between all CCS components, the CCS/radio system interface, the OBS/CCS interface, AVL data interface to My Bus/Bus View, the CCS transit service- and geographic-data-import-process.	X	X	X	(2)	Appendix C. Interface Control Document
L2.P1.M1 L2.P1.M2 L2.P1.M3	Design: Software Interfaces	A schedule and list of responsibility for the completion and approval of detailed definitions of all system interfaces	X	X	X	(1)	
L2.P1.M1 L2.P1.M2 L2.P1.M3	Design: SW/DB	Entity-Relationship Diagram of data attributes, flow diagrams, pseudo code and definition of all primary keys for each proposed database.	X	X	X	(1)	
L2.P1.M1 L2.P1.M2 L2.P1.M3	Design: SW/DB	Entity-Relationship Diagram, primary keys, foreign keys, modules for interfacing, and software flow charts for each proposed database.	X	X	X	(2)	

Milestone No.	*Category*	Deliverable Description	Required for Milestone Completion			Notes	Reference
			PDR	CDR	FDR		
L2.P1.M1 L2.P1.M2 L2.P1.M3	Design: GUI	Content and format of user-interface messages, including those for the CAD/AVL modules, system administration tools, and CCS servers; and error and diagnostic messages. User-interface information shall include at a minimum: user interface descriptions field-level definitions, function-key (or other control) definitions and processing logic, implemented business rules and/or special processing logic, CRUD (create, read, update, delete) functions, and access and/or security restrictions.	X	X	X	(2)	Subsection 3.B Level 2 Functional Requirements, Subsection 3.A, Level 2 Technical Specifications
L2.P1.M1 L2.P1.M2 L2.P1.M3	HW/ Elec.	Physical dimensions, power and other facility requirements for each equipment type, including wiring and schematics.	X	X	X	(1)	
L2.P1.M1 L2.P1.M2 L2.P1.M3	System	Narrative description of problem tracking, resolution, and reporting process; and problem tracking and resolution reports for all project phases, warranty, and maintenance.	X	X	X	(1)	
L2.P1.M1 L2.P1.M2 L2.P1.M3	Testing	Narrative descriptions, designs, methodologies, and performance standards for the complete set of proposed Test Plans for each required function and each level of required testing (factory, bench, installation, etc.) organized by project phase and milestone. At FDR, each test plan will identify the required function(s) and/or functionality tested, identifying functions by lowest SOW or Use Case subsection.	X	X	X	(2)	Subsection 3.A.7.5, Testing
L2.P1.M1 L2.P1.M2 L2.P1.M3	Testing	Description of testing plan(s) for all functional requirements and each level of required testing.	X	X	X	(2)	Subsection 3.A.7.5, Testing

Milestone No.	*Category*	Deliverable Description	Required for Milestone Completion			Notes	Reference
			PDR	CDR	FDR		
L2.P1.M2 L2.P1.M3	Design: GUI	Complete user interface information and drawings for all CCS components, including the CAD/AVL modules, system administration tool and servers, including flow charts, display graphics, audio, messages and menus, accommodations of all operating boundary and error conditions.		X	X	(4)	
L2.P1.M2 L2.P1.M3	Design: GUI	Detailed OBS/CCS text-messaging function description and design.		X	X	(4)	
L2.P1.M1 L2.P1.M2 L2.P1.M3	Design: HW	Complete list of all proposed CCS equipment including device name, model number, provider (Contractor, OEM, or subcontractor), power requirements, physical dimensions, and available documentation (technical, reference, support, installation, user manuals, etc.).	X	X	X	(1)	
L2.P1.M1 L2.P1.M2 L2.P1.M3	Design: HW	Detailed technical specifications for all CCS equipment including Coordinator workstations, and CCS servers and data backup storage. Detailed technical descriptions, technical reference, support, installation and user manuals and documentation provided by original equipment manufacturers for any Contractor-provided equipment.	X	X	X	(2)	
L2.P1.M2 L2.P1.M3	Design: HW	Detailed hardware interface descriptions, including mounting arrangements and installation methods for all CCS equipment.		X	X	(4)	
L2.P1.M1 L2.P1.M2 L2.P1.M3	Design: Power	Single-line power diagrams and functional block diagrams for each device, including a functional overview and a description of how each device or subcomponent goes out of service and reports its health status.	X	X	X	(2)	

Milestone No.	*Category*	Deliverable Description	Required for Milestone Completion			Notes	Reference
			PDR	CDR	FDR		
L2.P1.M1 L2.P1.M2 L2.P1.M3	System Standards	Conformance Plan, including systems architecture physical and logical diagrams that map the CCS to the National ITS Architecture Standards.	X	X	X	(1)	Subsection 2.A.1.2.1, Industry Standards: ITS and TCIP Compliance
L2.P1.M1 L2.P1.M2 L2.P1.M3	System Standards	Detailed description of methodology used to meet implemented national, County, and industry standards including complete documentation on all non-County standards utilized.	X	X	X	(1)	Subsection 2.A.1.2.1, Industry Standards: ITS and TCIP Compliance
L2.P1.M3	Design: SW/DB	Data dictionary, and metadata.			X		
L2.P1.M1 L2.P1.M2 L2.P1.M3	Design: SW/DB	Detailed descriptions of all data formats and database design schema.	X	X	X	(2)	
L2.P1.M1 L2.P1.M2 L2.P1.M3	Testing	Detailed description of special tools for system testing, installation, and maintenance, including test bench requirements.	X	X	X	(1)	Subsection 3.A.7.5, Testing
L2.P1.M1 L2.P1.M2 L2.P1.M3	Design: SW	Detailed description of special software requirements.	X	X	X	(1)	
L2.P1.M1 L2.P1.M2 L2.P1.M3	System	Detailed description of operational and physical compatibility with the existing equipment and equipment installations.	X	X	X	(2)	
L2.P1.M1 L2.P1.M2 L2.P1.M3	System	Detailed human-factors engineering and usability analysis results.	X	X	X	(2)	
L2.P1.M1 L2.P1.M2 L2.P1.M3	Design: Security	Design of access control for the equipment and the software menus.	X	X	X	(2)	

Milestone No.	*Category*	Deliverable Description	Required for Milestone Completion			Notes	Reference
			PDR	CDR	FDR		
L2.P1.M1 L2.P1.M2 L2.P1.M3	Design: SW	Software system-level flow charts.	X	X	X	(1)	
L2.P1.M1 L2.P1.M2 L2.P1.M3	Design: DB, archive	CCS data retention schedule.	X	X	X	(2)	
L2.P1.M2 L2.P1.M3	Design: SW	Software-design descriptions (top level of software documentation) for microprocessor-based and programmable equipment.		X	X	(4)	
L2.P1.M1 L2.P1.M2 L2.P1.M3	Design: SW	Detailed descriptions of all CCS System Administrator tools, CCS Database Administration Tools, report-generation tools, Strategies Administration tool and CCS software requirements.	X	X	X	(2)	
L2.P1.M2 L2.P1.M3	Design	CCS equipment mock-ups and prototypes.		X	X	(4)	Subsection 2.A.3.1.2, Project Deliverables
L2.P1.M2 L2.P1.M3	Design: Reports	Draft reports and formats, including report description, reporting data set, all user parameters indicating whether required or optional, each field definition including data source, and any calculations, special formatting requirements, access or security restrictions.		X	X	(4)	
L2.P1.M2 L2.P1.M3	Design: System	System Availability Measurement Plan		X	X	(4)	Subsection 3.A.7.5.1.4, CCS Availability Testing
L2.P1.M2 L2.P1.M3	Design: System	Shutdown and startup sequences for the CCS, each CCS component, and each use-case specification including CCS transitional and voice-mode operation sequences.		X	X	(4)	
L2.P1.M3	Documentation	Flow charts or structure charts that give an overview of the processor software modules.			X		

Milestone No.	*Category*	Deliverable Description	Required for Milestone Completion			Notes	Reference
			PDR	CDR	FDR		
L2.P1.M3	Documentation	Software documentation at the second level, consisting of the data model (entities, attributes, data dictionary, and meta data) to the lowest level of decomposition with software module descriptions (or elemental process descriptions) in structured narrative format. The second level of software documentation is one level above source code and should include descriptions for each equipment type.			X		
L2.P1.M2 L2.P1.M3	Documentation	Input and output data definitions at both CCS and module levels.		X	X	(4)	
L2.P1.M2 L2.P1.M3	Design: Data	Proposed system controls and methodology to create, manage, report, troubleshoot, and debug all types of data logging.		X	X	(4)	
L2.P1.M3	Documentation	Identification of available interrupt levels for hardware and software.			X		
L2.P1.M3	Documentation	Detailed description of configurable program parameters at both CCS and module levels.			X		
L2.P1.M2 L2.P1.M3	Documentation	Diagnostic and error-handling routines for processor self-test and subsystem self-tests, including detailed descriptions of cases requiring error-handling routines.		X	X	(4)	
L2.P1.M1 L2.P1.M2 L2.P1.M3	Design: GUI	Design and appearance of CCS user interface and screens, CCS reports, CCS System Administration tools, CCS Database Administration tools, and Strategies Administration tools.	X	X	X	(2)	
L2.P1.M1 L2.P1.M2 L2.P1.M3	Design: Communications	OBS/CCS communications interfaces, protocols, and data messages.	X	X	X	(2)	Subsection 3.A.6.6 Communications Layers

Milestone No.	*Category*	Deliverable Description	Required for Milestone Completion			Notes	Reference
			PDR	CDR	FDR		
L2.P1.M1 L2.P1.M2 L2.P1.M3	Design: Polling	OBS/CCS polling scheme design.	X	X	X	(2)	CC3- Manage Revenue Vehicle Polling
L2.P1.M1 L2.P1.M2 L2.P1.M3	Design: DB	CCS database design.	X	X	X	(2)	
L2.P1.M1 L2.P1.M2 L2.P1.M3	Design: SW, HW	OBS Level 2 modifications design.	X	X	X	(2)	
L2.P1.M1 L2.P1.M2 L2.P1.M3	Design: SW	CCS Software, Server operating system, database software specifications.	X	X	X	(2)	
L2.P1.M1 L2.P1.M2 L2.P1.M3	System	Data Backup, Archiving, and Recovery Plan.	X	X	X	(5)	Subsection 3.A.6.4. Data Backup, Archiving, and Recovery
L2.P1.M1 L2.P1.M2 L2.P1.M3	Installation	Installation Plan	X	X	X	(5)	Subsection 3.A.7.3, Installation
L2.P1.M1 L2.P1.M2 L2.P1.M3	Implementation	Implementation Plan	X	X	X	(5)	Subsection 3.A.7.3, Installation
L2.P1.M1 L2.P1.M2 L2.P1.M3	Testing	Factory Acceptance Test (FAT) Plan	X	X	X	(5)	Subsection 3.A.7.5, Testing
L2.P1.M1 L2.P1.M2 L2.P1.M3	Testing	System Integration Test Plan	X	X	X	(5)	Subsection 3.A.7.5, Testing

Milestone No.	*Category*	Deliverable Description	Required for Milestone Completion			Notes	Reference
			PDR	CDR	FDR		
L2.P1.M1 L2.P1.M2 L2.P1.M3	Testing	CCS User Bench Test Plan	X	X	X	(5)	Subsection 3.A.7.5, Testing
L2.P1.M1 L2.P1.M2 L2.P1.M3	Testing	Field Test Plan	X	X	X	(5)	Subsection 3.A.7.5, Testing
L2.P1.M1 L2.P1.M2 L2.P1.M3	Testing	Pilot Test Plan	X	X	X	(5)	Subsection 3.A.7.5, Testing
L2.P1.M1 L2.P1.M2 L2.P1.M3	Testing	Failure Review Process	X	X	X	(5)	Subsection 3.A.7.5, Testing
L2.P1.M1 L2.P1.M2 L2.P1.M3	Testing	Conditional Acceptance Testing Plan	X	X	X	(5)	Subsection 3.A.7.5, Testing
L2.P1.M1 L2.P1.M2 L2.P1.M3	Testing	Test Procedures	X	X	X	(5)	Subsection 3.A.7.5, Testing
L2.P1.M1 L2.P1.M2 L2.P1.M3	Testing	Overall Inspection and Test Plan	X	X	X	(5)	Subsection 3.A.7.5, Testing
L2.P1.M1 L2.P1.M2 L2.P1.M3	Testing	Test Reports	X	X	X	(5)	Subsection 3.A.7.5, Testing
L2.P1.M1 L2.P1.M2 L2.P1.M3	Training	Training Program Plan	X	X	X	(5)	Subsection 3.A.7.2, CCS Training Requirements

Milestone No.	***Category***	**Deliverable Description**	**Required for Milestone Completion**			**Notes**	**Reference**
			PDR	**CDR**	**FDR**		
L2.P1.M1 L2.P1.M2 L2.P1.M3	Training	Training Manuals, Materials and Equipment	X	X	X	(5)	Subsection 3.A.7.2, CCS Training Requirements
L2.P1.M1 L2.P1.M2 L2.P1.M3	System	System Security Plan, including proposed methodology for providing system security for all servers and data.	X	X	X	(5)	Subsection 2.A.1.4.5, System Security
L2.P1.M1 L2.P1.M2 L2.P1.M3	Documentation	System Operations Manual	X	X	X	(5)	Subsection 3.A.7.6.2.4, Documentation Requirements
L2.P1.M1 L2.P1.M2 L2.P1.M3	Documentation	System Maintenance Manual	X	X	X	(5)	Subsection 3.A.7.6.2.4, Documentation Requirements
L2.P1.M1 L2.P1.M2 L2.P1.M3	Documentation	Software Documentation	X	X	X	(5)	Subsection 3.A.7.6.2.4, Documentation Requirements
L2.P1.M3	Documentation	All other required Software Documentation			X		Part B, Exhibit 1, “Software Documentation” Subsection 3.A.7.6.2.4, Documentation Requirements

Notes:

(1) Deliverable shall include only update and modifications on an as-needed basis for CDR and FDR.

(2) Deliverable shall be provided in Progressive stages of completion for each design review as follows: 50% complete for PDR, 75% complete for CDR, 100% complete for FDR.

(3) Deliverable shall be provided as a final report.

(4) Deliverable shall be provided in detailed draft form at CDR, with further refinements at FDR.

(5) Deliverable shall be provided in detailed narrative form at PDR, first detailed draft at CDR, and final draft at FDR.

Table 3.A.7.6.2.5.c, Level 2 Design and Development Phase Deliverables: Factory Acceptance Test & User Bench Test

Deliverables for the Level 2 Factory Acceptance Test Acceptance and CCS User Bench Test Acceptance Milestones.

Milestone No.	Milestone Name	Deliverable Description	Reference
L2.P1.M4	FAT Acceptance	Certification of Factory Acceptance Test Readiness	Subsection 3.A.7.5, Testing
L2.P1.M4	FAT Acceptance	Factory Acceptance Test Plan (final)	Subsection 3.A.7.5, Testing
L2.P1.M4	FAT Acceptance	Detailed Factory Acceptance Test Procedures	Subsection 3.A.7.5, Testing
L2.P1.M4	FAT Acceptance	Factory Acceptance Test Reports	Subsection 3.A.7.5, Testing
L2.P1.M4	FAT Acceptance	12 Portable Radio Simulators	Subsection 2.A.3.8.5.8, Portable Radio Simulator
L2.P1.M4	FAT Acceptance	Problem Tracking and Resolution Reports	Subsection 2.A.3.7, Progress and Performance Monitoring
L2.P1.M5	CCS User Bench Test Acceptance	Certification of CCS User Bench-Test Readiness	Subsection 3.A.7.5, Testing
L2.P1.M5	CCS User Bench Test Acceptance	CCS User Bench-Test Plan (final)	Subsection 3.A.7.5, Testing
L2.P1.M5	CCS User Bench Test Acceptance	Detailed CCS User Bench-Test Procedures	Subsection 3.A.7.5, Testing
L2.P1.M5	CCS User Bench Test Acceptance	CCS User Bench-Test Reports	Subsection 3.A.7.5, Testing
L2.P1.M5	CCS User Bench Test Acceptance	Automated CCS User Bench-Test tools, including Test Bench, and all equipment and other materials.	Subsection 3.A.7.5, Testing
L2.P1.M5	CCS User Bench Test Acceptance	Problem Tracking and Resolution Reports	Subsection 2.A.3.7, Progress and Performance Monitoring

Table 3.A.7.6.2.5.d, Level 2 Installation and Test Phase Deliverables

Deliverables for the Level 2 Readiness Acceptance, Installation Acceptance, and Field Test Acceptance Milestones.

Milestone No.	Milestone Name	Deliverable Description	Reference
L2.P2.M1	Readiness Acceptance	CCS server, Coordinator workstations, and data backup storage final specifications.	Subsection 3.A.7.3, Installation
L2.P2.M1	Readiness Acceptance	Server operating system final specifications.	Subsection 3.A.7.3, Installation
L2.P2.M1	Readiness Acceptance	Database software final specifications.	Subsection 3.A.7.3, Installation
L2.P2.M1	Readiness Acceptance	CCS Software and CCS Database Schema and data.	Subsection 3.A.7.3, Installation
L2.P2.M1	Readiness Acceptance	Installation Plan and schedule (final)	Subsection 3.A.7.3, Installation
L2.P2.M1	Readiness Acceptance	Installation Test Plan (final)	Subsection 3.A.7.5, Testing
L2.P2.M1	Readiness Acceptance	System Integration Test Plan (final)	Subsection 3.A.7.5, Testing
L2.P2.M1	Readiness Acceptance	CCS server and Coordinator workstations configuration and installation final documentation and procedures.	Subsection 3.A.7.3, Installation
L2.P2.M1	Readiness Acceptance	CCS software	Subsection 3.A.7.3, Installation
L2.P2.M1	Readiness Acceptance	CCS system-administrator tools	Subsection 3.A.7.3, Installation
L2.P2.M1	Readiness Acceptance	CCS database-administration tools	Subsection 3.A.7.3, Installation
L2.P2.M1	Readiness Acceptance	Report-generation tools	Subsection 3.A.7.3, Installation
L2.P2.M1	Readiness Acceptance	Strategies-administration tool	Subsection 3.A.7.3, Installation
L2.P2.M1	Readiness Acceptance	Contractor-provided hardware, if any	Subsection 3.A.7.3, Installation
L2.P2.M1	Readiness Acceptance	Current Parts List	Subsection 3.A.7.7.2, Current Parts List
L2.P2.M1	Readiness Acceptance	CCS Manuals and documentation (final)	Subsection 3.A.7.7. Documentation
L2.P2.M1	Readiness Acceptance	Data Backup, Archiving, and Recovery Plan (final)	Subsection 3.A.6.4, Data Backup, Archiving, and Recovery
L2.P2.M1	Readiness Acceptance	Implementation Plan (final)	Subsection 3.A.7.3, Installation

Milestone No.	Milestone Name	Deliverable Description	Reference
L2.P2.M1	Readiness Acceptance	On-Call Contractor Contact: detailed notification and response contact information (telephone and pager numbers).	Subsection 2.A.3.3, Project Management and Staffing
L2.P2.M1	Readiness Acceptance	Training Plan (final)	Subsection 3.A.7.2, CCS Training Requirements
L2.P2.M1	Readiness Acceptance	Training Schedule (final)	Subsection 3.A.7.2, CCS Training Requirements
L2.P2.M1	Readiness Acceptance	Training Manuals, Materials, and Equipment	Subsection 3.A.7.2, CCS Training Requirements
L2.P2.M1	Readiness Acceptance	System-administration training classes	Subsection 3.A.7.2, CCS Training Requirements
L2.P2.M1	Readiness Acceptance	Train the Trainer training classes	Subsection 3.A.7.2, CCS Training Requirements
L2.P2.M1	Readiness Acceptance	Problem Tracking and Resolution Reports	Subsection 2.A.3.7, Progress and Performance Monitoring
L2.P2.M2	Installation Acceptance	CCS Installation Certification	Subsection 3.A.7.3, Installation
L2.P2.M2	Installation Acceptance	Installation Test Report	Subsection 3.A.7.5, Testing
L2.P2.M2	Installation Acceptance	System-Integration Test Reports	Subsection 3.A.7.5, Testing
L2.P2.M2	Installation Acceptance	Automated System-Integration Test Tools	Subsection 3.A.7.5, Testing
L2.P2.M2	Installation Acceptance	Problem Tracking and Resolution Reports	Subsection 2.A.3.7, Progress and Performance Monitoring
L2.P2.M2	Installation Acceptance	Test Equipment	Subsection 3.A.7.5, Testing
L2.P2.M3	Field-Test Acceptance	Certification of Field-Test Readiness	Subsection 3.A.7.5, Testing
L2.P2.M3	Field-Test Acceptance	Field-Test Plan (final)	Subsection 3.A.7.5, Testing
L2.P2.M3	Field-Test Acceptance	Detailed Field-Test Procedures	Subsection 3.A.7.5, Testing
L2.P2.M3	Field-Test Acceptance	Field-Test Report	Subsection 3.A.7.5, Testing
L2.P2.M3	Field-Test Acceptance	Automated Field-Test Tools	Subsection 3.A.7.5, Testing
L2.P2.M3	Field-Test Acceptance	Problem Tracking and Resolution Reports	Subsection 2.A.3.7, Progress and Performance Monitoring

Milestone No.	Milestone Name	Deliverable Description	Reference
L2.P2.M3	Field-Test Acceptance	Revised Documentation and Manuals	

Table 3.A.7.6.2.5.e, Level 2 Implementation Phase Deliverables

Deliverables for the Level 2 Pilot Test Acceptance, Mid-Implementation Test Acceptance, and Conditional Acceptance Milestones.

Milestone No.	Milestone Name	Deliverable Description	Reference
L2.P3.M1	Pilot-Test Acceptance	Certification of Pilot-Test Readiness	Subsection 3.A.7.5, Testing
L2.P3.M1	Pilot-Test Acceptance	Pilot-Test Plan (final)	Subsection 3.A.7.5, Testing
L2.P3.M1	Pilot-Test Acceptance	Detailed Pilot-Test Procedures	Subsection 3.A.7.5, Testing
L2.P3.M1	Pilot-Test Acceptance	Pilot-Test Report	Subsection 3.A.7.5, Testing
L2.P3.M1	Pilot-Test Acceptance	Automated Pilot-Test Tools	Subsection 3.A.7.5, Testing
L2.P3.M1	Pilot-Test Acceptance	Problem Tracking and Resolution Reports	Subsection 2.A.3.7, Progress and Performance Monitoring
L2.P3.M1	Pilot-Test Acceptance	Revised Documentation and Manuals	
L2.P3.M2	Mid-Implementation-Test Acceptance	Certification of Mid-Implementation-Test Readiness	Subsection 3.A.7.5, Testing
L2.P3.M2	Mid-Implementation-Test Acceptance	Mid-Implementation-Test Plan (final)	Subsection 3.A.7.5, Testing
L2.P3.M2	Mid-Implementation-Test Acceptance	Detailed Mid-Implementation-Test Procedures	Subsection 3.A.7.5, Testing
L2.P3.M2	Mid-Implementation-Test Acceptance	Mid-Implementation-Test Report	Subsection 3.A.7.5, Testing
L2.P3.M2	Mid-Implementation-Test Acceptance	Automated Mid-Implementation-Test Tools	Subsection 3.A.7.5, Testing
L2.P3.M2	Mid-Implementation-Test Acceptance	Problem Tracking and Resolution Reports	Subsection 2.A.3.7, Progress and Performance Monitoring

Milestone No.	Milestone Name	Deliverable Description	Reference
L2.P3.M2	Mid-Implementation-Test Acceptance	Revised Documentation and Manuals	
L2.P3.M3	Conditional Acceptance	Certification of Conditional-Acceptance-Test Readiness	Subsection 3.A.7.5, Testing
L2.P3.M3	Conditional Acceptance	Conditional-Acceptance-Test Plan (final)	Subsection 3.A.7.5, Testing
L2.P3.M3	Conditional Acceptance	Detailed Conditional-Acceptance-Test Procedures	Subsection 3.A.7.5, Testing
L2.P3.M3	Conditional Acceptance	Conditional-Acceptance-Test Report	Subsection 3.A.7.5, Testing
L2.P3.M3	Conditional Acceptance	Automated Conditional-Acceptance-Test Tools	Subsection 3.A.7.5, Testing
L2.P3.M3	Conditional Acceptance	Problem Tracking and Resolution Reports	Subsection 2.A.3.7, Progress and Performance Monitoring
L2.P3.M3	Conditional Acceptance	Training Program Plan (revised)	Subsection 3.A.7.2, CCS Training Requirements
L2.P3.M3	Conditional Acceptance	Training Manuals, Materials, and Equipment (revised)	Subsection 3.A.7.2, CCS Training Requirements
L2.P3.M3	Conditional Acceptance	System Operations Manual (revised)	Subsection 3.A.7.7, Documentation
L2.P3.M3	Conditional Acceptance	System Maintenance Manual (revised)	Subsection 3.A.7.7, Documentation
L2.P3.M3	Conditional Acceptance	Software Documentation (revised)	Subsection 3.A.7.7, Documentation
L2.P3.M3	Conditional Acceptance	"As-built" drawings and system documentation for all Level 2 hardware and software, including but not limited to schematics, diagrams, illustrations, manuals, and descriptions	Subsection 3.A.7.7, Documentation
L2.P3.M3	Conditional Acceptance	Other revised Documentation and Manuals	
L2.P3.M3	Conditional Acceptance	Problem Tracking and Resolution Reports	Subsection 2.A.3.7, Progress and Performance Monitoring

Table 3.A.7.6.2.5.f Level 1&2 Full System Acceptance Phase Deliverables

Milestone No.	Milestone Name	Deliverable Description	Reference
FSA.1	Full System Acceptance	Problem Tracking and Resolution Reports	Subsection 2.A.3.7, Progress and Performance Monitoring

Table 3.A.7.6.2.5.g Level 2 Ongoing Deliverables to be provided throughout project

Milestone No.	Milestone Name	Deliverable Description	Reference
TBD	(Not applicable)	Monthly Progress Reports	Subsection 2.A.3.7, Progress and Performance Monitoring
TBD	(Not applicable)	Detailed OBS/CCS Progress Reports	Subsection 2.A.3.7, Progress and Performance Monitoring
TBD	(Not applicable)	Problem Tracking and Resolution Reports	Subsection 2.A.3.7, Progress and Performance Monitoring
TBD	(Not applicable)	Fault Tracking and Maintenance Performance Reports	Subsection 2.A.3.7, Progress and Performance Monitoring

3.A.7.7. Documentation

Level 1 Documentation Requirements as described in Subsection **2.A.3.2, Documentation** shall apply to Level 2.

3.A.7.7.1. Software Documentation

The Contractor shall provide Level 2 Software Documentation, including but not be limited to:

- All CCS software, including the CCS System Administration Tool and Strategies Tool.
- All Level 2 OBS modifications.
- All Level 2 software provided by the Contractor under this contract.

3.A.7.7.2. Current Parts List (CPL)

The Contractor shall provide a Current Parts List (CPL) for all Level 2 Contractor-provided equipment as described in Subsection **2.A.3.2.2.7, Current Parts List**.

3.A.7.8. Project Management and Staffing

Level 1 Project Management and Staffing Requirements as described in Subsection **2.A.3.3, Project Management and Staffing**, shall apply to Level 2.

The Level 2 OBS/CCS shall be supported by a local contractor at all times from the start of the Level 2 Installation and Test Phase to Full System Acceptance. The Installation and Test Phase shall begin upon issuance of User Bench-Test Acceptance and Notice of Apparent Completion of

the Design and Development Phase. Key personnel shall reside in the King County area and be available to respond 24x7.

3.A.7.9. Progress and Performance Monitoring

Level 1 Progress and Performance Monitoring Requirements as described in Subsection **2.A.3.7, Progress and Performance Monitoring**, shall apply to Level 2.

3.B. Level 2 Functional Requirements

The following section contains Use Case Specifications (UCS) for Level 2 of the project and describes OBS/CCS functional requirements for system implementation in conjunction with the TRS implementation.

Describe how the proposed system will satisfy the functional requirements for Level 2 described in each UCS in this subsection and include a description of how the modifications to Level 1 UCSs required in Level 2 will be provided.

3.B.1. Introduction to Level 2 UCS

Level 2 functional requirements include but are not limited to required functionality for either the CCS Replacement (Alternative A) or CCS Upgrade (Alternative B) and modifications to OBS Level 1 functionality to enable the TRS and CCS implementation.

The following Level 1 Use Case specifications also contain descriptions of Level 2 functionality and can be found in Subsection **2.B.**

- ***RV1-Initiate Vehicle for Operation***
- ***RV3-Take Vehicle Out of Operation***
- ***RV5-Monitor System Health***
- ***RV6-Manage Events***
- ***RV7-Determine Vehicle Location***
- ***RV8-Monitor Route and Schedule Adherence***
- ***RV11-Manage AVM***
- ***RV12-Interface to DDU***

A table summarizing Level 2 modifications to OBS Level 1 by individual use-case specification may be found in Subsection **3.A.7.4, OBS Level 2 Modifications**.

Note: The use-case specification, as a description of the dialogue between the system and its user or other actors, contains statements such as "The Coordinator will select a vehicle for tracking." These statements should be interpreted as capabilities the system shall provide.

New, Adjusted, and Current functions

To assist CCS Upgrade (Alternative B) proposers in estimating the change in current system functionality represented by CCS requirements, the requirements have been labeled to indicate functions that are not supported by the current system. "New" in superscript $^{(NEW)}$ indicates a function not currently provided by the legacy CAD/AVL system. "Adjusted" in superscript $^{(ADJUSTED)}$ indicates a function that is partially provided by the legacy CAD/AVL system, but will require enhancement or other modification in the next system to meet CCS requirements. No label indicates a function currently supported by the legacy system.

Stated performance requirements should be considered as new, given that improvements in performance are expected from an upgraded system.

This information is intended to indicate the scope of the Upgrade effort to potential proposers, but is not be considered a definitive list of the system functions that may require upgrading, nor is the information intended to describe the full extent of the Upgrade effort.

3.B.1.1. Overview

There are a total of 16 Level 2 UCS: 15 address functions that will reside in the Communications Center and one describes Revenue Vehicle functionality required to implement the new CCS and Transit Radio System. For a more complete description of the physical architecture see Subsection **2.A.1.5.1, Domain Descriptions**.

The response to this section shall adhere to Part A, Section **1.T.4, Guidelines for Interpretation and Response to Functional Requirements**.

Each use case name has an alphanumeric prefix indicating the domain where the functionality is to reside and a unique number assigned to it, e.g., ***CC1*** is the first use case in the Communications Center domain. The different domains each have a number of use cases whose functionality interact with and mirror each other. Level 1 of the project involves the Revenue Vehicle and Base Operations domains which are addressed in Subsection **2.B, Level 1 Functional Requirements**.

3.B.1.1.1. Revenue Vehicle (RV)

This use case includes the Level 2 functionality that must reside on-board revenue vehicles in order to manage the exchange of information between the Revenue Vehicle and the Communications Center. The Transit Radio System (TRS), described in Subsection **1.C.3.**, will provide the communications medium between the Revenue Vehicle and the Communications Center.

RV17-Interface to 700MHz Radio

3.B.1.1.2. Communications Center (CC)

The CCS will reside in the new KCM Communications Center. The Level 2 CC use cases include:

CC1-Log in CCS User

CC2-Log in Revenue Vehicle

CC3-Manage Revenue Vehicle Polling

CC4-Monitor Revenue Vehicles

CC5-Initiate Communications to Revenue Vehicle

CC6-Respond to Revenue Vehicle Communications

CC7-Manage Transit Service & Geographic Data

CC8-Manage Incidents

CC9-Manage Field Staff

CC10-Log out Revenue Vehicle

CC11-Log out CCS User

CC12-Manage Data Reporting

CC13-Manage Configuration

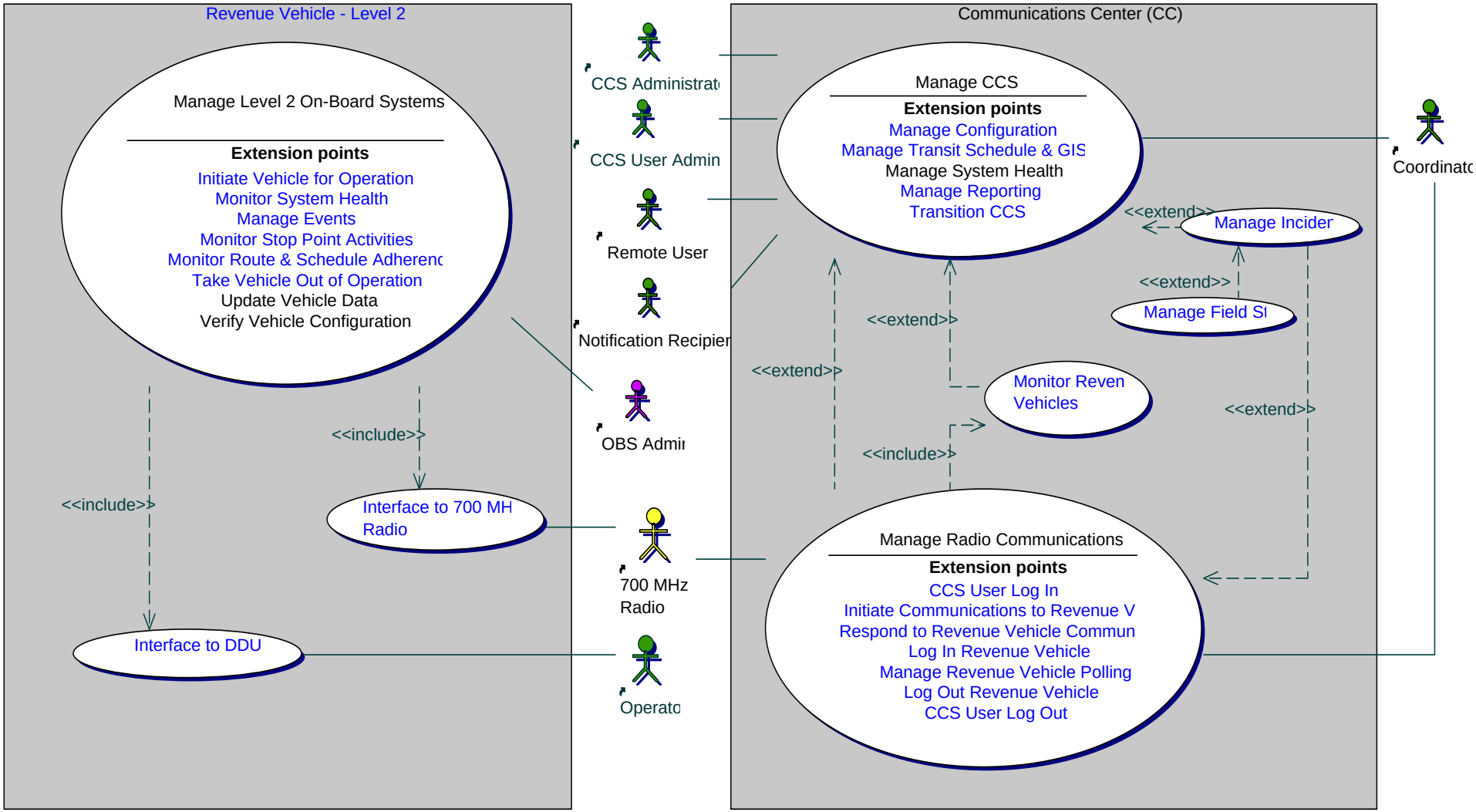
CC14-Manage System Health

CC15-Transition CCS

3.B.2. Level 2 Business Model

Figure **3.B.2,** provides an overview of the Level 2 use cases and their relationships to the system and to each other.

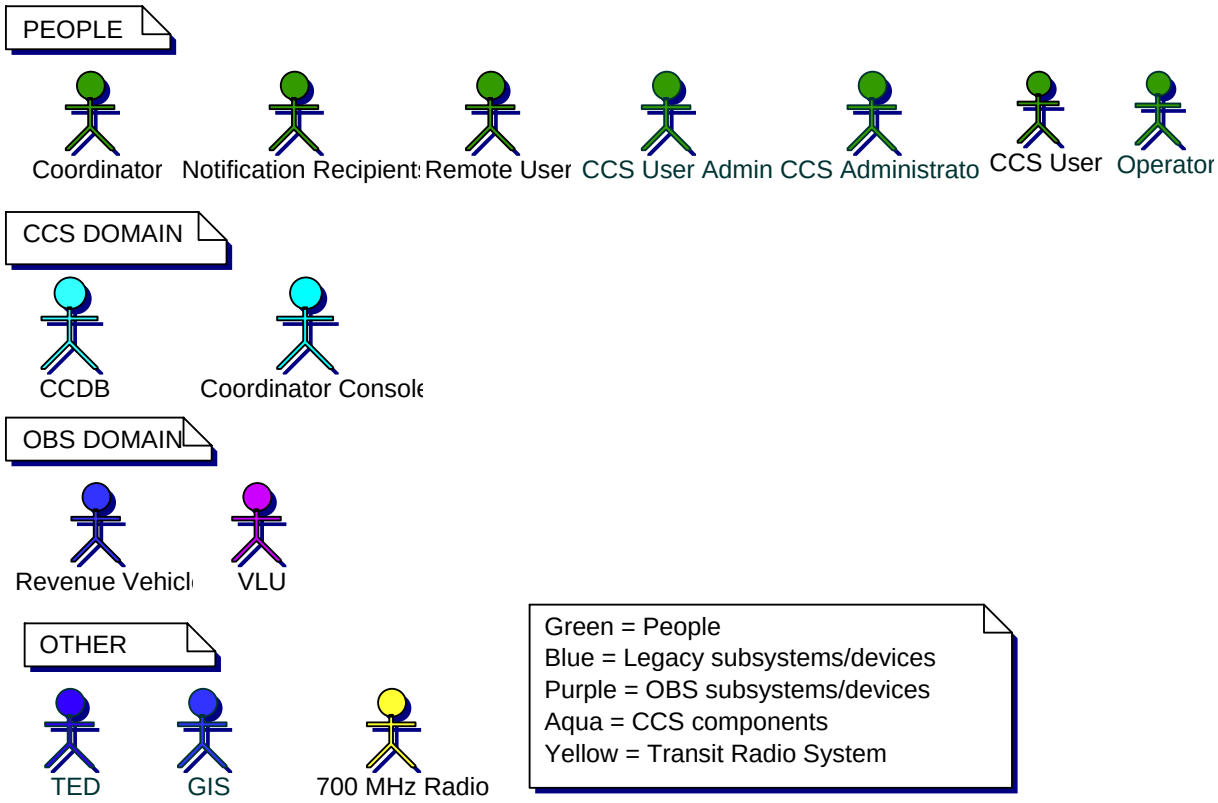
Figure 3.B.2, Level 2 Global Business Use Case



3.B.3. Level 2 Actors Glossary

Figure **3.B.3,** depicts the Actors that were identified in the Level 2 use cases. The glossary includes all Level 2 actors and their descriptions.

Figure 3.B.3. Level 2 Actors



- **Actor** *700 MHz Radio*

  The 700 MHz Radio includes both the on-board mobile radio subsystem and the radio system infrastructure provided by the Transit Radio System project.

- **Actor** *CCDB*

  Communications Center Database

- **Actor** *CCS Administrator*

  The Communications Center System (CCS) Administrator is the KCM technical support and systems administrator staff responsible for the CCS.

- **Actor** *CCS User*

  Coordinators, Service Communication staff, CCS User Admin and CCS Administrator, who have access to CAD/AVL functions or administer the CCS, typically from within the Communications Center.

- **Actor** *CCS User Admin*

  This actor represents the Service Communications (CAD/AVL user group) staff person or persons designated to maintain the Strategies Process and various information lists utilized by Communications Center staff.

- **Actor** *Coordinator*

  Coordinator refers to a job classification of Service Communications Coordinator and work out of the Communications Center. Coordinators are the primary users of the CAD/AVL system. The Coordinators manage service operations, incident response and voice communications.

- **Actor** *Coordinator Console*

  Coordinator workstation which includes the CAD/AVL applications.

- **Actor** *GIS*

  KCM Geographic Information System

- **Actor** *Notification Recipients*

  Notification Recipients are KCM configurable lists of positions, e.g. system administrator, manager of operations, that receive automated notification, e.g. email or live page, when designated system events occur, including but not limited to system health alerts.

- **Actor** *Operator*

  Operator is used to refer to any KCM employee who is licensed and authorized to operate a Metro coach or fixed rail vehicle including Operations, Maintenance, Training, Service Quality staff, etc. Transit Operator is the job classification title for employees whose job is to operate a vehicle in revenue service.

- **Actor** *Remote User*

  Transit staff including, Service Quality, Rider Information Office, Base Chiefs, etc. accessing electronic CSR data from outside the Communications Center.

- **Actor** *Revenue Vehicle*

  A revenue vehicle (RV) is the mobile platform for the OBS. A RV is the entity that is managed and tracked by Coordinators in the Communications Center. RV may refer to a coach, streetcar, train or van, but is most typically a coach.

- **Actor** *TED*

  Transit Enterprise Database (TED) contains the route, schedule and customer information data for the OBS/CCS.

- **Actor** *VLU*

  The vehicle logic unit (VLU) provides the central management and computing functions for the OBS. Of primary importance will be its ability to handle radio and poll response messages simultaneously with all on-board component requirements.

3.B.4. UML Model: Level 2

3.B.4.1. Revenue Vehicle Use Case Specification

The Contractor shall provide the functionality described in specification, ***RV17-Interface to 700MHz Radio***, which requires that the VLU manage the voice and data communications interface with a new radio system to be provided by others.

This use case package includes the following UML diagrams:

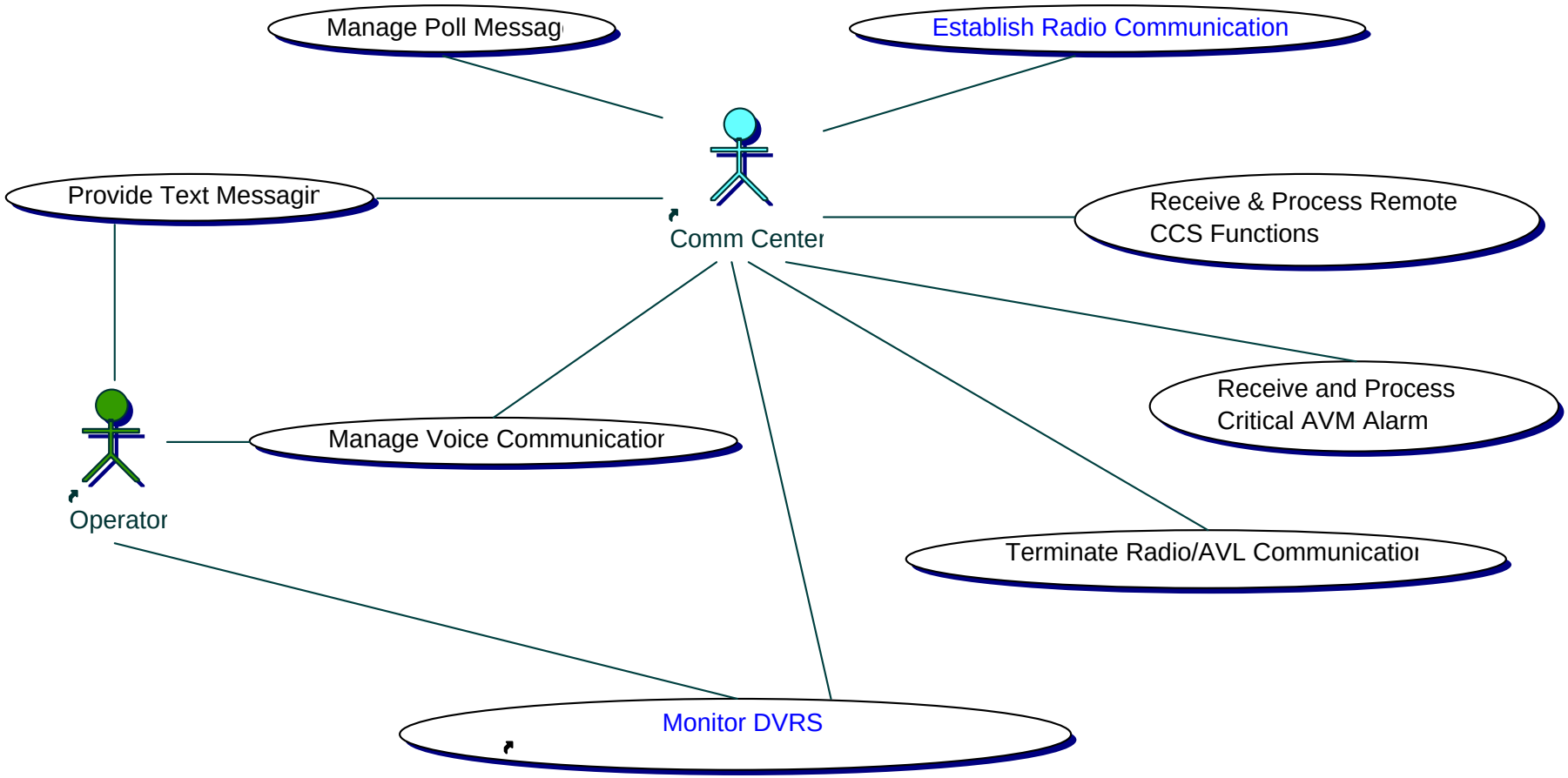
UseCase Diagrams

Figure *3.B.4.1.RV17.a. RV17-Interface to 700 MHz Radio*

Activity Diagrams

Figure *3.B.4.1.RV17.b. Establish Radio-AVL Communications*

Figure 3.B.4.1.RV17.a. ***UseCase Diagram RV17-Interface to 700 MHz Radio***



1. RV17-Interface to 700 MHz Radio

1. Brief Description

The VLU will include a Radio Communications Manager to oversee the transmittal and receipt of radio communications between the Revenue Vehicle and Communications Center System. Radio Communications include voice, data, poll-response and text messages, and Emergency and Critical AVM alarms. Radio communications will function continuously from the *Start up system* step in the ***RV1-Initiate Vehicle for Operation*** use case until completion of the *Shut down OBS* step in the ***RV3-Take Vehicle out of Operation*** use case.

In Level 2, the new radio will be connected to the VLU and the OBS will acquire full responsibility for managing the encoding and decoding of the new 700 MHz radio message traffic. All radio messages will adhere to standard message protocols detailed in Subsection **3.A.6.6, Communications Layers**.

Additionally, KCM will be operating its vehicles in a transit-only tunnel shared with LINK light rail, also operated by KCM. The tunnel communications center will be separate from KCM's Communications Center and the CCS. Tunnel radio communication will function differently from surface-street communications in that all Revenue Vehicles in the tunnel will follow the protocols normally used by rail. KCM vehicles will be required to automatically switch their radios to the tunnel channel just prior to entering the tunnel and switch the channel back just after exiting the tunnel. The seamless transition to the tunnel channel and the handoffs between the KCM Communications Center and the tunnel communications center is safety-critical functionality that needs to be addressed in Level 2 design and in collaboration with the TRS contractor.

This use case addresses radio communications within the Revenue Vehicle domain only. Overarching OBS/CCS requirements such as standard message protocols, exceptions to the standard message protocols, and the requested content of the various types of messages can be found in Subsection **3.A.6.6, Communications Layers**.

2. Pre-conditions

The Radio system is up and running.

The CCS is up and running in data mode. (See use case ***CC15-Transition CCS***.)

The Revenue Vehicle has successfully completed the *Start up system* step from use case ***RV1-Initiate Vehicle for Operation***.

3. Flow of Events

This use case is triggered when an Operator powers up a vehicle.

3.1 Basic Flow

Establish radio/AVL communications
Radio communications shall be automatically established when a Revenue Vehicle radio powers on.

1) As soon as a Revenue Vehicle radio is powered on, the OBS will automatically establish radio communications with the CCS as an unlogged coach with limited OBS/CCS functionality. (See alternative flow *Unlogged vehicles* in the ***CC2-Log in Revenue Vehicle*** use case.)

2) The Operator must provide a valid login and successfully complete the *Manage login process* step of the ***RV1-Initiate Vehicle for Operation*** use case to enable full OBS functionality and to provide complete poll-response messages to the CCS. (See ***CC3-Manage Revenue Vehicle Polling*** and ***CC4-Monitor Revenue Vehicles*** use cases.)

Manage poll-response message
The OBS shall support a continuous, automated, non-exception-based regular polling and fast polling scheme.

1) The OBS will continuously monitor for CCS transmissions and respond to polling messages directed to the vehicle. (See use case ***CC3-Manage Revenue Vehicle Polling***.)

2) The poll-response message will comply with the Level 2 synchronization requirements. See Subsection **3.A.6.6, Communications Layers** *Time Synch* requirement.

Manage voice communication

The OBS shall provide the ability for Operators to initiate and respond to voice communications with the CCS.

1) Operator-Initiated Call:
    a) Operator will initiate a request to talk or a priority request to talk (RTT/PRTT) message through key press on the DDU. (See the RV12-Interface to DDU and the CC6-Respond to Revenue Vehicle Communications use cases.)
    b) The OBS will send an RTT/PRTT message to the CCS via the radio.
    c) The OBS will expect to receive an acknowledgment that the message arrived to the Communications Center. When received, a message will be displayed on the DDU to notify the Operator that the RTT/PRTT is in the Coordinator's queue.
    d) The OBS will wait for a CCS call set-up message in response.
    e) Operators will be able to cancel an RTT/PRTT request after it has been transmitted to the CCS.
2) CCS-Initiated Call: The OBS will have the ability to receive and process call set-up commands from the CCS for all types of voice calls.
    a) Two-way call: the Operator can have a two-way conversation with a Coordinator using the handset. (See use case CC5-Initiate Communications to Revenue Vehicle for further details.)
        i) The set-up message will direct the Revenue Vehicle radio to use a specific voice channel for two-way voice communications until the call is ended.
        ii) When the OBS receives a set-up call message from the CCS, the OBS will prompt the Operator to pick up the incoming call.
        iii) The Coordinator may transmit an audio message via the hailing speaker to request that the Operator pick up her handset. (See use case RV10-Manage PA and Annunciator.)
        iv) An Operator will have the ability to respond to the two-way call by picking up the mobile radio handset and speaking with the Coordinator.
    b) Receive Only: one-way communication from a Coordinator to one or more vehicles. (See use case CC5-Initiate Communications to Revenue Vehicle for further details.)
        i) Hailing mode: a Coordinator broadcasts an announcement to Operators over the hailing speaker. (See use case RV10-Manage PA and Annunciator.)
        ii) Handset mode: a Coordinator instructs the Operator, over the hailing speaker, to pick up the handset and listen.
        iii) PA announcement: a Coordinator broadcasts an announcement to Operators and passengers over a coach's public address system.
3) All incoming calls, at a minimum, can be listened to via the handset.
    a) A tone will emanate briefly from the DDU alerting an Operator to an incoming call.
        i) There will be a distinct tone to each call type; as determined in design.
    b) A message that identifies the type of incoming call will be displayed and remain on the DDU until an Operator responds to the call or the transmission is ended.
4) End Voice Communications.
5) Following voice communications of all types, a voice channel will stay engaged on the radio until one of the following occurs:
    a) A Coordinator sends an "end radio call" command.
        i) The Revenue Vehicle processes the end-of-call message from the CCS.

(1) When an end-of-call message is not received, the OBS will alert the CCS. (See Stuck Microphone in Technical Specifications below.)

(2) The Operator picks up and then hangs up the handset during any type of radio communication.

ii) The Revenue Vehicle will send an end-of-call message to the CCS.

iii) The Revenue Vehicle, after a defined and configurable amount of time, detecting no voice activity on the radio channel it is occupying, "times out" the channel and switches its radio back to data mode.

(1) The Revenue Vehicle will send an end-of-call message to the CCS.

Manage text message

The OBS shall provide the capability for Operators to initiate and receive text messages.

1) Operators will select from a list and send a canned text message through the DDU. (See use case ***RV12-Interface to DDU***.)
2) Operator will receive canned and custom text messages from the CCS.
   a) The DDU will provide a distinct notification tone for text messages.

Manage Emergency Alarm

An Operator shall always have the ability to initiate an Emergency Alarm to the CCS.

1) When the EA switch is activated, the OBS will provide all EA functions as the highest priority. (See use case ***RV6-Manage Events***.)
2) When the switch is activated, an Emergency Alarm message will be transmitted to the CCS via two channels:
   a) The normal data channel.
   b) A dedicated redundant pathway, voice channel, for emergency operations.
3) The EA message will deviate from the standard message protocols. See Subsection **3.A.6.6, Communications Layers**.
4) Activation of an EA will trigger the following related functions:
   a) The vehicle will respond to fast-poll queries by the CCS. (See use case ***CC3-Manage Revenue Vehicle Polling***.)
   b) The vehicle's running lights will commence flashing when the EA is activated and will continue flashing until a follow-up PRTT is sent. (See use case **RV6-Manage Events,** Alternative Flow, *Manage Emergency Alarm Process*.)
   c) When the vehicle is equipped with a security camera system, the system will begin transmitting audio to the Communications Center upon Coordinator acknowledgment of an EA. (See use case **RV6-Manage Events**, Alternate Flow, *Manage EA Process*.)
   d) There will be no in-vehicle indicator that systems are in EA mode separate from whatever “EA in progress” indicator appears on the DDU.
5) When the Operator initiates a follow-up PRTT to the EA, all EA-related functions will cease.
   a) An Operator will be able to initiate a PRTT to follow up an EA without regard to the time elapsed since the last PRTT. (Note that this deviates from standard message protocols.)
6) In the event that a PRTT is not initiated as a follow-up to an EA, system design will provide a back-up method to ensure the security microphone and running lights are turned off when they are no longer needed. (See *Emergency-Alarm-Related Features* in **Technical Specifications**.)

Receive and Process Critical AVM Alarm
A Critical AVM Alarm shall initiate a message to the CCS and Revenue Vehicle Operator.

1) When a Critical AVM Alarm is activated, the OBS will automatically send a message to the CCS immediately rather than wait for the next poll response. (See ***RV11-Manage AVM***, ***RV6-Manage Events***, and ***CC3-Monitor Revenue Vehicles*** use cases.)
2) When a Critical AVM Alarm is activated, the OBS will display a message to the Operator on the DDU. (See use case ***RV12-Interface to DDU***.)

Receive and process remote function(s)
The Revenue Vehicle shall receive and process messages from the CCS to perform remote functions.

1) The OBS will support a remote Operator login performed by a Coordinator using the CCS.
   a) The login data changes will occur in the CCS and the VLU and on the vehicle's DDU.
   b) The Revenue Vehicle will be able to accept the following data from the Coordinator for any specified vehicle. (See use case ***CC5-Initiate Communications to Revenue Vehicle***.)
      i) Operator Logout.
      ii) New Operator ID.
      iii) Block Logoff.
      iv) New Block ID.
2) The OBS will support a remote "roll back" command, via the TRS, to the previous service data set performed by the OBS.
   a) OBS Administrators will have the ability to send a roll back to an individual vehicle, group of vehicles, or to the entire fleet.
   b) This "trigger" will cause the VLU to utilize the "Previous" service data set stored on the VLU. (See use case **RV4-Update Vehicle Data**, *Process service data sets* step.)

Terminate radio communications
Radio communications shall terminate when a vehicle's radio powers off.

1) OBS will signal the CCS that a vehicle's radio is shutting down. (See use case **RV3-Take Vehicle out of Operation**, *Terminate radio/AVL communications* step.)

Log all radio/AVL communication events
OBS shall log all radio/AVL communications events.

A configurable list of desired Event Log Data Fields and possible Events is provided in Appendix ***G, Event Log Matrix***.

3.2 Alternative Flows

3.2.1 Unlogged Coach

Operate as an Unlogged Coach
When a Revenue Vehicle has been started up but no Operator login has been received, the vehicle shall be able to establish radio communications with the CCS with limited OBS functionality.

1) An unlogged coach will be provided the following limited communications functionality:
   a) Emergency Alarm, as described in the Manage Emergency Alarm step above.
   b) RTT/PRTT capabilities, as described in the Manage voice communications step above.
   c) Poll response, as described in Manage Poll response message step above.

2) An unlogged coach that leaves the base, or otherwise exceeds the parameters for requiring a login, will be prompted for an Operator login as detailed in the *Manage login* step of the ***RV1-Initiate Vehicle for Operation*** use-case specification.

3.2.2 Operate in Voice Mode

Operate in voice mode
Revenue Vehicles with radios that are powered on when data mode is down shall operate in voice mode.

1) Vehicles that have successfully completed the *Manage login* step of use case ***RV1-Initiate Vehicle for Operation*** when data mode is down will operate in voice mode with full on-board functionality.

2) OBS and CCS design will provide an efficient method for restoring and updating Operator logins to the CCS when the system returns from voice mode to data mode. See the use case ***CC15-Transition CCS*** and the **Issues** section below.

3.2.3 Operate in the DSTT

Operate in the DSTT
The OBS in conjunction with the Transit Radio System shall manage and ensure the seamless transition of KCM Revenue Vehicle radios from surface-street to the tunnel talk group. (See Subsection ***1.C.6.2, Joint Tunnel Operations***.)

1) The OBS/CCS will:

a) Provide a reliable way to identify any coach entering and exiting the transit-only tunnel at the agreed-upon service-area boundaries.

b) Automatically switch the mobile radio, at the DSTT service area boundaries, from data radio to open (voice) channel communications on the Joint 700/800 MHz Tunnel Talk Group.

c) Disable the RTT/PRTT as part of the automated switch to the Joint 700/800 MHz Tunnel Talk Group.

d) Provide real-time notification to the Operator of the change from data radio to open channel communication with an audible tone and display message on the DDU.

e) Facilitate the automatic handoff of coaches from the KCM Communications Coordinator to the DSTT Controller. (See use cases ***CC5-Initiate Communication to Revenue Vehicle***, ***CC6-Respond to Revenue Vehicle Communication***, and ***CC8-Manage Incidents***.)

f) Facilitate the automatic handoff back to the KCM Communications Coordinator when the coach leaves the DSTT service area boundaries. (See use cases ***CC5-Initiate Communication to Revenue Vehicle***, ***CC6- Respond to Revenue Vehicle Communication***, and ***CC8-Manage Incidents***)

g) Automatically switch the mobile radio back to data mode at the surface-street service-area boundaries.

h) Provide real-time notification to the Operator of the change from open channel communications back to data radio with an audible tone and display message on the DDU.

2) The OBS/CCS contractor will work with the TRS contractor in the development and implementation of the design. (See Subsection **1.C.1.3, Technical Interface Committee (TIC)**)

4. Post-conditions

The vehicle has been properly logged off of the CCS and the radio powered off.

5. Special Requirements

5.1 Performance

5.1.1 Support Polling Data Rate

Support Polling Data Rate
The VLU shall support high data-rate polling (9600bps or higher) over-the-air-link.

5.1.2 Data Message Processing

Data Message Processing
The process utilized by OBS to handle data messages—receive, decode, respond to and if necessary display on the DDU—shall take 500 milliseconds or less.

5.2 Technical Specifications

5.2.1 Interface with Transit Radio System Specified Standard Interface

Interface with Transit Radio System Specified Standard Interface
The TRS final design will specify a standard interface to be used between the radio system and the Revenue Vehicle mobile radio. The OBS design shall provide a corresponding communications port to support the specified interface.

5.2.2 Provide Reliable Interface Between OBS and Radio System

Provide Reliable Interface Between OBS and Radio System
OBS design shall include system redundancies and protections to ensure that the OBS interface with the radio system will function reliably.

Radio communications is the single most critical on-board function and must be protected as such.

5.2.3 Process Voice and Data Transmissions Separately and Simultaneously

Process Voice and Data Transmissions Separately and Simultaneously
If the new radio system is able to handle both voice and data transmissions simultaneously, then the VLU must be capable of processing both voice and data information separately and simultaneously.

5.2.4 Operate in the DSTT

Operate in the DSTT
Joint tunnel operations will require the seamless transition between KCM Revenue Vehicle mobile radio communications with the CCS and the DSTT's Communication Center open radio channel.

1) The system must ensure the reliable transition of radio communications for KCM coaches between the KCM Communications Center and the DSTT Control Center. *Describe how the proposed system will accomplish this.*

    a) System must identify any coaches entering or leaving the joint operations area between Royal Brougham and the CPS staging area so that it can switch the mobile radio to the appropriate mode of operation. *Discuss methods for this.*

    b) System must disable/enable the RTT/PRTT, notify the Operator of the radio status, and switch the mobile radio to the appropriate mode of operation. *Discuss methods for this.*

5.2.5 Manage Stuck-Open Channel

Manage Stuck-Open Channel
System shall manage a failed End Radio Call command

Transit currently uses an End Radio Call command when the CCS wishes to end a call with a Revenue Vehicle(s). However, sometimes the command fails.

For example, if a vehicle's handset is hung up incorrectly (e.g., with the mouthpiece, rather than the earpiece, in the phone cradle) following two-way radio communications, the microphone continues to pick up background noise from the Revenue Vehicle environment.

The Radio System interprets this noise as channel activity, and as long as the vehicle is transmitting this noise, it cannot receive the Coordinator's End Radio Call command. The future system will need to include a method for notifying the CCS that an End Radio Call command was not received and processed by a Revenue Vehicle. *Describe how your proposed system would prevent the occurrence of or manage a failed End Radio Call command.*

5.2.6 Manage Security Microphone Transmissions and Other Simultaneous Radio Functions

Manage Simultaneous Radio Functions
Security-camera-equipped Revenue Vehicles shall have a security microphone already installed which will be used as the OBS security microphone in the event of an EA.

1) The security microphone is installed in the cockpit area above the driver's seat.
2) Audio picked up by the security microphone will automatically begin transmitting to the Communications Center upon Coordinator acknowledgment of an EA.
3) Though EA-related functions take precedence over other functions, it will still be necessary for the on-board radio to handle other functions while transmitting the security microphone audio to the CCS. *Describe how your proposed system would handle simultaneous transmittal of security microphone audio and other radio functions.*

5.2.7 Manage EA-Related Functions

Conclude EA-Related Functions
System will manage manual and automatic ending of EA-related functions.

Initiation of the EA triggers the security microphone transmission and the flashing marker lights. These EA-related functions will need to be turned off when the emergency has ended.

1) System design must include ways to automatically turn off EA-related functions. *Describe how your proposed system would manage automatically turning off EA-related functions once the emergency has ended.* The primary method will be to cease EA-related functions when the Operator initiates a follow-up PRTT.
2) Possible back-up methods may include:
    a) The Revenue Vehicle having the ability to receive and process a data message from a Coordinator telling the OBS to stop security microphone transmission and flashing marker lights.
    b) EA-related functions ending when a Coordinator closes the EA from the CCS end.

5.2.8 Manage Text Messages

Manage Text Messages
System shall provide for canned and custom text message functionality.

OBS communication shall include canned and custom text messages. The technical specifications for text message functionality will be determined and agreed upon in design by the Contractor and KCM Project Manager. *Describe your company's successful experience implementing text message functionality at other agencies. Describe how your proposed system would manage on-board text message functionality. Be sure to address:*

- *Length constraints of canned and custom text messages.*
- *Possible solutions to the concern of Operators being distracted by text messages while in motion.*
- *Processes for saving and deleting text messages throughout a block of work that includes assignments for more than one Operator, including keeping only those messages that are current and relevant to the logged-in Operator assignment in a block.*

5.3 Testing

6. Extension Points

CC2-Log in Revenue Vehicle

CC3-Manage Revenue Vehicle Polling

CC5- Initiate Communications to Revenue Vehicle

CC6-Respond to Revenue Vehicle Communications

CC8-Manage Incidents

CC10-Log out Revenue Vehicle

CC14-Manage System Health

CC15-Transition CCS

RV1-Initiate Vehicle for Operation

RV3-Take Vehicle out of Operation

RV6-Manage Events

RV10-Manage PA and Annunciator

RV11-Manage AVM

RV12-Interface to DDU

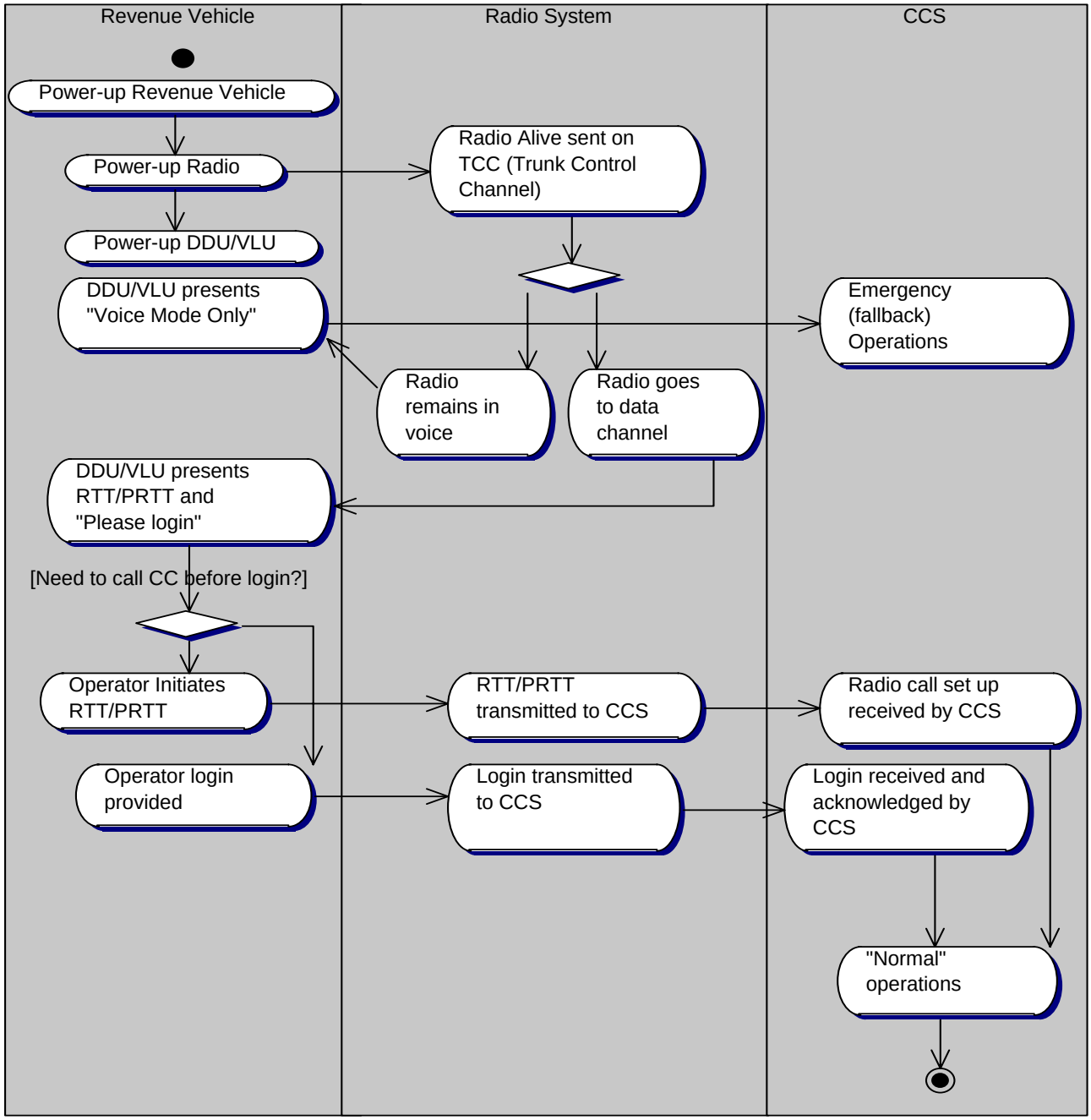
RV15-Interface to Security Cameras

7. Assumptions

The Contractor shall work with the TRS contractor, when selected, to develop new message formats and interfaces to be used between Revenue Vehicles and the CCS.

8. Issues

Figure 3.B.2.4.RV17.b. ***Activity Diagram Establish Radio-AVL Communications***



3.B.4.2. Communications Center Use Case Specifications

The Contractor shall provide the functionality described in specifications, which requires either the replacement of upgrade of the current CAD/AVL system and to manage the new radio system to be provided by others.

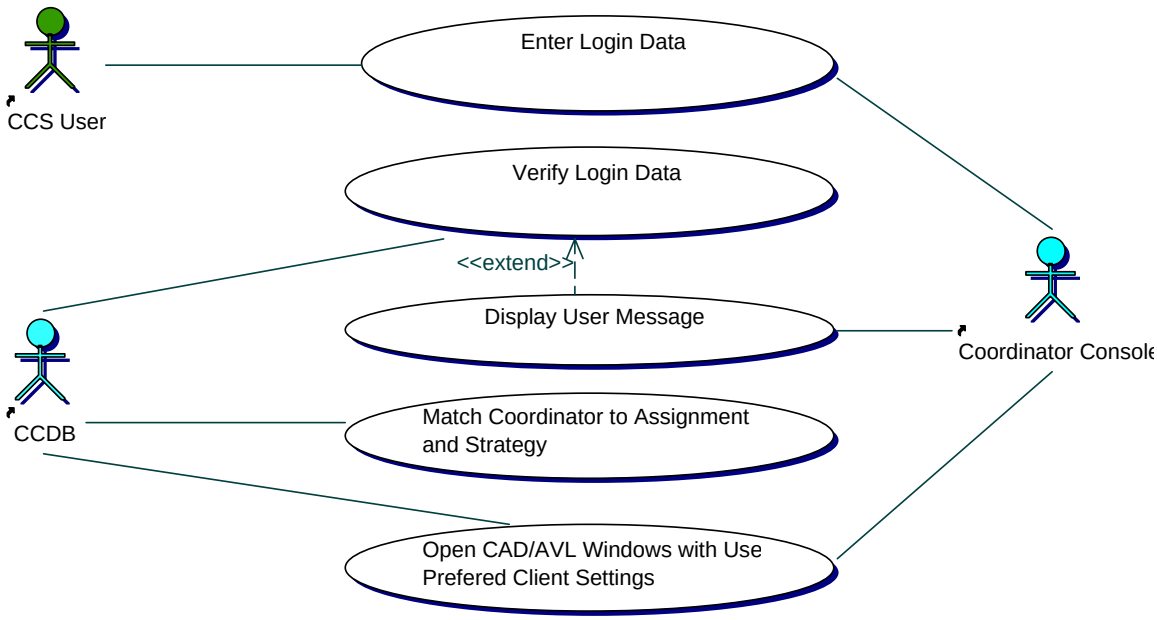
3.B.4.2.1. CC1-Log in CCS User

This use case package includes the following UML diagram:

UseCase Diagrams

Figure ***3.B.4.2.1.CC1. CC1-Log in CCS User***

Figure 3.B.4.2.1.CC1. UseCase Diagram CC1-Log in CCS User



2. CC1-Log in CCS User

1. Brief Description

This use case describes the process of logging a user into the CCS. CCS users include communications coordinators, Service Communications supervisors and CCS administrators. Successful completion of this process results in access to CAD/AVL and related functionality associated with the user's access permissions. For Coordinators, the user login data serves to match their assignment number to a Strategy. (See use case ***CC13-Manage Configuration***.)

2. Pre-conditions

The CCS is up and running.

An individual CAD/AVL terminal has been started, and the basic operating systems screens indicate successful start of the user's terminal.

3. Flow of Events

This use case is triggered following successful startup of the user's terminal.

3.1 Basic Flow

Enter login data
CCS user shall log in to the Radio/AVL system using the CAD/AVL module at a Coordinator's console.

1) Following a successful start of a Coordinator's console, the system will display a CAD/AVL login screen with user instructions for entering the login data.
2) User will enter login data as prompted.
    a) Login data required of all users will include:
        i) User identification number.
        ii) User password.
    b) Login data required of Coordinators will also include:
        i) Coordinator assignment number: Coordinators scheduled to be assigned to a Strategy will provide an assignment number in their login data for the purpose of the CCS attaching a Strategy to a Coordinator's shift. Other users will have the option of ignoring the prompt for a user assignment.
3) CCS will set and recognize access permissions according to the user's identification number. (See use case ***CC13-Manage Configuration***.)

Verify login data
The system shall verify that the entered login data is valid.

1) System will verify the following data:
    a) *User ID* must be an authorized ID in the CCS database.
    b) *Password* must be associated with the user ID in the database.
    c) *Assignment number*, where applicable, must be a valid assignment number in the database.
2) CCS will recognize and set access permissions according to the user ID. (See use case ***CC13-Manage Configuration***.)

Match Coordinator to assignment and Strategy
Where an assignment number is supplied by a Coordinator at login, the system shall associate assigned groups to the Coordinator assignment and console, as defined by the Strategies process.

(See use case ***CC13-Manage Configuration***.)

Grant user access (ADJUSTED)
Upon verification of the login data, the system shall allow the user to access the designated appropriate level of use.

(See use case ***CC13-Manage Configuration***.)

Open CAD/AVL windows with users' preferred client settings (NEW)
The system shall open the CAD/AVL system windows according to the user's saved preferences.

1) If no established preferences are on file for the user, the system shall apply the default configuration setting. (See use case ***CC13-Manage Configuration***.)

3.2 Alternative Flows

3.2.1 Invalid login data is entered

Display user message (NEW)
If the CCS determines the user has entered invalid login data (see use case ***CC13-Manage Configuration***), the system shall provide a message to the user indicating which login data are incorrect, and instructions for entering the correct data.

Return to Basic Flow at *Enter login data*.

4. Post-conditions

Upon completion of the login process, the CCS shall provide the user with access to the full range of CCS functions associated with his designated level of user access.

5. Special Requirements

5.1 Performance

Two-second authentication
The CCS will process a CCS user login that requires *authentication only* within two seconds.

Five-second assignment to Strategy
The CCS will process a CCS user login that requires authentication *and the attachment of a user assignment to a Strategy* in no more than five seconds.

5.2 Technical

5.3 Testing

Standard CCS Testing
Functions in this use case shall be subject to Level 2 testing requirements described in Subsection **3.A.7.5, Testing.** The test plan shall include, but not be limited to, test cases for each requirement statement and all supporting details in this use case.

6. Extension Points

CC13-Manage Configuration

7. Assumptions

8. Issues

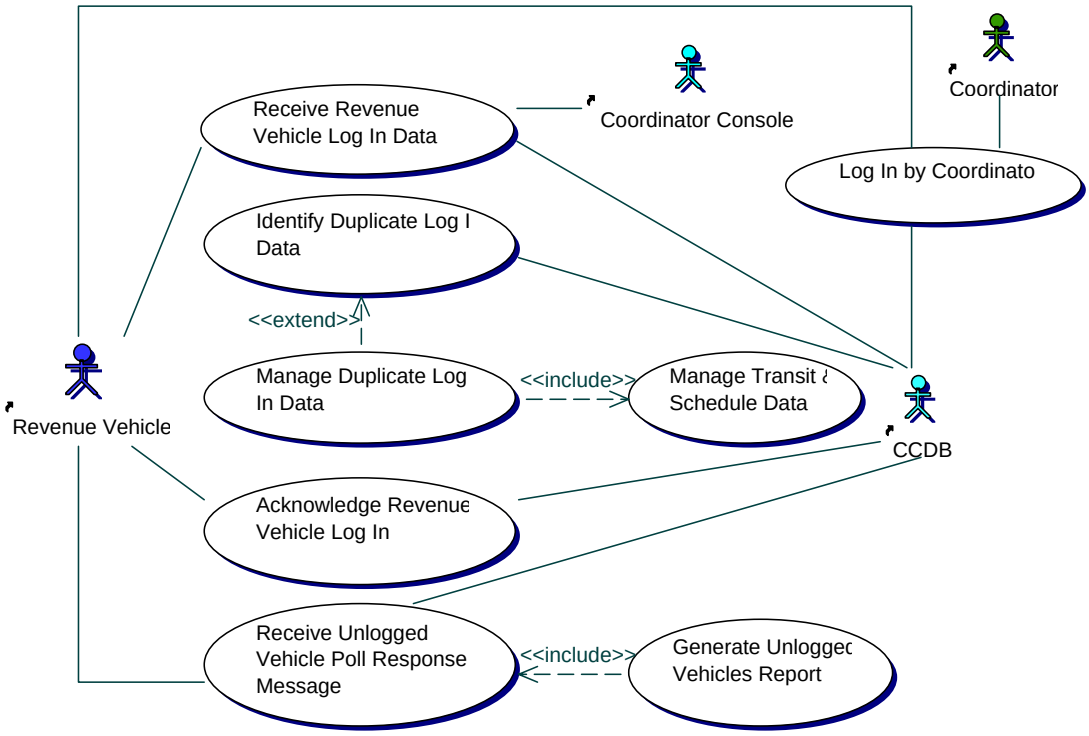
3.B.4.2.2. CC2-Log In Revenue Vehicle

This use case package includes the following UML diagrams:

UseCase Diagrams

Figure ***3.B.4.2.2.CC2. CC2-Log In Revenue Vehicle***

Figure 3.B.4.2.2.CC2. UseCase Diagram CC2-Log In Revenue Vehicle



3. CC2-Log in Revenue Vehicle

1. Brief Description

This use case describes the activities at the Communications Center related to logging a Revenue Vehicle into the CCS.

2. Pre-conditions

The CCS is up and running in data mode, as described in use case ***CC15-Transition CCS.***

The radio system is up and running.

The use case ***RV1-Initiate Vehicle for Operation*** has started. The OBS and mobile radio have started.

The *Establish Radio/AVL Communications* step in use case ***RV17-Interface to 700 MHz Radio*** has started, establishing polling (as described in use case ***CC3-Manage Revenue Vehicle Polling***) and radio communications capability for the unlogged vehicle.

An Operator has entered login data as described in the *Manage Login Process* step of use case ***RV1-Initiate Vehicle for Operation***.

3. Flow of Events

The use case begins when the OBS validates the login data and transmits it to the CCS via the 700 MHz Transit Radio System (TRS). See the use cases ***RV1-Initiate Vehicle for Operation*** and ***RV17-Interface to 700 MHz Radio.***

3.1 Basic Flow

Receive Revenue Vehicle login data (ADJUSTED)
The CCS shall receive and log Revenue Vehicle login data transmitted to the CCS via the TRS. (See use case ***RV1-Initiate Vehicle for Operation***.)

1) The Transit Operator login data message shall include:
   a) A unique message identifier. (NEW)
   b) Vehicle ID (VID).
   c) Operator identification number (OID).
   d) Block ID (Route number and Run number).
2) The login data are logged for use by the CCS.

Identify duplicate login data (NEW)
Upon receiving the Operator login message at the Communications Center, the CCS shall verify that the OID or Block ID (route/run) does not duplicate an OID or Block ID already in service.

1) The CCS shall add the Transit Operator's name to the CCS login data for display along with the OID on the CCS CAD/AVL screens.
   a) OIDs and Transit Operator names shall be provided to the CCS via the CCS data management process described in use case ***CC7-Manage Transit Service & Geographic Data.***
2) If the CCS determines the login is a duplicate, see the Alternative Flow *Duplicate Login Data* below.

Acknowledge Revenue Vehicle login
After screening the Operator login data for duplication among currently logged-in vehicles, the CCS shall send a login acknowledgment message to the Revenue Vehicle. (See use case ***RV1-Initiate Vehicle for Operation***.)

3.2 Alternative Flows

3.2.1 Duplicate login data

Manage duplicate login **(NEW)**
The CCS shall provide a process for managing duplicate login data, including, but not limited to:

1) The CCS shall designate the login data as a duplicate if it contains a OID or Block ID already logged into the CCS. *(NEW)*
2) The CCS shall create a log of all duplicate login events. *(NEW)*
   a) Log will capture:
      i) Date of duplicate login.
      ii) Time of duplicate login.
      iii) Login data that was entered.
3) The CCS shall provide Coordinators with near-real-time reporting of duplicate login event data. *(NEW)*
   a) Current service day duplicate login data shall be available to Coordinators through a CCS desktop application. (See use case ***CC12-Manage Data Reporting***.)
4) The CCS shall transmit a login correction message to the Revenue Vehicle OBS. (See use case ***RV1-Initiate Vehicle for Operation***.) *(NEW)*
   a) The login correction message shall also indicate the problem, so that the OBS can generate the appropriate message for display on the DDU, and provide direction to the Operator; for example "Login duplicates a block already in service. Do you wish to overwrite the existing block? Please resubmit your login to confirm."

3.2.2 Non–Transit Operator Login

Log in other (non-Operator) staff **(ADJUSTED)**
The CCS shall provide a non–Transit Operator login process for Vehicle Maintenance, Radio Maintenance, and training purposes. (See use case ***RV1-Initiate Vehicle for Operation.***)

1) The non-Operator login message transmitted from the OBS to the CCS shall include:
   a) Employee ID.
   b) Block ID, including a method for indicating such non-revenue service as: **(NEW)**
      i) Road test.
      ii) Coach change/road jump.
         (1) The login data entry process for coach changes and road jumps shall include a mechanism for ensuring that radio communications from this replacement coach will be routed to the appropriate Coordinator via the Strategies process. (See use case ***CC13-Manage Configuration***.) For example, radio communications from a coach change (replacement coach) for a Route 71 coach will be routed to the Coordinator responsible for Route 71, according to the Strategies process.
      iii) Training.
      iv) Testing.
      v) Safety and Security staff coach operation.
   c) VID.

3.2.3 Enter login data from Communications Center

Enter login data
The CCS shall provide the ability for a Coordinator to log in an unlogged or incorrectly logged-in coach. (ADJUSTED)

1) The login data changes shall be reflected in the CCS database, on the Coordinators' CAD display, and on the vehicle's DDU. (ADJUSTED)
2) This "Remote login" function of the CCS CAD shall provide the ability for the Coordinator to enter the following login data for any specified VID:
   a) Operator identification number.
   b) Block ID (route/run).
3) The DDU shall notify the Operator of the remote login by a method to be determined, such as displaying a message "login completed by Coordinator." (See use case ***RV1-Initiate Vehicle for Operation***). (NEW)

3.2.4 Unlogged vehicles

Generate Unlogged Vehicles report (ADJUSTED)
CCS shall generate an "Unlogged Vehicles" report, to identify in-service, scheduled vehicles that are not logged into the system. (See use case ***CC12-Manage Data Reporting***.)

1) The CCS shall provide Coordinators with the ability to access an Unlogged Vehicles report from the CCS CAD module user screen.
2) The CCS shall identify unlogged vehicles for the report by comparing the Block IDs (route/run) of Revenue Vehicles currently logged into the system with Block IDs that are scheduled to be in service, i.e., those vehicles whose login has not been received before their scheduled pull-out time.
3) The Unlogged Vehicles report shall provide the ability for Coordinators to view the list of unlogged vehicles by selecting an operating base.
   a) The data provided by the report shall include Block ID, last scheduled timepoint, scheduled time of arrival at the last timepoint, and scheduled pullout time.
   b) The Unlogged Vehicles report shall be available to Coordinators in near-real time.
   c) Unlogged Vehicles report data shall be refreshed with new data when a Communications Coordinator submits a report query.
4) By an automated process, the CCS shall compare expected logins with received logins within a configurable time interval, e.g. every two minutes, controlled by the CCS system administrator. (See use case ***CC13-Manage Configuration***.) (NEW)
   a) The CCS shall send an electronic message notification to a designated Coordinator, providing available data related to the unlogged vehicle. The designated Coordinator shall be identified through the Strategies process, as described in use case ***CC13-Manage Configuration***. (NEW)
   b) CCS will provide the automated notification as an optional feature that can be toggled on and off by a Coordinator. (NEW)

Receive unlogged vehicle poll response message (NEW)
Upon Revenue Vehicle startup, unlogged coaches shall transmit their location to the CCS via the polling process. (See use case ***CC3-Manage Revenue Vehicle Polling***.)

1) The CCS shall provide Coordinators with the option of filtering out from the AVL display unlogged coach locations at operating bases. (See use case ***CC4-Monitor Revenue Vehicles***.) (NEW)

4. Post-conditions

The Revenue Vehicle has logged into the CCS. All login data are available to downstream CCS functions.

5. Special Requirements

5.1 Technical Specifications

5.2 Performance

Vehicle login management
The CCS shall provide a process for effectively managing and processing increases in vehicle login message traffic due to peak hour operation and other events.

1) CCS vehicle login processing, from receipt of the login message to logging the data in the CCDB, shall be instantaneous.
2) The CCS design shall provide orderly management and processing of numerous Revenue Vehicle logins during peak-hour operation, without negatively impacting CCS performance or cycle time of login processing.
3) Similarly, processing vehicle logins as the fleet returns to data mode following a period of voice mode operation shall not negatively impact CCS performance or login processing cycle time. (See use case ***CC15-Transition CCS***.)

Provide Duplicate Login Data
Duplicate login data shall be processed by the CCS and available to Coordinators within two seconds of the login data message's arrival at the CCS.

5.3 Testing

Login function testing
Testing of the functions described in this use case shall be conducted according to Level 2 testing requirements described in Subsection **3.A.7.5, Testing.** The test plan shall include, but not be limited to, test cases for each requirement statement and all supporting details in this case.

5.4 Usability

6. Extension Points

CC3-Manage Revenue Vehicle Polling

CC4-Monitor Revenue Vehicles

CC7-Manage Transit Service & Geographic Data

CC12-Manage Data Reporting

CC13-Manage Configuration

RV1-Initiate Vehicle for Operation

RV17-Interface to 700 MHz Radio

7. Assumptions

Assuming the next radio system requires assigning a default radio voice channel to the Revenue Vehicle (for emergency/limited radio operations, currently provided by the Operator login process), we expect the default radio channel assignment will be included with the schedule data provided to the vehicle by the WLAN. The CCS will have the same schedule data and default channel assignments.

For each service change, Service Communications will provide default voice channel assignments for each Block ID to TED. (See use case ***CC13-Manage Configuration***.)

Upon coach startup, the OBS and CCS shall provide the ability for an Operator to send an RTT, PRTT, or Emergency Alarm before a login is completed.

Revenue Vehicle polling shall be initiated upon coach startup.

8. Issues

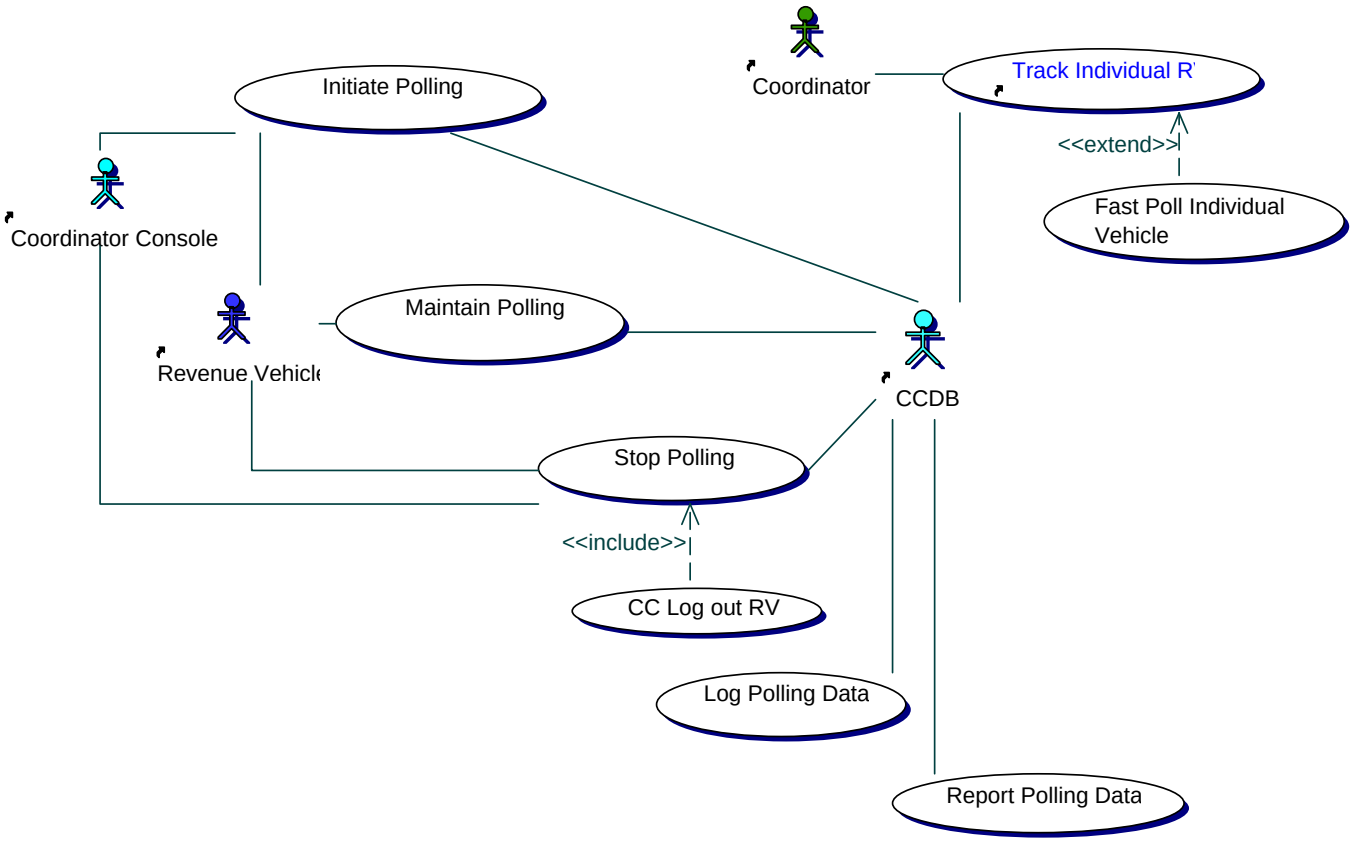
3.B.4.2.3. CC3-Manage Revenue Vehicle Polling

This use case package includes the following UML diagrams:

UseCase Diagrams

Figure ***3.B.4.2.3..CC3. CC3-Manage Revenue Vehicle Polling***

Figure 3.B.4.2.3.CC3. UseCase Diagram CC3-Manage Revenue Vehicle Polling



4. CC3-Manage Revenue Vehicle Polling

1. Brief Description

This use case describes the automated Revenue Vehicle polling process which provides frequent and orderly Revenue Vehicle status updates—vehicle location, schedule adherence, and other information—to the Communications Center. The CCS shall provide an automated process for initiating, maintaining, and ceasing the Revenue Vehicle polling process.

The term "polling" as it is used here may include methods other than a strictly poll/poll-response scheme for achieving regular status updates from Revenue Vehicles, but excludes a purely exception-based reporting method.

2. Pre-conditions

The Revenue Vehicle has been started as described in use case ***RV1-Initiate Vehicle for Operation*** and the *Start up System* step has been completed.

On-board vehicle radio communications systems are in good health, as described in use case ***RV5-Monitor System Health***.

The radio system is up and running and in good health.

Communications Center systems are up and running and in good health, as described in use case ***CC14-Manage System Health***.

3. Flow of Events

The use case is triggered upon completion of the *Establish Radio/AVL Communications* step of the use case ***RV17-Interface to 700 MHz Radio***.

3.1 Basic Flow

Initiate Polling
The Communication Center System shall automatically initiate the polling process for each Revenue Vehicle that completes vehicle startup. **(NEW)**

1) Receive VID.
    a) Upon successful startup, the Revenue Vehicle shall transmit its VID and if possible, its location, to the CCS. **(NEW)**
2) The CCS shall add the VID to the CCS polling table.**(ADJUSTED)**
3) If a poll/poll-response scheme is employed, the Communication Center System shall immediately begin polling each VID added to the polling table by generating a poll message to the vehicle. **(ADJUSTED)**
    a) Poll-message data requirements are detailed below in the Technical Specifications section of this use case.
4) Receipt of the poll message by the OBS shall elicit a poll-response message from the vehicle. (See use case ***RV17-Interface to 700 MHz Radio***.)
    a) Poll-response message data requirements are detailed below in the Technical Specifications section.

Maintain Polling
Once polling is initiated, the CCS shall maintain a regular poll/poll-response cycle to provide Revenue Vehicle status updates to the CCS.

1) The polling function shall include:
    a) A mechanism for maintaining time synchronization between the CCS polling function and downstream systems, and the Revenue Vehicle VLU, including: **(ADJUSTED)**

i) A recommended method for maintaining CCS and OBS time synchronization if GPS is unavailable due to urban canyon, etc.

b) A mechanism for maintaining timepoint event synchronization and tracking between the on-board systems, VLU, and CCS polling module, and downstream systems, to ensure OBS and CCS are referring to the same timepoint event (timepoint and trip). (See Subsection **3.A.6.6.1.4, Time Synchronization**) **(ADJUSTED)**

2) The CCS polling function shall provide continuous, automated polling, and shall seamlessly accommodate with no interruption in polling, the addition of new VIDs from the polling table, or deletion of VIDs from the polling table due to vehicle logouts.

3) The CCS polling function shall monitor expected timepoint events and stop event reports from the Revenue Vehicle.

a) A missed timepoint event or stop event shall be logged by the CCS.

b) A missed poll-response message from the vehicle shall elicit another poll message or, if a poll/poll-response scheme is not used, a query message from the CCS to the vehicle.

i) A missed poll-response message shall be logged by the CCS as a missed event.

ii) The CCS shall indicate visually on the AVL display a vehicle whose status has not been updated due to a missed poll response. (See use case ***CC4-Monitor Revenue Vehicles***.) **(NEW)**

(1) The change in the vehicle's displayed status shall be triggered by the amount of time since the vehicle's last update or the number of missed poll responses.

(2) The trigger shall be configurable. (See use case ***CC13-Manage Configuration***.)

4) If the CCS or TRS has been unavailable, the OBS and the CCS polling function shall have a mechanism for reporting any unreported timepoints to the CCS when the system becomes available. **(ADJUSTED)**

a) The OBS and CCS polling function shall place first priority on providing current status updates, and reporting any unreported events as a secondary priority.

b) Missed-event reporting to the CCS shall be provided for the current service day only.

Fast-Poll Vehicle
The CSS polling module shall poll the Revenue Vehicle at an accelerated rate in response to receipt of an Emergency Alarm message (see use case ***CC6-Respond to Revenue Vehicle Communications*** alternate flow *Respond to Emergency Alarm*) or tracking the location of an individual Revenue Vehicle (see use case ***CC4-Monitor Revenue Vehicles***).

Fast polling shall cease when one of the following occurs:

1) A Coordinator stops tracking an individual vehicle. (See use case ***CC4-Monitor Revenue Vehicles***.)

2) A Coordinator removes an Emergency Alarm from the EA queue. (See use case ***CC6-Respond to Revenue Vehicle Communications***.)

3) A Coordinator closes the CSR associated with the EA. (See use case ***CC8-Manage Incidents***.)

Log Polling Data
The CCS shall provide a process for logging Revenue Vehicle poll data.

1) The system shall make poll data available in real time to CCS functions including the CCS AVL display (see use case ***CC4-Monitor Revenue Vehicles***), Revenue Vehicle schedule adherence reports for Coordinators (see use case ***CC7-Manage Transit Service & Geographic Data***), and the My Bus/BusView applications.

2) The logged poll data shall be accessible by KCM CCS Administrators and shall contain all poll-response-message data fields.

3) The CCS design shall include a process for providing the required real-time AVL data for My Bus/Bus View. KCM will provide the Contractor with My Bus/BusView data requirements.

4) The Contractor shall provide an interface control document and data requirements for the My Bus/Bus View applications.

Stop Polling
The system shall stop polling an individual Revenue Vehicle when the CCS receives a "vehicle logout" or similar message to log a vehicle out of the CCS. (See the OBS use case ***RV3-Take Vehicle out of Operation***.)

1) Upon receipt of the vehicle logout message at the Communications Center, the CCS shall remove the VID from the polling table. (See use case ***CC10-Log out Revenue Vehicle***.)

2) The removal of the VID from the polling table will be logged as a CCS event.

3) Polling shall cease for any Revenue Vehicle logged out by the CCS through the nightly system logout process. (See use case ***CC10-Log out Revenue Vehicle***.)

3.2 Alternative Flows

4. Post-conditions

Polling of the Revenue Vehicle has ceased, and the VID is properly removed from the CCS polling table. Poll data are logged and available to downstream functions.

5. Special Requirements

5.1 Technical Specifications

Polling function design
The OBS/CCS design shall provide a polling scheme, subject to King County Metro approval, based on the characteristics of the procured 700 MHz Radio System.

1) The Contractor shall work collaboratively with the TRS contractor to design and deliver a polling scheme to meet the specified performance characteristics.

Poll message
Assuming a poll/poll response scheme is utilized, the poll message shall include identifying data specified by KCM.

1) A unique message identifier.

2) VID.

Poll-response message
The poll-response message from the Revenue Vehicle shall include all necessary information specified by KCM. **(ADJUSTED)**

1) Unique message identifier.

2) VID.

3) Service route currently operated by the vehicle. **(NEW)**

4) Vehicle location expressed as latitude and longitude (x,y). **(NEW)**

   a) Vehicle location data provided to the CCS AVL map display shall be translated into Northern Washington State Plane feet. (See use case ***CC4-Monitor Revenue Vehicles***.)

   b) The data translation into Northern Washington state plane feet shall be provided by either the CCS or the OBS as determined in the design phase.

5) Most recent timepoint encountered, expressed as a Timepoint Event: a unique ID that includes Timepoint ID, sequence number of the timepoint in the trip, and trip number. **(NEW)**

6) Schedule adherence at the vehicle's most recent timepoint (Timepoint Event), expressed in seconds. (See use case ***RV8-Monitor Route and Schedule Adherence***.) (NEW)

7) The data message shall accommodate a minimum of the vehicle's two most recent timepoint events and their associated schedule adherence.

8) Route adherence flag to indicate on- or off-route status. (NEW)

9) Vehicle location calculation confidence indicator. The OBS shall provide in its poll-response message a flag or indicator of the quality of the vehicle location calculation. (See use case ***RV7-Determine Vehicle Location***.) (NEW)

10) If the poll-response message can accommodate some or all of the following highly desirable elements, the message shall include:

    a) Passenger load after the most recently serviced stop, when APC data are available on the vehicle. (NEW)

    b) As many unreported timepoints as possible since the last poll response.

    c) Most recent serviced stop, expressed as a stop event (stop ID, sequence number of stop for the trip, and trip number) and time of occurrence. (NEW)

        i) The CCS shall utilize this data to generate a list of scheduled stop and timepoint events and time of their occurrence for use by Service Communications and other transit staff in near-real-time reporting. (See use case ***CC12-Manage Data Reporting***.)

11) If stop events are also included in the poll-response message, the message shall accommodate the most recent timepoint event and its schedule adherence, and at a minimum, another timepoint event or stop event. Accommodating a third stop or timepoint event is highly desirable. (NEW)

12) The poll-response message shall constitute the Revenue Vehicle's acknowledgment of the poll message, if a poll/poll-response scheme is utilized.

5.2 Performance

Polling rate

The CCS shall provide the ability to poll 2,000 vehicles in no more than 90 seconds. (ADJUSTED)

1) The maximum revenue fleet size in 2020 is estimated to be 2,000 coaches. The CCS shall provide a maximum polling cycle of 90 seconds for a fleet of 2,000 vehicles.

2) The CCS shall provide fast polling for up to 11 vehicles at a rate of five seconds per vehicle or less, without impacting the system polling rate to exceed the 90-second polling cycle maximum.

Fast polling

The CCS shall provide a Revenue Vehicle fast-polling rate of once every five seconds or less.

1) A fast-poll request/status shall have priority in the polling table over other poll messages.

2) The CCS shall provide fast polling without affecting the polling rate of the other vehicles in the polling table to exceed the 90-second polling cycle maximum.

3) The system shall have the capability of simultaneously fast-polling eleven vehicles (expected number of CAD workstations) without causing the system polling rate to exceed 90-second polling cycle maximum, or the fast-polling rate to exceed five seconds. (NEW)

Start polling cycle

Cycle time between receipt of the VID by the Communications Center and initiation of a poll message to the vehicle shall be a maximum of one second, to make poll data from the vehicle available to the CCS as soon as possible. (ADJUSTED)

1) Adding the VID to the CCS polling table shall be instantaneous.

Real-time Poll-Response Data
The CCS shall provide real-time processing of poll-response data for instantaneous availability of the data to downstream functions, such as the CCS AVL display and schedule adherence reports, and data for My Bus/Bus View.

5.3 Testing

Polling function testing
Functions in this use case shall be subject to Level 2 testing requirements described in Subsection **3.A.7.5, Testing**. The test plan shall include, but not be limited to, test cases for each requirement statement and all supporting details in this case.

5.4 Usability

6. Extension Points

CC4-Monitor Revenue Vehicles

CC6-Respond to Revenue Vehicle Communications

CC7-Manage Transit Service & Geographic Data

CC8-Manage Incidents

CC10-Log out Revenue Vehicle

CC12-Manage Data Reporting

CC13-Manage Configuration

CC14-Manage System Health

RV1-Initiate Vehicle for Operation

RV3-Take Vehicle Out of Operation

RV5-Monitor System Health

RV17-Interface to 700 MHz Radio

7. Assumptions

Implementation of a polling scheme might be achieved in a variety of possible ways, and may not include poll/poll-response structure. A purely exception-based reporting scheme, in which a Revenue Vehicle reports status update data to the fixed end only if it exceeds established parameters for schedule or route adherence, would not meet King County Metro business requirements for frequent, regular updates directly from the vehicle.

CCS emergency limited operation or "Fall back mode" will not require an increase in poll-response message frequency. KCM desires a regular schedule of status updates from the fleet. (See use case ***CC15-Transition CCS***.)

8. Issues

Describe the proposed approach to providing the CCS polling function. What data elements would be transmitted from the Revenue Vehicle to the CCS? What other information or data would be needed for a full analysis of the polling function?

Describe the mechanisms utilized by the proposed CCS polling function to ensure the reliability of the process.

Describe your firm's history and experience in designing and implementing a polling function for transit properties with over 500 revenue vehicles.

Describe the radio systems that were utilized and the technical specifications related to the project, including radio frequencies, bandwidth, communication protocols, polling rate, and fleet size.

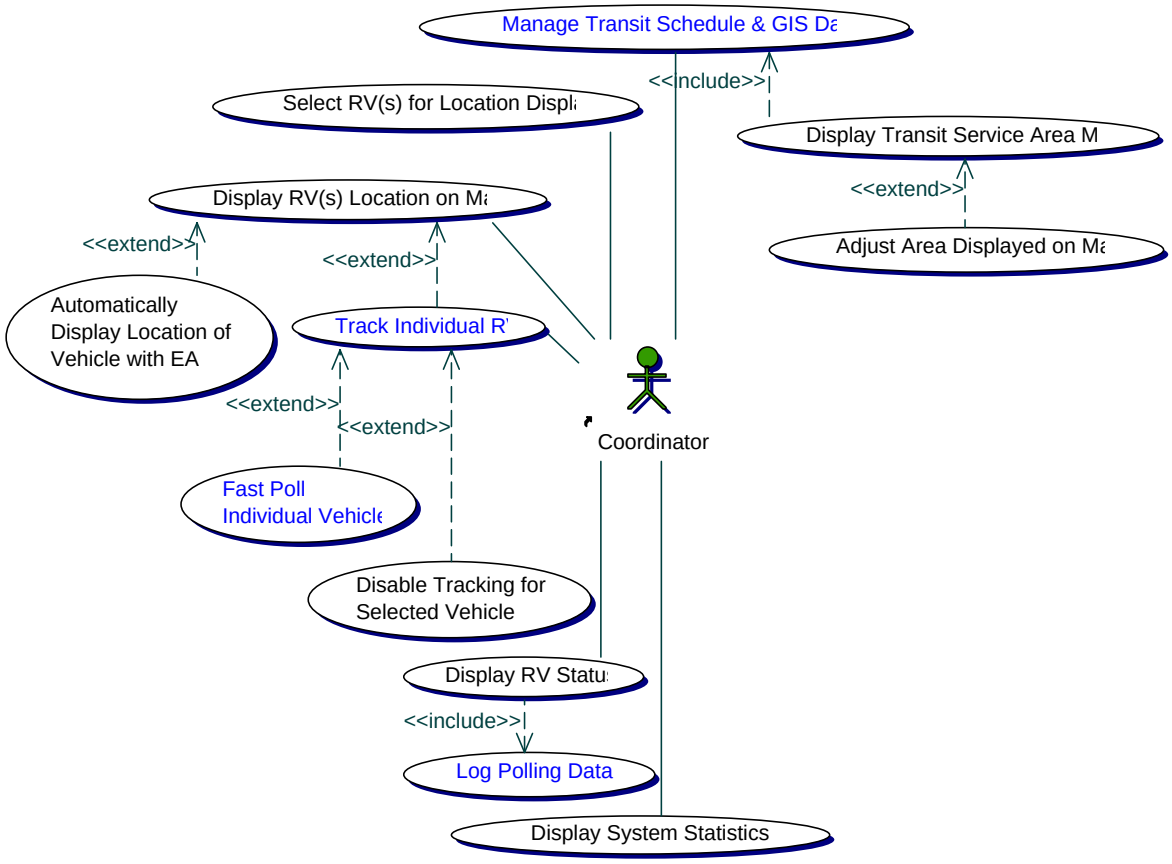
3.B.4.2.4. CC4-Monitor Revenue Vehicles

This use case package includes the following UML diagrams:

UseCase Diagrams

Figure ***3.B.4.2.4.CC4. CC4-Monitor Revenue Vehicles***

Figure 3.B.4.2.4.CC4. UseCase Diagram CC4-Monitor Revenue Vehicles



5. CC4-Monitor Revenue Vehicles

1. Brief Description

Includes the activities related to displaying the transmitted AVL and other on-board data on the KCM service area map. Communications Coordinators access this information through the CCS AVL module, typically for the purpose of viewing the location of a Revenue Vehicle associated with a radio call.

2. Pre-conditions

The radio and Communications Center systems are in good health, as defined in ***CC14-Manage System Health***.

Revenue Vehicles are logged in to the radio system and transmitting to the Communications Center.

The CCS is receiving poll responses from the fleet.

Use case ***CC1-Log in CCS User*** has been successfully completed.

3. Flow of Events

The use case is triggered by a successful login by a Communications Coordinator or other CCS user.

3.1 Basic Flow

The system shall enable the Communications Coordinator or other user to monitor the location and status of Revenue Vehicles on the King County Metro GIS Map.

Display transit service area map

The system shall display the KCM transit service area map with geographical and transit-related features.

1) The system will automatically display the basic geographic data of the transit service area map (including land masses and bodies of water), and the service area street network (including streets, highways, and bridges).
2) User will select various optional features for display on the base map.
    a) General geographic features available for display will include, but not be limited to:
        i) Street names.
        ii) Low block number (lowest house number on each block).
        iii) High block number (highest house number on each block).
        iv) Landmarks.
        v) Landmark names.
    b) KCM transit facilities features available for display will include, but not be limited to:
        i) Transit bases, and transit base names.
        ii) Park & Ride lots, and Park & Ride lot names.
        iii) Bus stops, and bus stop IDs.
        iv) AVL signposts, and signpost IDs (pending inclusion of signposts in the system design).
    c) KCM transit service route network features available for display will include, but not be limited to:
        i) Revenue segments of service routes.
        ii) Deadhead segments of service routes.
            (1) List of the service routes that use the deadhead segment.

iii) Electric trolley routes. (ADJUSTED)

(1) Revenue segments of electric trolley routes. (NEW)

(2) Deadhead segments of electric trolley routes. (NEW)

iv) Established, frequently used reroute paths (such as the Evergreen Point Bridge or Aurora reroutes. A comprehensive list will be assembled during system design). (NEW)

v) Timepoints.

vi) Timepoint location names.

d) Geographic and transit facility features including landmarks, transit bases, Park & Ride lots, AVL signposts, bus stops, and timepoints shall be displayed as distinct feature types.

i) KCM transit service route features including revenue, deadhead, electric trolley routes, and reroutes shall be displayed as distinct route types.

Adjust area displayed on map

Users shall have the ability to select and change the displayed area of the Transit GIS map.

Users will have a number of options for adjusting the area displayed on the map, including but not limited to:

1) Pan (move to an area outside the current map view).
2) Zoom in (magnify area) incrementally.
3) Zoom out incrementally.
4) Zoom out to view of entire service area.
5) Zoom to preset views.
   a) Select a map view (such as a specific neighborhood) from a predefined set.
   b) Define and add map views to the saved set for the duration of the current session.
6) Center the display around a specific location:
   a) A user-specified street address.
   b) A user-specified street intersection from a predefined set of "on streets" and "cross streets."
   c) A user-specified landmark. (NEW)

Select Revenue Vehicles for location display

User shall select individual vehicles and/or groups of vehicles for display on the AVL screen.

1) User will select a vehicle or group of vehicles by specifying a criteria, such as:
   a) All vehicles associated with one or more specified radio call group (Assigned Group) numbers.
   b) All vehicles associated with one or more specified service route numbers.
      i) A user will be able to select from lists of weekday, Saturday, and Sunday service route numbers.
   c) All vehicles associated with a specified route cluster or parent route (for example, the parent route 71 includes service routes 71, 72, and 73).
   d) All vehicles associated with a specified type of trip (that is, all vehicles operating an express trip, or all vehicles operating a local trip).
   e) All vehicles whose on-board AVL equipment matches a specified Health Status category (based on poll-response AVL confidence factor data). See ***CC3-Manage Revenue Vehicle Polling***. (ADJUSTED)

f) All vehicles that are not logged in and have left the base. (NEW)

i) User will have the option to select all unlogged vehicles, including those at the base that are polled by the CCS upon vehicle startup. (See use case ***CC3-Manage Revenue Vehicle Polling*** *step Initiate Polling*.) (NEW)

g) All vehicles whose schedule adherence matches a specified criterion (early vehicles, on-time vehicles, or late vehicles).

Display Revenue Vehicle(s) location on map
The system shall display the location of the selected vehicle(s) on the KCM GIS street network map on the user's screen.

Display Revenue Vehicle status
Along with the location of the vehicle, the system display shall indicate the vehicle's status and other identifying information on the KCM GIS map.

1) The system will graphically indicate the status of each vehicle displayed on the map, in the following categories:
   a) On-Route Status: On-route or off-route.
   b) Schedule Adherence: Early, on time, or late.
      i) The system will display the number of minutes by which the vehicle is ahead of or behind schedule.
   c) Type of trip: Express or Local.
   d) Special Event or "extra" service. (NEW)
2) The system will graphically identify the following vehicle conditions:
   a) Vehicle with an AVL health status problem. (ADJUSTED)
   b) Vehicle that is not logged in, or that is logged in on an unscheduled block. (ADJUSTED)
3) The system will display the following attribute information for every vehicle:
   a) Direction of travel.
   b) Service route number being operated by the vehicle.
   c) User-selected vehicle information, to include the following options:
      i) Block ID (route and run number).
      ii) Vehicle identification (VID) number.
      iii) Operator identification (OID) number.
4) The system will continuously update the displayed vehicle location and status data as available through the polling process. (See use case ***CC3-Manage Revenue Vehicle Polling***.)
5) The system will continue to display the location of the selected vehicles until the user either selects another group of vehicles to monitor, or exits the application.

Display system statistics
The CCS shall display all required system statistics on the main user screen, subject to user preferences.

1) System will display the number of vehicles being polled by the CCS.
2) System will display the number of routes being polled in the current user's session.

a) System will indicate the number of routes assigned to the current user.

b) System will indicate the number of routes selected by the user for display.

3) The system will identify the latest (in schedule adherence status) block being tracked in the user's current session. (See use case ***CC13-Manage Configuration***.)

a) The CCS will provide users with the ability to set a limit (in terms of minutes behind schedule) for the latest vehicle that will be included in tracking, status, and other reports generated in the user's session.

i) The CCS will identify the latest block of all blocks assigned to the user.

ii) The CCS will identify the latest block of all blocks selected by the user for display.

3.2 Alternative Flows

3.2.1 Track an Individual Revenue Vehicle

Track Individual Revenue Vehicle
User shall track the location of an individual vehicle on the CCS AVL display.

The system will track the selected vehicle's location by keeping the location of the vehicle within the user's screen and adjusting the display as the vehicle's location changes on the map.

1) Users will select a vehicle by specifying a criteria, such as:

a) Route number and run number (block).

b) Vehicle identification number (VID).

c) Operator identification number (OID).

d) Vehicle associated with a radio call in the Coordinator's queue.

e) Latest vehicle (relative to its schedule) of *all vehicles being polled by the system*.

f) Latest vehicle (relative to its schedule) of *all vehicles in the Coordinator's assigned group*.

2) Users will have the ability to set tracking options:

a) "Fast polling" as the default setting for vehicle tracking. (See use case ***CC3-Manage Revenue Vehicle Polling***.)

b) "Automatic zoom-in" on the selected vehicle's displayed location as the default setting for vehicle tracking.

3) If while tracking the vehicle, the user changes the view of the map (for example, zooms to a wider view of the area), the system shall return to the vehicle being tracked following a configurable period of time. (See use case ***CC13-Manage Configuration***.)

4) When tracking the location of the selected vehicle, the system shall graphically indicate or highlight the vehicle's scheduled path on the street network.

5) The system shall track an individual vehicle while continuing to display and update the location of other selected vehicles within the map view.

Disable tracking for selected vehicle
User will have the ability to stop tracking the selected vehicle by selecting the "disable vehicle tracking" function.

1) Fast-polling a vehicle will stop if another vehicle is selected for tracking by the user.

3.2.2 Locate Vehicle with Emergency Alarm

Automatically display location of vehicle with EA
The system shall automatically display the location of any vehicle transmitting an Emergency Alarm.

1) Upon acknowledgment of an Emergency Alarm by a Communications Coordinator (see use case ***CC6-Respond to Revenue Vehicle Communications*** alternative flow *Respond to Emergency Alarm*), the CCS shall automatically display and track the current location of the vehicle on the AVL display of the Coordinator who acknowledged the EA.

   a) If the AVL application window is minimized, the CCS shall automatically maximize the AVL window and display the vehicle's location. **(NEW)**

   b) The system shall display the vehicle with the EA in a way that makes it clearly, immediately distinct from other vehicles on the map.

2) The CCS shall fast-poll the vehicle with the EA. (See use case ***CC3-Manage RV Polling***.)

3) The CCS shall continue to track the vehicle with the EA until the Coordinator selects the "disable vehicle tracking" function for the vehicle.

4. Post-conditions

The location of the selected vehicle or vehicles has been displayed on the AVL map. The displayed information is current, complete, and accurate.

5. Special Requirements

5.1 Performance

CCS Speed
The CCS AVL function shall complete all user-initiated commands within one second.

5.2 Technical

Northern Washington State Plane feet coordinates
In order to map vehicle locations on the CCS AVL display, vehicle location data from the OBS shall be expressed as Northern Washington State plane feet coordinates, to meet requirements stated in Subsection **2.A.1.7.4.3, GIS/Map Characteristics**.

Based on system design constraints and recommendation by the Contractor, the process shall be determined in the design phase of the project, subject to KCM Project Manager approval.

CCS AVL Display user access
User access to the AVL display shall be permitted to CCS users without radio call management privileges. (See use case ***CC13-Manage Configuration***.)

5.3 Testing

AVL Testing
The accuracy of the displayed OBS/CCS AVL shall be subject to acceptance testing that includes verifying a vehicle's displayed location on the CCS AVL map by KCM field staff observation.

1) The testing shall be conducted on a representative sample of King County Metro service, by a process subject to KCM approval that determines the statistical accuracy of the displayed AVL as compared to observed vehicle locations.

2) The testing process shall include random accuracy testing of displayed vehicle location by KCM staff.

Given the accuracy of the proposed on-board AVL solution and accuracy of the KCM Transit GIS map, what is the proposed accuracy of the AVL as displayed to Coordinators? How is this calculation determined? Describe.

Monitor Revenue Vehicles Functional Testing
Functions in this use case shall be subject to Level 2 testing requirements described in Subsection **3.A.7.5, Testing.** The test plan shall include, but not be limited to, test cases for each requirement statement and all supporting details in this case.

5.4 Usability

Map Utilities
The CCS AVL system shall provide users with tools to enhance usability of the map display.

Map utilities will include:

1) Optional street-specific information: User will have quick, on-the-fly access (e.g., by performing a mouse-over) to information associated with a given street, including:
    a) Street name.
    b) Route Numbers for service routes that operate on that street.
        i) Service route numbers that utilize the deadhead route.
2) Measuring tool: Users will have the ability to measure distance between two or more user-selected points on the map.
3) Pan/Zoom in/Zoom out tools: Users will have the ability to pan, zoom in or zoom out of the current map view by using tools such as a "magnification tool" or comparable streamlined method for adjusting the AVL map view.
    a) The user interface for these functions will provide ease of use greater than or equal to the current AVL display tools, measured by user satisfaction ratings.
4) Copy tool: Users will have the ability to copy the current map view to the clipboard.
5) Print tool: Users will have the ability to send the current map view to a printer or other device.
6) Legend: Where vehicle type or status is indicated graphically (e.g., vehicles with Emergency Alarm status represented in red), an onscreen legend will translate the symbology. The legend will provide a key to all map symbology, including the types of service routes (e.g. deadhead), landmarks, timepoints, and other geographic categories.

Vehicle-Specific Utilities
The CCS AVL system shall provide users with quick access (for example, through a "right click" pop-up or context menu) to certain functions for any selected vehicle.

1) Initiate a radio call to the vehicle.
2) End a radio call from the vehicle.
3) Delete a call from the vehicle from the call queue.
4) Create or edit a CSR for the vehicle.
5) Open a block detail, block train, or schedule list report for the vehicle.
6) Track the vehicle.
7) Stop tracking vehicle.
8) Acknowledge an EA from the vehicle.

Track Individual Revenue Vehicle: Tracking Status Messages

Status messages shall be activated when the user elects to track an individual Revenue Vehicle.

1) The system shall display messages to inform the user of the system's tracking status including:
   a) Once a vehicle is selected for tracking, the system shall display a message indicating which vehicle is being tracked.
      i) The vehicle shall be identified in the message as the vehicle was selected for tracking by the user, for example if selected by VID, "Tracking 2016."
   b) The system shall display the message "Not tracking" when no vehicle has been selected for tracking.
   c) The CCS shall display the message "Unable to track selected coach" when the tracking function is unavailable for the selected vehicle. The system shall also provide the user with a message indicating why the system is unable to track the selected coach. **(ADJUSTED)**

6. Extension Points

CC3-Manage Revenue Vehicle Polling

CC6-Respond to Revenue Vehicle Communications

CC13-Manage Configuration

7. Assumptions

8. Issues

Describe the proposed method to correct the vehicle location data utilized by the CCS AVL function, either the data provided by the OBS or subsequently processed by the CCS. Describe any corrections by a "snap to" function to adjust the vehicle location calculation based on the vehicle's schedule or similar location estimation process. Where in the vehicle location determination process do such corrections, if any, occur?

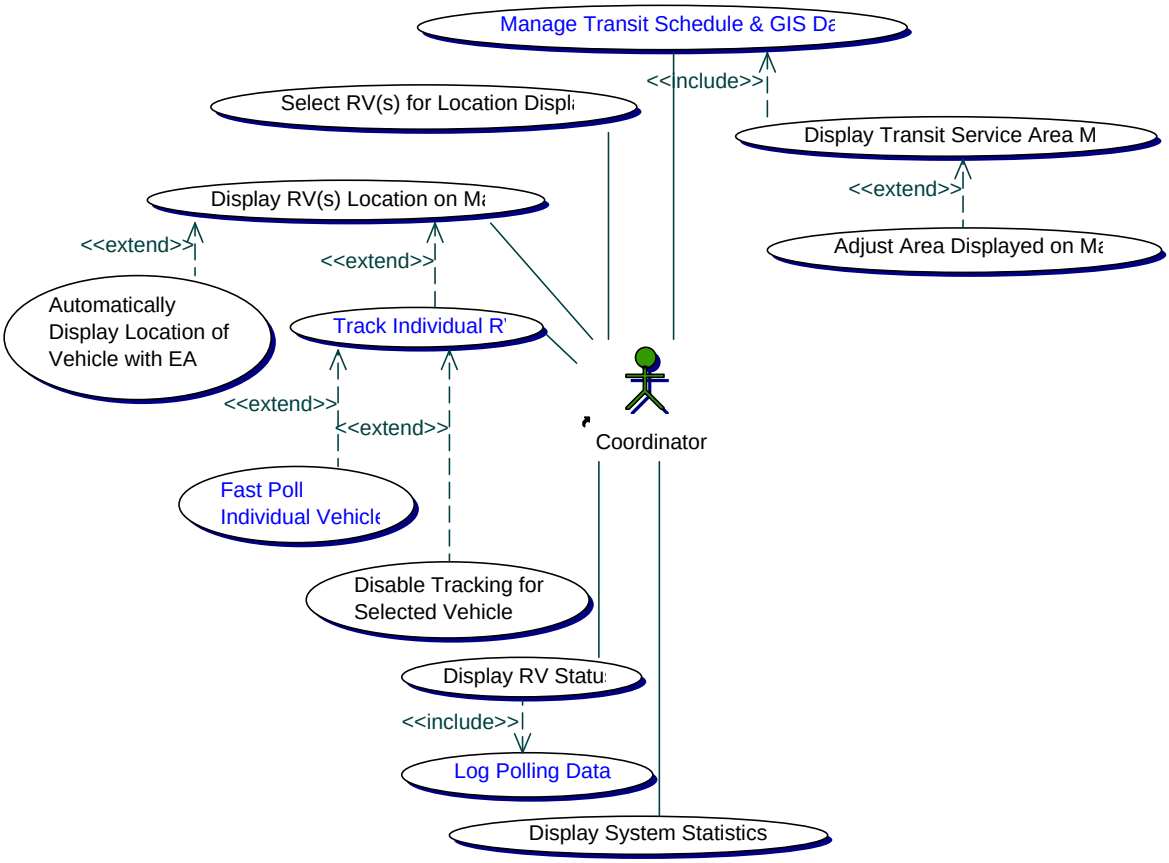
3.B.4.2.5. CC5-Initiate Communications to Revenue Vehicle

This use case package includes the following UML diagrams:

UseCase Diagrams

Figure ***3.B.4.2.5.CC5.a. CC5-Initiate Communications to Revenue Vehicle***

Figure 3.B.4.2.5.CC5.a. UseCase Diagram CC5-Initiate Communications to Revenue Vehicle



6. CC5-Initiate Communications to Revenue Vehicle

1. Brief Description

This use case describes how Communications Coordinators will utilize the CCS to initiate voice radio communications and text messages to one or more Revenue Vehicles.

2. Pre-conditions

The CCS and radio system are up and running and in good health, as described in use case ***CC14-Manage System Health.***

A Coordinator login has been completed, with a valid Coordinator assignment including radio communications privileges according to an active Strategy. (See use case ***CC13-Manage Configuration.***)

A Revenue Vehicle login has been completed. (See use case ***RV1-Initiate Vehicle for Operation.***)

3. Flow of Events

The use case is triggered when a Communications Coordinator needs to provide information to one or more Revenue Vehicles through a radio call.

3.1 Basic Flow

Select message recipient(s)
Communications Coordinator shall select recipient or recipients for a voice radio call.

1) Coordinator may select an individual Revenue Vehicle by providing (selecting or entering) one of the following vehicle identifiers:
   a) The vehicle's identification number (VID).
   b) An operator identification number (OID).
   c) A vehicle's block number (route/run).
2) Coordinator may select multiple vehicles by vehicle group criteria:
   a) By route cluster: A Coordinator selects vehicles to receive a radio call by route cluster or parent route, such as all route 71's, which would include all route 71, 72 or 73 coaches. **(ADJUSTED)**
   b) By service route: A Coordinator selects the vehicles to receive a radio call by service route, or the route number displayed to passengers on the vehicle signage, such as route 72.
   c) By Assigned Group: A Coordinator selects the vehicles to receive a radio call by selecting an Assigned Group or Groups.
   d) By geographic area: The Coordinator will designate the transit coaches to receive a call by selecting either a pre-defined geographic area, or a user-defined area on the map display. The system will determine which coaches are scheduled to be in the area. **(NEW)**
      i) Coordinator will also have the ability to define a time frame, for example, the next 60 minutes. The system will determine which vehicles are scheduled to be in the defined area in the next 60 minutes. (See use case ***CC13-Manage Configuration***.) **(NEW)**
3) Coordinator may select the entire in-service Revenue Vehicle fleet.
   a) Select all channels. The CCS shall provide Coordinators with the ability to transmit a radio call to the entire in-service fleet using all voice channels.
   b) Select one channel. A radio call shall be transmitted to the entire in-service fleet using one voice channel.

4) Coordinator may select two or more individual Revenue Vehicles and call them simultaneously. (NEW)

   a) Select vehicles by vehicle ID (VID). Set up the call to two or more vehicles by selecting or entering the vehicle identification numbers.

   b) Select vehicles by Operator ID (OID). Set up the call to two or more vehicles by selecting or entering the Operator identification numbers.

   c) Select vehicles by block number (route/run). Set up the call to two or more vehicles by selecting or entering the vehicles' route/run numbers.

   d) Select a "conference call." The system shall provide Coordinators with the ability to call two or more vehicles at the same time, with both Transit Operators able to hear the other. (This would be useful in arranging coach changes and transfers.)

Identify the VID(s) to receive message
Once the type of call and recipient options have been selected by the Communications Coordinator, the CCS shall identify the vehicle identification number or numbers (VIDs) that will receive the message.

1) The system shall identify the VID by searching the Revenue Vehicle login data. For example, if the Coordinator selects an individual vehicle by selecting an Operator identification number, the system shall identify the vehicle associated with the OID.

2) The system shall identify the VID for each type of required call described above.

Send call setup message to vehicle
The CCS shall send a call setup message to the designated Revenue Vehicle(s), specific to the type of message selected by the Communications Coordinator.

1) Call setup messages shall include:

   a) Single-vehicle calls.

   b) Multiple-vehicle calls, as defined above.

   c) All-vehicles calls, for calls to the in-service fleet, as defined above.

OBS/Radio system call setup
(This step is outside the scope of the CCS, and is within the scope of the OBS and the TRS. See ***RV17-Interface to 700 MHz Radio*** step *Manage Voice Communications* and ***RV12-Interface to DDU***.)

1) The transmitted call setup message is received by the vehicle OBS, which displays the message on the DDU and emits an audio alert.

2) Upon completion of a call setup by the radio system and OBS, the OBS shall transmit a call setup acknowledgment message to the CCS.

Process call setup
The CCS shall process the radio call setup.

1) The CCS shall receive a call setup acknowledgment message from the OBS.

2) The CCS shall display a "call setup complete" message on the Coordinator's computer-aided dispatch screen.

   a) The message shall include the radio channel utilized for the call.

Conduct radio voice communication
The Coordinator and Operator communicate utilizing voice communication functions of the TRS.

(This step is outside the scope of the CCS, and is within the scope of the OBS and radio system.

See ***RV17-Interface to 700 MHz Radio*** step Manage Voice Communications.)

The Transit Operator picks up the mobile radio handset and communicates verbally with the Coordinator. Alternatively, the Coordinator may choose to broadcast over the vehicle's hailing speaker, utilizing the functions of the TRS.

End radio voice communication
At the conclusion of the radio call, the Coordinator shall execute the "End Call" function to end the radio connection to the vehicle.

1) The CCS shall end the radio connection to the vehicle and vacate the channel.

Log messages
The CCS shall log all messages sent between the CCS and the Revenue Vehicle.

See ***CC12-Manage Data Reporting*** and ***CC14-Manage System Health*** use cases.

3.2 Alternative Flows

3.2.1 Initiate text message to Revenue Vehicle ***(NEW)***

Select vehicle(s) to receive text message
The Coordinator shall select vehicles to receive text messages as defined in the Basic Flow step *Select message recipients*.

Coordinator will select message recipients by the following criteria:

1) VID.
2) OID.
3) Block.
4) Route cluster.
5) Service route.
6) Assigned Group.
7) Geographic area.
8) All in-service vehicles.

Select pre-defined text message
The Coordinator shall be able to select from a list of pre-defined text messages to transmit to one or more vehicles, for display on the DDU.

1) The content of the text messages selected by the Coordinator and displayed on the DDU may change over time and shall be configurable by the CCS Administrator. (See use case ***CC13-Manage Configuration***.)
2) An initial set of 25 text messages shall be defined in the design phase, subject to KCM Project Manager approval.
    a) The number of pre-defined text messages available to Coordinators shall be determined in the design phase.
    b) The predefined text message function shall include a "cancel" or "undo" feature to cancel a message or exit the function before the message is sent.

Compose custom text message
Coordinators shall have the ability to compose and transmit custom text messages to Revenue Vehicles, for display on the DDU.

1) The CCS text-messaging function shall provide typical basic word-processing functions for ease of use including:
   a) Message delete.
   b) Message editing functions, including copy, paste, delete text, and spell-check.
      i) Function will provide the ability to cut and paste text messages into an e-mail or Word document.
   c) The custom text-message function shall include a "cancel" or "undo" feature to cancel a message or exit the function before the message is sent.

Send text message
The Coordinator shall execute a "send" text-message function to transmit the text message to the selected vehicle or vehicles.

1) The CCS shall transmit a data message for the selected text message via the radio system interface.

3.2.2 Select alternative broadcast method for audio messages

Select PA broadcast
The Coordinator shall have the option of broadcasting a voice radio call over the vehicle's public address system.

1) Coordinator will set up the call by selecting a "PA" menu item on the CCS CAD module, or by some similar method.
2) The "PA" call function shall allow Communications Coordinators to select a vehicle or multiple vehicles to receive the audio announcement by specifying one of the following criteria:
   a) VID.
   b) OID.
   c) Block.
   d) Route cluster.
   e) Service route.
   f) Assigned Group.
   g) All in-service vehicles on all voice channels.
   h) All in-service vehicles on one channel.
3) Coordinator will send the PA call setup message by clicking a “send” toolbar button or pressing the Enter key, or by some similar method.
4) The CCS shall identify the VIDs associated with the PA call, and shall send the PA call setup message to each of the VIDs, via the radio system interface.
   a) The OBS sets up to receive the PA call. (See use case ***RV17-Interface to 700 MHz Radio***.) (Note that this step is not within the CCS scope).
5) Coordinator will make the audio announcement utilizing the audio-communications function of the radio system. The announcement is broadcast over the vehicle's PA system. (This step is not within the CCS scope).
6) Coordinators will have the ability to end the PA call and vacate the channel.

Select recorded message (NEW)
Coordinators shall have the ability to quickly record messages and transmit them to the Operator's radio handset or coach hailing speaker.

1) Users may select a time frame to repeat the message, such as every 15 minutes or other user-defined timeframe. (See use case ***CC13-Manage Configuration***.)

3.2.3 Call unlogged Revenue Vehicle

Initiate call to unlogged coach
Coordinators shall be able to initiate a call to an unlogged vehicle that has left an operating base without completing a login. (See use case ***CC2-Log in Revenue Vehicle.***)

1) Coordinators will initiate an unlogged vehicle call by a streamlined method, such as clicking on the vehicle's symbol on the AVL map display, and launching the call to the VID by using a context menu.
2) CCS will provide the ability to initiate a call to all unlogged Revenue Vehicles. (NEW)

3.2.4 Initiate a call to vehicle in Transit Tunnel

Support Tunnel radio communications
The CCS functions described in this use case shall support seamless radio call management for transit coaches operating in the Downtown Seattle Transit Tunnel.

1) Revenue Vehicles entering the Tunnel shall switch to an open voice channel monitored by a tunnel controller. (See use case ***RV17-Interface to 700 MHz Radio*** and Subsection ***1.C.6.2, Joint Tunnel Operations***.) Radio communications from the vehicles in the Tunnel will be the responsibility of the tunnel controller, rather than a Communications Coordinator. (NEW)
2) Vehicles will return to data mode upon exiting the Tunnel, and responsibility for radio communications will revert back to the Communications Coordinator. (NEW)
3) The CCS design shall accommodate joint Tunnel operations with Sound Transit light rail. The specifics of this process will be determined jointly between the Contractor, the TRS contractor, and KCM in the design phase. (NEW)

4. Post-conditions

A communication has been initiated from the Communications Center System, and received by the OBS.

5. Special Requirements

5.1 Technical specifications

Call Initiation function design
The CCS Revenue Vehicle call-initiation functions described in this use case and their integration with the TRS shall be designed in collaboration with the TRS contractor and KCM.

Discuss your firm's experience in designing and implementing this functionality. What factors are critical in assuring a reliable communications for the functions described in this use case? Specifically, what performance measures do you propose to demonstrate the reliability of these functions?

5.2 Performance

Call-Setup Speed
The CCS and OBS call-setup process shall support KCM-determined speed requirements for calls initiated at the CCS:

1) The process utilized by the CCS and OBS to set up single vehicle calls shall not exceed two seconds to complete the call setup.

2) The call-setup process between the CCS and OBS for multiple vehicle or group calls shall not exceed three seconds

3) The process for the CCS and OBS to set up an "all vehicles" call shall not exceed one second.

5.3 Testing

Initiate Communication to RV Testing
The functions described in this use case shall be tested independently, and in conjunction with the TRS and On-Board Systems as described in Subsection **3.A.7.5, Testing**.

5.4 Usability

CAD User Interface
The user interface for the CCS functions described in this use case shall be determined in the design phase, subject to the KCM Project Manager approval.

1) The system shall provide Coordinators with a specific audio cue to indicate that a call setup or text messages has been sent from the CAD console. **(ADJUSTED)**

   a) CCS audio cues shall be configurable by the CCS Administrator. (See use case ***CC13-Manage Configuration***.)

2) The CCS shall provide Coordinators with a "store call" function for streamlining the call setup process for situations where the same coach will be called repeatedly. The function shall provide a way to flag or "bookmark" a call to repeat the call process to a selected coach. **(NEW)**

3) The user interface for the functions described in this use case shall provide ease of use greater than or equal to the legacy system user interface, measured by user satisfaction ratings.

6. Extension Points

CC2-Log in Revenue Vehicle

CC12-Manage Data Reporting

CC13-Manage Configuration

CC14-Manage System Health

RV12-Interface to DDU

RV17-Interface to 700 MHz Radio

7. Assumptions

The radio system will provide the ability for Coordinators to initiate a radio call to individual Revenue Vehicles or the fleet when the CCS is not operational, or the radio system is in voice mode (default operation mode). (See use case ***CC15-Transition CCS.***)

8. Issues

Propose features and approach for providing a user-friendly text-messaging function, both custom and pre-defined.

Describe a recommended approach for providing text messages for brief communications such as "Oil spill on I-90 westbound express lanes. Expect delays." Describe the factors that will determine the maximum length of the text message, given the known characteristics of the next radio system.

*For the purpose of transmitting re-route information, the CCS shall accommodate custom text messages to the OBS, such as the sample reroute in Figure **3.B.4.CC5.b, Sample Reroute for Text-Messaging Function**, below.*

Propose options for providing planned and unplanned re-route information to the OBS, given the known characteristics of the next KCM radio system. Describe any unknown radio system characteristics that may impact the recommended approach and their potential impact on the transmission of re-routes.

Figure 3.B.4.2.5. CC5. Sample Reroute for Text-Messaging Function

REROUTE #:**02-929-02**	ROUTE #:929
START DATE:6/24/02 REVISION DATE:	BY COORD/DIST #:D 41A
START TIME: Start of Service	REASON:Bridge Construction
DAYS OF OPERATION:All	END DATE:9/27/02
HOURS OF OPERATION:**24 Hours**	CHANNEL #:4

Eastbound:	**Westbound:**
Regular route to W Snoqualmie Valley Rd NE & NE 124 St	**Regular route to Carnation-Duvall Rd NE & Valley St.**
R on NE 124 St	**R on Valley St**
L on Carnation-Duvall Rd NE (SR203)	**L on Brown Av NE**
R on Valley St	**S f/s NE Richardson St (Drop Off / Pick Up**
L on Brown Av NE	**point for all of Duvall) Near True**
S f/s NE Richardson St(Drop off / Pick Up	**Value Hardware Store**
Point for all of Duvall) Near True	**C on Brown Av NE**
Value Hardware Store	**R on NE Ring St**
C on Brown Av NE	**L on 1 Av NE**
R on NE Ring St	**L on NE Stephens St**
L on 1 Av NE	**L on Carnation-Duvall Rd / Main / (SR203)**
L on Stephens St	**R on NE 124 St**
L on Carnation-Duvall Rd / Main / (SR203)	**L on W Snoqualmie Valley Rd NE**
C on Regular Routing	**C on Regular Routing**

Note:The “Main & Cherry” timepoint is replaced by “Brown & Richardson” on the reroute

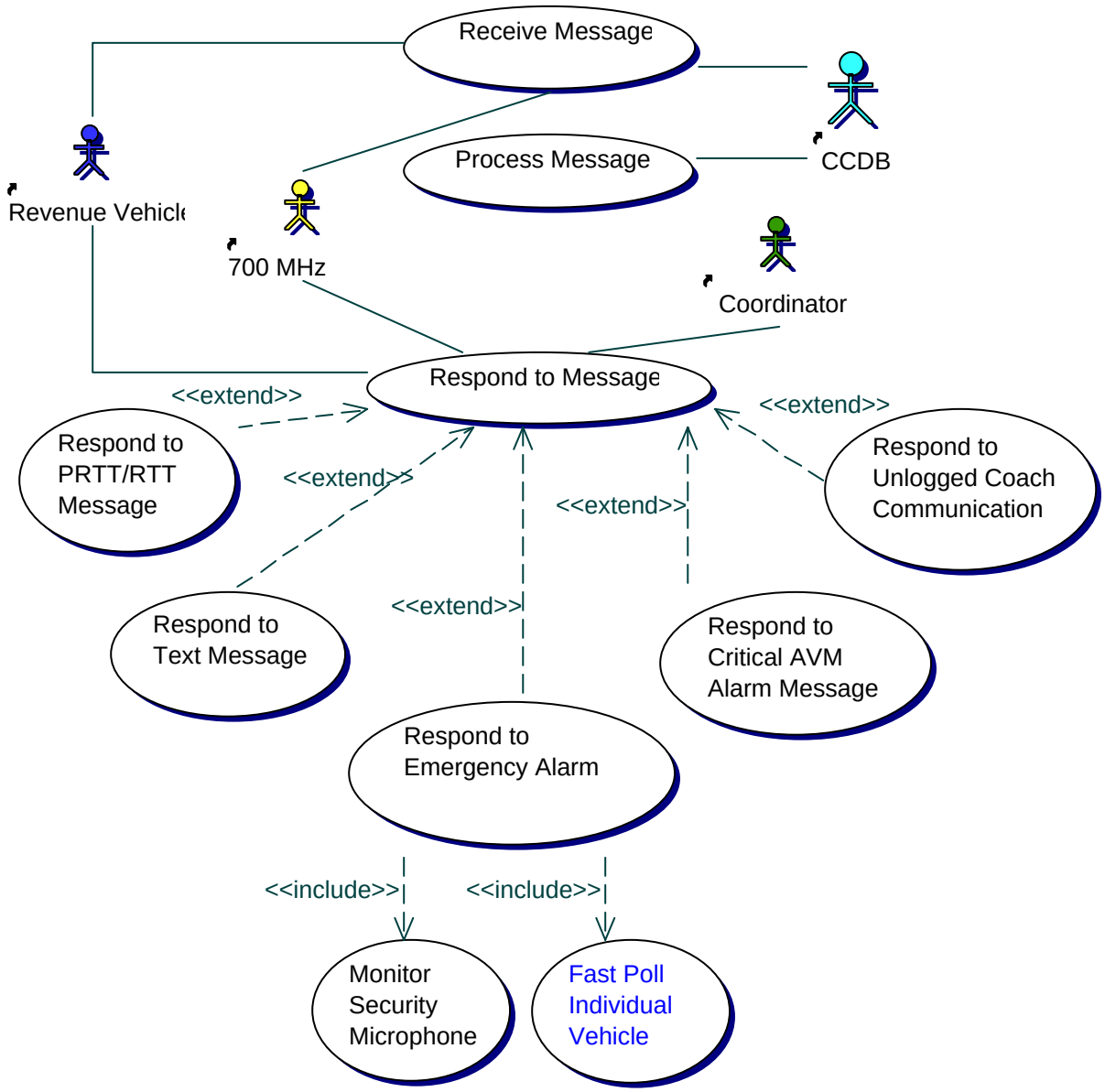
3.B.4.2.6. CC6-Respond to Revenue Vehicle Communications

This use case package includes the following UML diagrams:

UseCase Diagrams

Figure ***3.B.4.2.6. CC6-Respond to Revenue Vehicle Communications***

Figure 3.B.4.2.6. UseCase Diagram CC6-Respond to Revenue Vehicle Communications



7. CC6-Respond to Revenue Vehicle Communications

1. Brief Description

This use case describes how Communications Coordinators will utilize the CCS to respond to radio communications from Revenue Vehicles: PRTTs, RTTs, Emergency Alarms, and text messages, utilizing the CCS radio call management, prioritization, and queuing functions.

2. Pre-conditions

The CCS and radio systems are up and running and in good health as described in use case ***CC14-Manage System Health***.

A Coordinator login has been completed. (See use case ***CC1-Log in CCS User***.)

A Revenue Vehicle login has been completed, as described in use case ***CC2-Log in Revenue Vehicle***.

A Revenue Vehicle has sent a radio message (either a PRTT, RTT, Emergency Alarm, or text message) to the Communications Center. (See use case ***RV17-Interface to 700 MHz Radio**.)*

3. Flow of Events

This use case is triggered when the CCS receives a radio message originating from a vehicle via the radio system interface.

3.1 Basic Flow

Acknowledge RTT or PRTT
Upon receipt of a PRTT or RTT message by the CCS, the system shall transmit an acknowledgment message to the Revenue Vehicle, triggering an acknowledgment to be displayed on the DDU. (See use case ***RV12-Interface to DDU***.)

Assign Request to Talk message to Coordinator
The CCS shall assign the PRTT or RTT message to the appropriate Coordinator's call-management queue by employing the "Strategies" process. (See use case ***CC13-Manage Configuration***.)

1) The CCS shall determine which call group and Coordinator assignment are associated with the vehicle, based on:
    a) The vehicle's current service route, provided by the Revenue Vehicle.
    b) Call group and Coordinator assignment responsible for the service route.

Route and display incoming message in call queue
The CCS shall place the incoming PRTT or RTT into the appropriate Coordinator's call-management queue by message priority and the time of day the message was received.

1) The CCS call-management module shall provide three call queues: the PRTT call queue, the RTT call queue, and the EA call queue.
2) The system shall display each PRTT and RTT in its respective queue, sorted by time of receipt, with the oldest message appearing at the top of the queue.
    a) If a PRTT is received by the CCS as a follow-up to an EA, then see Alternative Flow *Receive Emergency Alarm Message from Revenue Vehicle*.
3) The CCS shall display the radio login data associated with the Request to Talk message in the Coordinator’s call queue including route/run, Operator ID, vehicle ID, service route, and the time of day the message arrived in the CCS.

a) When a Transit Operator submits an "upgrade" from a RTT to a PRTT, the system will delete the message from the RTT queue and place it in the PRTT queue, with the original data associated with the first message, such as time of receipt and time of upgrade. **(ADJUSTED)**

i) The upgraded message shall be displayed at the bottom of the PRTT queue.

b) When a Transit Operator cancels an RTT or PRTT, the CCS shall remove the message from the Coordinator's call queue, and log the message cancellation as a reported CCS event. (See use case ***CC12-Manage Data Reporting***.) **(NEW)**

4) At the same time the system displays the call in the Coordinator's queue, the CCS shall emit a specific tone from the CAD console to alert the Coordinator to the incoming radio message.

Select message from call queue
The Coordinator shall be able to select a Request to Talk message from his call queue display.

Methods for executing this function are described in the Usability section of this use case, below.

Set up call and conduct voice communications
The CCS shall set up a radio call to the Operator by sending a single vehicle call setup message.

The setup message is executed by completing the following steps of the use case ***CC5-Initiate Communication to Revenue Vehicle***:

Identify the VID(s) to receive message

Send call setup message to vehicle

OBS/Radio system call setup

Process call setup

Conduct radio voice communications

End radio voice communication

Log messages

Delete call from queue
Following the end of the radio call, the CCS shall automatically delete the PRTT or RTT from the Coordinator's call queue.

3.2 Alternative Flows

3.2.1 Respond to Emergency Alarm

Receive Emergency Alarm message from Revenue Vehicle
The Communications Center System shall receive and process Emergency Alarm messages from Revenue Vehicles. (See *Manage Emergency Alarm* step in use case ***RV17-Interface to 700 MHz Radio***.)

The Emergency Alarm data-message content description is described in the Technical Specifications section of this use case, below.

Trigger alarms in the Communications Center
Emergency Alarms shall be transmitted from a Revenue Vehicle to the CCS via two simultaneous paths.

1) EA shall be transmitted as a conventional data message on a data channel.

2) EA shall be transmitted as a data burst on a voice channel or a second data channel. This is to ensure EA delivery to the CCS if the radio system is operating under limited operations (fall back or voice mode), as well as to provide a redundant Emergency Alarm communications path during normal radio operations.

a) The backup path for communicating Emergency Alarms shall provide the ability to monitor radio channels for any EA activity. The presence of an EA data message shall trigger a dedicated EA printer and the audio alarms from the radio consoles.

i) The method for providing audio and visual alarms related to an EA shall be reviewed in the design phase in conjunction with the 700 MHz Radio contractor.

ii) Upon detecting an EA data message, the CCS shall send the EA message and its related data to a dedicated printer. The CCS shall print the data related to the incoming EA including:

(1) All data related to the EA message as described in the Technical Specifications section. **(ADJUSTED)**

(2) The date and time of day that the EA data message was detected by the CCS.

(3) The number of the voice channel that transmitted the EA.

iii) Provide a program to display the EA location on a King County street network map, independent of CCS CAD/AVL availability. **(NEW)**

3) All EA events shall be logged in the CCDB.

Queue and display Emergency Alarm messages

The system shall display Emergency Alarm messages in the EA queue in the order received.

1) The system shall display incoming EA messages in the EA call-management queues of all logged-in Coordinators with active assignments in the current Strategy. (See use case ***CC13-Manage Configuration***.)

a) The CCS shall display the data associated with the Emergency Alarm message in each Coordinator's EA queue, including:

i) Route/run.

ii) Operator ID.

iii) Vehicle ID.

iv) Service route.

v) Time of day the message arrived at the CCS.

Acknowledge Emergency Alarm

Coordinators shall use the CAD system to acknowledge responsibility for responding to an EA.

1) The system shall allow one Coordinator to utilize the CAD system to acknowledge the EA by selecting the "EA" menu toolbar button of the CAD screen, or selecting the F5 keyboard function key or similar action.

2) Acknowledgment of an EA by a Communications Coordinator shall end any audio or visual alarms related to the EA.

3) The system shall provide the Coordinators who have not acknowledged the EA with the ability to delete the message from their EA queues.

a) The system shall indicate an EA message that has been acknowledged with an "A" displayed beside the message in the Coordinator's queue, or by some similar method.

b) The system shall allow only acknowledged Emergency Alarms to be deleted from the EA queue.

4) Upon acknowledgment of the Emergency Alarm by a Coordinator, the CCS shall transmit an Emergency Alarm acknowledgment message to the Revenue Vehicle.

Fast-poll vehicle with EA
After the CCS sends the EA acknowledgment message, the CCS shall initiate "fast-polling" of the vehicle at an accelerated rate (e.g. every five seconds), as opposed to the usual polling rate. (See use case ***CC3-Manage Revenue Vehicle Polling***.)

Display EA information on Coordinator's console
The CCS shall automatically display information related to the Emergency Alarm on the acknowledging Coordinator's CCS console.

1) CCS will open the CSR window and populate the CSR with EA data and other known data. (See use case ***CC8-Manage Incidents***.)
2) CCS will display (maximize) AVL window indicating the vehicle's location. (See use case ***CC4-Monitor Revenue Vehicles***.) **(NEW)**
3) Open and display the block detail view of the vehicle's schedule. (See use case ***CC7-Manage Transit Service & Geographic Data***.) **(NEW)**

Monitor security microphone **(NEW)**
Coordinators shall be able to monitor audio transmissions from the on-board security microphone of a coach with an Emergency Alarm.

1) Acknowledgment of an EA by a Coordinator shall trigger audio transmissions by the on-board security microphone on the vehicle with the EA. (See use case ***RV17-Interface to 700 MHz Radio***.)
2) Coordinators will have the option of monitoring the security microphone audio transmissions by adjusting the transmission volume at their workstations.
3) The security microphone audio transmission will end when the Transit Operator sends a follow-up PRTT or RTT in response to the EA.
    a) Coordinators will have the ability to end the security microphone transmission remotely from the Communications Center in case of a false alarm.
4) The design of the security-microphone function is contingent upon the characteristics of the 700 MHz Radio system and shall be subject to KCM Project Manager approval in the design phase.
    a) The design of the security microphone function will support provision of critical Emergency Alarm–related functions such as:
        i) The ability to fast-poll the vehicle. (See use case ***CC3-Manage Revenue Vehicle Polling***.)
        ii) The ability to initiate a radio call to the vehicle, if deemed appropriate.

Display follow-up PRTT to an EA
The CCS shall display a PRTT from the vehicle that sent the EA at the top of the acknowledging Coordinator's PRTT queue.

1) When an RTT (rather than a PRTT) is received by the CCS as a follow-up to an EA, the system shall display the RTT at the top of the acknowledging Coordinator's RTT queue.
2) The CCS shall highlight or color-code a PRTT or RTT follow-up call to an EA. **(NEW)**
3) The CCS shall flag any unanswered PRTTs or RTTs in the Coordinator's call queue that preceded the EA. **(NEW)**

Remove EA from the call queue
The Communications Coordinator shall remove an EA from the call-management queue.

1) When a situation has been resolved, the Coordinator who acknowledged the EA will select a method for deleting the EA from the queue.
   a) Close CSR. (See use case ***CC8-Manage Incidents***.)
   b) Select “Delete Call” command on the CAD.
2) The system shall end fast-polling of the vehicle with the Emergency Alarm. (See use case ***CC3-Manage Revenue Vehicle Polling***.)

3.2.2 Alternative Flow: Respond to Text Message **(NEW)**

Assign text message to Coordinator
As with request-to-talk messages, the CCS shall assign an incoming text message to the appropriate Coordinator by employing the "Strategies" process, as described in use case ***CC13-Manage Configuration***.

Route and display incoming text message
The CCS shall place incoming text messages into the appropriate Coordinator's text-message queue, with the oldest text message displayed at the top of the queue.

1) The CCS shall display the text message, such as "I need transfers," along with the vehicle login data associated with the message including OID, VID, block ID, service route, and time of day the message arrived in the Communications Center.

Select text message from queue
Coordinators shall be able to respond to a text message by highlighting the message in the queue and pressing the "Enter" key, or similar action.

1) Upon selecting the message, Coordinators shall have the ability to respond to the text message by the methods defined in the use case ***CC5-Initiate Communications to Revenue Vehicle***:
   a) A pre-defined or custom text message.
   b) A voice radio call setup message, including:
      i) A single-vehicle call.
      ii) A group call.
      iii) A fleet call.
      iv) A simultaneous call to two or more individual vehicles.
2) For text messages that are advisory in nature and require no response message from the Coordinator, Coordinator shall have the ability to delete the text message from his text-message queue after reading the message.
3) The CCS shall transmit a message to the OBS, indicating that the text message was read by the Coordinator.

3.2.3 Respond to unlogged coach communication

Respond to radio communication from unlogged coach
Communications Coordinators shall have the ability to respond to PRTTs, RTTs, and Emergency Alarms from an unlogged coach. **(ADJUSTED)**

This is intended to provide radio communications to a Transit Operator who has not yet completed the OBS login process. (See use case ***RV1-Initiate Vehicle for Operation***.)

1) The CCS shall route PRTTs and RTTs from unlogged vehicles to a designated Coordinator according to the configurable Strategies process. (See use case ***CC13-Manage Configuration***.)

3.2.4 Respond to Critical AVM alarm message ***(NEW)***

Receive critical AVM alarm text message
The CCS shall receive critical Automated Vehicle Monitoring (AVM) alarms from the OBS for certain operating conditions.

1) Critically low engine oil pressure.
2) Critically low coolant level.
3) Critically low fuel level.

Display critical AVM message
According to the Strategies process, the critical AVM alarm shall be displayed in the appropriate Coordinator's text-message queue, displaying information associated with the message including a problem description, OID, VID, and location. (See use case ***CC13-Manage Configuration***.)

1) The specific content of the messages shall be drafted in the CCS design phase, subject to KCM Project Manager approval.
   a) The message shall be red-flagged or highlighted in some way so it is easily identified.
   b) It is assumed the Coordinator would call the Transit Operator to verify the condition of the coach and provide further direction. The Coordinator would then call Vehicle Maintenance for their assistance.

3.2.5 Respond to automated "Late beyond recovery time" message

Receive automated "Late beyond recovery time" message **(NEW)**
Coordinators shall receive an automated "Late beyond recovery time" message generated from the Revenue Vehicle as described in ***RV8-Monitor Route and Schedule Adherence***, step *Monitor schedule adherence data*.

1) The message shall appear in the appropriate Coordinator's text-message queue and shall be processed as described above in Alternative Flow *Respond to Text Message*.
2) The Coordinator shall have the ability to toggle on or off as needed his or her receipt of automated "Late beyond recovery time" messages.
3) The amount of lateness that triggers receipt of automated "Late beyond recovery time" messages by a Coordinator shall be configurable by an individual Coordinator. (See use case ***CC13-Manage Configuration***.)

3.2.6 Respond to Early Pull-In Message

Process Early Pull-In message

The CCS shall receive and process Early Pull-In messages automatically transmitted by the OBS to the CCS when the vehicle returns to the base prior to its scheduled pull-in time (see use case ***RV8-Monitor Route and Schedule Adherence***).

1) The amount of earliness in minutes that triggers the message from the OBS shall be configurable by OBS/CCS administrators. See use case ***RV8-Monitor Route and Schedule Adherence***.
2) The Early Pull-In message shall be processed, routed to the appropriate Coordinator, and displayed as a text message as described in Alternative Flow *Respond to Text Message*.
3) The CCS shall provide individual Coordinators the option to display or not display the messages on the CAD screen as a user preference. See use case ***CC13-Manage Configuration***.

3.2.7 Respond to Tunnel Bus Communication

Respond to Tunnel Bus communication
The CCS shall provide seamless radio call management for responding to communications from vehicles operating in the Downtown Seattle Transit Tunnel.

1) Revenue Vehicles entering the Tunnel shall switch to an open voice channel monitored by a Tunnel controller. Vehicles shall remain in voice mode while in the Tunnel. (See use case ***RV17-Interface to 700 MHz Radio*** and Subsection **1.C.6.2, Joint Tunnel Operations**.) Radio communications from the vehicles in the Tunnel will be the responsibility of the tunnel controller, rather than a Communications Coordinator. **(NEW)**

2) Vehicles will return to data mode upon exiting the Tunnel, and responsibility for radio communications will revert back to the Communications Coordinator. The CCS shall assign responsibility for responding to communications from the vehicle to Coordinators per the Strategies process. (See use case ***CC13-Manage Configuration***.) **(NEW)**

3) The specifics of this process will be determined jointly between the OBS/CCS and TRS contractors and KCM in the design phase.

4. Post-conditions

Communication is successfully completed.

5. Special Requirements

5.1 Technical Specifications

Message acknowledgments
The communications described in this use case shall be subject to the communications protocols and process described in Subsection **3.A.6.6, Communications Layers**, including the use of directed message acknowledgments (e.g. RTT-ack, PRTT-ack, EA-ack) rather than generic acknowledgments.

Emergency Alarm data message
The Emergency Alarm data message transmitted by the Revenue Vehicle shall include data identified as necessary by KCM. **(ADJUSTED)**

1) Vehicle identification number (VID).
2) Vehicle location (x, y). **(NEW)**
3) Location confidence factor. (See *Quality and Confidence Factors* step in ***RV7-Determine Vehicle Location*** use case.) **(NEW)**
4) Block ID (route/run).
5) Service route currently operated by the vehicle. **(NEW)**
6) Desirable options, if the data message can accommodate:
   a) Operator identification number (OID).
   b) Route Adherence (an on/off route flag). **(NEW)**
   c) Schedule adherence. **(NEW)**
   d) Passenger Count, if available. **(NEW)**

Communications Management function design
The CCS communications management functions described in this use case and their integration with the TRS shall be designed in collaboration with the TRS contractor and KCM.

Discuss your firm's experience in designing and implementing this functionality. What factors are critical in assuring a reliable communications for the functions described in this use case? Specifically, what performance measures do you propose to demonstrate the reliability of these functions?

Control EA video duration
Coordinators shall have the ability to extend or stop video recording of an event related to an Emergency Alarm. (See use case ***RV15-Interface to DVRS.***)

5.2 Performance

Respond to Revenue Vehicle communications function performance
The CCS shall complete any user-initiated command described in this use case within one second.

1) Call setup and other radio communication performance requirements are described in use case ***CC5-Initiate Communications to Revenue Vehicle***.

5.3 Testing

Each function in this use case shall be tested independently and in conjunction with the 700 MHz Radio System and OBS, subject to Level 2 testing requirements described in Subsection **3.A.7.5, Testing**.

5.4 Usability

Audio Cues
The CCS shall provide distinct audio cues to alert Coordinators to the type of incoming messages, to be determined in the design phase and subject to KCM approval.

Select message from call queue
The CCS shall provide multiple methods for Coordinators to select a PRTT or RTT from their call queues for a radio call setup.

Methods shall include:

1) Select “first call” menu option. The Coordinator may select the Request to Talk message (a PRTT or RTT) from the calls listed in the call queue by pointing and clicking on the “First Call” menu button on his PC screen, or by pressing the F1 keyboard key or similar options.
2) Select first PRTT call (oldest). By selecting the first call functions, the system shall select the oldest unanswered PRTT.
3) Select first RTT call (oldest). If there are no unanswered PRTTs, the first call function shall select the oldest unanswered RTT.
4) Highlight and select one call. Alternatively, the Coordinator may select the Request to Talk message (a PRTT or RTT) by highlighting the call listed in the call queue.
5) The CCS shall visually indicate that the call is selected from the queue for a radio call setup.

Respond to Revenue Vehicle communications user interface
The user interface for the CCS function described in this use case shall be determined in the design phase, subject to KCM CCS Project Manager approval.

1) The user interface shall provide ease-of-use greater than or equal to the legacy system user interface, measured by user satisfaction ratings.

6. Extension Points

CC3-Manage Revenue Vehicle Polling

CC4-Monitor Revenue Vehicles

CC5-Initiate Communication to Revenue Vehicle

CC7-Manage Transit Service & Geographic Data

CC8-Manage Incidents

CC12-Manage Data Reporting

CC13-Manage Configuration

RV1-Initiate Vehicle for Operation

RV 8-Monitor Route and Schedule Adherence

RV12-Interface to DDU

RV17-Interface to 700 MHz Radio

7. Assumptions

The TRS will provide the ability for Coordinators to initiate and respond to radio calls to and from individual Revenue Vehicles and the fleet when the CCS is not operational, or when the radio system is in voice mode (default operation mode). (See use case ***CC15-Transition CCS***.)

8. Issues

Should receipt of a call setup message from the CCS elicit a poll response from the vehicle (current practice) along with a "call setup complete" message?

Propose a recommended approach for providing the CCS text message functions described in this use case to Communications Coordinators, including key user functions.

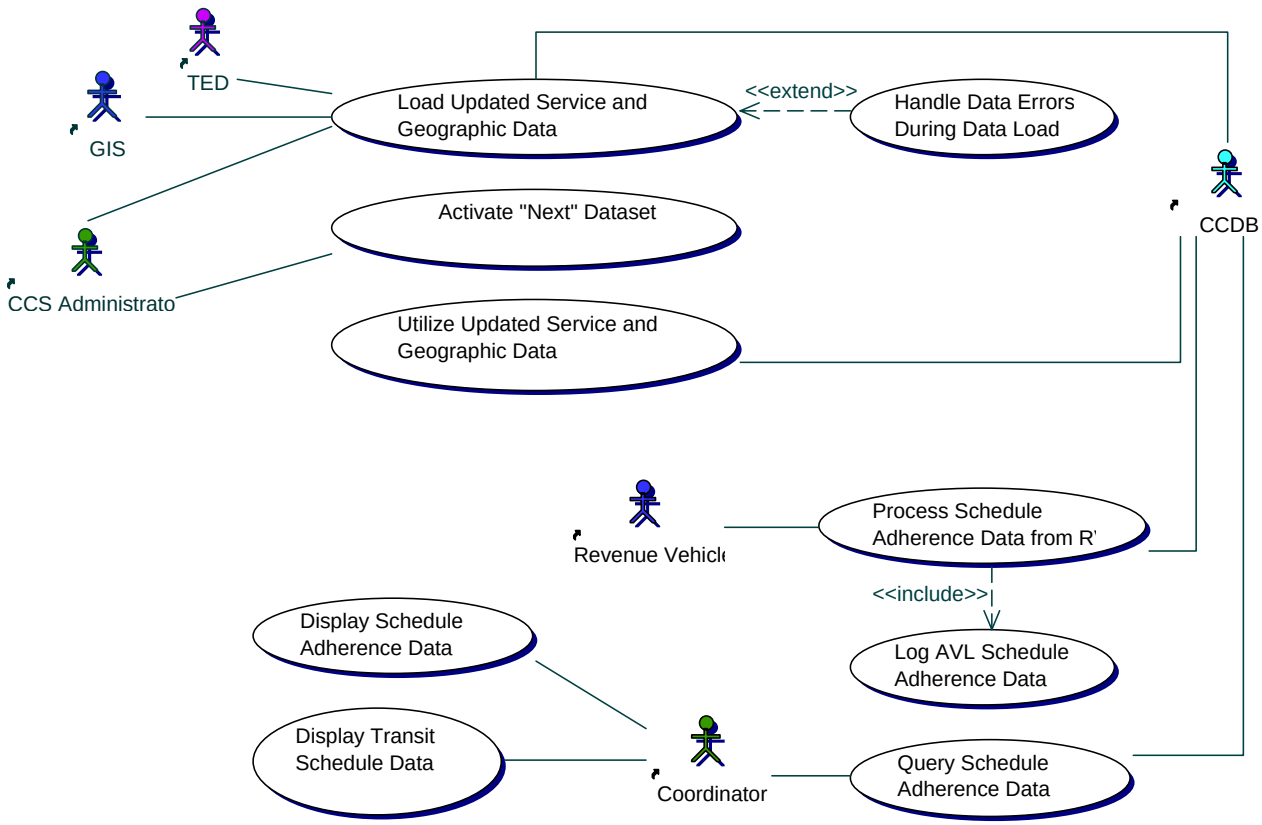
3.B.4.2.7. CC7-Manage Transit Service & Geographic Data

This use case package includes the following UML diagrams:

UseCase Diagrams

Figure ***3.B.4.2.7.CC7. CC7-Manage Transit Service & Geographic Data***

Figure 3.B.4.2.7.CC7. UseCase Diagram CC7-Manage Transit Service & Geographic Data



8. CC7-Manage Transit Service & Geographic Data

1. Brief Description

This use case describes the processes by which planned service data and actual schedule adherence data are provided to the CCS and processed, logged and displayed for CCS users. Data originating from the King County Metro Transit GIS is imported to update the geographic information displayed by the CCS AVL function.

Transit service data are updated as part of the service data production process for the OBS and CCS. (See use case ***BO2-Update Vehicle Data***.) CCS service data are updated to reflect changes in Revenue Vehicle planned operations, effective on a specified date. Typically, data updates will be provided to the CCS on a biweekly basis, but may occur more frequently.

Geographic service data unique to the CCS AVL function (see use case ***CC4-Monitor Revenue Vehicles***) are updated to reflect KCM GIS map and other data changes identified since the last update.

Schedule adherence data from the OBS are received and processed by the CCS, and made available for near-real-time access by CCS users.

2. Pre-conditions

Updated transit service data are stored in TED, the Transit Enterprise Database.

Updated geographic service data, including GIS spatial data, are available from a KCM production database.

The CCDB is up and running.

3. Flow of Events

This use case is triggered when new transit service or geographic service data are available. The CCS Administrator begins the CCS service and geographic data import process.

3.1 Basic Flow

Load updated service and geographic data
The CCS shall incorporate updates of KCM transit service and geographic data from TED and other Transit databases.

The CCS shall provide a data import process that will include:

1) CCS will import “Next” (latest available) service and geographic data updates. See Technical Specifications, *Data details*, below for data description.
2) The KCM CCS Administrator will manage the CCS service and geographic data import process. The CCS Administrator will:
    a) Select the appropriate service data from TED.
    b) Import the service data into the CCDB.
    c) Overwrite obsolete schedule tables from the CCDB.
    d) Import updated geographic service tabular data and shape files to CCS, including stop locations, timepoint locations, street names, and map shape files.
    e) Verify the process and data quality.
        i) The CCS will ensure that the imported data are complete by processes including but not limited to verifying row counts, field contents, and constraints.
        ii) The CCS shall provide a mechanism for ensuring that the service and geographic data-load process does not introduce errors.

Activate "next" dataset
The CCS Administrator shall implement the service and geographic data updates as the current version of the system's schedule and GIS data.

1) The CCS Administrator shall be able to replace or change the trigger for the data update for both the CCS and OBS.
2) "Next," "current," and "previous" data sets shall be available for activation by the CCS Administrator.
3) The CCS Administrator Toolkit shall allow the CCS Administrator to revert to the previous dataset if necessary.
4) The CCS shall provide CCS Administrators or User Administrators with the ability to revert the OBS to the previous dataset via radio command. This will allow a service dataset rollback on vehicles that have left the base.
5) The process shall ensure that the OBS and CCS operate utilizing the same service data set at all times. The CCS Administrator Toolkit for managing dataset activation shall provide both OBS and CCS Administrator Toolkit functions. **(NEW)**

Utilize updated schedule and geographic service data
The CCS CAD/AVL functions shall utilize the updated schedule and geographic service data as the current data set.

1) The CCS AVL function will utilize KCM geographic service data for displaying vehicle locations on the Communications Coordinators' CCS AVL display. See the use case ***CC3-Manage Revenue Vehicle Polling*** and Subsection **3.A.6.5, GIS/Map Characteristics**.
2) The CCS will provide a user interface for Coordinator access to destination sign codes, exterior and interior stop announcement data, and other OBS service data. The user interface will be determined in the design phase and subject to KCM approval. **(NEW)**

Display transit schedule data
The CCS shall provide Communications Coordinators with automated desktop access to transit service schedule data.

1) Provide Coordinators with the ability to view schedule data by schedule type, i.e. for weekday, Saturday or Sunday service for the active, current schedule dataset.
2) The system shall provide Coordinators with the following tabular views of schedule data:
    a) The Base Arrival report, which displays last scheduled timepoint, scheduled base arrival time, and other data for blocks operating from a user-specified base.
    b) The Block Train report, which provides the schedule of any user-specified Route/run by trip, for terminals only.
    c) The Schedule List report, which lists all trips operating a user-specified route and direction (e.g. "S" for South) listed in order of trip start time.
    d) The Block Detail report, which lists, for a user-specified route/run, each trip in trip sequence order, and all timepoints in sequence order for each trip.

Specific data descriptions for the Base Arrival, Block Train, Schedule List, and Block Detail reports may be found in the *Technical Specifications* section below.

Process schedule-adherence data from Revenue Vehicle
The CCS shall obtain Revenue Vehicle schedule adherence data from the Revenue Vehicle's poll-response message. (See the *Log Polling Data* step in use case ***CC3-Manage Revenue Vehicle Polling***.) **(ADJUSTED)**

1) The CCS will process and store schedule-adherence data for downstream CCS functions, such as the AVL Display. (See use case ***CC4-Monitor Revenue Vehicles***.) (ADJUSTED)

2) The CCS shall log schedule-adherence data in the CCDB for use by the CCS, primarily intended for short-term (same-day) schedule adherence reporting to Communications Center staff. (See the ***CC12-Manage Data Reporting*** and ***CC13-Manage Configuration*** use cases.) (ADJUSTED)

3) Schedule-adherence and other poll-response data provided to the CCS via the radio shall be retained for an amount of time to be determined in the design phase.

Query schedule-adherence data
Coordinators shall use the AVL display function (see use case ***CC4-Monitor Revenue Vehicles***) and the Block Detail Report to query schedule adherence data.

Display block-detail schedule-adherence data
The CCS shall provide Communications Coordinators with near-real-time schedule adherence data by populating the Block Detail schedule report with actual schedule-adherence data from the Revenue Vehicles.

1) The CCS will use AVL data to provide the actual time the vehicle operating the block arrived at or departed from a given timepoint.
   a) User may select to display the difference, in minutes, between actual and scheduled operation.
      i) Early, on-time, or late operation shall be clearly indicated (for example, “-4” to indicate four minutes late).
   b) The Block Detail report shall be available as a static schedule report if no schedule-adherence data are available for the block or if the block did not operate within the current service day.

3.2 Alternative Flows

3.2.1 Data Errors

Handle data errors during data load
The system will respond to data errors detected during the data load.

1) In the event of data errors, the CCS Administrator will be able to perform recovery operation.
   a) During the load, no errors will be allowed for data validation. (NEW)
   b) Any errors that occur will be tracked in an error table. (NEW)
   c) If data validation is not achieved, the tools shall enable CCS Administrator to reverse the data load.
   d) The CCS Administrator shall have the ability to override the data load at any point in the process, and the system shall roll back any changes automatically.

4. Post-conditions

The correct "current" and "next" service and geographic data sets are loaded into the CCDB for CCS use. The data displayed to CCS users are complete and accurate.

5. Special Requirements

5.1 Technical Specifications

Default radio voice channel
The CCS service-data management process shall accommodate default radio voice-channel assignment for a block, along with the other schedule data provided to the CCS by TED. (NEW)

Note: default radio voice channel was formerly provided to the legacy radio/AVL system through the operator login process.

Data details
Determination of a complete data set and data requirements for the CCS shall occur during system design by agreement between the Contractor and KCM.

1) KCM will provide CCS service and geographic data requirements to the CCS Contractor.
2) The Contractor will provide KCM with an interface control document and process documentation for importing KCM service and geographic data into the CCS.
3) A preliminary list of files and data sets includes:
    a) Service data (route, block, trip, schedule, and stop data).
    b) Geographic service data.
    c) Default voice radio-channel assignment for a given block. (See use case ***CC13-Manage Configuration***.)(NEW)
    d) Transit Operator identification number (OID) and name for the CAD/AVL display.
    e) Data specific to operating the OBS, including but not limited to:
        i) Destination-sign codes and data.
        ii) Exterior stop-announcement data.
        iii) Interior stop-announcement data.

Data error descriptions
All data errors detected during data load must have specific error descriptions and layperson terminology. (NEW)

Display the Base Arrival report
The system shall display the Base Arrival report data for a user-selected base.

For each block operating from the base, the report will display (in order of base arrival time):

1) The name of the block's last scheduled timepoint.
2) The block's scheduled arrival time at the last timepoint.
3) The block's scheduled arrival time at the base.
4) The block's route and run number.
5) The block's scheduled pullout time from the base.
6) The block's expected total mileage.
7) The Operator identification number and vehicle identification number assigned to the block that day, from the radio login data.

Display the Block Train report
The system shall display the Block Train report data for a user-selected block, listed in order of first to last trip.

Data will include:

1) The block's scheduled pullout time from the base.
2) The block's scheduled pull-in time.
3) For each trip the block is scheduled to operate, the report will provide:

a) The trip number.

b) The service route number operated for the trip.

c) The starting timepoint name and scheduled leave time.

d) The end timepoint name and arrival time.

e) Recovery time for the trip in minutes.

f) Relief timepoint name and scheduled time for road relief.

g) Trip-level indicates; for example Y routes. **(NEW)**

Display Schedule List report

The system shall display the Schedule List report for a user-selected service route and direction of service.

1) The report lists all trips operating the selected route and direction, listed in order of trip start time.

2) For each trip that operates the selected service route, the report will list:

a) Block number (route and run number).

b) Operating base from which the block originates.

c) The service route operated on the previous trip, if applicable.

d) The trip's scheduled pullout time from the base, if applicable.

e) The trip's scheduled start time.

f) Timepoint indicate for special operating instructions related to the timepoint.

g) The scheduled start time for the block's next trip.

h) The trip's scheduled pull-in time to the base, if applicable.

i) The service route that will be operated on the next trip of the block, and the expected schedule for each trip of the selected service route, by timepoint.

Display the Block Detail report

The system shall display the Block Detail report for a user-selected route and run.

1) The report shall list each trip in trip sequence order, and shall list all timepoints in sequence order for each trip.

2) The report shall display the following data for each timepoint of the block's expected schedule:

a) Timepoint name.

b) The scheduled arrival or departure time for the timepoint.

c) A trip indicate for special instructions, such as an express trip.

d) The amount of scheduled layover time at the timepoint, if applicable.

e) The trip number associated with the timepoint.

f) The service route number for the trip.

g) "Road relief" indicate if a road relief is scheduled for the timepoint.

h) The Block Detail report shall also provide actual schedule-adherence data for the block's on-time performance that day. See *Display Block Detail Schedule Adherence Data* step above.

5.2 Performance

Schedule data report display speed
The CCS schedule-report function shall display a user-requested schedule report within one second of a user command.

Process Block-Detail Schedule-Adherence Data
The CCS shall process schedule-adherence data for the Block Detail report and make it available to users within two seconds of a poll-response data-message arrival at the CCS.

5.3 Testing

Manage Transit Service and Geographic Data testing
Each function and supporting details described in this use case shall be tested, subject to the Level 2 testing requirements described in Subsection **3.A.7.5, Testing**.

5.4 Usability

Provide user utilities
The CCS shall provide users with schedule reports utility functions.

1) Highlight schedule line with time closest to “now:” The system display will highlight, with a colored background or other means, the line of data on the schedule report that refers to the current time of day.
2) Print report: Users will have the ability to print the schedule report they have generated.
3) Copy report: Users will have the ability to copy the schedule report to the clipboard of their PC and paste into another application.
4) For ease of use, the CCS shall provide multiple methods for accessing the Block Detail, Block Train, Schedule List, and Base Arrival reports including dedicated keyboard function keys, toolbar menu buttons, and the right-click pop-up menu. (See use case ***CC13-Manage Configuration***.)

6. Extension Points

BO2-Update Vehicle Data

CC3-Manage Revenue Vehicle Polling

CC4-Monitor Revenue Vehicles

CC12-Manage Data Reporting

CC13-Manage Configuration

7. Assumptions

The OBS and CCS will be provided with the same schedule data set by TED. Typically, data updates will be provided to the CCS on a biweekly basis, but may occur more frequently. The CCS data-update process must also ensure the CCS receives GIS shape files and schedule-list data required only by the CCS. (See use case ***BO2-Update Vehicle Data***.)

It is assumed the OBS will be provided with default radio-channel assignments through the service-data-load process by WLAN. For the service change, Service Communications staff will provide default radio-channel assignments to TED utilizing an enhancement to the Strategies tool. (See use case ***CC13-Manage Configuration***.)

8. Issues

Discuss your recommendation for providing a user interface for Communications Coordinators to OBS data elements such as stop-announcement data to enable Communications Center staff to respond to field staff questions and support OBS troubleshooting.

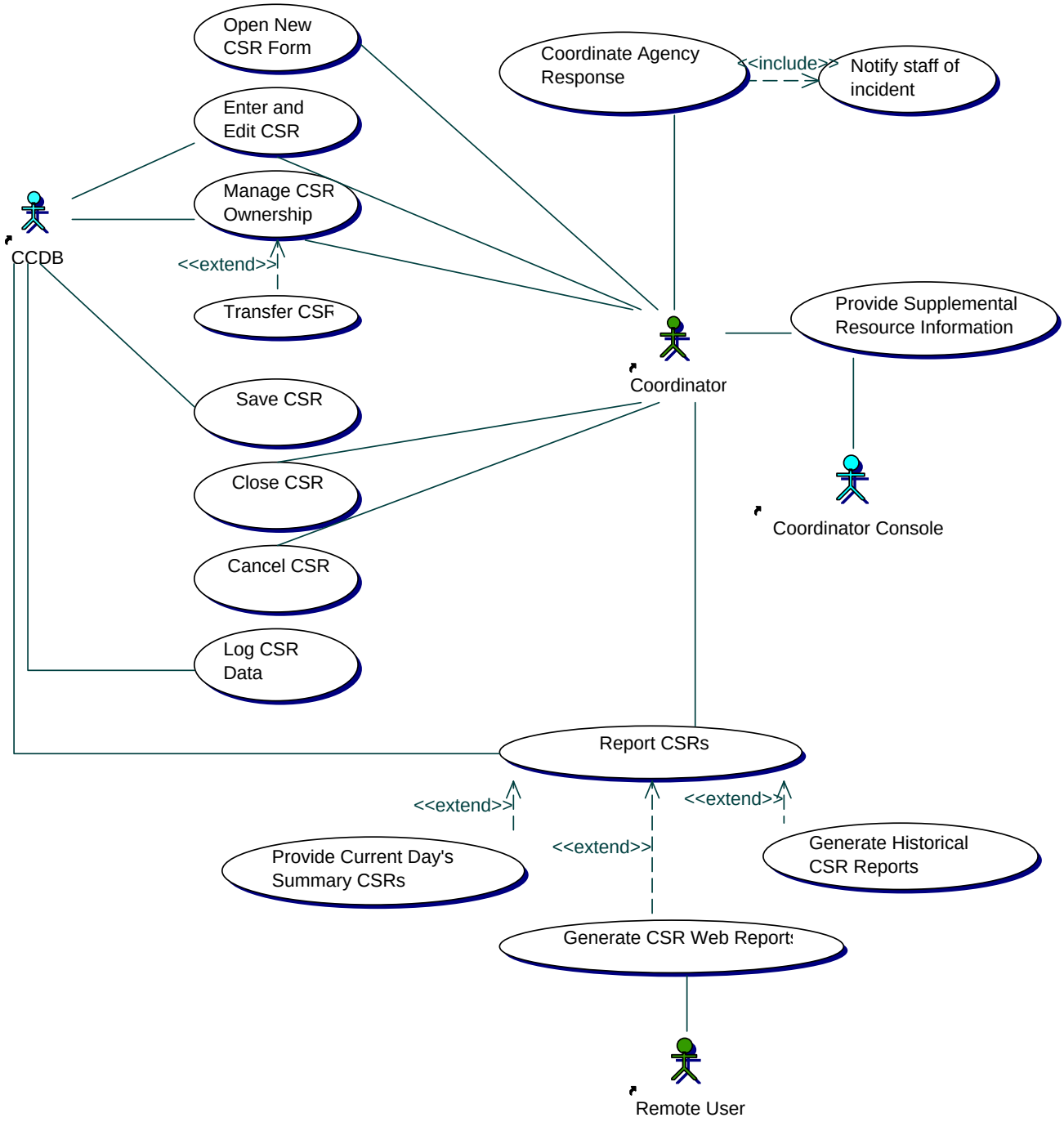
3.B.4.2.8. CC8-Manage Incidents

This use case package includes the following UML diagrams:

UseCase Diagrams

Figure ***3.B.4.2.8.CC8. CC8-Manage Incidents***

Figure 3.B.4.2.8.CC8 UseCase Diagram CC8-Manage Incidents



9. CC8-Manage Incidents

1. Brief Description

The Coordinator Service Record is Metro Transit's official corporate record of incidents affecting service and the actions taken to respond to them. Incidents requiring action by transit staff are documented and managed by Coordinators using the Coordinator Service Record (CSR). Through the CSRs, Communications Coordinators capture key data about an event, including Operator, coach, service route involved, responding staff, police case number, and other data. CSRs may include supporting documentation such as a notification list and a written summary of the incident from a Coordinator's perspective. Integration of the CSR function with other CAD/AVL system functions provides ease of use for Coordinators. CSR data are available to Service Communications staff with CCS access, and to other Transit staff through customized Web reports. Samples of existing reports can be found in Appendix **I, Legacy CAD/AVL Sample Reports**.

2. Pre-conditions

The CCS CAD/AVL functions and CCDB are available and operating.

The Radio system is available and operating.

Coordinators accessing the CSR function are logged in to the CCS, as described in use case ***CC1-Log in CCS User***.

3. Flow of Events

The use case begins typically in response to an incident or event that requires action and has come to the attention of the Communications Coordinator via a radio call from a Revenue Vehicle, field staff, or other means. See use case ***CC6-Respond to Revenue Vehicle Communications***.

3.1 Basic Flow

Open new CSR form
Communications Coordinator shall open a new individual CSR form for data entry related to an incident.

User functions related to opening a new CSR form may be found in the *Usability* section below.

Enter and edit CSR data
Communications Coordinator shall enter and edit data describing the incident into the open CSR form.

CSR data descriptions may be found in the *Technical Specifications* section below.

Manage CSR ownership
The CCS shall automatically track CSR responsibility and data-entry history.

1) The CCS will automatically enter and display the identification number of the Coordinator who opened the CSR, based on the Coordinator's CCS login. (See use cases ***CC13-Manage Configuration*** and ***CC1-Log in CCS User***.)
2) The CCS will automatically enter and display the identification number of the Coordinator who is currently responsible for the open CSR.
    a) When a Coordinator logs out of the CCS, any open CSRs for which the Coordinator is responsible will be automatically assigned to the next Coordinator responsible for the service route and Assigned Group related to the CSR, according to the Strategies process. (See use cases ***CC13-Manage Configuration*** and ***CC11-Log out CCS User***.)
3) An open CSR may be edited by any logged-in Coordinator with CSR access permission. (See use case ***CC13-Manage Configuration***.)
4) The CCS will track the history of edits (including date, time of day, and user ID) to any open or closed CSR. **(NEW)**

5) Upon execution of a Temporary Logout (TLO), the CCS will reassign the open CSRs from the Coordinator who has temporarily logged out to the Coordinator taking responsibility, per the temporary logout process. (See ***CC13-Manage Configuration*** and ***CC11-Log out CCS User*** use cases.)

   a) Upon execution of the Temporary Logout command, the reassigned open CSRs will be accessed through the recipient Coordinator's Summary CSR view. See *View current day's Summary CSRs*, below.

   b) When the Coordinator who has temporarily logged out returns and logs in again, all CSRs pertaining to that Coordinator's work assignment will revert back to that Coordinator, according to the Strategies process.

6) The CCS shall automatically enter and display the identification number of the Coordinator who closed a CSR.

Transfer CSR

A Coordinator shall be able to transfer an open CSR to another logged-in Coordinator by executing a "transfer CSR" command.

1) Upon execution of the command the other Coordinator will receive the transferred CSR on his CSR summary display, and will be allowed all CSR ownership and editing privileges.

Save CSR data

Coordinators shall be able to save edits to an open CSR by executing a *save* command, saving the CSR to the CCDB.

1) The saved CSR will remain displayed for additional edits.

2) The CCS will automatically save a CSR and any edits at regular time intervals.

   a) The time period between auto-saves will be configurable by the CCS system administrator. (See use case ***CC-13-Manage Configuration***.) **(NEW)**

Close CSR

Coordinator shall close a CSR, saving the edited CSR to the database, and changing the CSR form status to *closed*.

1) The CSR's status will remain open until the Coordinator uses the "close CSR" function.

2) When a CSR is closed, any Transit staff listed as dispatched to the incident will be automatically listed as "available" by the CAD/AVL Status Board function. (See use case ***CC9-Manage Field Staff***.)

3) Closing a CSR that has been automatically generated by an Emergency Alarm will remove the EA from the Coordinator's EA queue. (See use case ***CC6-Respond to Revenue Vehicle Communications***.)

4) A closed CSR will also be viewed through the summary CSR view, with its status indicated as closed.

5) All closed CSRs will be accessible for viewing and editing until they are moved to the historical CCDB, typically at 3:00 AM.

6) The CCS will provide an "Undo Close" function to allow reversal of a "Close CSR" command within a configurable time limit, for example two minutes. (See use case ***CC13-Manage Configuration***.) **(NEW)**

7) The Coordinator may close the CSR window without changing the CSR's open or closed status.

Cancel CSR

Coordinators shall have the ability to cancel an open CSR, which saves the edited CSR form to the CCS database and changes the CSR status to *canceled*.

1) Once canceled, the CSR will not be available to Coordinators for viewing, editing, or reporting.

2) Only open CSRs will be subject to cancellation.

Log CSR data
The CCS shall automatically log all CSR data.

1) All closed CSRs will be moved to the historical database at the end of the service day, typically at 3:00 AM.
   a) Once the closed CSRs are written to the historical database, no further edits will be possible.
2) Any open CSRs will remain open and available for editing.
3) The CSR numbers of all canceled CSRs will be logged for historical reporting.

Provide current day's Summary CSRs
The CCS Summary CSR function shall provide Communications Coordinators and Service Communications staff with the ability to generate and view a subset of CSR data for CSRs opened during the current service day, and any open CSRs carried over from the previous day.

1) The current day's CSRs will include all-night service that has not yet returned to the base, as well as early morning service that has just left the base. All related CSRs will be available in the CSR Summary view until the scheduled pull-in time of the last all-night service.

Summary CSR data are described in the *Technical Specifications* section below.

Select CSRs for Summary CSR
Users shall select individual CSRs to be included in the Summary CSR report.

1) Users may select CSRs by the following categories:
   a) All CSRs.
   b) CSRs for a specific call group.
   c) All adverse-weather-condition CSRs.
   d) All normal (non-adverse-weather) CSRs.

View individual CSR from Summary
From a Summary CSR view, the Coordinator shall select and view the full individual CSR data for any CSR presented in the Summary. See sample CSR summary reports in Appendix **I, Legacy CAD/AVL Sample Reports**.

Print CSRs
Coordinators shall have the ability to print either Summary CSRs or individual CSRs.**(NEW)**

Generate Supervisory and Web-based CSR Reports
The CCS shall provide the reporting function currently provided by the existing CSR Web reports and Service Communications Microsoft Access reports, for current service day and historical reporting.

See samples of existing reports in Appendix **I, Legacy CAD/AVL Sample Reports**.

Available report types will include:

1) Web reports: The CCS will provide current-day and historical CSR data to remote KCM Transit user groups such as the Rider Information Office, Customer Assistance Office, Operations, Transit Safety, and Transit Police staff, via reports distributed on the KCWAN.
   a) The CCS will ensure continued operation of the existing KCM CSR Web reporting function. The current Web reports are written in PHP.

b) The CSR Web reports will be managed and maintained by KCM staff. As the reports may change over time, they shall be configurable by King County Metro Transit staff.

c) Access to the CSR Web reports will be configurable by the KCM CCS Administrator.

2) Established Service Communications Supervisory Reports: The CCS will continue to provide the existing historical CSR reports function. Currently, the reports are generated by Service Communications staff using Microsoft Access. A list of reports follows. The report data are described in *Technical Specifications* below.

a) CSR Entries Per Day Report: Provides the total number of CSRs per day.

b) Total CSR Count Report: Provides a total count of all CSRs for the time period requested, e.g. one month.

c) Filled Trips Report: Reports trips that were in danger of being cancelled due to breakdown or other unplanned event but were filled using another Revenue Vehicle and/or Operator.

d) Base Delay Report: Reports Revenue Vehicles that were delayed from leaving the base on time (due to mechanical problems, no Revenue Vehicle, no Operator, etc.).

e) Cancelled- and delayed-service report.

f) Late Runs Report: Reports Revenue Vehicles deviating from their scheduled run time.

g) Overloads Report: Reports Revenue Vehicles with standing loads and overloaded vehicles that have passed up customers.

h) Lift Malfunctions Report: Reports Revenue Vehicles with disabled or problem wheelchair lifts.

i) The CCS will have the ability to generate miscellaneous one-time-only reports when CSR data is queried using Access or other KCM-approved equivalent, e.g. queries by Operator ID, Location, or Problem Code.

Provide supplemental resource information

The CCS shall provide information to Coordinators regarding staff resources, staff information, and other data used by Coordinators in managing incidents.

1) Weekly service supervisor assignments list: Including district number, geographic area description, and schedule of operation.

2) On-call Transit staff list: List of on-call Transit employees, including job category, home telephone number, and pager number.

3) Coordinator contact information: List of Communications Coordinators and their home telephone numbers.

4) Assigned Groups: List of transit service routes and their associated Assigned Groups.

5) Street address guide: List of primary street and associated block numbers for the City of Seattle by sub-area, including Seattle CBD, North and West, South and West, and North Avenues.

3.2 Alternative Flow

3.2.1 Manage Transit Tunnel Incidents

Provide CSR functions for Transit Tunnel vehicles **(NEW)**

The CCS Manage Incidents functions shall support Tunnel Controller dispatch of transit coaches operating in the Downtown Seattle Transit Tunnel, and voice-mode communications on an open voice channel.

1) The CCS shall provide CSR functions to a Tunnel Controller for buses operating in the Tunnel.

2) The CCS shall support automated handoff and efficient handling of CSRs between Communications Coordinator and the Tunnel Controller.

3) The CCS design shall accommodate joint Tunnel Operations with Sound Transit light rail as described in ***RV17-Interface to 700 MHz Radio*** and Subsection **1.C.6.2, Joint Tunnel Operations**. The specifics of this process will be determined jointly between the OBS/CCS and TRS contractors and KCM in the design phase.

4. Post-conditions

An incident is resolved and the related CSR data is completed, logged, and readily accessible to users.

5. Special Requirements

5.1 Technical Specifications

Automatically enter known data

The CCS shall automatically populate appropriate fields of a CSR form with data available from the system.

Data available for automatic population will include:

1) CSR number assigned by the system.
2) Date and time CSR was opened.
3) Identification number of the Coordinator who opened the CSR (from the CCS Coordinator login data).
4) CSR Status: Open (O) for an open CSR; Closed (C) for a closed CSR.
5) Revenue Vehicle–related data including:
   a) VID.
   b) OID.
   c) Block ID (Route/run).
   d) Most recent polled location (x,y coordinate). **(NEW)**
6) Data related to a closing a CSR, including:
   a) The identification number (CID) of the Coordinator who closed the CSR.
   b) The date and time that the CSR was closed.
   c) A (C) in the CSR Status field, indicating the CSR is closed.
7) If no data are available from the system, the CCS will allow the Coordinator to enter the data related to the Revenue Vehicle including:
   a) VID.
   b) OID.
   c) Block ID (Route/run).

Enter and edit information

The Coordinator shall have the ability to enter and edit certain data fields of the CSR form.

Editable fields will include:

1) Approximate time the incident began ("from" time).
2) Time that the problem was resolved ("to" time).
3) Location of the incident, to include:
   a) Street location of incident (text field).

b) Code for key geographic area (e.g., Ride Free Area).

4) Problem description (text field).
5) Problem code for type of problem.
6) Impact code for Coordinator's assessment of impact to transit service.
7) Response description (text field).
8) Response code (up to two response codes may be entered).
9) Time of day assistance was requested.
10) Scheduled time for delivery of assistance.
11) Actual time assistance was delivered.
12) Coach change information:
    a) Vehicle identification number (VID) for replacement coach.
    b) Replacement coach direction (N, S, E, or W).
    c) Coach-change location description (text field).
    d) Gain or loss in service mileage (plus or minus symbol).
13) Staff dispatched to incident:
    a) Service Quality Supervisor district number. (Up to three district numbers may be entered.)
    b) Vehicle Maintenance truck ID number. (Up to two truck ID numbers may be entered.)
    c) Transit Police unit number.
    d) Other responding agencies. (A code or text description may be entered.)
    e) Transit staff indicated as dispatched to the incident shall be automatically listed as "unavailable" by the CCS Status Board function. (See use case ***CC9-Manage Field Staff***.)
14) Performance Report was completed (Yes/No).
15) Adverse weather operations disabled coaches log:
    a) Zone code for predefined geographic area.
    b) Priority code.
    c) District supervisor's area number.
    d) Coach status (blocking or accident).
16) CSR number for related CSRs:
    a) Previous CSR number.
        i) The CCS shall associate the current CSR to the CSR number specified by the Coordinator.
    b) Next CSR number. The CCS shall associate the current CSR to the CSR specified by the Coordinator.
17) Accident/Incident (A/I) code for type of accident or incident.
    a) When a code is entered in this field, the CCS shall make data entry available for the following Accident/Incident form fields:
        i) Operator was relieved of duty (Y/N).
        ii) Employee was injured (Y/N).

iii) Hospital name (text field).

iv) Number of passengers injured.

v) Case number assigned by outside agency.

vi) Operating base.

vii) Brief description of injury (text field).

18) Document staff notifications of the incident on the "Notifications" form tab, which shall be available for data entry when an A/I code is provided. The Notifications form shall provide a tabular list of pre-defined external agencies and internal workgroups for which the following data may be entered:

a) Name of person contacted.

b) Time of notification.

c) “Agency or group was present at the incident scene” (check box).

19) Additional remarks: a "Remarks" form shall be provided for entering the Coordinator's additional comments related to the incident.

View CSR Summary data

After the Coordinator has selected which CSRs should be included in the Summary CSR, the CCS shall display a Summary CSR with CSR data arranged in a tabular report.

Summary CSR data will include:

1) The CSR number.
2) Vehicle identification number (VID).
3) Block ID (route/run).
4) Date and time the incident began (“from” date).
5) Date and time the incident ended (“to” date).
6) Incident location description.
7) Problem text description.
8) Response text description.
9) Responding Transit staff:
   a) Service Quality Supervisor ID (D#).
   b) Vehicle Maintenance truck number.
   c) Transit Police unit number.
   d) Other responding agencies.
10) Coach-change data:
   a) Time of day coach change was ordered.
   b) Scheduled time of the coach change.
   c) Actual time of coach change.
   d) VID of new coach.
   e) Coach-change location description (text field).

11) The Summary CSR view shall indicate the CSR as closed by displaying the identification number of the Coordinator who closed the CSR.
    a) Absence of any number in this field indicates the CSR status is "open."
12) Adverse weather operations data:
    a) Zone code.
    b) District service supervisor area number.
    c) Priority code.

Sort summary CSRs
Coordinators shall have the ability to sort the CSRs presented in the Summary CSR report.

Coordinator will select (for example, from a pull-down menu) the field on which to sort. Available sort keys will include:

1) CSR number, with open CSRs presented first, then closed CSRs.
2) Block ID.
3) VID.
4) “From” time.
5) “To” time.
6) “Coach change” replacement coach VID.
7) Problem description.
8) Adverse weather operations zone code.
9) Adverse weather operations district supervisor's area number.

CSR Data Codes
CSR data codes may change over time and shall be configurable by the KCM CCS Administrators. (See use case ***CC13-Manage Configuration***.)

Automated notification
While not within the scope of the CCS project, the CCS CSR function design shall support a potential future implementation of automated notification of staff by pager or other method.

Supervisory Report Fields
The CCS shall provide, at a minimum, the fields designated by KCM for the established Supervisory reports.

1) CSR Entries Per Day Report
    a) Total Count of CSRs for each day queried:
    b) Corresponding date for each total count of CSRs queried.
2) Total CSR Count Report:
    a) Count of all CSRs for the time period requested, e.g. for a month.
3) Filled Trips Report:
    a) CSR date.
    b) Response code 1: details action, if any, taken, e.g. late run—no action or supervisor action.
    c) Response code 2: identifies trip as a filled trip.

4) Base Delay Report:
   a) CSR day of week.
   b) CSR date.
   c) Base which owns the Revenue Vehicle.
   d) Time the delay began.
   e) Time the delay ended.
   f) Time the Shop was notified.
   g) Total schedule delay (in minutes).
   h) Route number.
   i) Run number.
   j) Vehicle ID.
   k) Operator ID.
   l) Problem Code.
   m) Text description of problem.
   n) Name of base at which Revenue Vehicle is delayed (sometimes different from base to which Revenue Vehicle belongs, e.g. North Base tripper stored at Central Base.)
5) Cancelled and Delayed Service Report:
   a) CSR date.
   b) Route number.
   c) Run number.
   d) Vehicle ID.
   e) Time the delay/cancellation began.
   f) Time the delay/cancellation ended.
   g) Total duration of time the delay/cancellation lasted.
   h) Text description of problem.
   i) Problem code.
   j) Impact code, e.g. x = lost one or more scheduled timetable trips.
6) Late Runs Report:
   a) Route number.
   b) Run number.
   c) CSR date.
   d) Operator ID.
   e) From: The time the late portion of the trip began or when it was first recorded.
   f) To: The time the late portion of the trip ended.
   g) Direction of Travel.
   h) Location where the lateness first began or was recorded.

i) Text description of problem causing off-schedule performance.

j) Response Code.

k) Impact Code.

7) Overloads Report:

a) Route number.

b) Run number.

c) CSR date.

d) Base.

e) Vehicle ID.

f) Time of event.

g) Location of event.

8) Lift Malfunctions Report:

a) Base.

b) CSR date.

c) Vehicle ID.

d) Text description of problem.

e) Problem code.

f) Response Code(s).

5.2 Performance

CSR speed
The CCS CSR function shall complete all user-initiated commands within one second.

CSR Web Reports
Current-day CSR data shall be available to CSR Web Report users in real time.

5.3 Testing

Individual CSR functions
Each individual function described in this use case shall be tested, subject to the Level 2 testing requirements described in Subsection **3.A.7.5, Testing**.

5.4 Usability

New CSR
The CCS CSR function shall provide Coordinators with multiple methods for opening a new individual CSR.

1) Methods will include:

a) By selecting the "New Record" function: a new CSR record form will open with a unique CSR number, the date and time the CSR was opened, and ID number of the Coordinator who opened the CSR, automatically entered by the system.

b) By Active Call: Users may create a new CSR form by specifying the VID of a vehicle in the Coordinator's PRTT, RTT, or text-message queue.

c) By VID: Users may create a new CSR form by specifying a VID. In response, the CCS shall open a CSR form for the vehicle.

d) By OID: Users may create a new CSR form by specifying an OID.

e) By Block ID: Users may create a new CSR form by specifying a Block ID (route/run).

f) By Acknowledging an Emergency Alarm: The CCS shall automatically open a new CSR form when an Emergency Alarm is acknowledged by a Communications Coordinator. (See use case ***CC6-Respond to Revenue Vehicle Communications***.)

2) The CCS will provide users with multiple methods for executing each of the "open a new CSR" functions described above, to include:

a) Pressing a keyboard function key.

b) Entering a command into the command line of the CAD/AVL module.

c) Selecting "Create CSR" from a right-click menu, available to Coordinators by clicking the right mouse button anywhere on the CAD/AVL module screen. (See use case ***CC13-Manage Configuration***.)

CSR form data entry
The CCS CSR module shall be organized to facilitate individual CSR-form data-entry and ease of use.

1) The module will provide the following features, or KCM-approved equivalents:

a) Pull-down lists for selecting and entering the available codes for the data field.

b) A tabbed-form layout, with the entry fields organized into four separate forms:

i) The Coordinator Service Record or new individual CSR form.

ii) The Incident form for all accident/incident-related fields.

iii) The Notifications form.

iv) The Remarks form.

c) An "undo" function to allow users to delete the most recent text edits.

2) The CCS CSR user functions will be integrated with the radio call management, vehicle location, and schedule information functions. (See use case ***CC13-Manage Configuration***.) Users will be able to launch major CAD/AVL module commands such as:

a) Initiate a radio call to the vehicle associated with the CSR or summary CSR record.

b) View the vehicle's schedule.

c) View the vehicle's location. (See use case ***CC13-Manage Configuration***.)

Transfer CSR command
The "transfer CSR" function shall be performed by an easily executed method, such as by entering "CST" and the recipient Coordinator's identification number into a CAD command line, or by a KCM-approved equivalent method.

CSR User Interface
The CCS CSR user interface shall provide ease-of-use greater than or equal to the existing CSR user interface, measured by user satisfaction ratings.

6. Extension Points

CC1-Log in CCS User

CC6-Respond to Revenue Vehicle Communications

CC9-Manage Field Staff

CC11-Log out CCS User

CC13-Manage Configuration

RV17-Interface to 700 MHz Radio

7. Assumptions

The design phase will include a review of CSR function usability, including examining the potential for increasing text-field sizes and changing some field types to alphanumeric.

8. Issues

Describe the proposed approach for continuation of the CSR Web reports and Service Communications Microsoft Access reports.

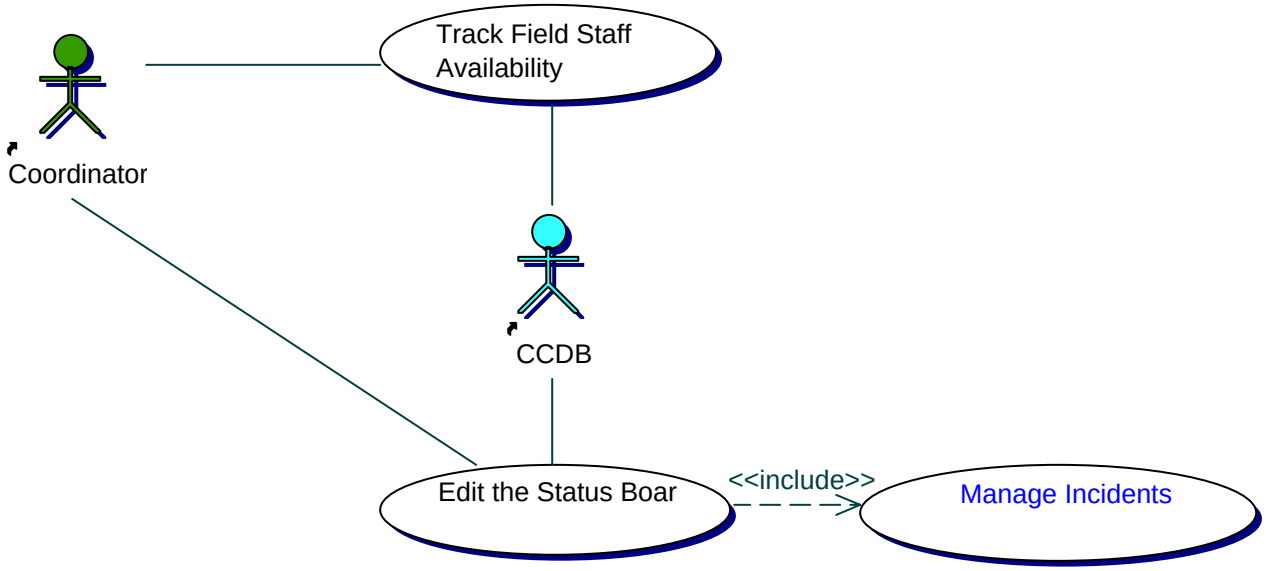
3.B.4.2.9. CC9-Manage Field Staff

This use case package includes the following UML diagrams:

UseCase Diagrams

Figure ***3.B.4.2.9.CC9. CC9-Manage Field Staff***

Figure 3.B.4.2.9.CC9. ***UseCase Diagram CC9-Manage Field Staff***



10. CC9-Manage Field Staff

1. Brief Description

This use case describes the Status Board, a CAD/AVL tool used by Coordinators to track and manage the availability of field staff dispatched by Communications Coordinators in response to service disruptions and incidents. The functionality of the Status Board is closely related to that of the Coordinator Service Record (CSR) described in use case ***CC8-Manage Incidents.***

2. Pre-conditions

The CCS is up and running in data mode. (See use case ***CC15-Transition CCS***.)

Coordinators are logged in to their workstations and monitoring vehicles. (See ***CC1-Log in CCS User*** and ***CC4-Monitor Revenue Vehicles*** use cases.)

3. Flow of Events

This use case is triggered when a Coordinator alters field staff data resulting in a change to the Status Board.

3.1 Basic Flow

Track field staff availability
User shall view a list of currently available field staff.

1) The list will:
   a) Include service supervisors and vehicle-maintenance trucks.
   b) Display all on-duty and off-duty staff by unit ID.
   c) Indicate available and unavailable staff with different symbols.
   d) Provide room for a brief description of the unit's current activity or other notation.
2) The user will be able to select various views of the list including:
   a) All staff (on and off duty).
   b) On-duty staff only.
   c) Assigned staff only.

Edit the Status Board
Users shall have the ability to edit the Status Board data.

1) Edit functions will include the ability to:
   a) Add or delete a field staff vehicle or individual staff member from the Status Board list.
   b) Indicate an individual field staff member or vehicle as on-duty or off-duty.
      i) On-duty or off-duty status will be indicated by a symbol on the Status Board list.
   c) Indicate availability or unavailability (currently dispatched to an incident) of an on-duty individual field staff member or vehicle.
2) Users will be able to edit the status board using multiple methods including:
   a) Entering information directly into the Status Board.
   b) Entering information through the CSR form. (See use case ***CC8-Manage Incidents***.)
      i) Field staff listed as responding staff in an open CSR will automatically be listed on the Status Board as unavailable (dispatched).

ii) The status of the field staff will automatically change to *available* when the CSR is closed or canceled. (See use case ***CC8-Manage Incidents***.)

c) Assigning work to an available unit by opening an "assign vehicle work" form.

i) The "assign vehicle work" form will provide the user the ability to enter:

(1) The start time of the staff assignment.

(2) The applicable group number.

(3) A CSR number. **(NEW)**

(4) A brief description of the situation.

3) All methods used to edit the Status Board will result in immediate automatic updates of the Status Board.

a) Indicate an assigned/dispatched unit as *unavailable* with a change in symbol.

b) Indicate an available unit as *available* with a change in symbol.

3.2 Alternative Flows

3.2.1 Status Board functionality unavailable when the CCS database shut down

Manually Track Field Staff
When the CCS database is shut down, Coordinators will manually track field staff availability. (See use case ***CC15-Transition CCS***.)

1) Coordinators will use radio voice communications to manually track field staff availability when the CCS database and Status Board functionality are brought down.

2) When the CCS database is booted back up and the Status Board functionality restored, Coordinators will manually bring the Status Board up to date.

4. Post-conditions

Field staff is accurately reflected as *available* or *unavailable*.

5. Special Requirements

5.1 Technical Specifications

5.2 Performance

5.3 Testing

The functions and supporting details described in this use case will be tested according to Level 2 testing requirements as described in Subsection **3.A.7.5, Testing**.

5.4 Usability

5.4.1 Status Board Accessibility

Status Board Accessibility
Coordinators shall access the Status Board as a CAD/AVL application window and/or a central wall monitor display, to be determined in the design phase.

6. Extension Points

CC8-Manage Incidents

CC15-Transition CCS

7. Assumptions

8. Issues

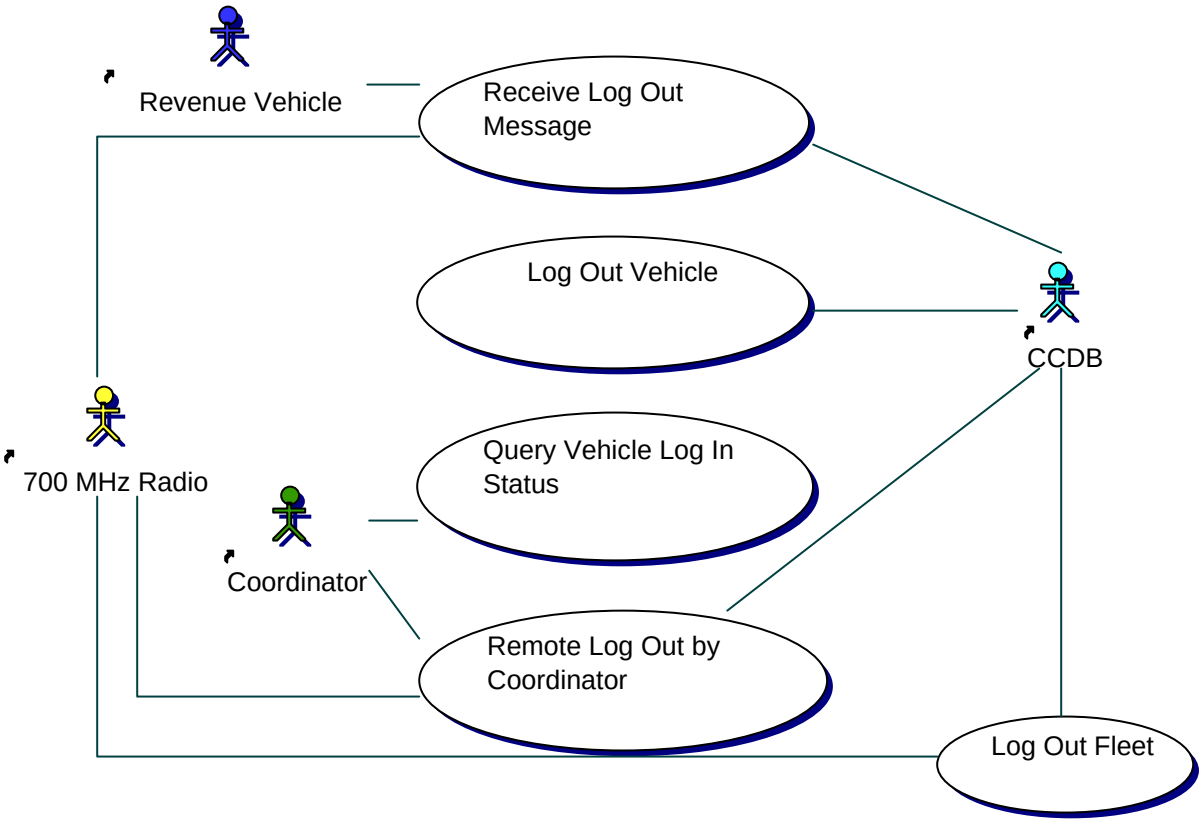
3.B.4.2.10. CC10-Log out Revenue Vehicle

This use case package includes the following UML diagrams:

UseCase Diagrams

Figure ***3.B.4.2.10.CC10. CC10-Log out Revenue Vehicle***

Figure 3.B.4.2.10.CC10. UseCase Diagram CC10-Log out Revenue Vehicle



11. CC10-Log out Revenue Vehicle

1. Brief Description

This use case describes how a Revenue Vehicle is logged out of the CCS, ending regular polling of the vehicle. The association of the vehicle login data—Operator ID, vehicle ID, and block ID—is then no longer active in the CCDB.

2. Pre-conditions

The Revenue Vehicle has logged into the CCS as described in use case ***CC2-Log in Revenue Vehicle***.

The OBS, TRS, and CCS are in good health.

3. Flow of Events

3.1 Basic Flow

The use case is triggered by the receipt of a logout message from a Revenue Vehicle at the CCS. (See use case ***RV3-Take Vehicle out of Operation***.)

Receive logout message
The CCS shall begin the Revenue Vehicle logout process when the system receives a logout message from the OBS.

1) Upon receipt of the logout message (see use case ***RV3-Take Vehicle out Of Operation***), the CCS shall transmit a logout acknowledgment message to the OBS. (NEW)

Log out vehicle
The system shall log out the vehicle from the CCS.

1) The system shall remove the vehicle's identification number (VID) from the CCS polling table, and stop polling the vehicle. (See use case ***CC3-Manage Revenue Vehicle Polling***.)
2) The system shall remove the vehicle from active radio communications status in the CCDB, including the association of Operator ID or Employee ID, vehicle ID, and block ID.
    a) The CCS shall receive and process any subsequent PRTT, RTT, or EA messages from the coach as unlogged vehicle radio communications. (See use case ***CC6-Respond to Revenue Vehicle Communications***.)

Query vehicle login status (NEW)
Coordinators shall have the ability to query the CCS to obtain the CCS login or logout status of the coach by vehicle ID, block ID, or OID/Employee ID.

1) The system shall provide the current status of the vehicle: currently logged in or logged out, and time of day of the login or logout.
2) This function may be provided as part of a current service-day playback function. (See use case ***CC12-Manage Reporting***.)

3.2 Alternative Flows

3.2.1 Remote Logout

Logout by Coordinator
Coordinators shall have the ability to log an individual Revenue Vehicle out of the CCS.

1) Coordinators shall select the "log out vehicle" function from the user interface and specify a VID. (User interface will provide a pull-down menu or comparable method.)

a) Remote logout of the vehicle by a Coordinator shall trigger a message for display on the DDU indicating "automated logout" to the Operator. **(NEW)**

b) The CCS shall receive a message from the OBS acknowledging the “automated logout” message. **(NEW)**

2) The CCS shall provide alternative methods for executing the "log out vehicle" function, such as entering "LV" followed by the VID on a command line, or a comparable method.

3.2.2 Nightly system logout

Log out fleet
The CCS shall provide an automated process for logging out all out-of-service coaches from the CCS by a nightly process, currently run each morning at 3:15 AM.

1) The CCS shall create an exception process for coaches scheduled to begin service past the system logout time (currently 3:15 am).

a) Special service, such as Revenue Vehicles used to assist the police or fire department, shall be considered as in-service vehicles and not logged out. **(ADJUSTED)**

4. Post-conditions

The Revenue Vehicle is logged out of the CCS and is no longer being polled.

5. Special Requirements

5.1 Technical Specifications

5.2 Performance

5.3 Testing

CCS vehicle logout function testing
The functions and supporting details described in this use case shall be tested according to the Level 2 testing requirements found in Subsection **3.A.7.5, Testing**.

5.4 Usability

6. Extension Points

CC2-Log in Revenue Vehicle

CC3-Manage Revenue Vehicle Polling

CC6-Respond to Revenue Vehicle Communications

CC12-Manage Data Reporting

RV3-Take Vehicle Out Of Operation

7. Assumptions

8. Issues

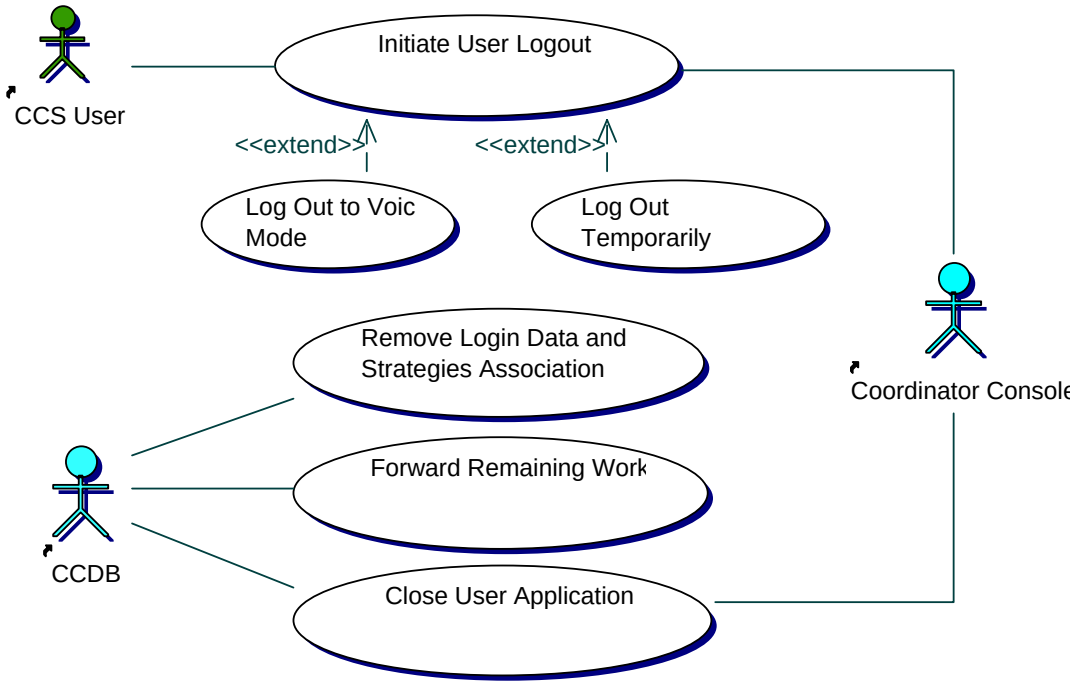
3.B.4.2.11. CC11-Log out CCS User

This use case package includes the following UML diagrams:

UseCase Diagrams

Figure ***3.B.4.2.11.CC11. CC11-Log out CCS User***

Figure 3.B.4.2.11.CC11. UseCase Diagram CC11-Log out CCS User



12. CC11-Log Out CCS User

1. Brief Description

This use case describes activities related to logging out a CCS user from CAD/AVL functionality.

2. Pre-conditions

The Communications Center System is up and running.

CCS user has successfully completed use case ***CC1-Log in CCS User***.

3. Flow of Events

The use case is triggered when a CCS user decides to log out of the CCS.

3.1 Basic Flow

Initiate user logout
User shall initiate logout through the CAD/AVL user interface.

Remove login data and Strategies association
Upon user logout, the system shall remove the association between the user's login data (user ID, assignment number, and, if applicable, Strategy) that was established through completion of the Coordinator login process.

(See use case ***CC13-Manage Configuration***.)

Forward remaining work
CCS shall forward any unanswered radio calls from the Coordinator's call queues and any open Coordinator Service Records (CSRs) to the appropriate active Coordinator assignment according to the Strategies process.

(See ***CC13-Manage Configuration*** and ***CC8-Manage Incidents***.)

Close user application
The system shall close the user application interface upon completion of the user's logout.

3.2 Alternative Flows

3.2.1 Temporary Logout (TLO)

Log out temporarily
A Coordinator who is logged in to the system and attached to a Strategy shall be able to execute a temporary logout (TLO) function, forwarding his or her work to another Coordinator's workstation.

1) User shall initiate logout through the CAD/AVL user interface.
2) Any open CSRs and unanswered Request To Talk messages belonging to the Coordinator who initiated the TLO will be transferred to the temporary Coordinator's CAD console screen. (See ***CC8-Manage Incidents*** and ***CC6-Respond to Revenue Vehicle Communications*** use cases.)
3) The TLO will end when the Coordinator who initiated the TLO logs back in to his or her assignment. (See use case ***CC13-Manage Configuration***.)

3.2.2 Log out to voice mode (default radio operations)

Confirm voice mode operation
Before the last logged-in Coordinator logs out of the CCS, the user shall receive a message from the CCS offering the Coordinator the option of transitioning the system to voice mode or keeping the system in data mode. **(NEW)**

(See ***CC15-Transition CCS***.)

4. Post-conditions

The user is logged out of the CCS and when applicable, any unanswered radio calls or open CSR's are routed to an active Coordinator's assignment.

5. Special Requirements

5.1 Performance

Temporary Logout Command Processing
The CCS will process the TLO command in no more than five seconds.

5.2 Technical

Multiple Logout Tools
The system shall provide users with multiple methods for logging out of the CAD/AVL system.

1) Logout methods may include, but not be limited to:
   a) Selecting “Log out” from a pull-down menu.
   b) Typing a “Log out” command into a command line.
   c) Closing the application window.

5.3 Testing

Functions in this use case shall be subject to Level 2 testing requirements described in Subsection **3.A.7.5, Testing**.

5.4 Usability

6. Extension Points

CC6-Respond to Revenue Vehicle Communications

CC8-Manage Incidents

CC13-Manage Configuration

CC15-Transition CCS

7. Assumptions

8. Issues

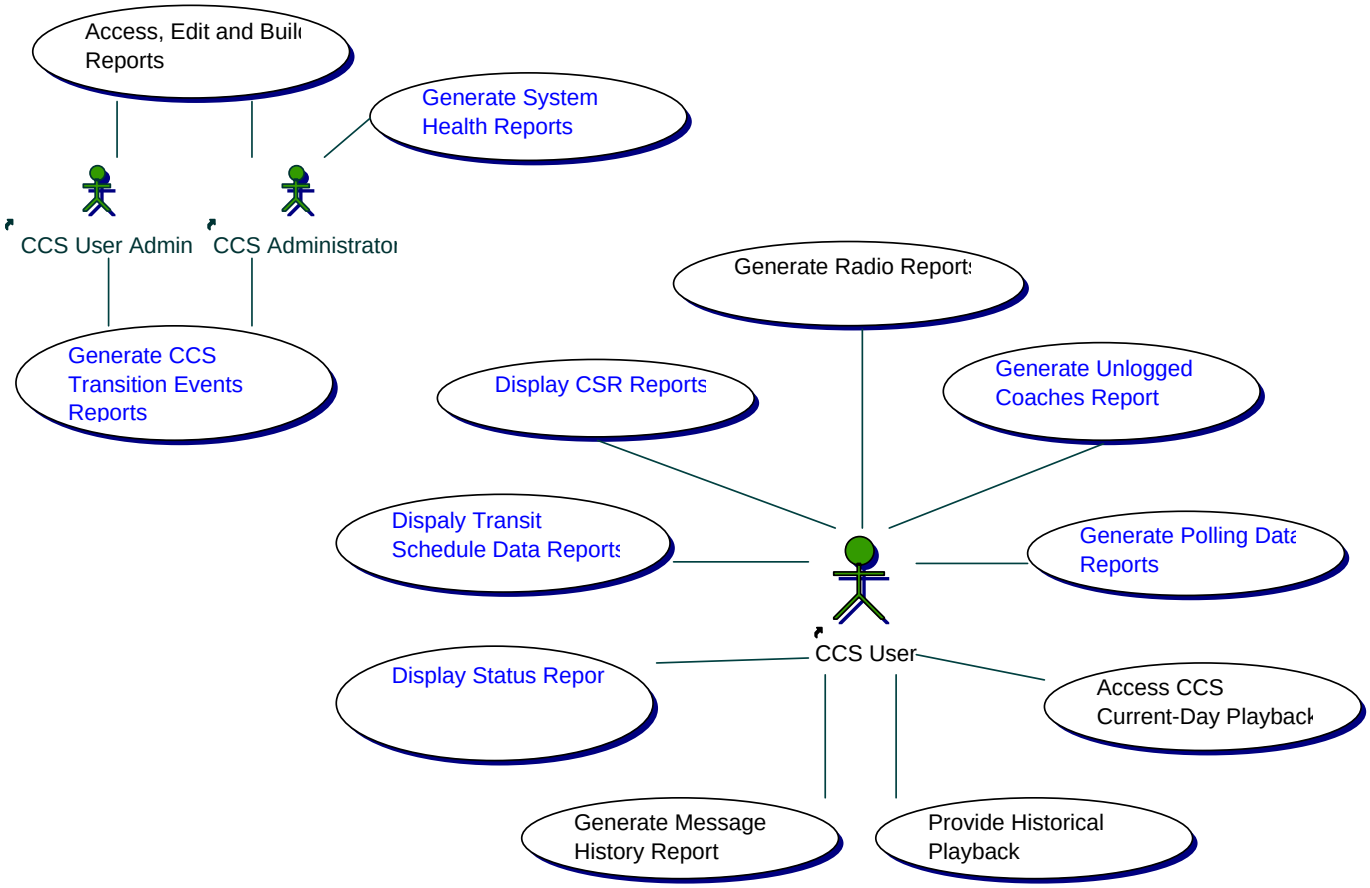
3.B.4.2.12. CC12-Manage Data Reporting

This use case package includes the following UML diagrams:

UseCase Diagrams

Figure ***3.B.4.2.12.CC12. CC12-Manage Data Reporting***

Figure 3.B.4.2.12.CC12. UseCase Diagram CC12-Manage Data Reporting



13. CC12-Manage Data Reporting

1. Brief Description

The Manage Data Reporting use case addresses reports generated from the CCS databases for use by CCS and remote users. Reports are generated using real-time, near-real-time, current, and historical data. Samples of existing reports can be found Appendix **I, Legacy CAD/AVL Sample Reports**.

2. Pre-conditions

The ***CC1-Log in CCS User*** use case has been successfully completed.

Revenue Vehicles are being monitored when applicable. (See use case ***CC4-Monitor Revenue Vehicles***.)

Required data is accessible to the reporting applications.

Users have been granted access permission for requested report(s). (See use case ***CC13-Manage Configuration***.)

3. Flow of Events

The use case is triggered when a user chooses to access a canned or custom-query report.

3.1 Basic Flow

Display Status Report
User shall view schedule adherence or "Status" reports.

Reports will contain, at a minimum, the data described below for the in-service vehicles selected for monitoring by the user's AVL display. (See the *Select Vehicles for Display* step of the ***CC4-Monitor Revenue Vehicles*** use case.) **(ADJUSTED)**

1) The CCS shall provide Status report data for the vehicles selected by the user by service route and, if the user chooses, by an individual route/run within a Service Route Group.
    a) Service Routes: The Status Report for service routes shall display at a minimum:
        i) The total number of vehicles operating the service route.
        ii) The number of vehicles operating the service route early, on time, or late. **(NEW)**
        iii) For all vehicles operating behind schedule on the service route, the average number of minutes behind schedule.
        iv) For all vehicles operating ahead of schedule on the service route, the average number of minutes ahead of schedule.
    b) Status report functionality for service routes shall provide the ability to sort report data by:
        i) Service route number.
        ii) The average number of minutes late or early for each service route.
    c) Service route schedule adherence data shall be displayed graphically, indicating on-time, early, and late service routes with color coding or some other consistent and easily identifiable method.
        i) Average number of minutes ahead or behind schedule shall be displayed graphically, e.g. as a bar chart.
    d) Route/run (Block): Users shall be able to select a route from the service routes displayed in the Status report to obtain a detailed view of data for each route/run currently operating the selected route. This data will include, at a minimum:
        i) The current service direction of the route/run; for example, N,S,E,W.

ii) The schedule adherence status—early, on time, or late—for each route/run, to be indicated graphically, e.g. by color.

iii) The number of minutes the route/run is ahead of or behind schedule.

(1) Schedule adherence for each route/run (in minutes) shall be displayed in graphically e.g. as a bar chart.

2) Users shall have the ability to print a copy of the displayed Status report.

3) Users shall have the ability to enter a text title for printed Status report data.

4) Users shall have the ability to select vehicles for the Status report display by minutes early or late. (For example, display the status of coaches more than 15 minutes late.) **(NEW)**

5) The specific format of the Status report shall be determined in the design phase subject to the KCM Project Manager's approval.

Display Transit Schedule Data reports
The CCS shall provide Communications Center staff with automated desktop access to transit service schedule and schedule-adherence information as detailed in use case ***CC7-Manage Transit Service & Geographic Data***.

Display Summary CSR reports
The CCS shall provide current-day summary CSR reports as detailed in use case ***CC8-Manage Incidents***.

Generate "archive" reports from current-day CSR data
The CCS shall provide existing reports generated from current-day CSR data, known as the "archive" reports.

See use case ***CC8-Manage Incidents*** for information on CSRs. (Note: Several CSR data and Radio reports are run as "archive" reports, generated as current-day CAD/AVL data are written to the historical database at the close of each business day. All "archive" reports are automatically printed.) See *Technical Specifications* below for the data to be included in each report.

Existing current-day CSR data "archive" reports include, but are not limited to:

1) CSR reports: lists the details for each CSR included in the current-day CSR data.

2) Farebox malfunction reports: lists the details for each farebox malfunction recorded in the current day's CSR data.

3) Late operations reports: lists the details for each occurrence of Late operations recorded in the current day's CSR data.

4) Lift malfunction reports: lists the details for each occurrence of lift malfunctions recorded in the current day's CSR data.

5) Notification Report: details each security incident for which a Coordinator, according to established business processes, notified a public safety agency to help manage the incident, or notified KC staff, e.g. Managers, Public Relations or Directors, to make them aware of the incident.

6) Radio malfunction reports: lists the details for each occurrence of radio malfunctions recorded in the current day's CSR data.

7) Security Camera reports: lists the details for any security-camera activity recorded in the current day's CSR data.

8) Security Incidents Reports: lists the details for any security incident recorded in the current day's CSR data.

Generate Supervisory CSR reports
Users shall be able to generate Supervisory CSR Reports from historical CSR data, as detailed in ***CC8-Manage Incidents***.

Generate "Archive" Radio Reports
The CCS shall provide Radio Reports needed for use by Service Communications supervisory staff. (ADJUSTED)

Required radio reports include:

1) The Daily Call report. (See ***CC5-Initiate Communications to Revenue Vehicle*** and ***CC6-Respond to Revenue Vehicle Communications*** use cases.) See *Technical Specifications* below for the fields to be included in The Daily Call report.
   a) The Daily Call report shall provide an hourly count of radio calls by type:
      i) Request to Talk.
      ii) Text message. (NEW)
      iii) Emergency Alarms.
      iv) Coordinator-initiated calls.
   b) The Daily Call report shall show the hourly breakdown of calls by call group, including the maximum and average number of minutes a message is in the queue before a response, and the number of CSRs generated.
   c) The Daily Call report shall provide the data summarized by specified time periods.
      iv) Time periods shall be configurable and shall be defined by the user. For example, time parameters may include the beginning and end date for a past shake-up.
2) The Weekly report. (See ***CC5-Initiate Communications to Revenue Vehicle*** and ***CC6-Respond to Revenue Vehicle Communications*** use cases.) The Weekly report shall provide a count for each day of a week for:
   a) Driver-initiated calls.
      i) RTTs.
      ii) PRTTs.
      iii) RTT-to-PRTT upgrades.
      iv) Text Messages. (NEW)
   b) Coordinator-initiated calls.
      i) Single Vehicle Calls.
      ii) All Calls.
      iii) Strategy, Service Route, and Route Cluster Calls.
      iv) Text Messages.
3) Duplicate Login report for current-day and historical data. (See use case ***CC2-Log in Revenue Vehicle*** for functional requirements related to duplicate logins.) See *Technical Specifications* below for the fields to be included in the Duplicate Login report. (NEW)
4) Remote RV Login/Logout by Coordinator report. (See ***CC2-Log in Revenue Vehicle*** and ***CC10-Log out Revenue Vehicle*** for functional requirements related to remote Revenue Vehicle logins.) See *Technical Specifications* below for the fields to be included in the Remote RV Login/Logout by Coordinator report. (NEW)

5) Calls Received from Unlogged Revenue Vehicles report. (See use case ***CC2-Log in Revenue Vehicle*** for functional requirements related to unlogged Revenue Vehicles.) See *Technical Specifications* below for the fields to be included in the Calls Received from Unlogged Revenue Vehicles report.

6) Operator Login/Base Pullout Comparison Report. See *Technical Specifications* for the fields to be included in the Operator Login/Base Pullout Comparison Report. **(NEW)**

7) Coordinator Login/Logout report. (See ***CC2-Log in Revenue Vehicle*** and ***CC11-Log out CCS User*** for functional requirements related to Coordinator login/logout.) The Login/Logout report shall provide Coordinator assignment logins, Coordinator temporary logouts, and Coordinator logouts by time of day. See *Technical Specifications* below for the fields to be included in the Coordinator Login/Logout report.

8) Emergency Alarm report. (See use case ***CC6-Respond to Revenue Vehicle Communications*** for functional requirements related to the Emergency Alarm.) See *Technical Specifications* below for data to be included in the Emergency Alarm report. **(ADJUSTED)**

9) Critical AVM Alarm Report. (See use case ***CC6-Respond to Revenue Vehicle Communications*** for functional requirements related to critical AVM alarms.) See *Technical Specifications* below for data to be included in the Critical AVM Alarm Report. **(NEW)**

10) "Cancel RTT/PRTT" report. (See ***CC6-Respond to Revenue Vehicle Communications*** and ***RV17-Interface to 700 MHz Radio*** for functional requirements related to canceling RTT/PRTTs.) See *Technical Specifications* below for data to be included in the Cancel RTT/PRTT report. **(NEW)**

Generate Radio Data Message Audit Trail Report **(NEW)**
CCS Administrators shall be able to generate a combined systems (CCS, TRS and OBS) Radio Data Message Audit Trail report, as detailed in Subsection **3.A.6.6, Communications Layers**.

1) The Audit Trail Report shall provide CCS Administrators with the ability to troubleshoot data-message processing across the CCS, TRS, and OBS as well as between major system components.

2) Emergency Alarm or Critical AVM reporting: The Audit Trail Report will join historical data and provide a time-and-system-sequenced history of all data and voice communications calls initiated to and from the VID from which an EA or Critical AVM has been launched.

3) The Audit Trail Report will be provided for a configurable amount of time preceding and following an event or point in time. For example, the report will include a record of all data and voice communications for 30 minutes before and after an Emergency or Critical AVM Alarm is initiated.

Generate the Message Events Report **(NEW)**
The CCS shall provide a Message Events report upon request.

1) The Message Events Report will include all Request to Talk and text message arrival and departure information as well as EA or Critical AVM alarm receipt, acknowledgment, and responses for near-real-time, current-day, and historical CCS data. See *Technical Specifications* below for detailed list of data to be included in the Message Events report.

2) CCS Users will be able to filter and sort the Message Event Report by one or more fields, e.g. by date, VID, OID, CID.

Generate System Health Reports **(NEW)**
The CCS shall generate System Health Reports as detailed in use case ***CC14-Manage System Health***.

Generate Unlogged Vehicles Report **(ADJUSTED)**
The CCS will generate an "Unlogged Vehicles" report to identify in-service vehicles that are not logged in to the system. (See use case ***CC2-Log in Revenue Vehicle***.)

Generate Poll Response Summary Report **(NEW)**
Coordinators shall have near-real-time access to a tabular summary of data included in an in-service Revenue Vehicle's poll response. (See use case ***CC3-Manage Revenue Vehicle Polling***.)

1) Coordinators will be able to query the poll response summary data by VID, OID, and Block ID for the current service day.

Access CCS Current-Day Playback **(NEW)**
Coordinators shall be able to access playback of CCS current-day transmitted data from the Revenue Vehicles.

1) Current-day playback will provide the current day's CCS data only and will display all transmitted events from the coach on the AVL map. (See use case ***CC3-Manage Revenue Vehicle Polling*** and ***BO3-Manage Historical Data***.)
    a) Poll response data transmitted to the CCS including:
        i) Location data.
        ii) Schedule-adherence data.
        iii) All other poll-response data.
    b) EA messages.
    c) Critical AVM alarms.
2) Playback function will be able to reach back a configurable amount of time from the time of request for playback and replay all recorded events. For example, Coordinators can replay events for a vehicle that occurred up to 1.5 hours prior to the time of the playback request.
3) Playback will include established iconography and GIS map as well as a section of screen displaying tabular data. See use case ***CC4-Monitor Revenue Vehicles***.
4) Staff will have the ability to choose established AVL display map features/layers for playback display at the time of or during playback.

Provide Historical Playback **(NEW)**
CCS users shall have desktop access to the OBS historical data playback function as described in use case ***BO3-Manage Historical Data***.

Generate CCS Transition Events Reports **(NEW)**
The CCS shall provide reports for all CCS transition events.

See use case ***CC15-Transition CCS*** for functional requirements related to the CCS Transition Events report. See *Technical Specifications* below for data to be included in the CCS Transition Events report.

Events will include:

1) Automated or manual voice/data transitions.
2) Automated or manual CCS component(s) shutdown/boot-up.
3) A switch to redundant system.

Automatically E-mail Designated Reports
CCS shall have the ability to automatically e-mail identified reports to designated KC staff via the KCWAN.

1) As archive reports are automatically printed out, a pre-designated list of reports chosen from the menu of printed archive reports will be automatically e-mailed to designated report recipients.
2) Automatically e-mailed reports will include but not be limited to:

a) Reports from CSR Data.

i) Security Incidents

ii) Unlogged Coaches

iii) Late Operations

iv) Security Cameras

v) Farebox Malfunction

vi) Base Delays

vii) CSR

viii) Emergency Alarm

ix) Lift/Ramp

x) Radio Malfunction

xi) Notifications

3) The reports chosen for automated e-mail, and the recipients to receive the reports, shall be configurable by CCS Administrators.

Access, Edit, and Build Reports
CCS Administrators shall be able to access, edit, and build CCS reports.

1) The CCS reporting functions will utilize or be compatible with standard reporting tools such as Web reporting, Crystal Enterprise, or other KCM-approved equivalent.

2) The CCS will provide full enterprise-level multi-user database administration tools.

3) The CCS will provide interface tools that allow CCS users to query CCS databases and generate reports.

4) The CCS design will enable KCM to build its own reports.

3.2 Alternative Flows

4. Post-conditions

5. Special Requirements

5.1 Performance

Log data messages
Data related to data messages transmitted between the Revenue Vehicle and the CCS shall be logged and available to Message Events Report and Poll Response Summary Report users within two seconds of data message arrival at the CCS or departure from the CCS.

5.2 Technical Specifications

5.2.1 Fields within Reports

Report design
The CCS shall provide reports and data including but not limited to those reports and data fields described below.

1) CCS reports and their content shall be determined in the design phase, subject to KCM Project Manager approval.

Current-day CSR "Archive" reports

The Current-day CSR Archive reports will require the listed fields of information.

1) CSR reports:
    a) Route.
    b) Run.
    c) VID.
    d) OID.
    e) Time incident began.
    f) Time incident ended.
    g) Location where incident took place or was reported.
    h) Direction of revenue vehicle at the time of the incident.
    i) Vehicle Maintenance Shop truck number that responded to incident if applicable.
    j) Coordinator ID (CID).
    k) Time coach change took place if applicable.
    l) VID of coach change if applicable.
    m) Location where coach change took place if applicable.
    n) Change of coach direction if applicable.
    o) Problem code.
    p) Problem description.
    q) Response code.
    r) Response description.
2) Farebox malfunction reports:
    a) Route.
    b) Run.
    c) VID.
    d) Time malfunction began.
    e) Time malfunction ended.
    f) Location where malfunction took place or was reported.
    g) Direction of revenue vehicle at the time of the malfunction.
    h) ID number of Vehicle Maintenance Shop truck that responded to malfunction if applicable.
    i) Coordinator ID (CID).
    j) Time coach change took place if applicable.
    k) VID of coach change if applicable.
    l) Change of coach direction if applicable.
    m) Problem code.

n) Problem description.

o) Response code.

p) Response description.

q) Service supervisor that responded (D-number).

3) Late Operations reports:

a) Route.

b) Run.

c) VID.

d) OID.

e) Time incident began.

f) Time incident ended.

g) Location where incident took place or was reported.

h) Direction of Revenue Vehicle at the time of the incident.

i) ID number of Vehicle Maintenance Shop truck that responded to incident if applicable.

j) Coordinator ID (CID).

k) Time coach change took place if applicable.

l) VID of coach that replaced broken coach.

m) Location where the coach change took place.

n) Change of coach direction if applicable.

o) Problem code.

p) Problem description.

q) Response code.

r) Response description.

4) Lift Malfunction reports:

a) Route.

b) Run.

c) VID.

d) Time malfunction began.

e) Time malfunction ended.

f) Location where malfunction took place or was reported.

g) Direction of Revenue Vehicle at the time of the malfunction.

h) ID number of Vehicle Maintenance Shop truck that responded to malfunction if applicable.

i) Coordinator ID (CID).

j) Time coach change took place if applicable.

k) VID of coach change if applicable.

l) Location where coach change took place if applicable.

m) Change of coach direction if applicable.

n) Problem code.

o) Problem description.

p) Response code.

q) Response description.

5) Notification report:

a) Reference of CSR number.

b) Block ID.

c) Case number.

d) Incident time.

e) VID.

f) Coordinator ID (CID).

g) Incident day of the week.

h) Operator ID and name.

i) Direction of Travel.

j) Incident date.

k) Base.

l) Location of incident.

m) Employee status.

n) Injured - yes or no.

o) Hospital sent to for treatment if applicable.

p) Passenger status.

q) Description of passenger status.

r) Number of passengers injured.

s) Description of injuries.

t) Emergency response group contacted, e.g. police, base chief, Union president.

u) Name of person contacted in response group.

v) Time response group (s) was notified.

w) Emergency response group sent to the scene?

x) Problem description.

y) Response description.

z) Coordinator remarks.

6) Radio malfunction reports:

a) Route.

b) Run.
c) VID.
d) Time malfunction began.
e) Time malfunction ended.
f) Location where malfunction took place or was reported.
g) Direction of Revenue Vehicle at the time of the malfunction.
h) ID number of Vehicle Maintenance Shop truck that responded to malfunction if applicable.
i) Coordinator ID (CID).
j) Time coach change took place if applicable.
k) VID of coach change if applicable.
l) Service Supervisor that responded (D-number).
m) Problem description.
n) Response description.

7) Security Camera Incidents reports:
   a) Route.
   b) Run.
   c) VID.
   d) OID.
   e) Time incident began.
   f) Time incident ended.
   g) Location where incident took place or was reported.
   h) Direction of Revenue Vehicle at the time of the incident.
   i) ID number of Vehicle Maintenance Shop truck that responded to incident if applicable.
   j) Coordinator ID (CID).
   k) Time coach change took place if applicable.
   l) Time the Vehicle Maintenance Shop was notified if applicable.
   m) Problem description.
   n) Response to problem.
8) Security incidents report content will include but not be limited to the following fields:
   a) Route.
   b) Run.
   c) VID.
   d) OID.
   e) Time incident began.
   f) Time incident ended.

g) Location where incident took place or was reported.

h) Direction of Revenue Vehicle at the time of the incident.

i) ID number of Vehicle Maintenance Shop truck that responded to incident if applicable.

j) Coordinator ID (CID).

k) Time coach change took place if applicable.

l) Time the Vehicle Maintenance Shop was notified if applicable.

m) Problem description.

n) Response description.

Radio reports

The Radio reports will require the listed fields of information.

1) Daily Call Report:

   a) Each hour of the day followed by a row of data which will include but not be limited to the following fields:

      i) Number of Routine Request to Talk calls.

      ii) Number of Priority Request to Talk calls.

      iii) Number of all Request to Talk calls.

      iv) Emergency Alarm Activations.

      v) Coordinator-initiated calls.

      vi) The number of calls within each hour that occurred within each Call Group.

      vii) The maximum/average call wait time within each Call Group for the hour, in minutes.

      viii) The CSRs generated from calls within each Call Group.

      ix) A total number for each field except the maximum/average call wait time field.

      x) A total number for each field, except the maximum/average call wait time field grouped within preset time parameters rather than hourly, e.g. five-hour increments.

2) Duplicate Login Report:

   a) Date of duplicate login.

   b) Time of duplicate login.

   c) Login data that was entered.

   d) Operator name.

   e) VID numbers for each vehicle logged with a duplicate login.

3) Remote RV Login/Logout by Coordinator report:

   a) Date.

   b) Time.

   c) User ID of the initiating Coordinator.

   d) Vehicle ID.

   e) Operator ID.

f) Route/Run.

4) Calls Received from Unlogged Revenue Vehicles report:
   a) Date.
   b) Time.
   c) Route.
   d) Run.
   e) Operator ID.
   f) Coordinator ID.
   g) CAD workstation.
   h) Type of Request to Talk message.
   i) Type of text message. (NEW)
   j) Vehicle ID.
5) Operator Login/Base Pullout Comparison report: (NEW)
   a) Date of Operator login.
   b) Time of Operator login.
   c) Route.
   d) Run.
   e) Operator ID.
   f) Vehicle ID.
   g) Date/Time stamp for the Base Pullout.
6) Coordinator Login/Logout report:
   a) Coordinator identification number.
   b) Date of Login/Logout.
   c) Time of Login/Logout.
   d) Strategy identification number.
   e) Event type, i.e. Login or Logout.
   f) Coordinator work assignment number.
7) Emergency Alarm report. (ADJUSTED)
   a) Date the EA was received.
   b) Time the EA was received.
   c) Time the EA was acknowledged by a Coordinator.
   d) Time a PRTT follow-up was received by CCS if applicable. (NEW)
   e) Time the follow-up PRTT was acknowledged by a Coordinator. (NEW)
   f) Time "end call" was activated by Coordinator. (NEW)
   g) Route/run.

h) Vehicle's operating base.

i) X,y coordinates of the Revenue Vehicle at the time the EA was initiated. (NEW)

j) Vehicle ID.

k) Operator ID.

l) Coordinator ID.

m) CSR number(s).

8) Critical AVM Alarm report: (NEW)

a) Date the Critical AVM alarm was received.

b) Time the Critical AVM alarm was received.

c) Time the Critical AVM alarm was acknowledged.

d) Type of Critical AVM alarm/error code generated.

e) Route/run.

f) Vehicle's operating base.

g) X,y coordinates of the location at which the Critical AVM alarm occurred.

h) Vehicle ID.

i) Operator ID.

j) Coordinator ID.

k) CSR number(s).

9) Cancel RTT/PRTT report: (NEW)

a) Date of cancellation.

b) Time of cancellation.

c) Vehicle ID.

d) Operator ID.

e) Route/run.

Message Events report (NEW)

The Message Events report content will include but not be limited to the specified fields whenever applicable.

1) Date and time stamp.

2) Message type.

3) Unique message identifier.

4) Originating VID.

5) Originating OID.

6) Originating CID.

7) Originating Block ID.

8) Time at which the message arrived in the CCS.

9) Time at which the alarm message was acknowledged by the responding Coordinator.

10) Time at which the message was responded to by initiating a call to an Operator.
11) How long the call setup took.
12) The time at which the “end call” command was requested.
13) The time at which the channel the call was occupying was actually released.
14) For text messages the following fields are also required:
    a) Message Content.
        i) Pre-defined (canned) messages: message code and description.
        ii) Custom (free-form) message content.
    b) Read Receipt.

CCS Transition Events report (NEW)
CCS Transition Events report content will include but not be limited to the specified fields as applicable for the type of Transition event.

1) Event or event code.
2) Date the event occurred.
3) Time the event occurred.
4) Who activated the event.
    a) System.
    b) CCS System Administrator ID.
    c) CCS User Administrator ID.
5) Record of all event-associated automated notifications sent to or by the CCS.

5.2.2 CCS Data Retention

Data Retention Schedule
The retention schedule for CCS data shall be determined in the design phase, and will be subject to KCM approval.

1) Data that is transmitted from Revenue Vehicles, such as poll response data, will be retained on a short-term basis.
    a) CCS shall retain its poll-response and other raw data received from Revenue Vehicles, at a minimum, until OBS data is securely recorded, archived, and accessible to CCS databases.
2) Data unique to the CCS, such as CSR or CCS system administration data, will be retained on a long-term basis.

Describe the system processes that would ensure OBS data is received by the CCS, stored in the CCS, and accessible to CCS reporting applications before CCS raw, current-day data is purged or archived. Discuss system health alarms, automated recovery, or other functionality that would ensure no data is lost.

5.2.3 CCS Data design

Radio system data
CCS design shall accommodate the radio system's record, archive, and playback features for voice calls and related message data. (ADJUSTED)

Join OBS and CCS historical data
The CCS shall have the ability to query OBS and CCS databases to correlate systems data, e.g. match CSR numbers with Revenue Vehicle events. **(NEW)**

Describe how your proposed systems would accomplish joining OBS and CCS historical data for reporting purposes. Discuss any cost implications.

5.3 Usability

5.3.1 Report Format Design

Report Format Design
The design format of all CCS reports shall be determined in the design phase and subject to KCM approval.

5.3.2 User access to reports

Varied Report Access
The CCS shall provide a variety of methods (e.g. context clicking, function keys and drop-down menus) to access CCS reports, as appropriate to report type.

1) Methods for user access to reports will be determined and agreed upon by KCM and the Contractor in design.

5.4 Testing

CCS Report testing
The CCS reporting functions and supporting details described in this use case shall be tested according to the Level 2 testing requirements described in Subsection **3.A.7.5, Testing**.

6. Extension Points

BO3-Manage Historical Data

CC2-Log in Revenue Vehicle

CC2-Log in Revenue Vehicle

CC3-Manage Revenue Vehicle Polling

CC4-Monitor Revenue Vehicles

CC5-Initiate Communications to Revenue Vehicle

CC6-Respond to Revenue Vehicle Communications

CC7-Manage Transit Service & Geographic Data

CC8-Manage Incident

CC10-Log out Revenue Vehicle

CC11-Log out CCS User

CC14-Manage System Health

CC15-Transition CCS

7. Assumptions

CCS Database access for Contractor interfaces and user applications shall be read-only.

8. Issues

Using the information KCM has provided in the RFP, describe any CCS database size constraints, and your company's experience with successfully identifying, designing, implementing, and maintaining similarly constrained databases. Discuss the allotment of space to current-day, historical, and archived data, and address processes for archiving, accessing, and restoring archived data. Discuss any cost implications.

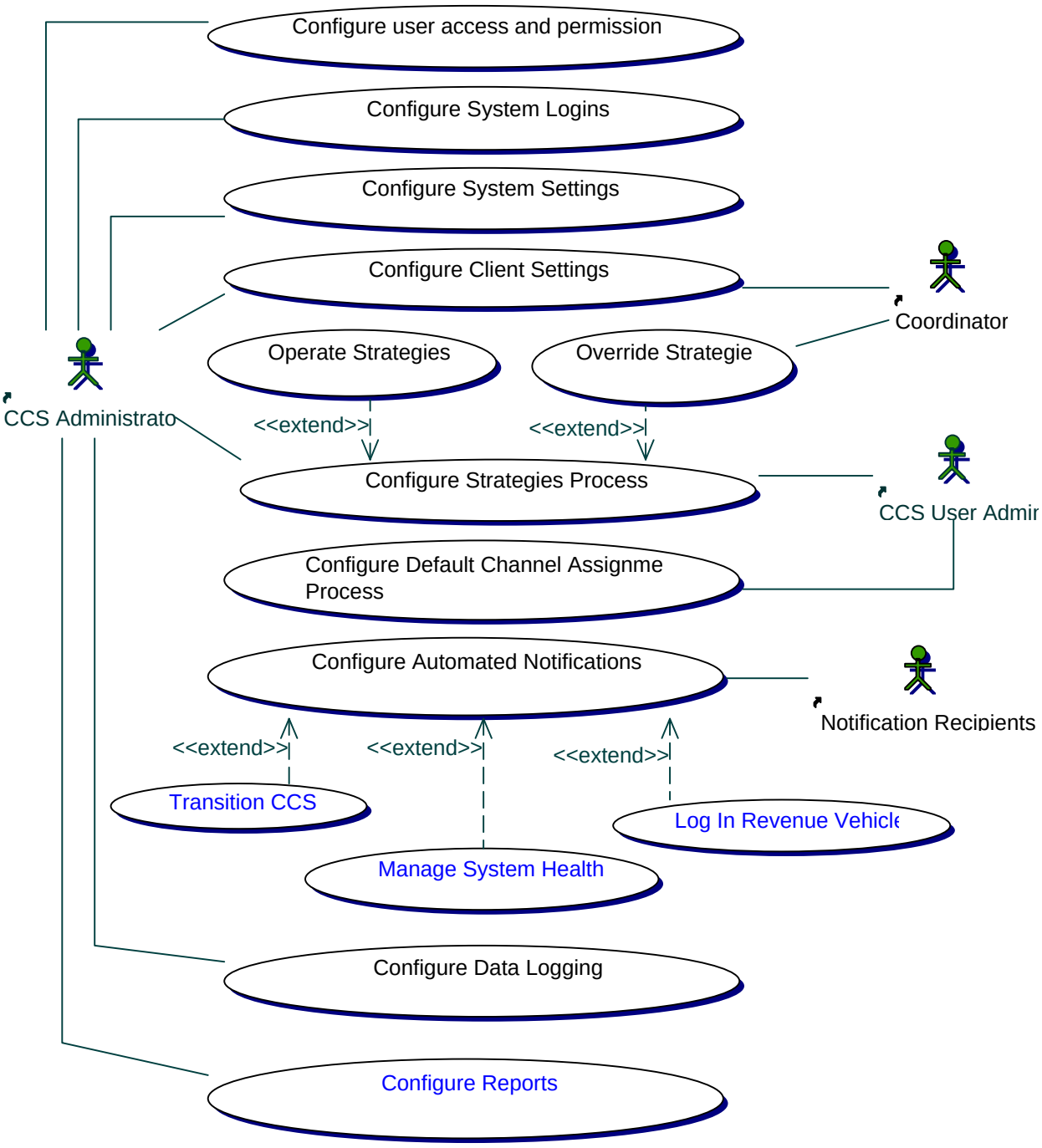
3.B.4.2.13. CC13-Manage Configuration

This use case package includes the following UML diagrams:

UseCase Diagrams

Figure ***3.B.4.2.13.CC13. CC13-Manage Configuration***

Figure 3.B.4.2.13.CC13. UseCase Diagram CC13-Manage Configuration



14. CC13-Manage Configuration

1. Brief Description

This use case addresses configuration of CCS access and permission levels, processes, settings, and graphical user interfaces.

2. Pre-conditions

The CCS is up and running. (See use case ***CC15-Transition CCS***.)

The Radio system is up and running.

Revenue Vehicles are being monitored by Coordinators. (See use case ***CC4-Monitor Revenue Vehicles***.)

3. Flow of Events

This use case is triggered when the CCS is brought up or running. (See use case ***CC15-Transition CCS***.)

3.1 Basic Flow

Configure User Access Permissions
The CCS administrator shall have the ability to set CCS user access and permissions to ensure systems security. **(ADJUSTED)**

1) The CAD/AVL system will provide three types of user access permission levels for each hardware configuration.
   a) Permission Level 1, general Coordinator functionality, will include but not be limited to:
      i) Monitoring vehicle location.
      ii) Processing radio calls.
      iii) Generating, saving, editing, and closing CSRs.
      iv) Accessing a user view of schedule data.
      v) Functionality that will be enabled for individual users within Level 1. **(NEW)**
         (1) Building, editing and launching Strategies.
         (2) Transitioning the CCS between levels of functionality.
   b) Permission Level 2, Managers/Analysts functionality, will include all Permission Level 1 functionality plus:
      i) Accessing schedule lists, block details, and timepoints that are loaded into the database.
      ii) Service Communications supervisory staff functions, including the ability to initiate reports such as the Call Report. (See use case ***CC12-Manage Data Reporting***.)
   c) Permission Level 3, CCS Administrator functionality, will include all Permission Levels 1 and 2 functionality plus:
      i) Setting CCS access controls and user permissions. **(NEW)**
      ii) Running CCS administration and troubleshooting reports. (See use case ***CC12-Manage Data Reporting***.) **(NEW)**
      iii) Conducting CCS maintenance and troubleshooting functions. (See use case ***CC14-Manage System Health***.) **(NEW)**

2) CCS Administrators will be able to fully reconfigure user access and permission levels for system users. **(NEW)**

   a) The Contractor will work with KCM to establish initial user access and permission levels for CCS users.

   b) The number of permission levels shall be configurable, e.g., KCM may decide to have four rather than three levels.

   c) The permissions within each level shall be configurable, e.g., KCM may decide to add or delete permissions from one of the levels.

3) CCS Administrators will have the ability to toggle on and off specific permissions, to be determined in the design phase, within a level for individual users. (For example, processes that require additional training, such as transitioning CCS levels of functionality, may be made accessible to some users but not others.) (See use case ***CC15-Transition CCS***.) **(NEW)**

Configure system logins
CCS Administrator shall be able to configure CCS systems logins.

1) Whether a login is required, and the type of login required for access to each CCS application, will be predefined and configurable by the CCS Administrator for all CCS applications.

2) When a CCS user login is required, the CCS will verify the login data (e.g., authorized user identification number, associated password, and assignment number). (See *Verify Login Data* step in use case ***CC1-Log in CCS User***.)

3) When a login is required, the number of login attempts allowed before the system denies the user a retry will be configurable by CCS Administrator.

4) User passwords will be valid for a configurable amount of time. CCS Administrators may require the CCS to prompt a user to reset his password three months after its origination, or may allow a password to remain valid indefinitely. **(NEW)**

Configure System Settings
CCS users shall be able to configure system settings as their access permissions allow. **(ADJUSTED)**

Configurable system settings will include parameters for time, conditions, content and radio call management.

1) Time

   a) Time Frame for Geographical Boundary: User may define which Revenue Vehicles will be in a geographical area within a defined time frame when setting up a radio call. For example, if a Coordinator initiates a radio call to all vehicles passing a ten-block area, then the CCS will determine which vehicles are scheduled to be in that area within the next 60 minutes and include them in the call. (See use case ***CC4-Monitor Revenue Vehicles***.) **(NEW)**

   b) Repeat Broadcast at Intervals and Within a Set Timeframe: User may elect to rebroadcast a recorded voice message to Revenue Vehicles in a configurable cycle of minutes within a configurable defined period of time. For example, a Coordinator might make a quick recorded message such as "Please close the coach windows when you return to the base," and the message would be broadcast every 15 minutes for two hours. (See use case ***CC5-Initiate Communications to Revenue Vehicles***.) **(NEW)**

   c) Automated End-of-Service-Day Fleet Logoff: User may set and configure time for an automated end-of-service-day logoff. For example, all Revenue Vehicles that are not in service may be automatically logged off of the radio system each morning at 3:15. (See use case ***CC10-Log out Revenue Vehicle***.)

d) Refresh Record of Unlogged Coaches: The CCS will have a configurable interval at the end of which it will compare expected logins with received logins to determine which Revenue Vehicles are operating as unlogged vehicles. (See use case ***CC2-Log in Revenue Vehicle***.) **(NEW)**

e) Entry of CCS Early/Late Tolerance Parameters: The CCS will have configurable parameters for displaying a Revenue Vehicle's schedule adherence status as running early or late on the CCS map display and other functions. For example, on a day with heavy traffic, a CCS User Administrator may decide to change the late tolerance parameter to 20 minutes instead of the usual 15 minutes, resulting in less visual interruption from the Revenue Vehicle icons changing color when a vehicle enters into late operations. (See use case ***CC4-Monitor Revenue Vehicles***.) **(NEW)**

   i) CCS Early/Late Tolerance Parameters Refresh: The CCS will have a configurable amount of time within which it refreshes any early/late tolerance parameters that have been entered. For example, the CCS may refresh and apply any new early/late tolerance parameters every 8 minutes.

f) Automated Late Beyond Recovery Message Time Parameters: The CCS will provide coordinators with the ability to select time parameters for triggering receipt, at the coordinator console level, of the automated Late Beyond Recovery message from the Revenue Vehicle. (See use case ***CC6-Respond to Revenue Vehicle Communication***.) **(NEW)**

   i) Coordinators will have the ability to toggle on or off receipt of the Late Beyond Recovery messages at their individual coordinator consoles. For example, on a day with heavy traffic, a coordinator may choose to toggle off the feature so that he is not inundated with automated messages.

   ii) CCS User Administrators and CCS Administrators will have the ability to toggle on or off the receipt of automated Late Beyond Recovery messages, at the coordinator console level and at the system level.

g) Processing Time: The CCS will have a configurable time set(s) for the processing of live messages between system components. For example, if a "component alive" message is not received within the expected time limit, the CCS will assume the component has failed. **(ADJUSTED)**

h) Logging Health Checks: The CCS will have configurable time intervals at which it will log component and interface health checks. (See use case ***CC14-Manage System Health***.) **(ADJUSTED)**

i) Non-Volatile Memory Refresh: When applicable, the CCS will have a configurable amount of time within which it saves its volatile memory to disc. For example, every 10 minutes the CCS application will write volatile memory to the appropriate CCDB.

j) Non-Receipt of Sent Message Parameter: The CCS will have a set time frame at the end of which it will alert a Coordinator that a message sent by the CCS to the OBS was not received by the Radio System. For example, after six seconds, the CCS will stop reading the device from which it expects to receive an acknowledgment, and send a message to the Coordinator who initiated the message, letting him know the message was not received. (See Subsection **3.A.6.6.1.1, Radio Data Message Protocols**.) **(NEW)**

k) Cease Fast Polling: The CCS will have a configurable set of time and other conditions that will trigger the end of fast polling. For example, when a bus has been out of motion for a specified time frame and fast polling was not initiated by an EA, the system will automatically cease fast-polling the vehicle. (See use case ***CC4-Monitor Revenue Vehicles***.) **(NEW)**

l) Unanswered Queued Call Prompt: The CCS will have a set time frame for alerting a Coordinator that a call has gone unanswered in his CAD queue. For example, if a call sits in a Coordinator's queue for a full 30 seconds in conjunction with the absence of CAD queue activity, the CCS will produce a distinct audible tone to alert the Coordinator that a call is in his queue. (See use case ***CC6-Respond to Revenue Vehicle Communications***.) **(NEW)**

m) CSR Auto Save: The time period between auto saves for open CSR forms will be configurable. (See use case ***CC-8-Manage Incidents***.)

n) Undo Feature: Select CAD/AVL functions, such as closing a CSR, will have a configurable amount of time or number of keystrokes (e.g. 60 seconds or three keystrokes) within which the action can be undone. (NEW)

o) Current Day Playback: The CCS will provide a Playback feature using the current day's data that will reach back a configurable amount of time from the time of request for playback and replay all recorded events. For example, Coordinators can replay events for a vehicle for up to 1.5 hours prior to the time of the playback request. (See use case ***CC12-Manage Data Reporting***.) (NEW)

2) Conditions

a) Triggers for icon behavior: The CCS will require icons representing Revenue Vehicles to change color or behavior (e.g. flash) when the Revenue Vehicle exceeds a configurable parameter. For example, when the CCS detects it has not received five expected consecutive poll responses from a Revenue Vehicle, the Revenue Vehicle's icon on the AVL map may change color to alert the Coordinator. (See use case ***CC4-Monitor Revenue Vehicles***.) (ADJUSTED)

b) Logging Health Checks: The CCS will have configurable conditions (e.g. a change in state from unhealthy to healthy) that will require the CCS to log component and interface health checks. (See use case ***CC14-Manage System Health***.) (ADJUSTED)

3) Content

a) CCS CAD/AVL Console Audio Cues: CCS CAD/AVL console audio cues are used to alert Coordinators to CAD/AVL module functionality, e.g. to indicate that a call setup or text message has been sent from the CAD console to the Revenue Vehicle. These audio cues will be configurable by CCS System Administrators. (See ***CC5-Initiate Communication to Revenue Vehicles***.)

b) Predefined Text Messages: CCS Administrators will be able to configure he content of predefined text messages selected by Coordinators for transmission to the Revenue Vehicle. (See ***CC5-Initiate Communication to Revenue Vehicle***.) (NEW)

c) Data Codes in CSR Form: The data codes from which Coordinators choose when filling out a CSR shall be configurable. (See use case ***CC5-Manage Incidents***.)

4) Radio Call Management

a) CCS Message Queue Limits: The CCS message queue (including the total of all Coordinators' radio call queues) will accommodate messages without impacting system performance. For example, the CCS will have a configurable limit to the number of messages it can receive and hold in its queue at any one time. Once the CCS has reached the message limit, it will reject any additional messages. Rejected messages will continue to retry, rather than jeopardize CCS performance. *Describe CCS constraints and the mechanisms that will prevent system failure or reduced performance if system capacity limits are reached*. (ADJUSTED)

Configure Client Settings

Coordinators shall choose and save their client settings within configurable parameters. (NEW)

1) The CCS will provide default settings for CAD/AVL client settings.

2) The CCS will save a Coordinator's user preferences for his or her desktop appearance from session to session, such as: (NEW)

a) Colors and font.

b) Window arrangement, e.g. the size and placement/storage of minimized windows for the AVL, schedule information, and the CSR applications.

c) Settings for user's default options, e.g. displaying street labels, deadhead routes, landmarks, or transit facilities on display map.

d) Volume levels for incoming audio calls and other audible tones.

e) Fast-poll activation in conjunction with tracking an individual vehicle.

3) The CCS will provide the ability to reset an individual user preference or all saved user preferences to the default settings on a user's terminal. **(NEW)**

4) All CCS applications' visual and audio cues will be fully configurable by CCS Administrators. (See use case ***CC4-Monitor Revenue Vehicles*** for details of data characteristics.)

a) The CCS vendor will work with KCM to establish the initial characteristics of CAD/AVL screen data visual and audio cues.

Configure Strategies Process

The CCS User Administrator and CCS Administrator and shall have the ability to administer the Strategies process.

A Strategy ensures Coordinator coverage of Revenue Vehicles as well as a balanced workload for Coordinators. Each Strategy covers a 24-hour period and is broken into sections that reflect shifts in Coordinator assignments and their Assigned Groups of vehicles within that 24-hour period. Every service route in the system is included in every Strategy.

There are 12 Strategies to choose from in the current system, though the number is configurable. The service needs for the day (e.g. weekdays, Saturday, Sundays, Holiday, Partial Holiday, or Special Event Days) will dictate which Strategy is implemented by Service Communications staff. Communications Center staff may choose to create and implement new Strategies at any time.

1) The CCS will provide a tool for building, editing, and implementing Strategies. The Strategies tool will be integrated with other CCS system-administration tools.

2) Strategies will be configurable.

a) Predefined Strategies will be stored in the CCDB.

b) The Strategies tool will be included in all CCS work stations.

3) Permission access for building, editing, and implementing Strategies will be predefined and configurable by KCM.

Operate Strategies

The CCS Strategies process shall assign incoming radio messages (PRTTs, RTTs, text messages) to the appropriate Coordinator assignment based on the service route operated by the vehicle, as determined by the vehicle's most recent poll response message. (See use case ***CC3-Manage Revenue Vehicle Polling***.)

1) The CCS will track and assign all pieces of a Block's work to the correct Service Route Group.

2) A Strategy will attach every Service Route to the appropriate Service Route Group.

a) KCM currently has Service Routes divided among six Service Route Groups. The rationale behind the Service Route Groups is to divide the Service Routes to the extent possible according to service area region.

b) The number of Service Route Groups may change over time and will be configurable.

c) Radio call groups, Service Routes, and other characteristics by which Service Route Groups are defined may change over time and will be fully configurable by the CCS Administrator.

d) Any unlogged coaches, i.e. those without a service route, shall be assigned to a designated Service Route Group(s).

3) A Strategy will allocate every Service Route Group to a Coordinator work assignment.
    a) The Strategies process will include quality checks to ensure all existing or newly created Strategies adhere to the following:
        i) Strategies will include all service routes. No service route will be dropped or omitted from the process.
        ii) Strategies will assign all radio calls (except Emergency Alarms). There will be no unassigned radio calls.
        iii) Strategies will include all coaches, whether they are logged in to the system or are unlogged.
4) A Coordinator's login will result in the allocation of a work assignment from the current Strategy.
    a) A Coordinator's work assignment assigns the responsibility for specific Service Route Group(s) (known as the Coordinator's Assigned Group(s)) during that Coordinator's shift.
        i) Coordinator responsibilities for his Assigned Group(s) will include but not be limited to the following:
            (1) Revenue Vehicle monitoring.
            (2) Resolving service disruptions.
            (3) Receipt of and response to RTT/PRTTs when in Normal Operations Mode.
            (4) Receipt of and response to Voice Communications when in Emergency/Fallback Mode.
            (5) Receipt of and response to (if applicable) Text Messages. **(NEW)**
            (6) Incident Response.
                (a) CSR ownership.
5) The Strategies process will display EA messages sent by a Revenue Vehicle in the EA call management queue of all Coordinators logged in to the current Strategy. (See Queue and *Display Emergency Alarm Messages* step in use case ***CC6-Respond to Revenue Vehicle Communications***.)
6) The Strategies process will display RTT/PRTT messages sent by a Revenue Vehicle in the appropriate Coordinator's radio call queue according to work assignment. (See use case ***CC6-Respond to Revenue Vehicle Communications***.)
7) The Strategies process will display text messages sent by a Revenue Vehicle in the appropriate Coordinator's queue according to work assignment. **(NEW)**
8) The Strategies process will have the ability to add or delete Assigned Groups to Coordinators' assignments as it balances service coverage needs with Coordinator shift changes during its 24-hour period.
9) Coordinator logout from a Strategies work assignment will result in the forwarding of any remaining work—unanswered radio calls from the Coordinator's call queues and any open Coordinator Service Records (CSRs)—to the appropriate active Coordinator assignment according to the Strategies process. (See ***CC11-Log out CCS User*** and ***CC8-Manage Incidents*** use cases.)
10) The CCS will launch a Strategy only if every Service Route during a Strategy's 24-hour period is assigned to a Coordinator.

Override Strategies
The CCS shall accommodate temporary overrides of the Strategy process by allowing Communications Coordinators to override a Strategy on individual radio calls.

1) The CCS will provide Coordinators with the ability to view and work the queue of another Coordinator from their CAD consoles. (NEW)
2) A CSR will stay with the Strategy-assigned Coordinator until it is transferred to another Coordinator or closed by the Strategy-assigned Coordinator.
3) The CCS will provide the flexibility for Service Communications staff to alter the Strategies to accommodate changes in Coordinator work shift such as: (NEW)
    a) Coordinator starting his shift early or late.
    b) Coordinator ending his shift early or late.
4) The CCS Strategies process and the Schedule Data Management process (see use case ***CC7-Manage Transit Service & Geographic Data***) will provide a mechanism for checking the new schedule data for new service routes that are required for the Strategies process.

Configure Default Channel Assignment Process (ADJUSTED)
The CCS shall provide a process for providing Block default channel assignments to the Radio System for voice mode operations. (See use case ***CC15-Transition CCS***.)

1) CCS User Administrators and CCS Administrators will have a tool for assigning a default voice channel for a Block, typically done at Service Change. (NEW)
2) Each Block will be assigned a default voice channel by a CCS User Administrator when a new Block is created. (NEW)
    b) A Block's default channel will be submitted to the appropriate Transit database by a CCS User Administrator.
        i) The default channel information is part of a Block's data in Transit databases.
3) In voice mode, when no CCS call management functions are available, a Block's assigned default channel is used to route voice communications to the appropriate Coordinator radio consoles. Coordinators will continue their work assignments by listening for Revenue Vehicle voice communications on the voice channel that transmits the communications for the Coordinator's Assigned Groups. (See use case ***CC15-Transition CCS***.)

Configure automated notifications
The CCS will send automated notifications alerting designated staff to exceeded parameters or other conditions. (NEW)

1) Automated notifications will be sent when events such as the following occur:
    a) The CCS detects an in-service unlogged Revenue Vehicle. (See use case ***CC2-Log in Revenue Vehicle***.) (NEW)
    b) The CCS transitions from one level of functionality to another. (See use case ***CC15-Transition CCS***.) (NEW)
    c) The CCS is automatically or manually switched to a redundant system. (See use case ***CC14-Manage System Health***.) (NEW)
    d) A CCS component or connection is failing. (See use case ***CC14-Manage System Health***.) (NEW)
2) The events, the parameters that precipitate them, and the designated staff to receive the automated notifications will be fully configurable. (NEW)

Configure data logging
The CCS shall provide the ability to configure CCS data that is logged.

1) The following data-logging properties will be configurable:
   a) Adding, deleting, or editing fields for logged data.
   b) Frequency at which data is logged.
   c) Conditions under which data is logged, e.g. in some cases only when there is a change in state.

Configure reports
Designated KCM staff shall have the ability to configure the reports as detailed in use case ***CC12-Manage Data Reporting***.

1) The following aspects of CCS reports will be configurable:
   a) The reporting toolset through which a report is generated, e.g Crystal reports, SQL, Brio, etc.
   b) The type of report that is generated—canned or custom query.
   c) The time parameters for which a report can be queried, e.g. from shakeup begin date to shakeup end date.
   d) The maximum number of canned reports.
   e) The report content.
   f) The report format.
   g) Report types to be automatically emailed to designated recipients upon generation.
   h) Designated recipients for automatically e-mailed reports.
   i) New report types.

Configure access to standard desktop applications
The CCS shall allow Coordinators to configure access to KCM standard software from the desktop, e.g. e-mail, Web browsers, word processing. See Appendix **J, Current CAD/AVL Technical Environment**, for details of the current computing environment.

3.2 Alternative Flows

4. Post-conditions

5. Special Requirements

5.1 Technical Specifications

5.1.1 Ensure network security

Ensure network security
The Contractor will describe a CCS network security design that ensures authorized use of CCS workstations, and ensures that only authorized workstations are enabled with CCS applications.

For example, only a login with the assigned permission level, valid user ID, password, specified subnet, IP addresses, and the correct ODBC (Open Data Base Connectivity) would result in successful login.

5.1.2 24/7 Operation of CCS Databases

Provide 24/7 operation of CCS databases
The CCS shall provide live backups to ensure 24/7 operation.

1) The backup process will not impede system performance.

Ensure self-sufficiency in CCS design
The CCS system design shall ensure system self-sufficiency in an emergency or mishap.

1) The system shall not rely upon the availability of the King County network. Authentication of users shall be done locally, within the boundaries of the Communications Center.

2) System design shall provide a firewall or other mechanism to allow CCS Administrators to disconnect the system from the KC WAN as needed.

5.1.3 User Interface

CCS user interface
The CCS user interface shall be determined in the design phase, subject to KCM Project Manager approval.

1) The CCS user interface will provide user satisfaction greater than or equal to the current system user interface, measured by user satisfaction ratings.

5.1.4 System Configuration

Provide tools for CCS configuration
The CCS shall provide tools that allow CCS Administrators to configure CCS functions.

Configure system hardware
CCS user consoles will provide two types of hardware configuration: CAD/AVL terminals equipped with a radio console that will operate with call processing enabled, i.e. can initiate and receive radio calls, and CAD/AVL terminals without a radio console that will operate with call processing disabled, i.e. cannot initiate or receive radio calls or acknowledge Emergency Alarms.

1) The design and configuration shall incorporate hardware decisions to be agreed upon by KCM and the Contractor in the design phase.

5.2 Usability

5.2.1 Alternative methods for executing major CAD/AVL functions

Alternative methods for executing major CAD/AVL functions
Users shall have multiple methods for executing major CAD/AVL functions, such as toolbar menus, pull-down menus, keyboard function keys, context clicking (e.g. "right click") menus, a command line or command history and direct access to functions from CSR forms.

1) The following specifications are based on what the current CAD/AVL user interface provides. A replacement system should provide these same usability options, or KCM-approved equivalents:
   a) Pull-down menus located along the top of the application screen.
   b) Function keys, e.g. users may acknowledge an EA by pressing the F5 function key.
   c) Context clicking when pointing to an icon or pop-up menu.
      i) The system will provide users with the ability to select an individual vehicle by context clicking
         (1) when pointing at a vehicle symbol in a close grouping of vehicles.
            (a) The system will display the vehicle identification numbers of the vehicles in the grouping as a pop-up menu, from which the user may select the desired individual vehicle.
         (2) when pointing at the displayed schedule report for the vehicle.
         (3) from the Coordinator's queue of radio calls to highlight the individual vehicle in the queue list, then perform context clicking on the highlighted line. **(NEW)**

(a) Confirm Radio Call Setup to EA Queue: To prevent users from setting up a radio call to a Revenue Vehicle with an Emergency Alarm, the system will provide a default message such as "Do you really want to call this coach (route/run)? Y/N."

ii) Users will have the ability to select functions from the list of context-click menu options. For example, once the vehicle is selected, the user may choose the desired system function from the "right click" menu by "left clicking" on the pop-up menu list of system functions.

(1) System functions available for selection will include the following:

(a) *Call Block* function to initiate a radio call to the selected vehicle.

(b) *Create CSR* function to open a new Coordinator Service Record form.

(c) *Edit CSR* function to edit an existing CSR for the selected vehicle.

(d) *Block Detail* function to open the block detail report for the selected vehicle's assigned block

(e) *Block Train* function to open the block train report for the selected vehicle's assigned block.

(f) *Schedule List* function to open the schedule list report for the selected vehicle's service route.

(g) *Acknowledge EA* function to acknowledge an Emergency Alarm from the selected vehicle.

(h) *Delete Call* function to delete a radio call from the selected vehicle in the Coordinator's radio call queue.

(i) *End Call* function to conclude a radio call between the selected vehicle and the Coordinator by ending the radio connection to the selected vehicle.

(j) *Track Vehicle* function to track the selected vehicle on the AVL display.

(k) *Disable Vehicle Tracking* function to discontinue tracking the selected vehicle on the AVL display.

d) Users will have the ability to select major CAD/AVL functions by pointing and clicking on toolbar buttons representing each function.

e) Users will have the ability to execute CAD/AVL functions by typing command abbreviations into the command line.

f) Users will have the ability to execute CAD/AVL functions by selecting from a pull-down list of recently executed commands.

g) Users will have the ability to execute CAD/AVL functions directly from an open CSR form. (See use case ***CC8-Manage Incidents***.)

i) Users will be able to launch major CAD/AVL functions such as:

(1) Initiate a radio call to the vehicle associated with the CSR or summary CSR record.

(2) View the vehicle's schedule.

(3) View the vehicle's location.

h) Alternative methods for launching CAD/AVL functions may be substituted for those listed, based on favorable usability assessment results and KCM Project Manager approval.

5.3 Testing

5.3.1 Isolation chamber functionality

Provide test environment
The CCS shall supply a test station that provides isolation-chamber or firewall-like functionality.

6. Extension Points

CC1-Log in CCS User

CC2-Log in Revenue Vehicle

CC3-Manage Revenue Vehicle Polling

CC4-Monitor Revenue Vehicles

CC5-Initiate Communications to Revenue Vehicles

CC6-Respond to Revenue Vehicle Communication

CC6-Respond to Revenue Vehicle Communications

CC7-Manage Transit Service & Geographic Data

CC8-Manage Incidents

CC10-Log out Revenue Vehicle

CC11-Log out CCS User

CC12-Manage Data Reporting

CC12-Manage Data Reporting

CC14-Manage System Health

CC14-Manage System Health

CC15-Transition CCS

7. Assumptions

8. Issues

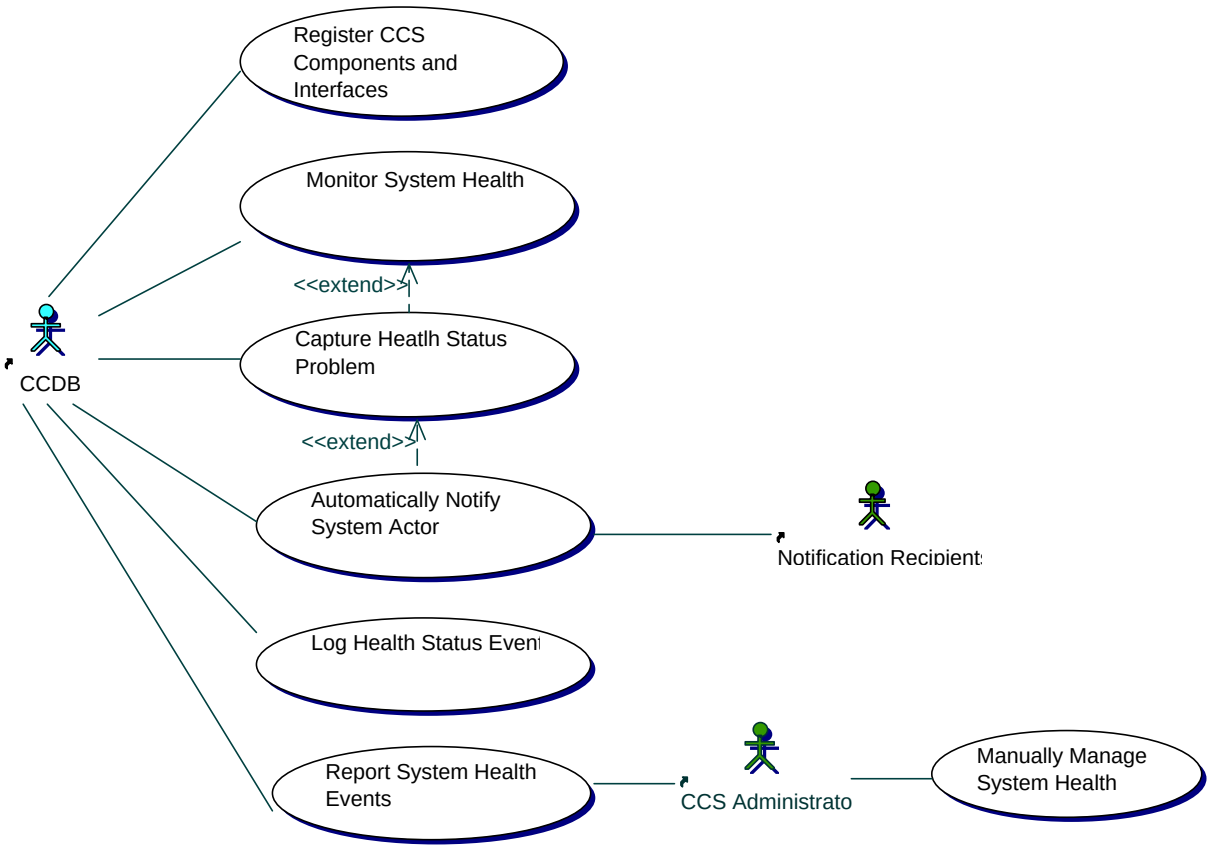
3.B.4.2.14. CC14-Manage System Health

This use case package includes the following UML diagrams:

UseCase Diagrams

Figure ***3.B.4.2.14.CC14. CC14-Manage System Health***

Figure 3.B.4.2.14.CC14. UseCase Diagram CC14-Manage System Health



15. CC14-Manage System Health

1. Brief Description

The Manage System Health use case addresses monitoring, diagnosing, and correcting health problems; notifying end users of system problems if applicable, and logging and reporting all health status events of the Communications Center System. These actions will occur through both automated and manual processes.

2. Pre-conditions

The CCS is up and running. (See use case ***CC15-Transition CCS.***)

The CCS is able to successfully communicate with the radio system.

One or more Revenue Vehicles is logged in to the CCS. (See ***RV1-Initiate Vehicle for Operation*** and ***CC4-Monitor Revenue Vehicles*** use cases.)

3. Flow of Events

This use case is triggered by the successful start up of the CCS.

3.1 Basic Flow

Register CCS components and interfaces (NEW)
The CCS shall automatically register and conduct a health check of all major CCS components and interfaces upon booting up the CCS.

1) If the CCS captures a health problem during registration it will correct the problem or notify the appropriate CCS user. (See use case ***CC13-Manage Configuration***.)

Monitor system health
The CCS shall continually automatically monitor the health of its major components and interfaces.

1) The CCS will monitor the health of its components and interfaces as determined and agreed upon by the Contractor and KCM in system design. (ADJUSTED)
    a) Components and interfaces will include but not be limited to the following:
        i) CCS databases. (ADJUSTED)
        ii) CCS components. (NEW)
        iii) CCS modules, e.g. the polling module. (ADJUSTED)
        iv) CCS internal interfaces. (ADJUSTED)
        v) CCS interface with the Radio System. (NEW)
2) The CCS will provide capability for monitoring messaging and "system alive" status. (ADJUSTED)
    a) When a component "alive" message is not received within a configurable amount of time, the CCS health status tracking mechanism will assume component failure. (See use case ***CC13-Manage Configuration***.) (ADJUSTED)
    b) When a failing component or system cannot send notification of its failure to the CCS, then the CCS will immediately notify the appropriate CCS user of a failed connection. (NEW)

Capture Health Status Problem (NEW)
The CCS shall capture failed health status in real time.

1) If a health problem occurs within the CCS or with its interface to the radio system, then the CCS will capture the problem.

a) Problem categories may include but not be limited to:

i) A component exceeds its healthy threshold or parameters. (See use case ***CC13-Manage Configuration***.)

ii) A component is absent (ceases to transmit or receive) from the system.

iii) An expected event is absent.

iv) A process cannot be completed.

Automatically notify system actor
When a health problem is captured, the CCS will automatically notify the appropriate system actor with the appropriate type of notification, as determined and agreed upon by the Contractor and KCM in design. (ADJUSTED)

1) Types of notification include:
   a) Writing the capture to the CCS database. (ADJUSTED)
   b) A near-real-time message to designated user(s). (ADJUSTED)
   c) Real-time alarm notification. (NEW)
2) Notification will include:
   a) Error code. (NEW)
   b) Error description. (ADJUSTED)
   c) Time and date of capture. (ADJUSTED)
   d) Time and date of automated fix if applicable. (NEW)
3) Appropriate system actors and types of notification may change over time and will be configurable by CCS Administrators. (See use case ***CC13-Manage Configuration***.) (ADJUSTED)

Log health status events
The CCS will log all health status events for CCS components and interfaces.

1) CCS health status events will include:
   a) Date and time stamp on all events. (ADJUSTED)
   b) Component registration. (NEW)
   c) Health status at startup. (NEW)
   d) Health checks at configured intervals. (See use case ***CC13-Manage Configuration***.) (NEW)
   e) Problem captures:
      i) Component, interface, or process error codes. (NEW)
      ii) Component, interface, or process error messages. (ADJUSTED)
   f) Automated notifications. (ADJUSTED)
   g) Diagnosis. (NEW)
   h) Corrections. (NEW)

Report system health events
The CCS shall report logged health events in a way that is useful to CCS Administrators, as determined and agreed upon by the Contractor and KCM in design.

1) System Health Event reports will include:

a) Radio system interface reports. (NEW)

i) The CCDB will log radio health status messages and events and provide them to CCS users in a Radio Status Report. (See use case ***CC12-Manage Data Reporting***.)

b) CCS System reports. (NEW)

i) Component registration.

ii) Health status at startup.

iii) Health checks at configured intervals.

iv) Component, interface, or process error codes.

v) Component, interface, or process error descriptions.

vi) Automated notifications.

vii) Date and time of health status message and event, e.g. registration, malfunction, notification, etc.

c) A combined systems (OBS, Radio System, and CCS) Radio Data Message Audit Trail Report. (See Subsection **3.A.6.6.1.3, Radio Data Message Audit Trail Report**.) (NEW)

2) The Contractor will provide up to 12 canned System Health reports. (NEW)

a) The number of canned reports may vary over time, and will be configurable by KCM. (See ***CC12-Manage Data Reporting*** and ***CC13-Manage Configuration*** use cases.)

3.2 Alternative Flows

3.2.1 Manual management of CCS system health

Manual management of CCS system health
CCS Administrators shall have the ability to manually monitor system health.

1) System Administrators will have tools to review and interact with the various data messaging systems and subsystems in real and/or near-real time. (ADJUSTED)

2) Administrators will use System Administration tools to monitor, test, diagnose, and troubleshoot the general functions of the systems and subsystems including:

a) CCS databases.

i) The database administration tool will provide the ability to check the underlying structure and integrity of CCS databases. (ADJUSTED)

b) CCS modules and processes.

i) Polling.

(1) CCS Administrators will have the ability to research poll messages, including:

(a) Accessing all of the data in a poll message that exists in the fields of the polling table. (NEW)

(b) Accessing poll data through the CCS database (s). (ADJUSTED)

(c) Monitoring real-time poll data messages as they are processed by the CCS. (ADJUSTED)

(2) Queries will be submitted by vehicle identification number or time of day for the purpose of identifying missed messages. (ADJUSTED)

c) CCS internal interfaces. (NEW)

d) CCS interfaces with the radio system. (NEW)

3) Administrators will use System Administration tools to access combined systems (CCS, the radio system, and OBS) data to monitor, test, diagnose, and troubleshoot data-message functions. (NEW)

4) System administration tools will provide the ability to:

   a) Monitor real-time message input and output for individual components. (NEW)

   b) Verify message quality. (NEW)

   c) Determine which CCS component is responsible for message corruption or identify that the problem originated from beyond the CCS radio interface (outside of CCS boundary). (NEW)

   d) Correct CCS health status problems, including component and interface processing errors and failures. (NEW)

4. Post-conditions

Any unhealthy system components or processes have been identified and corrected. System components and processes are healthy.

5. Special Requirements

5.1 Performance

Notify designated users
The CCS will automatically send near-real-time notifications to designated system users within two seconds of health problem capture by the system.

5.2 Technical Specifications

5.2.1 System Health Reports

Provide System Health Reports
Describe your proposed system health report formats and how they would be useful to system administrators. Be sure to discuss how the system or system administrators can easily select the most useful information for the report and not be inundated by superfluous data.

Describe your proposed method for ongoing system availability measurement and reporting.

5.2.2 CCS Redundancies

Provide Redundancies for all parts of the CCS
CCS redundancy will include a duplicate parallel system that will incorporate "hot standbys." (NEW)

1) All system parts will have redundant counterparts including but not limited to:

   a) Hardware.

   b) Software.

   c) Network.

   d) Databases and their content.

2) Client software will be sourced from a minimum of two different machines. (NEW)

3) The CCS will provide live redundancy enabling a quick and easy switch to backup with no degradation of service. (NEW)

4) The CCS will provide the ability to conduct maintenance on one redundant system and not the other (e.g. updating schedule data). (NEW)

5) CCS should be configured to provide 99.999% system availability. *Describe system configuration in terms of providing availability.* **(NEW)**

5.3 Testing

Each function will be tested according to Level 2 testing requirements as described in Subsection **3.A.7.5, Testing**. *Describe how the functionality and performance of each process described in this use case would be tested and measured.*

6. Extension Points

CC12-Manage Data Reporting

CC13-Manage Configuration

7. Assumptions

8. Issues

Describe the proposed system's response to emergency events such as floods, storms, and accidents, that cause a large number of emergency alarms or request-to-talk to be generated, or a large number of revenue vehicles to be off-route or late. Describe any limits to normal system operation under emergency event conditions.

It will be important to manage health status events in such a way as to facilitate maintenance without generating too much data for it to be useful. *Discuss how the CCS system health event log can be filtered and sorted to optimize its use.*

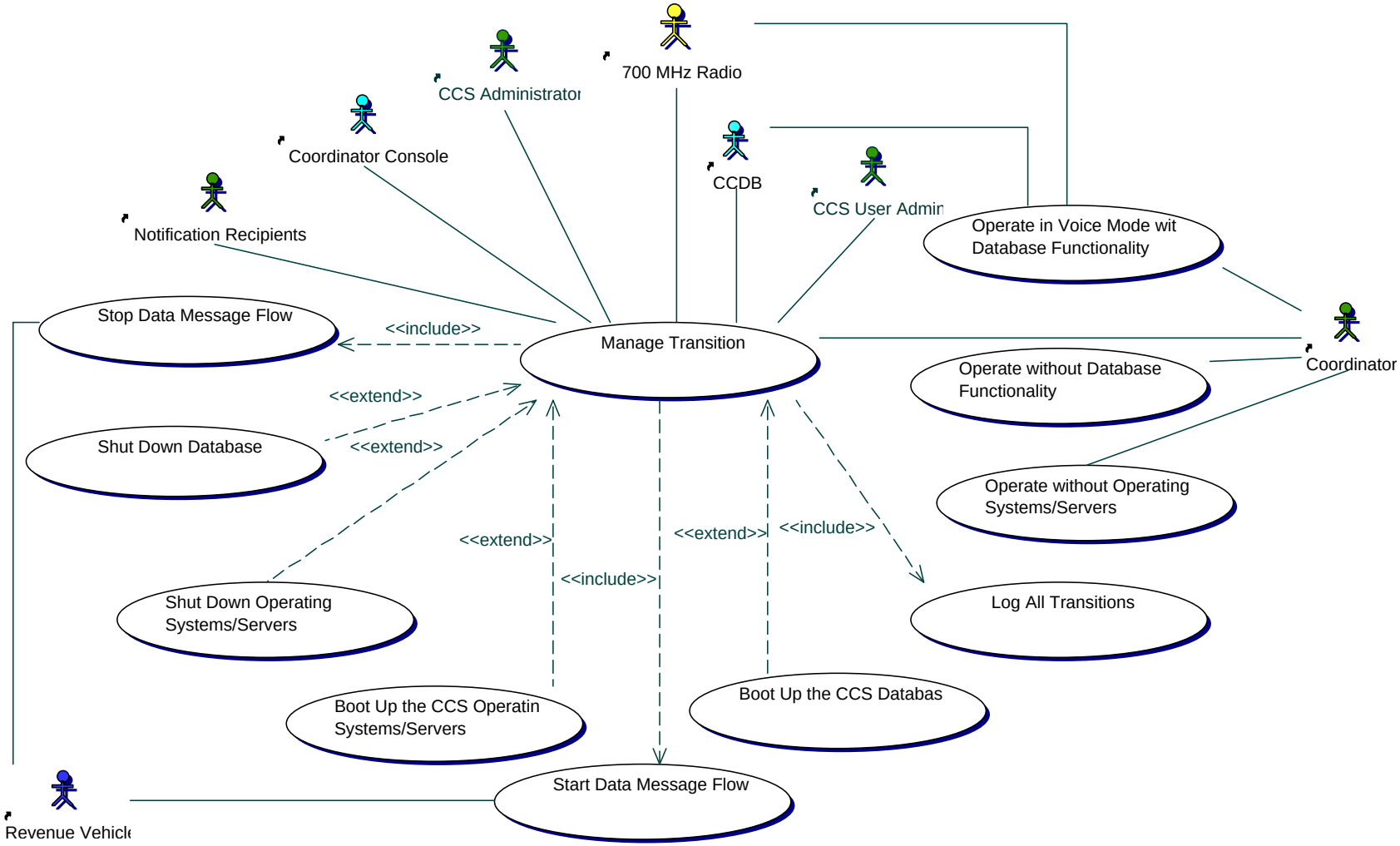
3.B.4.2.15. CC15-Transition CCS

This use case package includes the following UML diagrams:

UseCase Diagrams

Figure ***3.B.4.2.15.CC15. CC15-Transition CCS***

Figure 3.B.4.2.15.CC15. UseCase Diagram CC15-Transition CCS



16. CC15-Transition CCS

1. Brief Description

This use case describes the requirements for a) transitioning the CCS from data mode to voice mode and back to data mode again, and b) shutting down and then booting back up the CCS application and/or database functionality (including Schedule, GIS, and CSR data) as part of a planned maintenance process or an unplanned outage.

When the CCS is in data mode, there is a regular data flow between the CCS and Revenue Vehicles that includes poll, request-to-talk, EA and Critical AVM Alarm and other data messages. The CCS uses the data in its CAD and AVL functionality to monitor Revenue Vehicles and to prioritize and respond to request-to-talk, text, and alarm messages. There is no flow of data-message traffic between the CCS and the revenue fleet when the CCS is in voice mode; thus CCS functionality that would normally result from data message receipt is not operational. See **Assumptions** below for required independence of CCS functions.

2. Pre-conditions

The CCS is up and running in data mode.

Coordinators are logged in to the CCS and utilizing CCS CAD/AVL functions.

3. Flow of Events

This use case is triggered when an expected (planned) or unexpected event requires a change in the level of CCS functionality.

3.1 Basic Flow

Each level of functionality will be independent and contained: a user can choose to stop at any level, rather than move into the next level of transition, and operate at that level without time or similar restriction.

Stop data-message flow
CCS user shall stop the CCS from sending data message communications to Revenue Vehicles.

1) User will have the ability to stop the CCS from sending data message communications to Revenue Vehicles from a subset of CAD/AVL terminals as well as from the CCS or Radio System equipment housed in the Communications Center. **(ADJUSTED)**
    a) When the Revenue Vehicles detect the absence of data messages after a configurable amount of time, then their radios will drop into voice mode. (See use case ***RV17-Interface to 700 MHz Radio***.)

Manage transition of CCS functionality
The CCS shall manage the transition of the level of CCS functionality.

1) Upon the user initiating a transition, the CCS shall present the user with an informational dialogue, to include: **(NEW)**
    a) The level of functionality that the user is moving from.
    b) The level of functionality that the user is moving to.
    c) A prompt for confirmation of the user's intent to transition the system.
2) The CCS shall automatically notify designated users and other staff that the CCS is transitioning from one level of functionality to another. **(ADJUSTED)**
    a) CCS users: As the CCS transitions, the system will automatically send an e-mail and/or live page message to CCS Administrators, Managers, and other staff as configured.
3) The CCS shall retain any and all unanswered queued calls (RTT/PRTT, text or EA messages) generated prior to the moment of transition. **(ADJUSTED)**

a) All unanswered RTT/PRTT, text or EA messages received prior to transitioning the level of functionality shall remain visible in Coordinators' queues during and after transition when technically possible. When it is not technically possible for unanswered queued calls to remain visible, the calls will be saved to system memory and reappear in Coordinators' queues when technically possible, as they were, just prior to the moment of transition.

4) The CCS will be able to receive all transmitted EA messages during the transition.

a) The CCS shall ensure that all EA messages are received by the CCS in its redundant path on a voice channel. (See use case ***CC6-Respond to Revenue Vehicle Communications***.)

Operate in voice mode with database functionality
The CCS shall retain limited functionality when operating in voice mode.

1) The CCS will provide the ability to retain schedule, GIS map data, and CSR functionality when the system is in voice mode.

a) CSR functionality will include the ability to generate, automatically populate to the extent possible (e.g. CSR number), edit, and save CSRs.

b) The CCS will provide vehicle location data transmitted prior to the transition to voice mode for use by the CCS AVL function. **(ADJUSTED)**

2) When in voice mode the CCS shall not receive data messages.

3) When in voice mode, Coordinators communicate with the Revenue Vehicle fleet using the 700 MHz radio system.

Shut down CCS database
User shall be able to shut down the CCS database.

1) Designated staff will shut down the CCS database from a subset of CAD/AVL terminals and from CCS or Radio System equipment housed in the Communications Center. **(ADJUSTED)**

2) The CCS will ensure that all requirements listed in step *Manage transition of CCS functionality* are met when the CCS database is shut down.

Operate without CCS database functionality
Coordinators shall be able to access tools and communicate with Revenue Vehicles when the CCS database is shut down.

1) Coordinators will retain access to the KC Intra- and Internet on their CAD/AVL terminals when the CCS is shut down.

2) Coordinators will communicate with Revenue Vehicle Operators using voice mode when the CCS is shut down.

Shut down CCS operating system/servers
Designated CCS staff shall have the ability to shut down the CCS operating system and servers.

1) The CCS will ensure that all requirements listed in the *Manage transition of CCS functionality* step are met when the CCS operating system/servers are shut down.

Operate without CCS operating system/servers
Coordinators shall be able to access tools and communicate with Revenue Vehicles when the CCS operating system/servers are shut down.

1) Coordinators will retain access to the KC Intra- and Internet on their CAD/AVL terminals when the CCS operating system/servers are shut down.

2) Coordinators will communicate with Revenue Vehicle Operators using voice mode when the CCS operating system/servers are shut down.

Boot up the CCS operating system/servers
The CCS shall provide the ability to boot up the CCS operating system/servers.

1) Upon boot-up, the CCS shall automatically register and conduct a health check of all major CCS components and CCS connections with interfacing systems. **(ADJUSTED)**

   a) If the CCS captures a health problem with CCS major components or CCS connections with interfacing systems, OBS, or the radio systems, it shall correct the problem or notify the appropriate configured CCS user. (See the ***CC14-Manage System Health*** and ***CC13-Manage Configuration*** use cases.) **(ADJUSTED)**

2) The CCS will ensure that all requirements listed in *Manage transition of CCS functionality* are met when the CCS operating system/servers are booted up.

Boot up the CCS database
The CCS shall provide the ability to boot up the CCS database from a subset of CAD/AVL terminals as well as from the CCS or TRS equipment housed in the Communications Center. **(ADJUSTED)**

1) The CCS will ensure that all requirements listed in *Manage transition of CCS functionality* are met when the CCS database is booted up.

Start data message flow
Users shall have the ability to resume sending data message communications to Revenue Vehicles from a subset of CAD/AVL terminals as well as from the CCS or TRS equipment housed in the Communications Center. **(ADJUSTED)**

1) User will resume data message communications.

   a) The Revenue Vehicles will detect the presence of data messages, such as poll or contention-allowed slots from the CCS, and will return to data mode. (See use case ***RV17-Interface to 700 MHz Radio***.)

2) CCS components such as CAD/AVL screens and queues will be up and running and ready to accept data messages.

3) The CCS will ensure that all requirements listed in the *Manage transition of CCS functionality* step are met when the data-message flow is restored.

4) The CCS will be able to update its record of Revenue Vehicle logins upon returning to data mode, quickly and efficiently in a manner to be determined and agreed upon in design by the Contractor and KCM. (See use case ***RV1-Initiate Vehicle for Operation***.)

   a) The CCS will automatically pace its processing of Operator re-logins without negatively impacting CCS functionality.

Operate in data mode with full CCS functionality
The CCS shall provide the ability to operate in data mode as described in all CCS use case specifications.

1) When in data mode the CCS will have a regular data flow between the CCS and Revenue Vehicles that includes poll, request-to-talk, EA and Critical AVM Alarm and other data messages. **(ADJUSTED)**

   a) The CCS will use the data in its CAD and AVL functionality to monitor Revenue Vehicles, and to prioritize and respond to request-to-talk, text, and alarm messages. **(ADJUSTED)**

Log all CCS transitions between levels of functionality
The CCS shall log all events related to the transition levels of functionality. **(ADJUSTED)**

1) The log for each event will identify:
   a) The event type (e.g. switch from data to voice mode).
   b) The reason for launching the transition (e.g. CAD/AVL terminal maintenance).
   c) The user who launched the transition (e.g. Coordinator or System Administrator ID).
   d) The terminal or other equipment from which the event was launched (e.g. CAD/AVL terminal # 3).
   e) The time at which the transition was launched.

3.2 Alternative Flows

An unplanned event switches the CCS from data to voice mode or shuts down the CCS database or operating system/servers when redundant systems cannot support functionality. (See use case ***CC14-Manage System Health***.)

3.2.1 Unplanned Transition to Voice Mode and CCS Shutdown

Automated decrease in level of functionality

The CCS shall automatically decrease its levels of functionality, as defined above, as is appropriate in response to an unplanned event.

1) The CCS will automatically notify designated users and other staff that the CCS is decreasing its functionality. **(ADJUSTED)**
   a) The notification will state the specific change in functionality.
2) The CCS will retain any and all unanswered queued calls (RTT/PRTT, text or EA messages) generated prior to the moment of decrease in functionality.
   a) All retained unanswered queued calls will remain visible in Coordinators' queues after the decrease in functionality.
   b) If the CAD screen goes blank, the CCS will retain unanswered queued calls in its memory and display them in the Coordinators' queues when functionality is restored.
3) The CCS will ensure that all requirements listed in step *Operate in voice mode with database functionality* are met when the CCS automatically transitions into voice mode.
4) The CCS will ensure that all requirements listed in step *Operate without CCS database functionality* are met when the CCS automatically shuts down its database.
5) The CCS will ensure that all requirements listed in step *Operate without CCS operating system/servers* are met when the CCS automatically shuts down its operating system/servers.
6) Outside of any acceptable time parameters for automated correction, to be determined in CCS design, the CCS will require a manual boot-up of the CCS operating system, servers, and databases, and restoration of the data-message flow once the CCS or other system impacting the radio communications mode recovers its health.
   a) Users will be able to boot up the CCS databases and start the flow of data messages from a subset of CAD/AVL terminals as well as from the CCS or TRS equipment housed in the Communications Center. **(ADJUSTED)**
      i) The CCS will present the user who is initiating a restoration of functionality with a message that requires confirmation of the user's intent to restore that specific functionality. **(NEW)**
7) Return to step *Boot up the CCS operating system/servers* in the Basic Flow.

4. Post-conditions

The CCS database is up and running and the CCS is operating in data mode.

5. Special Requirements

5.1 Technical Specifications

5.1.1 Retain existing data/voice mode indicator light

Retain data/voice mode indicator light
The CCS will retain the data/voice mode indicator light alarm, or KCM-approved equivalent, to alert CCS staff to a change from data to voice mode.

1) The data/voice mode indicator light will be located where all Coordinators can see it at all times. (In the legacy system, a light is installed on the ceiling. It stays green when the radio system is operating in data mode and turns red instantly when the radio system drops into voice mode.)

5.1.2 Maintain independent functionality

Maintain independent functionality
The flow of data message communications, voice message communications and CCS database functionality shall be independent of each other, as will the ability to poll Revenue Vehicles and maintain data radio-call functions.

1) The CCS will provide the ability to receive data messages initiated by Operators (RTT/PRTT, Text and EAs) in Coordinators' CAD/AVL queues when the CCS has stopped polling Revenue Vehicles.
2) The CCS will have the ability to maintain CCS database (Schedule, GIS, and limited CSR) functionality when in voice mode.
3) The CCS will provide the ability for Coordinators to initiate and respond to voice radio calls to and from individual Revenue Vehicles and the fleet when the CCS is down or the TRS is in voice mode.

5.1.3 Transition CCS design

Design Transition CCS Process
The specific steps required to transition between the levels of CCS functionality while maintaining constant communications with the Revenue Vehicle fleet will be determined in the design phase in collaboration with the selected 700 MHz Radio system contractor.

A simple process is highly desirable

5.2 Performance

5.2.1 Mode-transitioning performance

Mode-transitioning performance
The process for transitioning from voice to data modes and for shutting down and booting up the CCS will require no more than three steps for a user to follow for each decrease in level of functionality.

Transitioning through levels of CCS functionality will not produce any unintended negative events for CCS components or functionality.

5.3 Testing

Transition CCS Testing
Each function and supporting detail described in this use case specification shall be tested according to the Level 2 testing requirements described in Subsection **3.A.7.5, Testing**.

5.4 Usability

6. Extension Points

CC6-Respond to Revenue Vehicle Communications

CC13-Manage Configuration

CC14-Manage System Health

RV1-Initiate Vehicle for Operation

RV17-Interface to 700 MHz Radio

7. Assumptions

The ability to initiate planned CCS transitions and CCS shutdown/boot-up events will be granted according to a user's access permission levels.

CCS staff will have the ability to notify Revenue Vehicle Operators of voice/data mode changes prior to their occurrence.

8. Issues

3.C. Questions for Level 2 Technical Requirements

This subsection contains questions to be addressed by Proposers in responding to the requirements included in Part C, Subsection **3.A, Level 2 Technical Requirements**. Proposals shall address the questions in the order presented, identifying each answer by the question number shown below. Subsection **3.C** Questions reflect the organization and content of Subsection **3.A**., for example, questions related to Subsection **3.A.7.3, Installation** may be found below in Subsection **3.C.7.3, Installation**. Answers need to be specific, detailed, and straightforward using clear, concise, easily understood language.

When formulating answers, Proposers shall consider information provided and requirements included in the entire RFP. Special consideration should be given to the instructions provided in Part A, the Terms and Conditions detailed in Part B, and applicable standards, regulations, and functional requirements described in Part C. Failure to do so will be at the Proposer's own risk.

Along with other proposal contents specified in Part A, Subsection **2.E., Proposal Scoring and Priority**, the Proposer's responses to questions contained in Subsection **3.C.** are intended to provide KCM reviewers with the information needed to judge the worthiness of each proposal. KCM's proposal evaluation team will assign points to each proposal based on the guidelines set forth in Part A, Section **2, Proposal Evaluation and Contract Award.** That section sets forth the weighted-maximum-scoring-points system that will be used for evaluating each proposal, including the responses to the questions contained in this section.

The answers to these questions shall constitute the Proposer's full response to Part C, Subsection **3.A, Level 2 Technical Requirements** comprised of:

- Subsection **3.A.1. Level 2 Overview**.
- Subsection **3.A.2. Procurement Process Description (Upgrade vs. Replacement)**.
- Subsection **3.A.3. Communications Center System Statement of Work**.
- Subsection **3.A.4. Communications Center System Replacement (Alternative A)**.
- Subsection **3.A.5. Communications Center System Upgrade (Alternative B)**.
- Subsection **3.A.6. Level 2 Technical Specifications**.
- Subsection **3.A.7. Other Level 2 Project Requirements**.

Proposers shall prepare their answers in accordance with the instructions provided in Part A, Subsection **1.T.3**, **Response Content Requirements**. Answers to these Part C, Subsection **3.C.** questions, in combination with the Proposer's System Self-Assessment described in Part A, **Subsection 1.T.5**, and.responses to the Level 2 Functional Requirements in Part C, **Subsection 3.B**, will constitute the Proposer's detailed Level 2 system proposal to KCM.

In addition to providing their responses to the questions below, Proposers may identify in their answers any concerns or issues raised by the stated requirements.

3.C.1. Level 2 Overview

No questions.

3.C.2. Procurement Process Description (Upgrade vs. Replacement)

3.C.2.1. OBS/CCS Level 2 Proposal Evaluations: Phase III Activities

a. CCS Replacement Proposers:

Describe in detail the proposed simulated benchmark testing environment that, if selected to participate, you will provide for KCM user evaluations.

b. CCS Upgrade Proposers:

Provide a description of your proposed Upgrade team (name, job title, organization, and project role) and their qualifications and relevant experience.

Describe the information needed for your proposed Upgrade team to conduct a thorough Upgrade Assessment and develop detailed proposed CCS Upgrade project schedule and costs.

3.C.3. Communications Center System Statement of Work

3.C.3.1. CCS Scope Overview

No questions

3.C.3.1.1. Continuity in Existing Level of system Functionality

No questions

3.C.3.1.2. Expected Changes in Next System Functionality

No questions

3.C.3.1.3. User Function enhancements

No questions

3.C.3.2. CCS and Transit Radio System Project Boundaries

No questions

3.C.3.2.1. Project Dependencies

No questions

3.C.3.3. Communications Center System Interfaces

No questions

3.C.3.4. Level 2 Project Phases

Describe your proposed approach to the required Level 2 project phases.

Discuss any recommended additions or deletions to the Level 2 project phases and associated milestones and activities.

Referring to your proposed Level 2 work plan (as required in Part A, Subsection **1.T.3**, **Response Content Requirements**) discuss key points of coordination between your firm, KCM, and other contractors to ensure well-designed and coordinated Level 1 and Level 2.

3.C.4. Communications Center Systems Replacement (Alternative A)

3.C.4.1. CCS Replacement Scope

Summarize your proposed approach to providing the CCS Replacement, with an overview of your proposed solution to Subsection **3.A.4.1.1, Replace the Existing CAD Module,** through Subsection **3.A.4.1.9, Provide CCS System Administration, Troubleshooting and Other Tools.**

3.C.4.2. Communications Center System Replacement Tasks

Describe your proposed approach to the CCS Replacement tasks listed in Table **3.A.4.2, CCS Replacement Tasks**. For each task, identify the Task ID and task name and provide the following:

1. What activities will your firm undertake to accomplish the task?
2. What member(s) of the proposed project team will be assigned to the task? What skills and experience qualify them to do the work?
3. What software development industry best practices and other techniques will technical staff apply to the task?

In addition, provide answers to the following questions for these Tasks:

Task 2.2 Design OBS/CCS communications protocols and data messages:

- What TRS characteristics will constrain or affect the design of the OBS/CCS communication protocols and data messages?
- What techniques and technologies will you employ in designing the protocols and data messages to optimize system performance?

Task 2.3 Design the CCS/OBS polling scheme:

- What TRS characteristics will impact the polling-function design? How?
- What techniques will you employ during system design to ensure that the polling function meets stated requirements and maximizes system performance?

Task 2.4 Incorporate the existing Coordinator Service Record functions:

- Describe your proposed approach to providing existing CSR functionality through your firm's existing incident-management module, and/or incorporating KCM's CSR module.
- Discuss the rationale for this proposed approach. What technical advantages/disadvantages does it offer?
- If utilizing KCM's CSR module, discuss the proposed technical approach to incorporating the module.

Task 2.4.1 CSR Web Reports:

- Describe your proposed technical solution to providing the existing CSR web reports.
- How does this solution provide the best fit with the proposed system architecture and required functionality?

Task 2.5 Design the CCS Databases:

- Describe the processes your firm will utilize to design the CCS databases.

- Discuss the database design choices and considerations related to handling CCS real-time data and historical data.
- What role do you expect KCM staff to play in CCS database design?
- What information and data will you require from KCM?

Task 2.6 Incorporate the Strategies functions:

- Describe your proposed technical solution for providing the Strategies functions and rationale for this approach.

Task 2.7.1 Radio/CCS/OBS Integration:

- What information will you need a from the TRS contractor for interface design?
- What radio-system characteristics or features will you consider in designing the OBS and CCS interfaces to the TRS?

Task 2.7.2 TED Service and GIS data integration:

- Discuss the proposed design process for incorporating KCM service and GIS data into the CCS.
- What information will you need from KCM?
- What is your proposed technical solution for integrating this data into the CCS?

Task 2.7.3 My Bus/Bus View interface integration:

- Discuss the proposed technical approach for providing real-time AVL data to My Bus/Bus View.

Task 2.8.2 Develop System Interfaces:

- For each sub task (Tasks 2.8.2.1, 2.8.2.2, and 2.8.2.3), discuss your proposed approach to interface development, including:
- Your proposed development environments and tools.
- What software-development best practices will utilize to develop the interfaces?

3.C.5. Communications Center Systems Upgrade (Alternative B)

3.C.5.1. CCS Upgrade Scope

3.C.5.1.1. Overview

No questions.

3.C.5.1.2. Current System and Upgrade Tasks Overview

Summarize your proposed approach to providing the CCS Upgrade, with an overview of your proposed solution to Subsection **3.A.5.1.2.2, CAD/AVL** through Subsection **3.A.5.1.2.10, CSR Web Reports.**

3.C.5.2. CCS Upgrade Tasks

Describe your recommended approach for conducting the CCS Upgrade without affecting the availability and reliability of the legacy Radio/AVL system (a mission-critical King County

Metro Transit system), including a description of the proposed development and test environment.

Describe your proposed approach to the CCS Upgrade tasks listed in Table ***3.A.5.2***, ***CCS Upgrade Tasks***. For each task, identify the Task ID and task name and provide the following:

- What activities will your firm undertake to accomplish the task?
- What member(s) of the proposed project team will be assigned to the task? What skills and experience qualify them to do the work?
- What software development industry best practices and other techniques will technical staff apply to the task?

In addition, provide answers to the following questions for these Tasks:

Task 1.5 Conduct Visual Basic Alternatives Analysis:

- Describe the proposed process for conducting the Visual Basic Alternatives Analysis.
- Given the information available in this document, describe the options under consideration to replace Visual Basic 6.0. Briefly described their respective advantages and disadvantages.
- Describe your preliminary recommended option and rationale for the recommendation.
- What additional information would be required for a full alternatives analysis and recommendation to KCM?

Task 1.6 Conduct Upgrade Impact Analysis:

- Describe the proposed process for conducting the Upgrade Impact Analysis.

Task 1.7 Conduct Informix Migration Alternatives Analysis.

- Describe the proposed process for conducting the Informix Migration Alternatives Analysis.
- Given the information available in this document, describe the options under consideration to replace IBM/Informix. Briefly describe their respective advantages and disadvantages.
- Describe your preliminary recommended option and rationale for the recommendation.
- What additional information would be required for a full alternatives analysis and recommendation to KCM?

Task 2.1.1 Design OBS/CCS communications protocols and data messages:

- What TRS characteristics will constrain or affect the design of the OBS/CCS communication protocols and data messages?
- What techniques and technologies will you employ in designing the protocols and data messages to optimize system performance?

Task 2.1.2 Design the CCS/OBS polling scheme:

- What TRS characteristics will impact the polling-function design? How?

- What techniques will you employ during system design to ensure that the polling function meets stated requirements and maximizes system performance?

Task 2.1.3 CSR Web Reports:

- Describe your proposed technical solution to providing the existing CSR Web reports.
- How does this solution provide the best fit with the proposed system architecture and required functionality?

Task 2.2 Redesign Existing Modules

- Describe the proposed approach to the work.

Task 2.2.1 Redesign CAD/AVL:

- Describe the proposed staff assigned to this task and their experience and expertise in designing user interfaces.
- Describe the proposed process for incorporating user input in the redesign of the CCS user interface. At what point in the process will user input be solicited and incorporated in the design? Using what methods?

Task 2.2.2 Redesign DACS:

- Describe the proposed technical staff's experience with radio call-setup/call-management design for systems interfaced with non-trunked and trunked radio systems.
- What changes in call-setup/call-management processing are anticipated in moving from a non-trunked to a trunked radio system?
- Describe the proposed approach to providing DACS system administration tools.

Task 2.2.3 Redesign the DCC:

- Describe the proposed team's experience with design/redesign of real-time data communications processing and data messages, including:
    - Real-time data-message communications timing.
    - Polling-function management.
    - Inbound data-message voting function.
- Describe the proposed approach to providing DCC system-administration tools.

Task 2.2.4 Redesign the historical database:

- Describe the qualifications and experience of proposed technical staff in database design as it relates to this task.
- Describe the proposed process technical staff will utilize to redesign the historical database to meet CCS requirements.
- Identify key sub-tasks and techniques for ensuring quality database design work. What industry best practices will be utilized?
- Identify any key tasks for KCM input and participation.

Task 2.2.5 Redesign the VDCC:

- Describe the proposed process for redesigning the VDCC.
- Describe the qualifications of the proposed assigned technical staff and their related experience in providing Emergency Alarm redundancy.

Task 2.2.6 Redesign the Strategies:

- Describe the proposed process for redesigning the Strategies tool to meet new CCS requirements.
- Discuss the options for redesigning the existing Strategies tool, written in Visual Basic 6.0, to a supported software language, and provide a preliminary recommendation and rationale.
- Discuss the feasibility of combining existing Strategies tool functionality with the other required functions of the CCS Administrator Tool (see Appendix **K, OBS and CCS Administrator Toolkits**).

Task 2.2.7 CCS Integration Design

Task 2.2.7.1 Radio/CCS Interface:

- Discuss the proposed design approach for:
  - The CCS/radio-system interface.
  - The DCC/radio-system interface.
  - The VDCC/radio-system interface.
- What information would you need from the TRS contractor for interface design?
- What radio-system characteristics or features should we consider in designing the CCS interfaces to the TRS?

Task 2.2.7.2 Schedule and GIS data integration:

- Discuss the proposed redesign process for incorporating KCM service and GIS data into the CCS.
- What information will you need from KCM?
- What is your proposed technical solution for integrating this data into the CCS?

Task 2.2.7.3 My Bus/Bus View interface integration:

- Discuss the proposed technical approach for providing real-time AVL data to My Bus/Bus View.

Task 2.2.7.4 CCS module integration:

- Describe the proposed approach to CCS modules and component integration including:
  - CAD/AVL and DACS interface and processing redesign.
  - DACS and DCC interface and processing redesign.

Task 2.3 Development

Task 2.3.1 Revise Individual Modules:

- Describe the proposed development environment and proposed development process for each of the following:
    - Task 2.3.1.1 Revise CAD/AVL.
    - Task 2.3.1.2 Revise DACS.
    - Task 2.3.1.3 Revise the DCC.
    - Task 2.3.1.4 Revise the historical database.
    - Task 2.3.1.5 Revise the VDCC.
    - Task 2.3.1.6 Upgrade the Strategies tool.

Task 2.3.2 CCS module integration:

- Describe the proposed approach to module integration for the following:
    - CAD/AVL and DACS interface and processing.
    - DACS and DCC interface and processing.

Task 2.3.3 Revise System Interfaces:

- For each of the interfaces listed below, discuss your proposed approach to interface development, including:
    - Your proposed development environments and tools.
    - The proposed software development best practices that will be utilized to develop the interfaces.
        - Schedule, GIS, and other service data imported via a new process from TED and other KCM production databases.
        - CCS/My Bus/Bus View interface.
        - CCS/radio-system interface.
        - DCC/radio-system interface.
        - VDCC/radio-system interface.

3.C.5.3. Other CCS Upgrade Requirements

3.C.5.3.1. CCS Upgrade Software Maintenance

Describe the proposed approach to providing ongoing software maintenance at minimal or no cost to KCM, in exchange for certain intellectual property rights to the KCM CAD/AVL module software.

3.C.6. Level 2 Technical Specifications

3.C.6.1. Level 2 OBS/CCS Technical Requirements

Discuss how the proposed Level 2 solution meets the following Level 1 Technical Requirements, as described in Subsection **2.A.1.4, OBS/CCS Technical Requirements**. Describe any recommended additional requirements or proposed alternatives:

- Physical and Material Requirements
- Electrical Requirements
- Environmental Requirements
- General Software Requirements
- System Security Requirements:
    - Describe your approach to tracking software and data alterations (audit mechanism).
    - Describe other proposed system-security measures for Level 2, including those proposed for ensuring data integrity.
    - Describe the proposed approach to meeting requirements for tracking all diagnostic activities.

3.C.6.2. Hardware, Software, and Database Requirements

3.C.6.2.1. Operating Assumptions

Discuss how the proposed CCS solution will utilize technologies that are widely available, cost-effective, and standards-compliant, available from a selection of vendors and meet other requirements stated in this section.

3.C.6.2.2. Server Hardware

Describe proposed preliminary CCS server specifications.

Describe how the proposed CCS server hardware will meet stated requirements for scalability, availability, wide deployment, and other requirements stated in this section.

3.C.6.2.3. Computer Operating Systems

Describe the proposed CCS computer operating systems for each CCS component, and how the operating system meets stated requirements.

3.C.6.2.4. Server Operating Systems

Discuss the proposed CCS server operating systems and how they meet requirements stated in this section.

3.C.6.2.5. Database Software

Describe the proposed CCS databases and database software.

Discuss how the recommended database software meets requirements and is appropriate for mission-critical systems.

3.C.6.2.6. CCS Development Environments

Describe the proposed CCS development environments and how each meets stated requirements.

3.C.6.2.7. CCS Applications

Describe each proposed CCS application and how each meets stated requirements.

Discuss the long-term migration path for each application, and availability of long-term support

3.C.6.2.8. CCS Contractor Responsibilities

Describe the proposed CCS system architecture, and proposed CCS hardware and software solutions.

Describe any proposed custom or proprietary hardware to be provided, including the rationale for a custom or proprietary solution.

3.C.6.2.9. CCS Coordinator Consoles

Describe preliminary optimum hardware and operating-system specifications to operate the CCS Coordinator terminals, based on a five-year replacement cycle.

3.C.6.3. System Reliability and Availability Requirements

3.C.6.3.1. Equipment Reliability Requirements

Describe your proposed approach for measuring reliability for Level 2. Recommend a methodology and performance measures.

For each type of Level 2 equipment, provide proposed MTBF and supporting calculations.

3.C.6.3.2. System Availability

Discuss how the proposed CCS will meet the stated system-availability requirements.

Describe the proposed method and mechanisms for measuring the availability of the CCS.

3.C.6.3.3. System Downtime

Describe the proposed method and mechanisms for measuring CCS system downtime.

3.C.6.3.4. Failure Review Team

Describe the proposed approach to meeting requirements for the Failure Review Team, in Level 2.

Discuss any additions or revisions to the Failure Review Team process for Level 2.

3.C.6.3.5. Corrective Action

Discuss the proposed approach to meeting Corrective Action requirements in Level 2.

3.C.6.4. Data Backup, Archive, and Recovery

Describe the Level 2 data backup, archive, and recovery processes for the proposed Level 2 system architecture.

3.C.6.5. GIS/Map Characteristics

Describe how the proposed system will meet the requirements for GIS/Map Characteristics as described in Subsection **2.A.1.7.4, Data-Exchange Requirements (Software)** in Level 2.

3.C.6.6. Communications Layers

Describe how the proposed system will meet the requirements described in Subsection **2.A.1.6, Communications Layers** in Level 2.

3.C.6.6.1. Level 2 700 MHz Transit Radio System

Provide a detailed description of your approach to and experience with developing connections to private transit radio systems provided by others. Name all of the radio systems with which you have integration experience. For each radio system:

- Describe the services your firm provided.
- Describe the radio system, including:
    - Whether trunked or non-trunked.
    - The number of vehicles that utilized the system (number of revenue vehicles and number of non-revenue vehicles).
    - The number of radio base stations.
    - The number of revenue and non-revenue vehicles that were tracked (polled) by the system, if applicable.
    - If fleet polling was conducted by the system,
        - Discuss the number of dedicated data channels utilized for system polling.
        - Describethe system component responsible for managing polling.
        - Did polling continue when revenue vehicles were engaged in the radio calls or listening to group calls?

Provide detailed technical descriptions of the proposed functional, electrical, and physical interfaces between the OBS, CCS, and TRS.

Describe how the proposed Level 2 OBS will meet the stated requirements for:

- Voice- and data-message processing.
- Data-transmission rates.
- Automated mobile radio testing.

Describe the proposed approach to providing the CCS digital voting function.

3.C.6.6.1.1. Radio Data Message Protocols

Describe the proposed communications protocols for Level 2 and how they will meet the stated requirements. (If insufficient information regarding the TRS design prevents the proposal of specific protocols, describe the options under consideration and their relative advantages and disadvantages. What additional information will be needed to identify the recommended alternative?)

Discuss proposed mechanisms for message traceability.

Discuss the method of foreword error detection provided by the proposer in past projects. Include the maximum number of errors corrected by the system, size of data packets and actual data throughput.

Describe the method of foreword error detection and correction employed by the proposed system. To the extent possible, discuss its potential error detection and correction performance.

3.C.6.6.1.2. Radio Data Message Elements

Describe the recommended approach and mechanisms for providing reliable and accurate data message communications.

3.C.6.6.1.2.1. Data-Message Content

Describe the proposed approach to meeting data-message requirements for:

- Common Content
- Message Content Order
- Message Content:

Given the information available in the RFP, discuss the potential poll and poll-response data messages, including their potential content, size, and related constraints.

3.C.6.6.1.2.2. Message Requirements

Describe the proposed Level 2 approach for ensuring reliable data-message communications, including:

- Receipt Acknowledgments
- Message retries
- Notifications of non-receipt
- Promotion, demotion, and cancellation of radio data messages
- Duplicate message prevention

3.C.6.6.1.3. Radio Data Message Audit Trail Report

Describe in detail the proposed systems approach to providing the Radio Data Message Audit Trail Report.

Discuss the technical process for joining, sequencing, querying, and generating the data for the report.

3.C.6.6.1.4. Time Synchronization

Describe the proposed technical approach to providing OBS/CCS time synchronization to meet stated requirements.

Discuss the proposed time source and method of time synchronization for Level 2 equipment.

How does the proposed solution prevent potential time inaccuracies due to:

- low on-board battery power?
- urban canyons?
- weather or signal interference?
- other anticipated problems in time synchronization?

3.C.7. Other Level 2 Project Requirements

3.C.7.1. Communications Center Environment

Discuss your proposed approach to coordinating with the Communications Center Relocation Project.

Describe the information related to the new Communications Center facility that will be required for CCS project planning, design, and installation.

Discuss any issues or areas of concern.

3.C.7.2. CCS Training Requirements

Discuss your proposed CCS training program, providing an overview of each course, its objectives and training providers, and other key training elements.

Describe the proposed ongoing KCM personnel training that will be provided after system implementation and through the duration of the Contract.

Describe how the proposed CCS training program shall meet the **General Training Requirements** as described in Subsection **2.A.3.8.2**.

3.C.7.2.1. Training Program Plans

Describe your proposed approach to meeting the stated requirements for the CCS Training Program Plan.

Discuss the qualifications of your proposed project training lead, and the roles and responsibilities of all proposed project team members who will be involved in the training effort.

3.C.7.2.2. System Administrator Training

Describe your proposed CCS Administrator training courses, including training supplier, proposed instructor, an overview of proposed course objectives and content, materials, and proposed number of sessions and hours of instruction.

3.C.7.2.2.1. System Overview Training

Describe your proposed CCS Overview training courses, including training supplier, proposed instructor, an overview of proposed course objectives and content, materials, and proposed number of sessions and hours of instruction.

3.C.7.2.2.2. Hardware Training

Describe your proposed CCS Hardware training courses, including training supplier, proposed instructor, an overview of proposed course objectives and content, materials, and proposed number of sessions and hours of instruction.

3.C.7.2.2.3. Software Training

Describe your proposed CCS Software training courses, including training supplier, proposed instructor, an overview of proposed course objectives and content, materials, and proposed number of sessions and hours of instruction.

In particular, discuss your proposed approach to providing the following courses:

- CCS Software Administration
- CCS Systems Software
- CCS Applications Software
- Other proposed courses

3.C.7.2.3. Train the Trainer Course

Describe your proposed CCS Train the Trainer training courses, including training supplier, proposed instructor, an overview of proposed course objectives and content, materials, and proposed number of sessions and hours of instruction.

The instructor will train KCM non-technical staff to train non-technical KCM users. Discuss the pertinent skills and qualifications of the proposed instructor.

3.C.7.2.4. Training Locations

Describe how the proposed training program will satisfy the requirements.

3.C.7.2.5. Manuals and Equipment

Describe your proposed approach to meeting the stated requirements.

3.C.7.2.5.1. Training Materials

Describe the proposed approach for providing training materials.

For each training course, provide a proposed list of training materials: instructor guides, student workbooks, mock-ups and scale models, overhead transparencies, video and interactive computer programs, and CCS Simulator. Describe how each meets the stated requirements.

Identify the source of each training manual, i.e. the Contractor, subcontractor, third party supplier, or OEM.

3.C.7.2.5.2. Training Program Approval and Instructor Qualification

Discuss the proposed approach to meeting requirements.

3.C.7.3. Installation

3.C.7.3.1. CCS Installation

Describe the proposed approach to Level 2 Installation for the CCS and Level 2 OBS.

Describe the proposed installation planning process and coordination with KCM's OBS/CCS and TRS Project Managers and the TRS contractor. Identify key points of coordination and information requirements.

3.C.7.3.2. Responsibilities

Describe your proposed approach to meeting the requirements described in Subsection **2.A.3.9.4, Installation Responsibility** for Level 2.

g. Describe the proposed approach to meeting the requirements in Subsection **2.A.1.3.4.3, Installation Requirements** for Level 2.

h. Provide a list of each proposed Level 2 hardware and software, identifying the installer (KCM, the Contractor, or other). Identify the proposed installation contact for each.

i. Discuss the steps your firm will take to ensure KCM staff are fully prepared for installation.

j. Radio Interface Installation: Discuss the proposed approach to installing the CCS/TRS interface, describing key points of coordination with the TRS contractor and information requirements.

3.C.7.3.3. Installation Ready: Deliverables

List and describe in detail proposed deliverables required to achieve Installation Readiness, including:

f. System Documentation

g. Training

h. Software

i. Databases

j. Test Plans

Provide any proposed additions to requirements.

3.C.7.3.4. Installation Plan

Describe the proposed approach for providing the required Installation Plan.

Discuss the level of involvement and roles of the KCM and the TRS contractor in plan development. Describe any required information from KCM and the TRS contractor.

List and describe key elements of the plan and any proposed additions.

3.C.7.3.5. Physical Installation Documentation

Describe the proposed approach to providing Physical Installation Documentation.

Provide a detailed description of the type of installation documentation that will be provided for: 1) the CCS installation and 2) the TRS Interface installation.

3.C.7.3.6. Installation Procedures

Describe the proposed approach for providing detailed installation procedures, describing in detail the type of procedural information, checklists, and instructions that will be supplied.

3.C.7.3.7. Implementation Plan

Describe the proposed approach for developing the Level 2 Implementation Plan to meet the stated requirements.

Discuss the recommended process for developing the plan in coordination with KCM staff and the TRS contractor.

Discuss your recommendations for ensuring reliable communications between Revenue Vehicles and the Communications Center during system implementation.

3.C.7.3.8. Installation Testing and Certification

3.C.7.3.8.1. Installation Testing

No questions (see Subsection **3.A.7.5, Testing**).

3.C.7.3.8.2. Installation Certification

Describe the proposed process for inspecting and certifying CCS installation, describing the activities required to ensure the CCS is installed correctly and meets installation requirements.

3.C.7.4. OBS Level 2 Modifications

No questions.

3.C.7.5. Testing

3.C.7.5.1. General Testing Requirements

Describe the proposed approach to meeting the following requirements for Level 2 Testing:

d. Subsection **2.A.2.1, General Testing Requirements**.

e. Subsection **2.A.2.2, Test Equipment**.

f. Subsection **2.A.2.4**, **Testing Procedures and Definitions**.

3.C.7.5.1.1. Functional Testing

Describe the proposed approach to Level 2 Functional testing.

3.C.7.5.1.2. CCS Usability Testing

Describe the proposed approach to CCS Usability Testing, including a detailed description of the proposed methodology.

3.C.7.5.1.2.1. Usability Problem Resolution

Discuss the proposed process for identifying and resolving CCS usability problems.

3.C.7.5.1.3. Level 2 System Response Simulation

Describe the proposed method and technology for simulated input and loading for verification of Level 2 functionality for the CCS and modified OBS.

3.C.7.5.1.4. CCS Availability Testing

Describe the proposed approach to availability testing to meet stated requirements, including test methodology, data collection and analysis.

3.C.7.5.1.5. Level 2 Overall Inspection and Testing Plan

Discuss any concerns or additions to the stated requirements.

3.C.7.5.2. Level 2 Test Stages

3.C.7.5.2.1. Factory Acceptance Testing (FAT)

Describe the proposed Level 2 test environment for factory acceptance testing of all Level 2 functionality.

Discuss the proposed approach for meeting requirements stated in Subsection **2.A.2.5, Factory Acceptance Testing** for Level 2. Identify the requirements applicable to Level 2 and the proposed test methodology.

3.C.7.5.2.1.1. CCS Factory Acceptance Testing

Describe the proposed approach to the CCS Factory Acceptance Testing, providing a detailed discussion of the test scope, methodology, and process.

3.C.7.5.2.1.2. OBS Factory Acceptance Testing

Describe in detail the proposed Level 2 OBS FAT to demonstrate stated requirements.

Discuss any proposed additions to the requirements.

3.C.7.5.2.2. CCS User Bench Testing

Describe the proposed CCS User Bench Test, providing a detailed discussion of the test scope, methodology, and process.

Provide an example of a previous User Bench Test Plan developed by your organization.

3.C.7.5.2.3. Installation Testing

Describe the proposed approach to Level 2 Installation Testing, including:

- CCS Installation Testing.
- Level 2 OBS Installation Testing.
- System Integration Testing.

3.C.7.5.2.4. Field Test

Describe the proposed approach to the Level 2 Field Test, including a detailed discussion of the test scope, methodology, and process.

Discuss required Field Test coordination activities with KCM and the TRS contractor.

Discuss any previous experience with similar testing on prior projects, including suggestions and lessons learned in the testing process.

3.C.7.5.2.5. Ongoing System Performance Monitoring

Discuss the proposed process for ongoing OBS/CCS performance monitoring to identify and resolve system performance problems during Level 2 Implementation to meet the requirements.

3.C.7.5.2.6. Pilot Test

Describe the proposed approach to the Level 2 Pilot Test, including a detailed discussion of the test scope, methodology and process.

Discuss any previous experience with similar testing on prior projects, including suggestions and lessons learned in the testing process.

3.C.7.5.2.7. Mid-Implementation Test

Describe the proposed approach to the Mid-Implementation Test, including a detailed discussion of the test scope, methodology, and process.

Identify additional items for functional and performance testing.

3.C.7.5.2.8. Conditional Acceptance Testing Settling-in Period

Describe the proposed approach to meeting the requirements described in Subsection **2.A.2.9.1, Acceptance Testing Settling-in Period**, in Level 2.

3.C.7.5.2.9. Conditional Acceptance Testing

Describe the proposed approach to the Level 2 Conditional Acceptance Testing, including a detailed discussion of the test scope, methodology, and process.

Provide a recommendation for the duration, in number of days, of the Conditional Acceptance Test.

Recommend the number of continuous, trouble-free days of OBS/CCS operation required for Level 2 Conditional Acceptance.

3.C.7.5.2.10. Full System Acceptance Testing

Describe the proposed approach to the Full System Acceptance Testing, including a detailed discussion of the test scope, methodology, and process to meet stated requirements.

3.C.7.6. Deliverables

3.C.7.6.1. Level 2 System Design and Design Reviews

Describe the proposed approach to conducting Level 2 Design Reviews according to the requirements stated in Subsection **2 A.3.1.1.1, Design Phases and Design Reviews**.

3.C.7.6.1.1. Level 2 Preliminary Design Review (PDR)

Describe in detail the proposed approach to conducting the PDR to meet stated requirements.

Provide recommendations for additional PDR agenda items and deliverables.

3.C.7.6.1.2. Level 2 Critical Design Review (CDR)

Describe in detail the proposed approach to conducting the CDR to meet stated requirements.

Provide recommendations for additional CDR agenda items and deliverables.

3.C.7.6.1.3. Level 2 Final Design Review (FDR)

Describe in detail the proposed approach to conducting the FDR to meet stated requirements.

Provide recommendations for additional FDR agenda items and deliverables.

3.C.7.6.2. Deliverable Requirements by Project Phase

3.C.7.6.2.1. General Requirements for Deliverables

Describe the proposed approach for meeting requirements stated in Subsection **2.A.3.1.2.1, General Requirements for Deliverables** in Level 2.

3.C.7.6.2.2. Design Mockups and Prototype Equipment

Describe the proposed approach for meeting design mockups and prototype equipment requirements as described in Subsection **2.A.3.1.2.1, General Requirements for Deliverables** in Level 2.

3.C.7.6.2.3. Production Baseline

Discuss any concerns related to meeting the stated requirements.

3.C.7.6.2.4. Documentation Requirements

Discuss any concerns related to providing Level 2 technical and other required documentation for all project design phases in accordance with the Documentation requirements described in Subsection **2.A.3.2, Documentation**.

3.C.7.6.2.5. Level 2 Deliverables by Project Phase and Milestone

Describe the proposed approach for providing the required deliverables.

Provide a detailed listing and description of any recommended additional or revised deliverables.

3.C.7.7. Documentation

Describe the proposed approach to meeting requirements as described in Subsection **2.A.3.2, Documentation** in Level 2, including:

- Subsection **2.A.3.2.1, Documentation Control and Management**.
- Subsection **2.A.3.2.2, Manuals**.
- Subsection **2.A.3.2.3, Maintenance Documentation and Manuals**.

Describe any recommended additions or changes to the stated requirements for Level 2.

Provide a detailed listing of all proposed Level 2 Documentation deliverables that will be provided in Level 2 and the source of the documentation (e.g., the Contractor, subcontractor, OEM).

3.C.7.7.1. Software Documentation

Indicate the proposed software documentation to be provided in the answer to **3.A.7.7, Documentation**, above.

3.C.7.7.2. Current Parts List (CPL)

List and describe any proposed Contractor-provided equipment for Level 2.

3.C.7.8. Project Management and Staffing

Describe the proposed project-management services to be provided in Level 2 to meet requirements stated in the following subsections:

- Subsection **2.A.3.3.1, Dedicated Staff throughout Project Life Cycle**
  - List Key Personnel and their related scope of responsibilities for each Level 2 project phase and milestone.
- Subsection **2.A.3.3.2, Design Phase Staffing**
  - Describe any concerns related to the requirements.
- Subsection **2.A.3.3.3, Pilot Phase to Full System Acceptance Staffing**
  - Identify the proposed local project support for Level 2.
- Subsection **2.A.3.3.4, Contractor "On Call"**
  - Describe the proposed services for meeting stated requirements in Level 2.
- Subsection **2.A.3.3.5, Contractor “On Site”**
  - Describe the proposed services for meeting stated requirements in Level 2.

3.C.7.9. Progress and Performance Monitoring

Describe the proposed services for meeting stated requirements, highlighting any proposed additional services for Level 2.