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**Ground Elements**

**Command, Control & Communications Project**

**System Design Document**

**Volume 5: Concepts of Execution: Flow Support and Data  
Repository Access**

**GOP507022-05**

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## 4.3.5

### 4.3.5.3 R&R Recording

This Concept of Execution analysis includes information for recording Constellation Data during Launch Control System (LCS) development, test, and operations. This analysis describes the system processes and functions of (1) recording raw CEV/CLV command and telemetry data and KGCS commands and data; (2) Vehicle and GSE processed data and LCS generated data (commands, events, and data); and (3) files generated by various systems and Users such as EHSC, SMC, Simulation, SDAS, and Screen Captures.

R&R has components in both the Internal and External Enclaves. The Internal Enclave component is part of each LCS Set, within the LCS firewall boundary, capturing data generated by test, simulation or operational mission and creating data blocks recorded in both the Internal Enclave and the External Enclave. Internal Enclave recorder provides access for retrievals for Applications and Users on a Command Workstation. The External Enclave component is outside the LCS firewall and provides redundant recording and archival for Support Workstations and External Users and Systems.

The R&R Recording Concept describes the general flow of the recording of LCS data within the Record and Retrieval System. LCS generated data collected from the LCS Command Network are recorded as Processed Data Blocks in the Internal Enclave and the External Enclave (EE). Raw Vehicle and GSE data packets, are collected and recorded as Unprocessed Data Blocks in the Internal Enclave and the OEE.

The Record and Retrieval System subscribes to all LCS generated commands, events, and messages; attaches UTC Time tag as each data element is received; tags with Meta-data to uniquely identify the data source and creates a Data Block in the Internal Enclave. Record and Retrieval records system generated log files and user generated files. The files such as EHSC, SMC, SDAS, and Simulation are transferred periodically and/or during termination of the LCS set operation. Screen captures and User generated scripts for retrievals are transferred periodically and/or during termination of the LCS set operation.

Data is transmitted/received to/from Vehicle as C3I packets, GSE in Ethernet/IP packets. These packets are recorded as transmitted/received, captured in an Unprocessed Data Block, recorded in the Internal Enclave, and also passed on to the External Enclave for redundant recording and archiving.

All block data files are passed on to the External Enclave where they are permanently stored, archived, and made available for retrievals by Constellation Engineers, External Users, and External Systems.

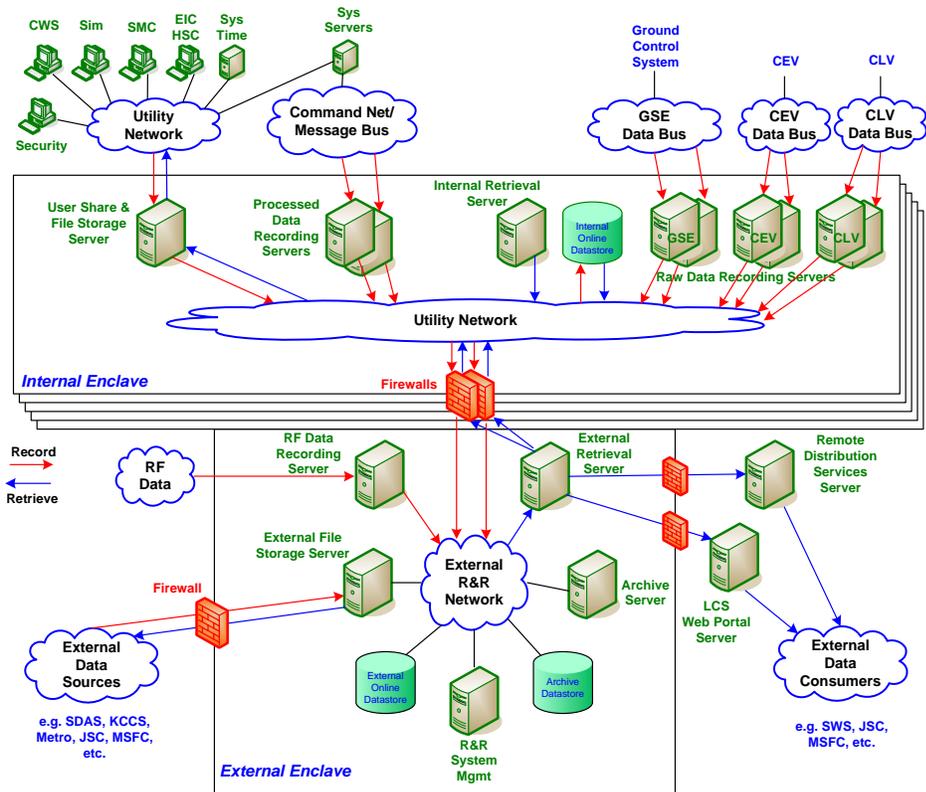


Figure 4.3.5-1 Redundant Recording Concept

### 4.3.5.3.1 Scope

The scope of this analysis is limited to the recording of data generated and processed through the LCS systems at the Kennedy Space Center.

The following items are not addressed in this analysis: (1) Archival of LCS data described in the R&R Archival Concept of Execution analysis, (2) Retrieval of LCS data described in the R&R Retrieval Concept of Execution analysis, (3) Recording of data outside KSC, (4) System health and failover of the Record & Retrieval System described in R&R System Management Concept of Execution, (5) Recording and control of Security scan data, (6) Emergency Safing Panel activity covered in the Emergency Safing Concept of Execution, or (7) Security/access described in the Data Access Control Concept of Execution analysis.

Table 4.3.5-1 LCS Recording Interfaces

LCS Interface	LCS R&R Raw	LCS R&R Processed
CEV Umbilical	Yes – CEV Network	Yes
CLV Umbilical	Yes – CLV Network	Yes
CLV Safing Discrete	Yes – GSE Network	Yes

DFI (Development Flight Instrumentation) Umbilical	No	No
End Item Controllers	Yes – GSE Network	Yes
Eastern Range	TBD	TBD
Mission Systems (MOL)	Yes – MS Network	Yes
CTN	No	No

#### 4.3.5.3.2 Actors

- **R&R Administrator:** The Record & Retrieval System Administrator initializes and monitors recording activities of the External Enclave portion of R&R.
- **MC Operator:** The SMC Operator/MC Operator initiates recording sessions in the Internal and External Enclaves as part of LCS set initialization.
- **CEV and CLV Data Stream:** The Inter-Element Data Stream provides Command and Telemetry data to/from CEV and CLV in C3I format.
- **KGCS Data Stream:** The KGCS Data Stream provides Commands, Events, and Data to/from LCS and KGCS.
- **Command Network:** The Command Network provides Intra-Element Recording of Message Bus specific processed data including commands, events, intra element data topics (e.g., derived measurement data)
- **EHSC Console Operator:** The EHSC Operator initiates file transfers from EHSC to the R&R Internal Enclave via the Utility Net.
- **Simulation Console Operator:** The Simulation Console Operator initiates a file transfer from Simulation to the R&R Internal Enclave via the Utility Net.
- **Constellation Engineer:** The Constellation Engineer initiates a file transfer to the R&R Internal Enclave saving manually initiated screen captures and retrieval scripts via the Utility Net.
- **Display Services and Framework:** The Display Services captures screen shots for User initiated commands and Prompt responses and initiates a file transfer of screen captures to the R&R provided User file share.
- **System Applications:** The System Applications initiates screen captures for application initiated commands and prompt responses resulting in a file transfer of screen captures to the R&R provided User file share.
- **External File Sources:** The External File Sources initiates a file transfer from misc. sources to the R&R External Enclave. This supports external sources such as SDAS and EHSC console when in remote mode.
- **Mission Systems (MS):** MS provides MOL Data to LCS.

### 4.3.5.3.3 Recording Use Cases

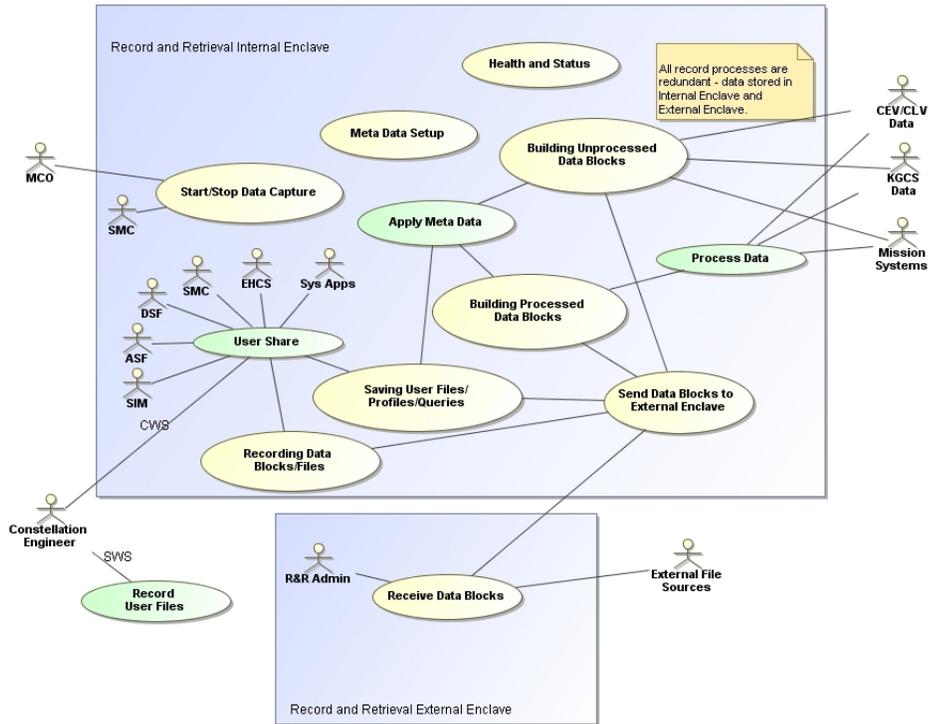


Figure 4.3.5-2 Recording Use Case Diagram

#### 4.3.5.3.3.1 REC01: Meta Data Setup

This use case describes setting up Meta Data tables for use during recording LCS data. Meta data includes critical information detailing the environment in which the data and files are captured such that retrievals can be made across a multitude of timeframes and missions. Meta Data is provided from the TCID, OSID, and SCID and includes items such as TCID, Data Type, Test Type, Test Set, and Vehicle ID and providing tags to uniquely identify data and files enabling expedient retrievals.

##### 4.3.5.3.3.1.1 ERD Requirements Addressed

R.GE7060	STRQ393
R.GE7119	STRQ167.1
R.GE7483	STRQ402

##### 4.3.5.3.3.1.2 REC01: Assumptions

None.

#### **4.3.5.3.3.1.3 REC01: Limitations**

R&R does not apply Meta-data to externally generated files (such as SDAS and EHSC) sent to R&R.

#### **4.3.5.3.3.1.4 REC01: Preconditions**

TCID, OSID, SCID, and EEID are available to support provisioning and initialization of the LCS set and the Internal and External Enclaves of Recording & Retrieval.

#### **4.3.5.3.3.1.5 REC01: Basic Flow**

*Trigger:* An LCS set is being configured for support.

1. Master Console Operator provisions the R&R Internal and External Enclave to support a test.
2. SMC, during initialization, builds the Meta-data Table from the TCID, OSID, and SCID and transfers the table to the R&R CSCI.
3. R&R Administrator ensures the External Enclave is initialized to support recording data blocks and externally generated files from the Internal Enclave.

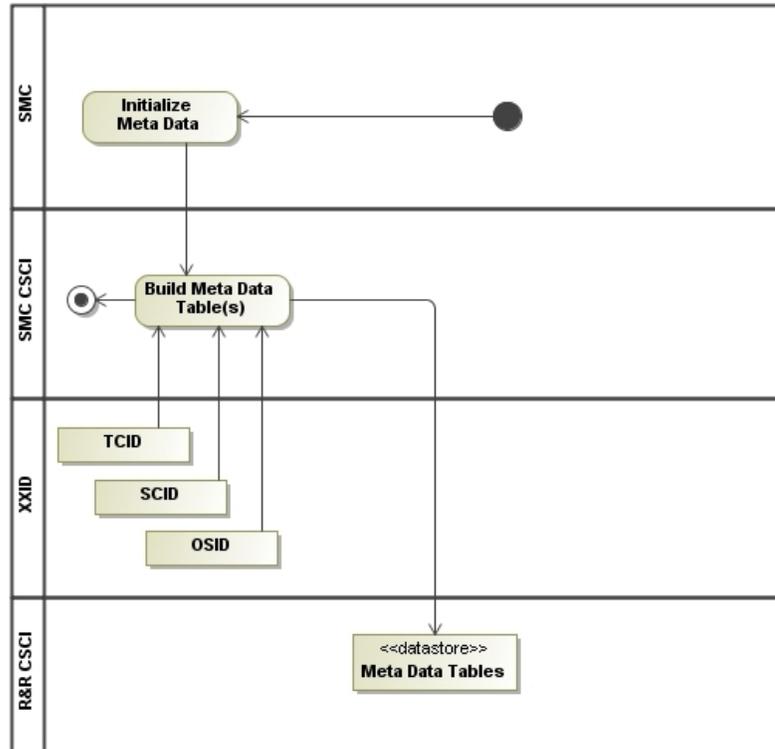


Figure 4.3.5-3 Meta Data Setup Activity Diagram

#### 4.3.5.3.3.1.6 REC01: Post Conditions

Meta-data Table in the Internal Enclave is loaded and ready to receive, tag, and record data blocks from the Internal Enclave or externally generated files.

#### 4.3.5.3.3.1.7 REC01: Derived Requirements

ALLOC1728
ALLOC1729
ALLOC1883
ALLOC1884
ALLOC1894
ALLOC2428
ALLOC2429
ALLOC2545
ALLOC2546

#### 4.3.5.3.3.2 REC02: Start/Stop Data Capture

This use case describes the process of starting and stopping the recording in the internal and external enclaves

#### 4.3.5.3.3.2.1 REC02: ERD Requirements Addressed

R.GE7059	STRQ392
R.GE7483	STRQ402
R.GE7539	STRQ405
R.GE7541	STRQ407

#### **4.3.5.3.3.2.2 REC02: Assumptions**

None.

#### **4.3.5.3.3.2.3 REC02: Limitations**

None.

#### **4.3.5.3.3.2.4 REC02: Preconditions**

- Meta-data table is loaded during initialization.

#### **4.3.5.3.3.2.5 REC02: Basic Flow**

**Trigger A:** MC Operator starts LCS initialization sequence.

1. MCO Operator initiates a recording session with the R&R CSCI.
2. R&R CSCI subscribes to all commands, data, and events on the Command Network.
3. R&R CSCI begins capturing commands, data, and events on the Command Network and building processed data blocks.
4. R&R CSCI begins capturing raw data to/from KGCS Networks and Vehicle Networks and building raw data blocks.
5. R&R CSCI begins to record Raw Data blocks and Processed Data blocks in both Internal and External Enclaves.
6. File Storage component of the R&R CSCI is available for FTP file transfers to/from the Utility Net.
7. R&R CSCI continues to perform redundant data recording in both Internal and External Enclaves until recording session is stopped by the MC Operator.

**Trigger B:** LCS test or mission is completed.

1. MCO Operator terminates a recording session with the R&R CSCI
2. R&R CSCI terminates capturing commands, data, and events on the Command Network.
3. R&R CSCI terminates capturing raw data to/from KGCS Networks and Vehicle Networks.
4. R&R CSCI terminates building of raw and processed data blocks in the internal enclave.

5. R&R CSCI terminates recording data blocks and files in the external enclave.
6. Any pending FTP file transfers are completed for this recording session
7. R&R CSCI completes termination of recording session.

#### **4.3.5.3.3.2.6 REC02: Post Conditions**

Trigger A: R&R CSCI has subscribed to all Commands, Data, and Events, is capturing data on Command, KGCS, and Vehicle networks, is building raw and processed data blocks, and is recording data blocks in both Internal and External Enclaves. FTP file transfers are enabled and initiation of recording session is complete.

Trigger B: R&R CSCI has unsubscribed to all Commands, Data, and Events, stopped capturing data on Command, KGCS, and Vehicle networks, stopped building raw and processed data blocks, and stopped recording data blocks in both Internal and External Enclaves. Pending FTP file transfers and termination of recording session is complete.

#### **4.3.5.3.3.2.7 REC02 : Derived Requirements**

ALLOC1885
ALLOC594

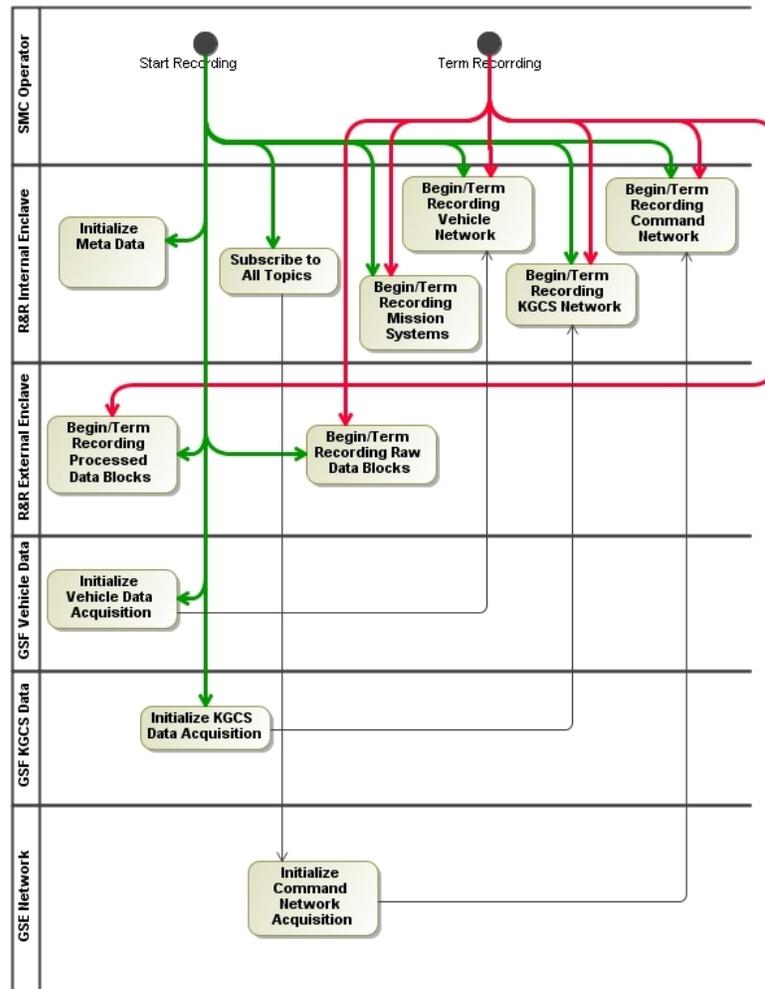


Figure 4.3.5-4 Start/Stop Data Capture Activity Diagram

#### 4.3.5.3.3.3 REC03: Building Processed Data Blocks

This use case describes the building of the data blocks which are collecting processed data (data, commands, and events).

##### 4.3.5.3.3.3.1 REC03: ERD Requirements Addressed

R.GE7019	STRQ298.1
R.GE7025	STRQ311
R.GE7026	STRQ312
R.GE7027	STRQ313
R.GE70443	STRQ1414
R.GE7059	STRQ392
R.GE7060	STRQ393
R.GE7063	STRQ395.1

R.GE7452	STRQ398
R.GE7453	STRQ399
R.GE7455	STRQ400
R.GE7458	STRQ351
R.GE7483	STRQ402
R.GE7496	STRQ413
R.GE7534	STRQ269
R.GE7539	STRQ405
R.GE7541	STRQ407
R.GE7869	STRQ998.1
R.GE7870	STRQ999.1

#### **4.3.5.3.3.3.2 REC03: Assumptions**

None.

#### **4.3.5.3.3.3.3 REC03: Limitations**

None.

#### **4.3.5.3.3.3.4 REC03: Preconditions**

Record & Retrieval is subscribed to and is acquiring all events, commands, and data.

#### **4.3.5.3.3.3.5 REC03: Basic Flow**

**Trigger:** LCS is initialized and R&R system is receiving live or simulated processed data.

1. Internal R&R tags all data, commands and events on the Command Network with UTC time and Meta Data based on Meta Data Table as received.
2. Internal R&R builds block files capturing data for a configurable time frame.
3. Internal R&R created a file header with a unique source name and recording time span information.
4. Internal R&R saves the processed file in the Internal Enclave.
5. Internal R&R also sends files across the Utility Net to the External Enclave for redundant recording and archival.
6. Internal R&R continues to capture data in block format until recording is stopped by the MC Operator.

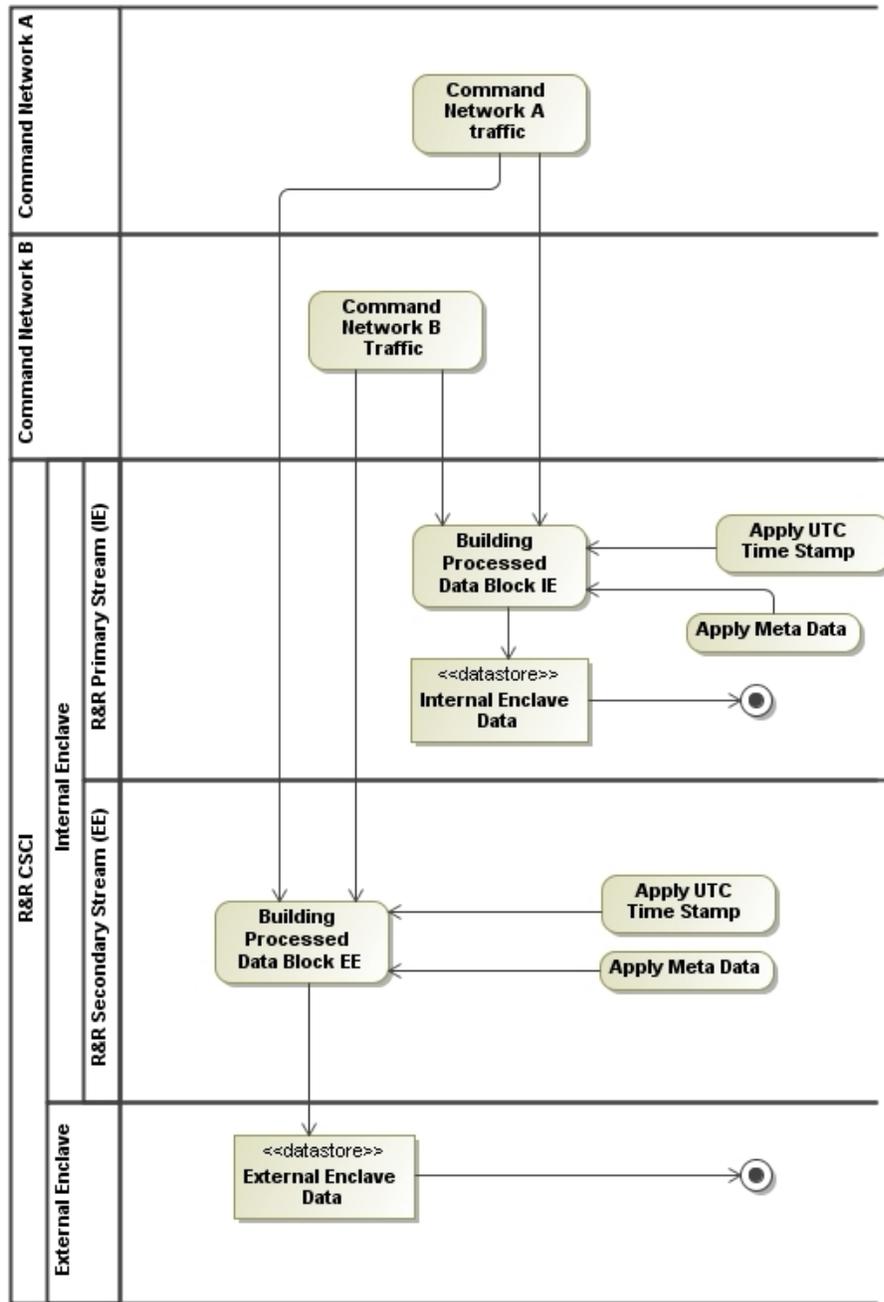


Figure 4.3.5-5 Building Processed Data Blocks Activity Diagram

#### 4.3.5.3.3.3.6 REC03: Post Conditions

All processed LCS data for the current activity have been captured in block format in the Internal Enclave and are ready for recording in the Internal Enclave and redundant recording and archiving in the External Enclave.

#### 4.3.5.3.3.7 REC03 : Derived Requirements

ALLOC1640
ALLOC1884
ALLOC1885
ALLOC1886
ALLOC1887
ALLOC1888
ALLOC1889
ALLOC2168
ALLOC2562
ALLOC401
ALLOC402
ALLOC406
ALLOC408
ALLOC503
ALLOC588
ALLOC591
ALLOC594
ALLOC601
ALLOC603
ALLOC622
ALLOC850
ALLOC851
ALLOC930

#### 4.3.5.3.3.4 REC04: Building Unprocessed Data Blocks

This use case describes the building of the unprocessed data blocks which are collected from the GSE Network, MOL network, CLV Network, and the CEV Network. Redundant recording is performed with independent recording of the CEV, CLV, MOL, and KGCS Network streams on independent recorders and paths to the External Enclave data stores.

#### 4.3.5.3.3.4.1 REC04: ERD Requirements Addressed

R.GE7019	STRQ298.1
R.GE7025	STRQ311
R.GE7026	STRQ312
R.GE7027	STRQ313
R.GE70443	STRQ1414
R.GE7059	STRQ392
R.GE7063	STRQ395.1
R.GE7112	STRQ396
R.GE7452	STRQ398

R.GE7453	STRQ399
R.GE7455	STRQ400
R.GE7458	STRQ351
R.GE7483	STRQ402
R.GE7489	STRQ403
R.GE7494	STRQ411
R.GE7495	STRQ412
R.GE7496	STRQ413
R.GE7539	STRQ405
R.GE7541	STRQ407
R.GE7869	STRQ998.1
R.GE7870	STRQ999.1

#### **4.3.5.3.3.4.2 REC04: Assumptions**

None.

#### **4.3.5.3.3.4.3 REC04: Limitations**

None.

#### **4.3.5.3.3.4.4 REC04: Preconditions**

None.

#### **4.3.5.3.3.4.5 REC04: Basic Flow**

**Trigger:** LCS is initialized and is sending/receiving raw, unprocessed C3I data to/from CEV/CLV vehicle(s) and/or Ethernet/IP to/from KGCS.

1. Internal R&R CSCI applies UTC time tags to packets as they are received by the R&R block processors (IE and EE).
2. R&R CSCI Block processors record the UTC time tagged packets as they are received in the Internal Enclave as a Block file for a configurable timeframe.
3. R&R CSCI applies Meta data to each block file.
4. R&R CSCI marks each data block with a unique source and time related filename.
5. R&R CSCI passes the file across the Utility Net to the R&R External Enclave for redundant recording, archiving, and external retrievals.
6. Internal R&R continues to capture data in block format until recording is stopped by the MC Operator.

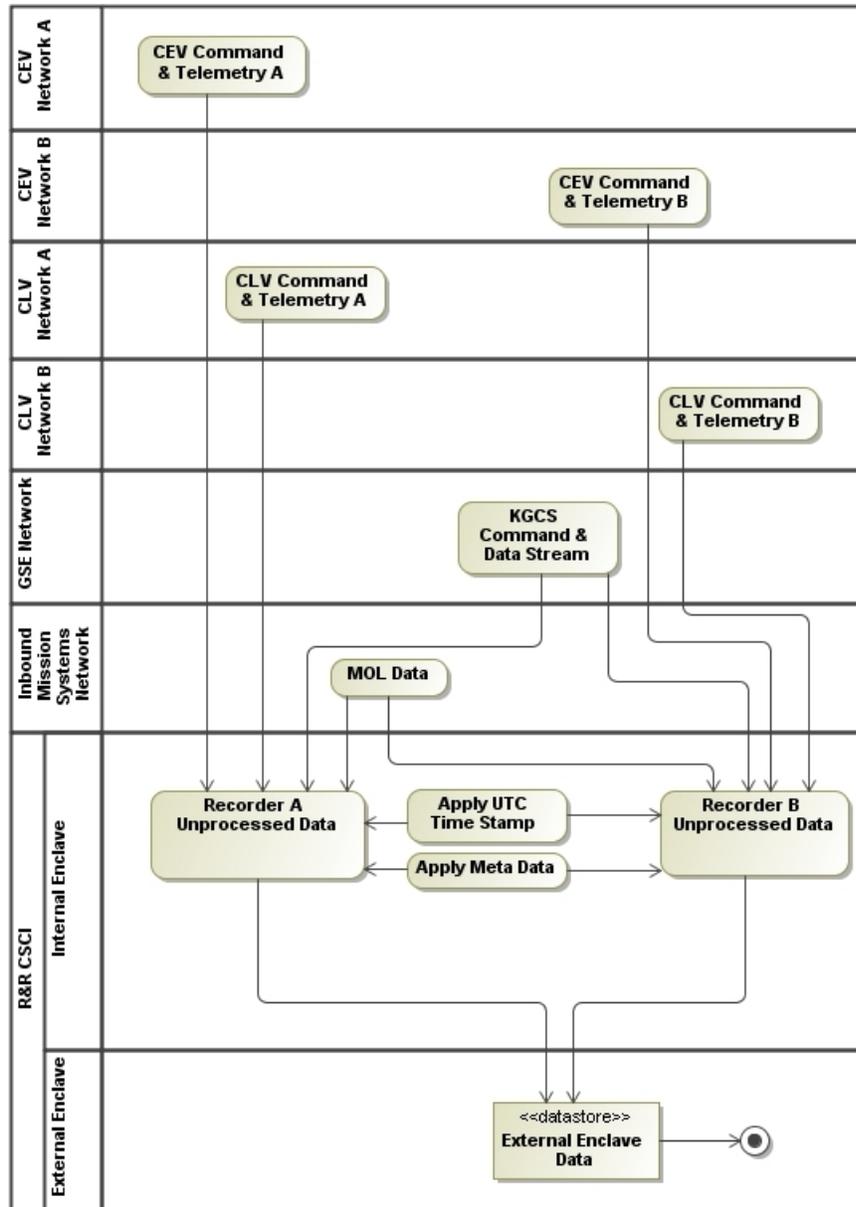


Figure 4.3.5-6 Building Unprocessed Data Blocks Activity Diagram

#### 4.3.5.3.3.4.6 REC04: Post Conditions

Unprocessed data blocks have been built from captured raw data and recorded in the External Enclaves.

#### 4.3.5.3.3.4.7 REC04 : Derived Requirements

ALLOC1640
ALLOC2168
ALLOC2561

ALLOC2566
ALLOC401
ALLOC402
ALLOC406
ALLOC408
ALLOC503
ALLOC588
ALLOC594
ALLOC598
ALLOC601
ALLOC603
ALLOC610
ALLOC620
ALLOC621
ALLOC622
ALLOC850
ALLOC851
ALLOC930

#### **4.3.5.3.3.5 REC05: Send Data Blocks to External Enclave**

This use case describes the sending of the processed and unprocessed data blocks from the Internal Enclave to the External Enclave.

##### **4.3.5.3.3.5.1 REC05: ERD Requirements Addressed**

R.GE7019	STRQ298.1
R.GE7026	STRQ312
R.GE7027	STRQ313
R.GE70443	STRQ1414
R.GE7060	STRQ393
R.GE7112	STRQ396
R.GE7455	STRQ400
R.GE7458	STRQ351
R.GE7489	STRQ403
R.GE7494	STRQ411
R.GE7496	STRQ413
R.GE7539	STRQ405
R.GE7541	STRQ407
R.GE7869	STRQ998.1

•

##### **4.3.5.3.3.5.2 REC05: Assumptions**

None.

#### **4.3.5.3.3.5.3 REC05: Limitations**

Limitation of 1Gigabit bandwidth across the Utility Net.

#### **4.3.5.3.3.5.4 REC05: Preconditions**

Processed and Unprocessed Data Blocks have been created with file type, meta-data, and time related header information sufficient for transfer to the External Enclave.

External R&R is available for FTP files from the Utility Net.

#### **4.3.5.3.3.5.5 REC05: Basic Flow**

*Trigger:* Internal Enclave has a completed Block Data File.

1. Internal R&R sends block file on the Utility Net to the firewall.
2. File is buffered by the Firewall as necessary to ensure Utility Net, Firewall, and/or External Enclave is not saturated.
3. Firewall passes file to the External Enclave for redundant recording, archiving and external retrieval.

#### **4.3.5.3.3.5.6 REC05: Post Conditions**

Block files are sent from the Internal Enclave to the External Enclave for redundant recording, archiving, and external retrieving.

#### **4.3.5.3.3.5.7 REC05 : Derived Requirements**

ALLOC1640
ALLOC1890
ALLOC1891
ALLOC1892
ALLOC1893
ALLOC2168
ALLOC402
ALLOC408
ALLOC503
ALLOC594
ALLOC598
ALLOC610
ALLOC620
ALLOC622

•

#### 4.3.5.3.3.6 REC06: Receive Data Blocks

This use case describes the handling of the processed and unprocessed data blocks from the Internal Enclave or external sources in the External Enclave.

##### 4.3.5.3.3.6.1 REC06: ERD Requirements Addressed

R.GE7019	STRQ298.1
R.GE7026	STRQ312
R.GE7027	STRQ313
R.GE7112	STRQ396
R.GE7458	STRQ351
R.GE7489	STRQ403
R.GE7494	STRQ411
R.GE7496	STRQ413
R.GE7541	STRQ407

##### 4.3.5.3.3.6.2 REC06: Assumptions

All data blocks and external files contain unique header information to sufficiently distinguish the source of data and allow for later retrieval.

##### 4.3.5.3.3.6.3 REC06: Limitations

None.

##### 4.3.5.3.3.6.4 REC06: Preconditions

None.

##### 4.3.5.3.3.6.5 REC06: Basic Flow

**Trigger:** Block Data files from the Internal Enclave are ready for recording in the External Enclave or External Systems have generated a Data File for permanent recording.

1. External R&R records unprocessed data blocks received from the Internal enclave.
2. External R&R records processed data blocks received from the Internal enclave.
3. External R&R records data files from users and external systems.

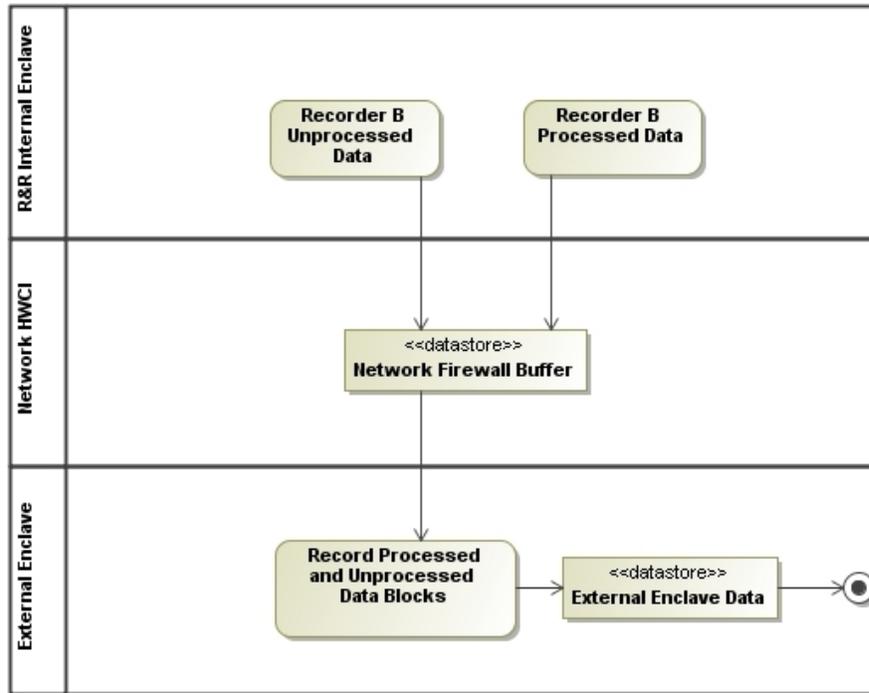


Figure 4.3.5-7 OEE Recording

#### 4.3.5.3.3.6.6 REC06: Post Conditions

Data blocks are recorded in the External Enclave.

#### 4.3.5.3.3.6.7 REC06: Derived Requirements

ALLOC1476
ALLOC1477
ALLOC1478
ALLOC1479
ALLOC1480
ALLOC1893
ALLOC2173
ALLOC2431
ALLOC2432
ALLOC2433
ALLOC2434
ALLOC2435
ALLOC2547
ALLOC2548
ALLOC402
ALLOC653
ALLOC851

#### 4.3.5.3.3.7 REC07: Saving User Files/Profiles/Queries

This use case describes saving User profiles, user created retrieval scripts, and files such as system created or user initiated screen captures and retrievals stored in User share datastore.

##### 4.3.5.3.3.7.1 REC07: ERD Requirements Addressed

R.GE7004	STRQ376
R.GE7060	STRQ393
R.GE7083	STRQ468
R.GE7441	STRQ397
R.GE7455	STRQ400
R.GE7494	STRQ411

##### 4.3.5.3.3.7.2 REC07: Assumptions

n/a

##### 4.3.5.3.3.7.3 REC07: Limitations

CCCE does not provide resources or services for User profiles and screen captures initiated on a Support Workstation.

##### 4.3.5.3.3.7.4 REC07: Preconditions

n/a

##### 4.3.5.3.3.7.5 REC07: Basic Flow

**Trigger A:** User requests a screen capture on a command workstation

1. Display Services and Framework creates a screen capture file to be stored on local user share.
2. R&R CSCI performs a periodic save of the files on the local user share to the Internal and External Enclave.

**Trigger B:** User issues command or responds to a prompt on a CWS.

1. Display Services and Framework creates a screen capture file to be stored on local user share.
2. R&R CSCI performs a periodic save of the files on the local user share to the Internal and External Enclave.

**Trigger C:** System Application issues command or responds to a prompt.

1. Display Services and Framework creates a screen capture file to be stored on local user share.

2. Record and Retrieval CSCI performs a periodic save of the files on the local user share to the Internal and External Enclave.

**Trigger D:** User initiates a retrieval from a command workstation.

1. Record and Retrieval CSCI saves retrieval to the User Share.
2. Record and Retrieval CSCI performs a periodic save of the files on the local user share to the Internal and External Enclave.

#### **4.3.5.3.3.7.6 REC07: Post Conditions**

.User/application initiated data files are stored.

#### **4.3.5.3.3.7.7 REC07: Derived Requirements**

ALLOC1476
ALLOC1477
ALLOC1478
ALLOC1479
ALLOC1480
ALLOC1893
ALLOC2173
ALLOC2431
ALLOC2432
ALLOC2433
ALLOC2434
ALLOC2435
ALLOC2547
ALLOC2548
ALLOC402
ALLOC653
ALLOC851

•

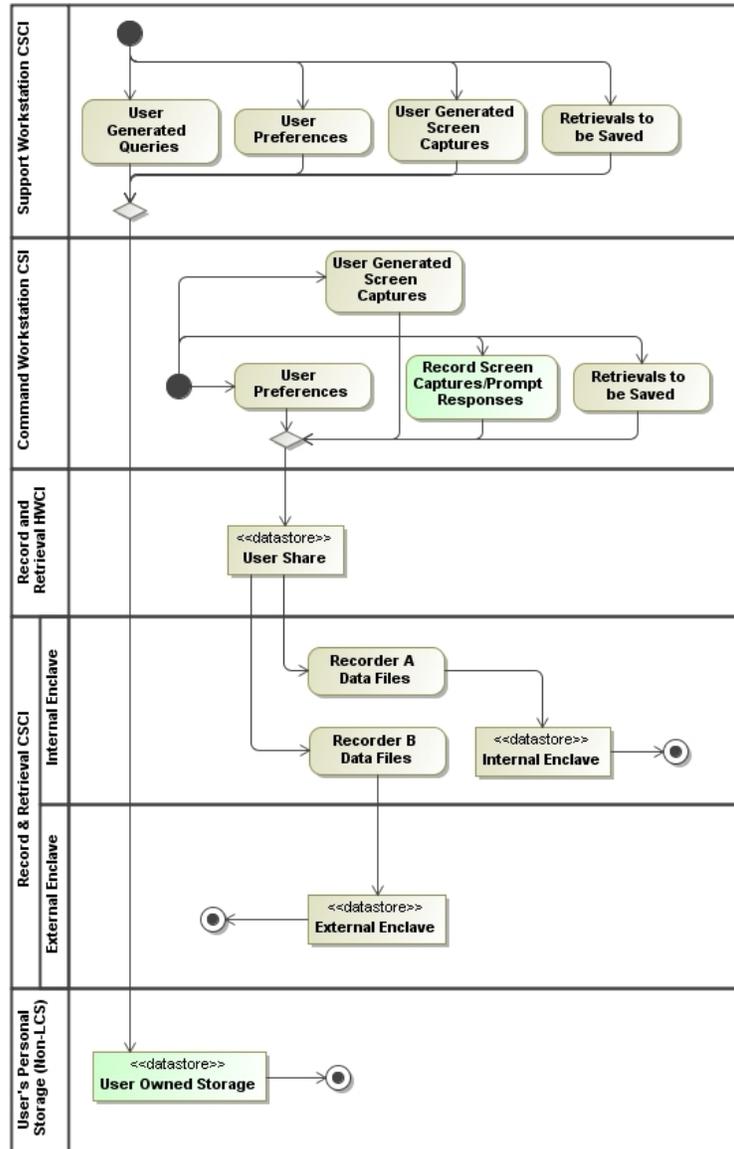


Figure 4.3.5-8 Saving User Data/Profiles Activity Diagram

#### 4.3.5.3.3.8 REC08: Recording Data Blocks/Files

This use case describes the recording of data blocks and files created by subsystems such as KGCS, SIM etc... and Log files created by servers and applications within LCS.

##### 4.3.5.3.3.8.1 REC08: ERD Requirements Addressed

R.GE70038	STRQ1064.1
R.GE7019	STRQ298.1
R.GE7060	STRQ393
R.GE70693	STRQ1608
R.GE7458	STRQ351

R.GE7489	STRQ403
R.GE7500	STRQ415

#### **4.3.5.3.3.8.2 REC08: Assumptions**

Log Files and External files are self-contained with a unique file name to ensure file retrieval at a later date without tagging or parsing by the Recording and Retrieval system.

#### **4.3.5.3.3.8.3 REC08: Limitations**

Retrieval of data from within externally generated files and log files is not supported by the Record and Retrieval CSCI. Retrieval requests shall be made for an entire file, retrieved by unique name on that file.

#### **4.3.5.3.3.8.4 REC08: Preconditions**

Data Files have sufficient header information (Meta-data) to ensure data is readily available for retrieval.

#### **4.3.5.3.3.8.5 REC08: Basic Flow**

**Trigger:** Data files have Meta-data appended to the header.

1. Internal R&R records Data Files as they are received.
2. Data Files are also sent to the External Enclave for permanent Archival.
3. External Enclave records files directly from files generated outside the Internal Enclave.
4. Internal and External R&R continue recording until stopped by the R&R Administrator.

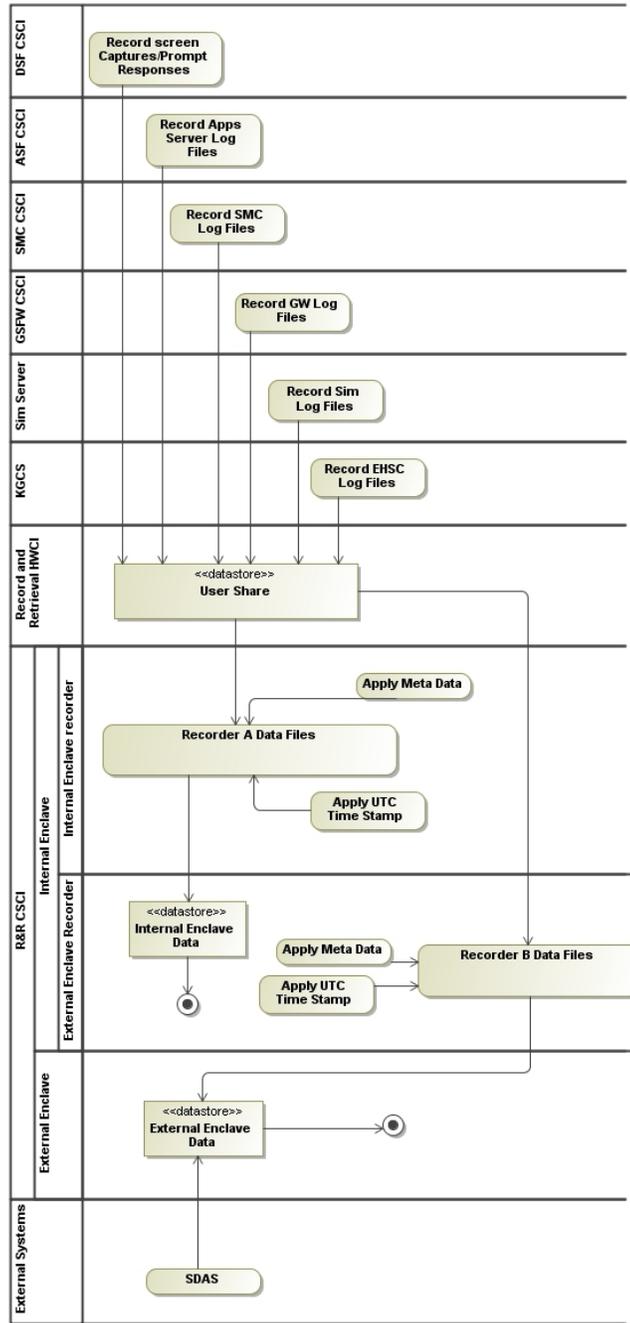


Figure 4.3.5-9 Recording Data Blocks/Files Activity Diagram

#### 4.3.5.3.3.8.6 REC08: Post Conditions

Each file is permanently recorded in the Internal and External Enclaves and available for archival and retrieval.

#### 4.3.5.3.3.8.7 REC08 : Derived Requirements

ALLOC1886
ALLOC1887
ALLOC1888
ALLOC1889
ALLOC1890
ALLOC1891
ALLOC1892
ALLOC2439
ALLOC406
ALLOC503
ALLOC591
ALLOC593
ALLOC690

#### **4.3.5.3.3.9 REC09: Health and Status**

This use case describes monitoring IE Record and Retrieval components for system health and available resources to support LCS operations. All system resources are monitored, such as the available recording space is less than TBD hours or percent, and events are created by the SMC CSCI.

##### **4.3.5.3.3.9.1.1 REC09: ERD Requirements Addressed**

##### **4.3.5.3.3.9.2 REC09: Assumptions**

None.

##### **4.3.5.3.3.9.3 REC09: Limitations**

None.

##### **4.3.5.3.3.9.4 REC09: Preconditions**

R&R is operational and has sufficient storage space available.

##### **4.3.5.3.3.9.5 REC09: Basic Flow**

**Trigger:** R&R set is in operational mode, supporting a test or mission.

1. SMC CSCI monitors Health and Status of Record and Retrieval.
2. Record and Retrieval CSCI monitors R&R recording resources available space and reports estimated percentage and time available for recording to SMC CSCI.
3. Record and Retrieval CSCI sends health and status to SMC CSCI.
4. SMC CSCI monitors R&R health and status and for availability of resources.

5. SMC CSCI generates an event when R&R system resources fail or reach a predetermined remaining level.
6. SMC CSCI timetags each event generated.

#### **4.3.5.3.3.9.6 REC09: Post Conditions**

System resources are operating properly – no data is lost.

#### **4.3.5.3.3.9.7 REC09: Derived Requirements**

#### **4.3.5.3.3.10 Key Decisions and Rationale**

R&R divided to an Internal function as part of each LCS set and an external function within the External Enclave. This separation is necessary to minimize constraints to security of the LCS and make data available to external Users.

#### **4.3.5.4 R&R Archival**

This Concept of Execution analysis includes information for backing up and archiving data contained in the OEE. The development of this Concept of Execution provides the high level concepts of back-up and archival associated with a Record and Retrieval System. This analysis describes the ability of the Record & Retrieval (R&R) System to back-up and archive Launch Control System (LCS) data and other data files residing in the External Enclave for long-term retention and disaster recovery functions.

#### 4.3.5.4.1 Scope

The scope of this analysis is limited to back-up and archival of data in the LCS Enclaves at the Kennedy Space Center and LCS sets at Johnson Space Center and Marshall Space Flight Center..

The following items are not addressed in this analysis: (1) Data migration across data tiers which is addressed in the System Management ConEx, (2) Storage at other NASA centers, (3) Recording of LCS data which is described in the R&R Recording Concept of Execution analysis (4) Retrieval of LCS data which is described in the R&R Retrieval Concept of Execution analysis or (5) Security/access which is described in the Data Access Control Concept of Execution analysis.

#### 4.3.5.4.2 Definitions

**Data archive:** migration of data (off-line) for long-term storage and disaster recovery efforts.

**Data backup:** creation of duplicate copy of data on a specified schedule to on-line and/or offline storage.

**Data restore:** restoration of data from a backup or archive copy (e.g., for recovery from a device failure or in response to a user request).

**Disaster recovery:** the production of duplicate copies of removable media for storage at a remote location to support restoring the R&R system after a major event causing loss of data at the LCS site.

**External Enclave Systems** – includes Configuration Management Server, Information Architecture Server, Record and Retrieval Server, SMC Server and the Security Server.

**Full Backup:** includes all active data currently residing on LCS systems.

**Incremental Backup:** includes new data or data which has changed since the last full backup of data to media.

**R&R Files:** Includes (1) recording raw CEV/CLV data bus and GSE data bus; (2) Vehicle and GSE processed data and LCS generated data (commands, events, and data); and (3) files generated by various systems such as EHSC, SMC, Simulation, SDAS, and Screen Captures.

**Session Archive:** includes all associated data generated by an LCS session – from Set Initialization to Set termination.

#### 4.3.5.4.3 Actors

Record & Retrieval Administrator - R&R system administrator archives entire data set at the conclusion of a session and performs restoration activities.

- External Enclave Systems - The EE Systems provide data files for back-up and/or archival. EE systems include R&R, SMC (Internal and External), IA, Security, and Configuration Management.

- User Data – Data stored in R&R HWCI provided share including retrieval scripts, retrieval parameters, and user initiated retrievals.
- Disaster Recovery - Secure, off-site storage of LCS data.

#### **4.3.5.4.4 Back-up/Restore/Archival Use Cases**

The R&R Archival Use Case diagram describes the general flow of the backup and archival of LCS data. Back-ups and the archival process are controlled by the R&R Administrator against a schedule to preserve LCS data. Daily and weekly back-ups are performed to an on-line source while monthly backups are performed to removable media and stored in a secure, off-site location. A data archive is performed at the end of a session. The archive includes the entire set of data generated (data and files) recorded from set initialization to set termination recorded on removable media for permanent secure storage. A duplicate set of media is created for secure off-site storage and made available for disaster recovery purposes.

Data restoration is performed by using the latest available back-up. The first consideration is to use the latest on-line back-up copies of data.

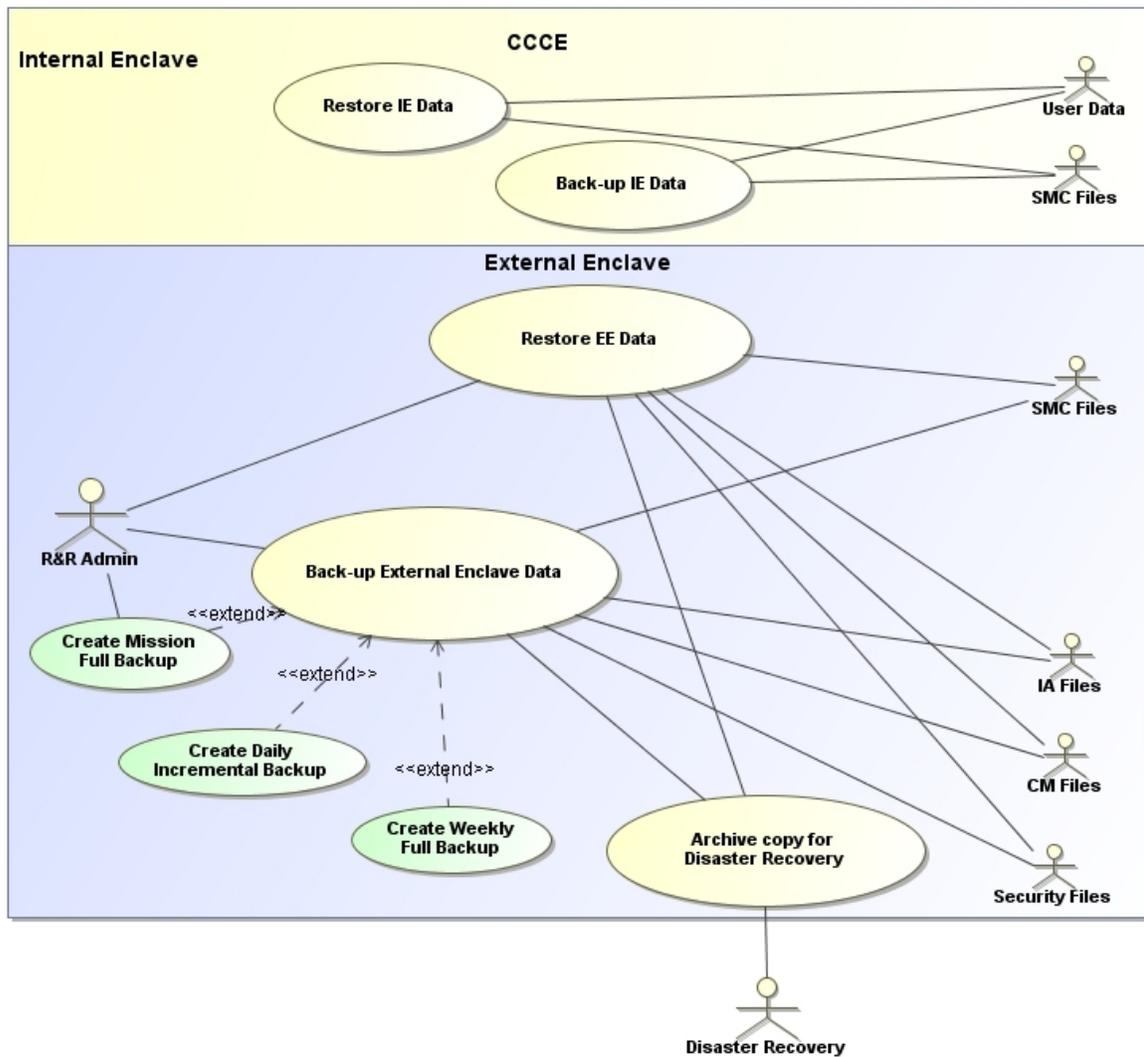


Figure 4.3.5-10 Back-up/Archival Use Case Diagram

Table 4.3.5-2 Back-up/Archival Scheme

	On-line Incremental Backup	On-line Full Backup	Off-line DR Back-up	Session Archive
<b>Daily</b>				
IE Processed Data				
EE Processed Data				
EE Unprocessed Data	X			
User Share (Files)				

	<b>On-line Incremental Backup</b>	<b>On-line Full Backup</b>	<b>Off-line DR Back-up</b>	<b>Session Archive</b>
System Files (log files)				
Servers (CM/IA/Security)	X			
External Files	X			
<b>Weekly</b>				
IE Processed Data				
EE Processed Data				
EE Unprocessed Data		X		
User Share (Files)				
System Files				
Servers (CM/IA/Security)		X		
External Files		X		
<b>Monthly</b>				
IE Processed Data			X	
EE Processed Data			X	
EE Unprocessed Data			X	
User Share (Files)			X	
System Files			X	
Servers (CM/IA/Security)			X	
External Files			X	
<b>Session</b>				
IE Processed Data				X
EE Processed Data				X
EE Unprocessed Data				X
User Share (Files)				X
Servers (CM/IA/Security)				X *
System Files				X
External Files				X

Table notes: Backups are limited to data that is not redundant. An X indicates a data set which is a unique item (no redundancy) and is backed up according to the appropriate schedule.

\*IA archives are accomplished with different timeframes from LCS sessions.

#### 4.3.5.4.4.1 Use Case 1: ARC01 – Back-up Data

Administrators are responsible for creating backups of the data contained in the LCS Sets (Internal and External Enclaves.). Backups are performed as follows:

- Record and Retrieval CSCI performs daily backup, incremental data backup, to on-line media within R&R.
- Record and Retrieval CSCI performs weekly backup, full backup, to on-line media within R&R.
- Record and Retrieval CSCI performs monthly back-up to removable media; copy of latest monthly media to be stored in an on-site facility and a copy to be stored in an off-site location to meet Disaster Recovery requirements.

##### 4.3.5.4.4.1.1 ERD Requirements Addressed

R.GE7455	STRQ400
R.GE7500	STRQ415
R.GE7703	STRQ119.1

##### 4.3.5.4.4.1.2 Use Case ARC01: Assumptions

Back-up limited to data on LCS systems.

##### 4.3.5.4.4.1.3 Use Case ARC01: Limitations

n/a

##### 4.3.5.4.4.1.4 Use Case ARC01: Preconditions

None.

##### 4.3.5.4.4.1.5 Basic Flow for ARC01

**Trigger A:** Predetermined condition is met within the Record & Retrieval Subsystem to initiate performing daily back-up of LCS data.

1. The R&R Administrator initiates incremental backups in the External Enclave, new data or data changed since the last back-up, on a daily basis.
2. The Administrator archives (Incremental/Full) from the following systems:
  - a. R&R External Enclave unprocessed data and external files
  - b. SMC
  - c. Security
  - d. IA
  - e. CM
3. The Administrator backs-up data to on-line resources.

**Trigger B:** Predetermined condition is met within the Record & Retrieval Subsystem to initiate performing weekly back-up of LCS data.

1. The R&R Administrator initiates a full backup session data in the External Enclave on a weekly basis.
2. The Administrator backs-up (Full) from the following systems:
  - a. R&R External Enclave unprocessed data and external files
  - b. SMC
  - c. Security
  - d. IA
  - e. CM
3. The Administrators back-up data to an on-line resource.

**Trigger C:** Predetermined condition is met within the Record & Retrieval Subsystem to initiate performing monthly back-up of LCS data.

1. The R&R Administrator initiates full backups, all current session data in the Internal Enclave and data and files currently residing within the External Enclave systems, on a monthly basis to removable media.
2. The Administrators backs-up (Incremental/Full) from the following systems:
  - a. R&R (all session data and files)
  - b. SMC
  - c. Security
  - d. IA
  - e. CM
3. The R&R Administrator packages, marks and readies latest monthly back-up media for delivery to on-site storage facility.
4. The R&R Administrator creates a duplicate copy of the monthly back-up for disaster recovery purposes.
5. The R&R Administrator packages, marks and readies latest monthly back-up media for delivery to off-site disaster recovery.

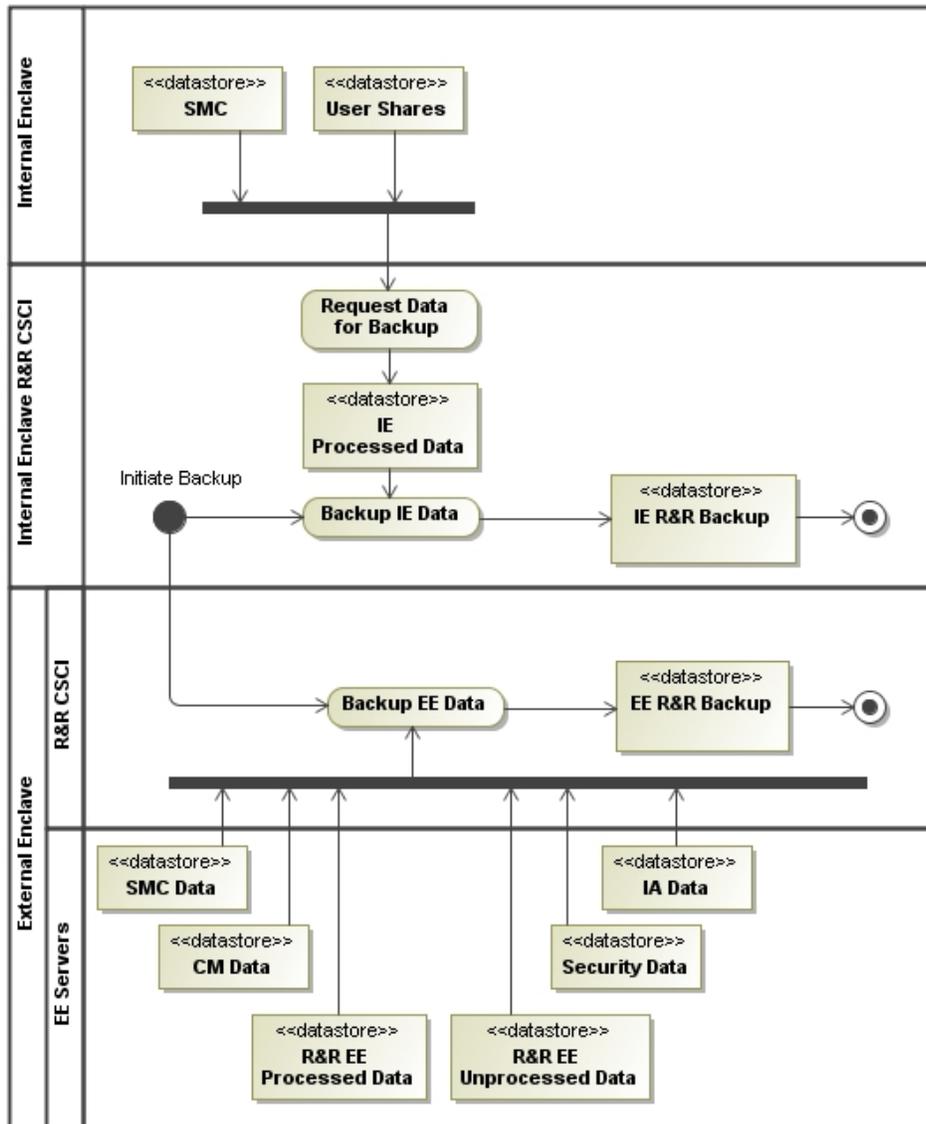


Figure 4.3.5-11 Backup Data On-line

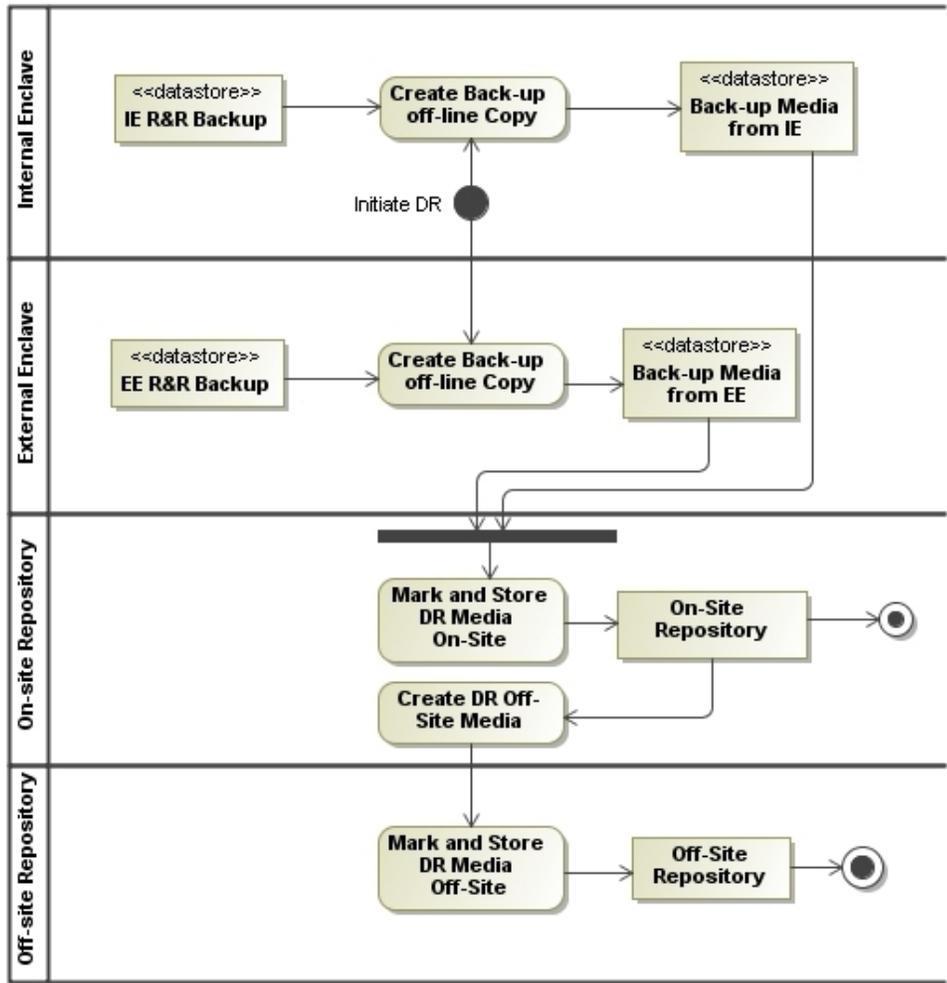


Figure 4.3.5-12 Backup Data Off-line

#### 4.3.5.4.4.1.6 Post Conditions

Data is permanently archived to support Disaster Recovery requirements – off-site storage.

#### 4.3.5.4.4.1.7 ARC01 Derived Requirements

ALLOC1031
ALLOC1032
ALLOC1033
ALLOC1565
ALLOC1566
ALLOC1567
ALLOC1568
ALLOC1569

ALLOC1570
ALLOC1571
ALLOC1572
ALLOC1573
ALLOC1574
ALLOC1575
ALLOC1576
ALLOC1577
ALLOC1593
ALLOC2435

#### 4.3.5.4.4.2 Use Case ARC02: Restore Data

As necessary, data is restored at a User’s request for systems in the Internal or External Enclaves. Data and/or files are restored from the latest incremental, full, or session backup media available to the R&R Administrator. Disaster Recovery copies stored at a secure off-site facility are requested as a last resort.

##### 4.3.5.4.4.2.1 ERD Requirements Addressed

R.GE7439	STRQ1653
R.GE7516	STRQ436
R.GE7620	STRQ418

##### 4.3.5.4.4.2.2 Use Case ARC02: Assumptions

None.

##### 4.3.5.4.4.2.3 Use Case ARC02: Limitations

Restoration of previously recorded sessions is limited to:

- being done on a non-interface basis
- 5 previous sessions in the Internal Enclave
- restores from removable media and not done in real-time.

##### 4.3.5.4.4.2.4 Use Case ARC02: Preconditions

n/a

##### 4.3.5.4.4.2.5 Basic Flow for ARC02

**Trigger:** Predetermined condition is met requiring a restoration of data or files from back-up source.

1. The R&R Administrator uses most recent backup media containing data files requiring restoration.
2. As necessary, the R&R Administrator requests most recent on-site media containing data files requiring restoration.
3. The R&R Administrator restores Data files on Internal and/or External Enclave system(s).

The R&R Administrator returns media to storage location as necessary.

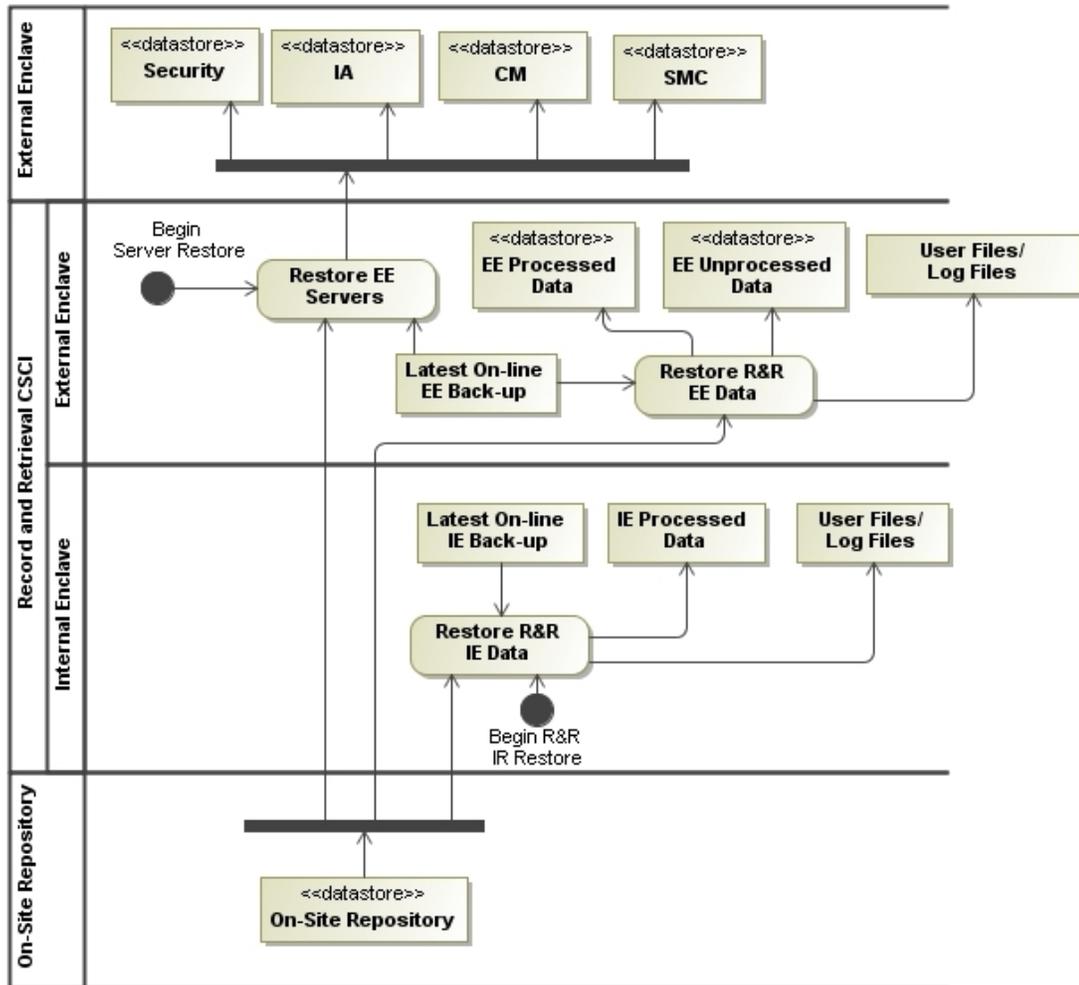


Figure 4.3.5-13 Restore Data

#### 4.3.5.4.4.2.6 Post Conditions

Data is restored.

#### 4.3.5.4.4.2.7 Derived Requirements

ALLOC1578
ALLOC1579
ALLOC1580
ALLOC1581
ALLOC1582
ALLOC1583
ALLOC1584
ALLOC1585
ALLOC1586
ALLOC1587
ALLOC1588
ALLOC1589
ALLOC626
ALLOC627

#### 4.3.5.4.4.3 Use Case ARC03: Archive and Disaster Recovery

At the end of a recording session, R&R Administrator performs a complete archive of the session data on removable media. Media is created for long-term off-line local storage and a copy created for off-line, off-site storage for disaster recovery.

##### 4.3.5.4.4.3.1 ERD Requirements Addressed

R.GE7000	STRQ408
R.GE7121	STRQ410
R.GE7500	STRQ415
R.GE7703	STRQ119.1

##### 4.3.5.4.4.3.2 Use Case ARC03: Assumptions

Archival limited to data at KSC and LCS sets at Johnson Space Center and Marshall Space Flight Center...

##### 4.3.5.4.4.3.3 Use Case ARC03: Limitations

n/a

##### 4.3.5.4.4.3.4 Use Case ARC03: Preconditions

Recording session has been completed.

##### 4.3.5.4.4.3.5 Basic Flow for ARC03

*Trigger:* Session data is ready for archival.

1. To Local Storage:

- a. Record and Retrieval CSCI makes a final data sweep for User shares and system log files.
  - b. The Record and Retrieval compares the redundant processed data files (internal and external files).
    - i. Where copies are verified to be the same, one file is kept for archive and the other is not archived.
    - ii. When the compares are different, R&R CSCI keeps the data file which is complete, or if both files are missing data, R&R CSCI creates a new super-set of data from the two files.
  - c. The R&R Administrator creates a full session archival to removable media.
  - d. The R&R Administrator removes all current session data from the R&R system.
  - e. The R&R Administrator packages, marks and readies Media for storage in secure local KSC facility.
  - f. Delivery is made to the local KSC facility.
2. To Off-site Storage:
- a. A duplicate copy of the Archived data session is made for disaster recovery.
  - b. The R&R Administrator packages, marks and readies session Media archival for delivery to off-site facility at the end of each recording session.
  - c. Delivery is made to the off-site facility.

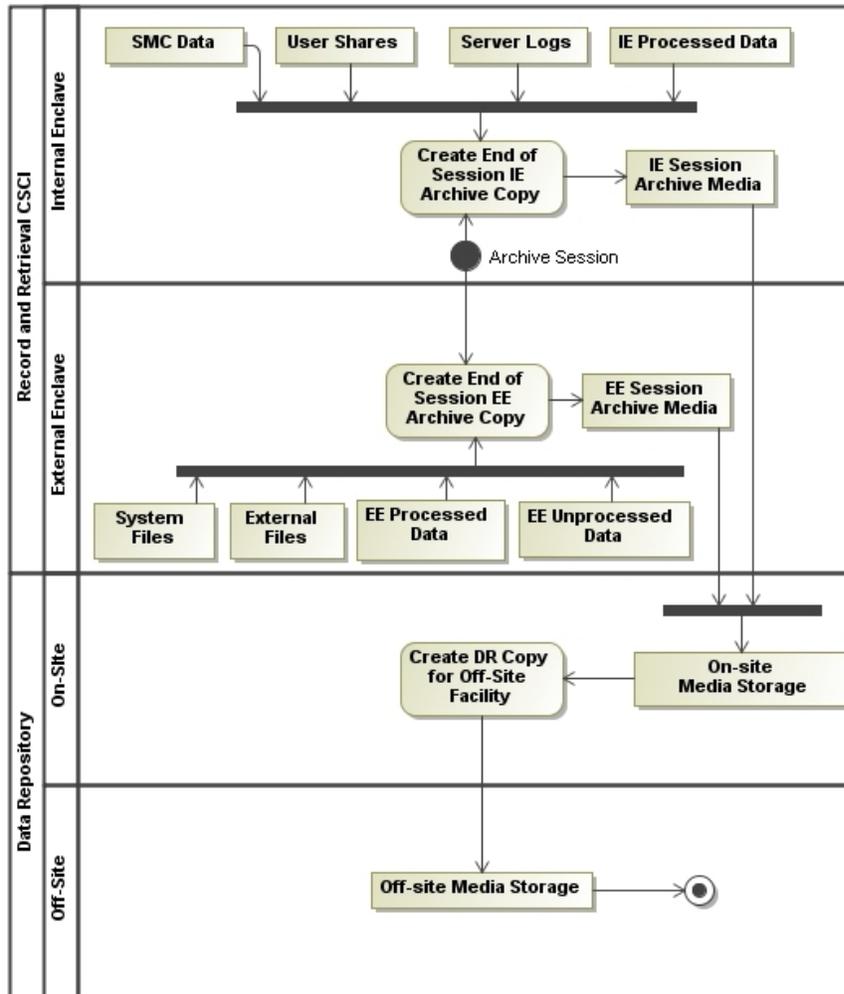


Figure 4.3.5-14 Session Archive and Disaster Recovery

**4.3.5.4.4.3.6 Post Conditions**

Data is removed from the Record and Retrieval system and removable media is stored in a secure on-site and off-site location for future restoration and Disaster Recovery.

**4.3.5.4.4.3.7 Derived Requirements**

ALLOC1031
ALLOC1032
ALLOC1033
ALLOC1567
ALLOC1571
ALLOC1574
ALLOC1577
ALLOC1592
ALLOC2827

ALLOC619
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ALLOC693
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#### 4.3.5.4.4 Key Decisions and Rationale

R&R divided to an Internal function as part of each LCS set and an external function within the External Enclave. This separation is necessary to minimize constraints to security of the LCS and make data available to external Users. Data is recorded in the Internal Enclave for use by Constellation Engineers on a CWS during the current session and permanently recorded in the External Enclave of R&R for redundancy, archival purposes and retrieving by external Users.

R&R Archival ConEx, as currently written, provides the ability to back-up and/or archive all systems within the External Enclave. These include: SMC, CM, IA, and Security.

Pros:

1. It is cheaper and more efficient for back-ups and archival to be done by a single entity, requiring a single process and single administrator for archival.
2. Cover all requirements for backup, archival, and restoring data.
3. A single archival requires less removable media to manage.
4. R&R contains the majority of data being archived.

Cons:

1. There is not a current ERD requirement for R&R to perform these duties.
2. The load on the R&R servers for archival may negatively impact LCS recording.
3. Collecting data from IA, CM, and Security require more recording resources within R&R.
4. R&R Administrator's role increases in responsibility.

Decision was made to record both Unprocessed Data streams in the External Enclave. Unprocessed data is not available from a Command Workstation, however both streams can be retrieved from a Support Workstation.

Backups are made daily and weekly for data and files which are not redundant. Monthly backups are made for the entire set of session data which has been recorded up to that point in time.

#### 4.3.5.5 R&R Retrieval

The purpose of this Concept of Execution analysis is to describe the system which provides the ability for Users to perform data retrievals of previously recorded Vehicle, GSE, and Application data. This ConEx includes all retrievals: Constellation Engineers within the LCS using Command Workstations, Constellation Engineers within the LCS using Support Workstations, External systems (external to KSC) as C3I compliant packages, and External Users within KSC but outside the LCS, through a Web Portal.

This ConEx also covers retrievals initiated by an application. Graphical display of data on a Command Workstation is initiated by the User by executing Plot Viewer. Plot Viewer will display real-time and/or retrieve historical data by requesting the data from Record and Retrieval CSCI. System Applications also request data based on system events executing a canned retrieval and set of parameters to retrieve data necessary for event evaluation by the application or monitoring CSE.

#### **4.3.5.5.1 Scope**

The scope of this analysis is limited to Launch Control System (LCS) data retrievals.

The following items are not addressed in this analysis:

- Streaming data – covered by Data Distribution Conex,
- Specifications for display terminals at external locations – these are the responsibility of the external locations,
- Security/access to LCS which will be described in the data access control concept of execution analysis,
- Recording of LCS data which will be described in the r&r recording concept of execution analysis
- Archival of LCS data which will be described in the r&r archival concept of execution analysis.

#### **4.3.5.5.2 Actors**

- External System(s): An External System is any system outside the border of LCS. Examples of an External Systems are Mission Support, CLV, or CEV.
- External User: An External User is any user outside the border of LCS using an office workstation to access recorded data in the External Enclave via web interface.
- Constellation Systems Engineer: A Constellation Engineer is a User inside the border of LCS using a Command Workstation or using a Support Workstation to retrieve data through the Web Portal.
- System Application: An LCS application (Control Application or a System Application) requesting a data retrieval based on an event.

### 4.3.5.5.3 R&R Retrieval Use Cases

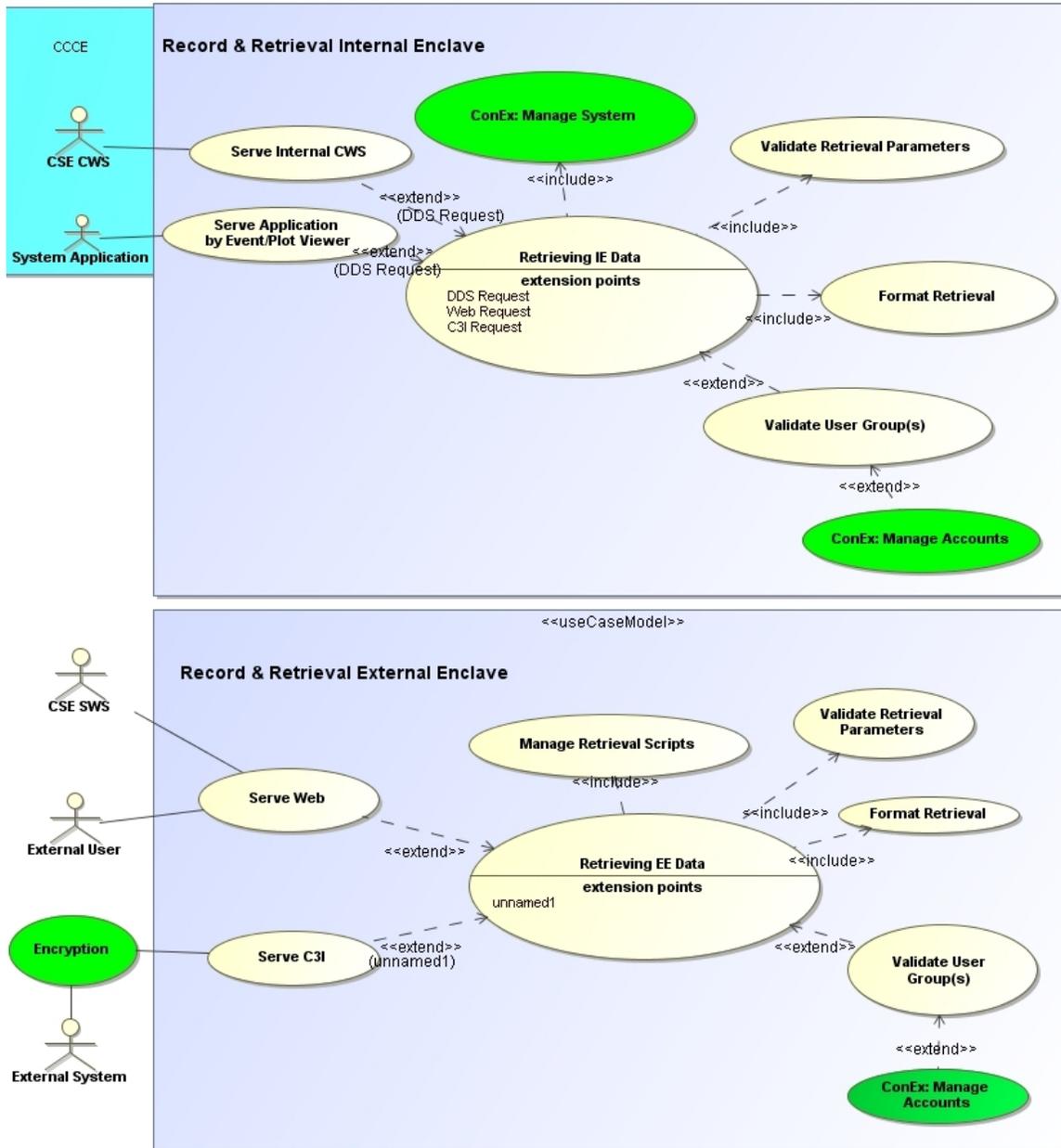


Figure 4.3.5-15 Retrieval Use Case

The Retrieval ConEx contains 6 use cases:

- Use Case 1: Serving Retrieval Request
- Use Case 2: Manage Retrieval Scripts
- Use Case 3: Validate Retrieval Parameters/User
- Use Case 4: Retrieving Data/Files
- Use Case 5: Format IE Retrieval

- Use Case 6: Format EE Retrieval

#### 4.3.5.5.3.1 RET01: Serving Retrieval Request

This analysis supports the User interface to request a retrieval of a file or data. Record and Retrieval provides a user interface for the Constellation System Engineer to request retrievals from a Command Workstation. Applications can also request retrieval of data for a User requested plot or an automated retrieval in response to an event.

A web interface is provided for a Constellation System Engineer using a Support Workstation, as well as for External User using their own workstation, and External System to request a retrieval. The User interfaces provide options for requesting various data retrievals across multiple missions, dates, and times as well as recorded files.

##### 4.3.5.5.3.1.1 RET01: Requirements Addressed

R.GE70203	STRQ1277
R.GE7029	STRQ314
R.GE70450	STRQ1421
R.GE70451	STRQ1422
R.GE7065	STRQ419
R.GE7066	STRQ420
R.GE7067	STRQ421
R.GE7068	STRQ422
R.GE7069	STRQ423
R.GE7070	STRQ424
R.GE7439	STRQ1653
R.GE7441	STRQ397
R.GE7479	STRQ427
R.GE7481	STRQ429
R.GE7483	STRQ402
R.GE7499	STRQ434
R.GE7516	STRQ436
R.GE7633	STRQ49.1
R.GE7643	STRQ59.1
R.GE7696	STRQ112.1
R.GE7795	STRQ42.1
R.GE7807	STRQ936.1
R.GE7808	STRQ937.1
R.GE7881	STRQ1655.1
R.GE7901	STRQ1195.1
R.GE7909	STRQ1203.1
R.GE7910	STRQ1204.1
R.GE7936	STRQ1225.1

- 

#### 4.3.5.5.3.1.2 RET01: Assumptions

- n/a

#### 4.3.5.5.3.1.3 RET01: Limitations

- Retrieval of CEV or CLV unprocessed data is limited to Users accessing the External Enclave.
- Near real-time Command PWS retrievals are limited to the current mission and 5 historical missions on-line. Retrievals from off-line missions require a data restore.

#### 4.3.5.5.3.1.4 RET01: Preconditions

The R&R system is active and communicating.

#### 4.3.5.5.3.1.5 RET01: Basic Flow

*Trigger A:* The User requests recorded data from a Command PWS – initiates retrieval.

1. Record and Retrieval CSCI displays retrieval interface on Command PWS.
1. Record and Retrieval CSCI provides CSE the ability to request a list of:
  - a. Available TCIDs
  - b. Available retrievals
2. Record and Retrieval CSCI provides the CSE the ability to select retrieval.
3. Record and Retrieval CSCI displays selected retrieval screen with default parameters.
4. Record and Retrieval CSCI provides the CSE the ability to select a saved set of retrieval parameters for selected retrieval.
5. Record and Retrieval CSCI provides the CSE the ability to modify parameters as necessary and issue retrieval command. Parameters include, but are not limited to:
  - a. TCID
  - b. CUI(s) or DEM headers
  - c. Start Time
  - d. Stop Time (or duration)
  - e. Retrieval output format
6. Record and Retrieval CSCI provides the CSE the ability to execute the retrieval command.
7. As necessary:
  - a. Record and Retrieval CSCI notifies User if retrieval parameters are invalid.
  - b. Record and Retrieval CSCI provides the CSE the ability to modify parameters as necessary and reissue retrieval command.

- c. Record and Retrieval CSCI notifies User if any selected data cannot be viewed due to User's permissions. Valid data requests are processed.

**Trigger B:** The User requests recorded data from a Monitor PWS or an office computer accessing LCS via web interface.

1. Record and Retrieval displays retrieval web page for Monitor PWS/User PC.
2. Record and Retrieval CSCI provides the User the ability to request a list of:
  - a. Available TCIDs
  - b. Available retrievals
3. Record and Retrieval CSCI provides the User the ability to select/create/modify a data retrieval.
4. Record and Retrieval CSCI provides the User the ability to select a saved set of retrieval parameters for selected retrieval.
5. Record and Retrieval CSCI provides the User the ability to modify parameters as necessary and issue retrieval command.
6. Record and Retrieval CSCI provides the User the ability to execute the retrieval command.
7. As necessary:
  - a. Record and Retrieval CSCI notifies User if retrieval parameters are invalid.
  - b. Record and Retrieval CSCI provides the User the ability to modify parameters as necessary and reissue retrieval command.
  - c. Record and Retrieval CSCI notifies User if any selected data cannot be viewed due to User's permissions. Valid data requests are processed.

**Trigger C:** An External System requests recorded data.

1. Record and Retrieval CSCI provides interface for External System to initiate a C3I compliant data retrieval.
2. Record and Retrieval CSCI provides the External System the ability to execute the retrieval command.
3. As necessary:
  - a. Record and Retrieval CSCI notifies External System if retrieval parameters are invalid.
  - b. Record and Retrieval CSCI provides the External System the ability to modify parameters as necessary and reissue retrieval command.
  - c. Record and Retrieval CSCI notifies External System if any selected data cannot be viewed due to User's permissions. Valid data requests are processed.

**Trigger D:** An LCS Application requests recorded data in response to an Event

1. Application Services CSCI executes the retrieval command for Record and Retrieval CSCI to retrieve data with retrieval parameters:
  - a. Start/stop time
  - b. CUI(s) requested
2. Record and Retrieval CSCI processes the retrieval command and distributes data to the requesting application.

**Trigger E:** Plot Viewer requests a retrieval for plot data.

1. System Applications CSCI executes the retrieval command for Record and Retrieval CSCI to retrieve data with retrieval parameters necessary to execute the requested plot:
  - a. Start/stop time
  - b. CUI(s) requested
2. R&R CSCI processes the retrieval command and distributes data to the requesting application.
3. .As necessary:
  - a. Record and Retrieval CSCI notifies Plot Viewer if retrieval parameters are invalid.
  - b. Plot Viewer provides the User the ability to modify parameters as necessary and reissue retrieval command.
  - c. Record and Retrieval CSCI notifies Plot Viewer if any selected CUI cannot be viewed due to User's permissions. Valid CUI requests are processed.

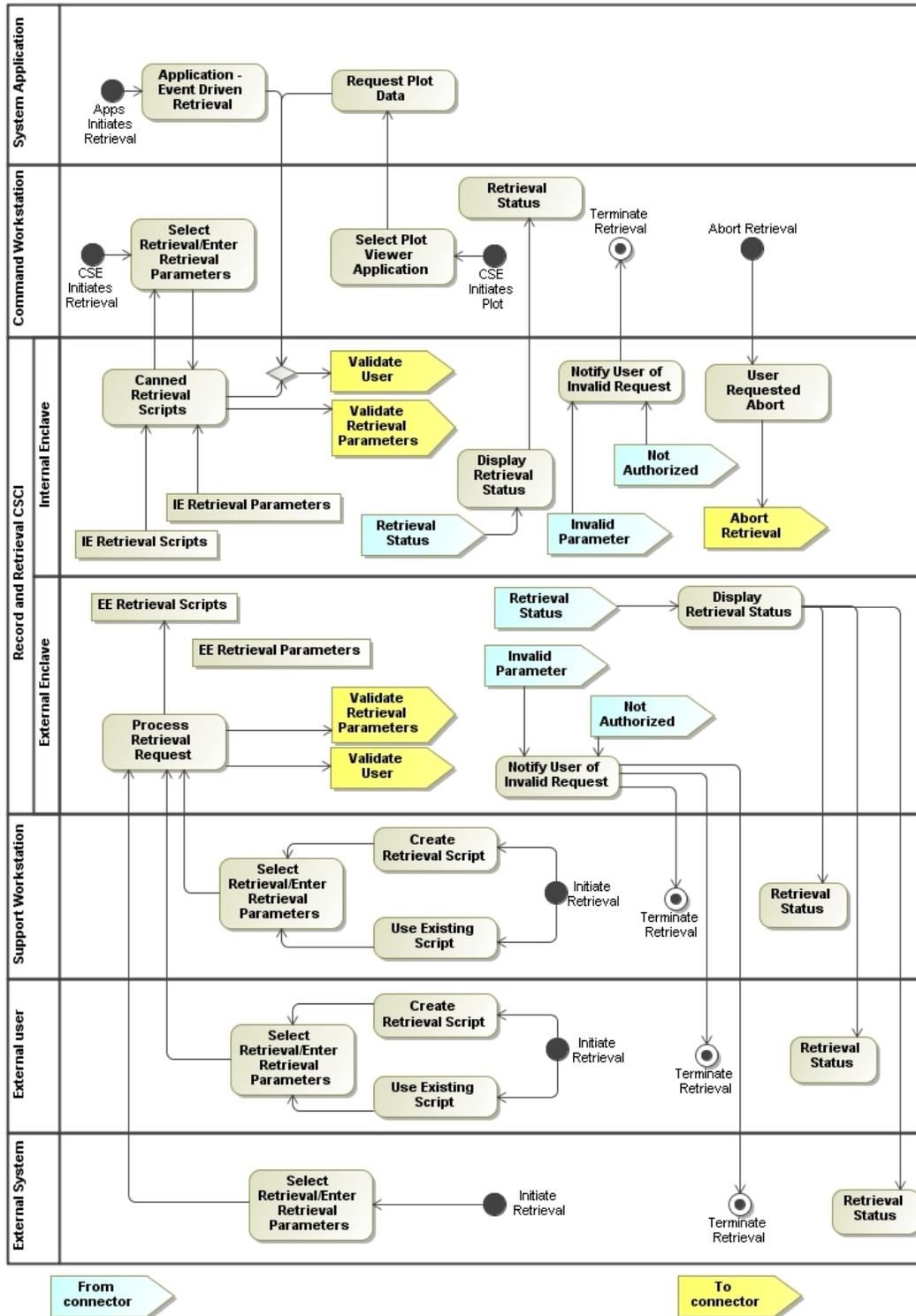


Figure 4.3.5-16 Serve User Retrieval Requests Activity Diagram

#### 4.3.5.5.3.1.6 RET01: Post Conditions

1. Data retrieval and parameters are processed..

#### 4.3.5.5.3.1.7 RET01: Derived Requirements

ALLOC1072	ALLOC2685	ALLOC2738
ALLOC1245	ALLOC2686	ALLOC2739
ALLOC1247	ALLOC2687	ALLOC2740
ALLOC1319	ALLOC2688	ALLOC2777
ALLOC1379	ALLOC2689	ALLOC2778
ALLOC1463	ALLOC2690	ALLOC600
ALLOC19	ALLOC2691	ALLOC627
ALLOC1903	ALLOC2692	ALLOC631
ALLOC1904	ALLOC2693	ALLOC634
ALLOC1907	ALLOC2694	ALLOC636
ALLOC1908	ALLOC2696	ALLOC639
ALLOC1909	ALLOC2697	ALLOC640
ALLOC2495	ALLOC2698	ALLOC642
ALLOC2675	ALLOC2699	ALLOC643
ALLOC2676	ALLOC2704	ALLOC644
ALLOC2677	ALLOC2705	ALLOC802
ALLOC2678	ALLOC2706	ALLOC836
ALLOC2679	ALLOC2707	ALLOC838
ALLOC2680	ALLOC2708	ALLOC839
ALLOC2681	ALLOC2709	ALLOC956
ALLOC2682	ALLOC2713	
ALLOC2683	ALLOC2714	
ALLOC2684	ALLOC2735	

#### 4.3.5.5.3.2 RET02: Manage Retrieval Scripts

This use case supports the management of retrieval scripts. Retrieval scripts for use by the Constellation System Engineer at a Command PWS and by Application retrievals are thoroughly tested and made part of the TCID. This use case uses the TCID default parameters for each retrieval as it is selected and gives the User the option to save retrieval parameters with a User selected name in the User's share for future use. The User may change the default parameters or select any previously saved set of retrieval parameters stored in the User's share.

User scripts can also be generated during an operation on a Support Workstation or by an External User. Monitor PWS User created scripts are saved in the User Share area. As with the Command PWS, the User may also save multiple retrieval parameters, by User selected name. User created scripts are saved and can be tested, and when approved, become part of a subsequent TCID build.

##### 4.3.5.5.3.2.1 RET02: Requirements Addressed

R.GE7065	STRQ419
R.GE7068	STRQ422

R.GE7069	STRQ423
R.GE7479	STRQ427
R.GE7480	STRQ428
R.GE7481	STRQ429
R.GE7499	STRQ434
R.GE7909	STRQ1203.1

#### 4.3.5.5.3.2.2 RET02: Assumptions

- n/a

#### 4.3.5.5.3.2.3 RET02: Limitations

- CSE on a Command PWS cannot create an ad hoc retrieval script.

#### 4.3.5.5.3.2.4 RET02: Preconditions

The R&R system is active and communicating.

##### 4.3.5.5.3.2.4.1 RET02: Basic Flow

**Trigger A:** CSE on a Command PWS executes a retrieval command with modified default parameters.

1. Record and Retrieval CSCI provides the User the ability to save retrieval parameters with User selected name.
2. Record and Retrieval CSCI saves the file in the User's share.

**Trigger B:** CSE on a Support Workstation executes a retrieval script with modified default parameters.

1. Record and Retrieval CSCI provides the User the ability to save retrieval parameters with User selected name.
2. Record and Retrieval CSCI provides the User with the ability to save the new default parameters to a User specified location.

**Trigger C:** CSE on a Monitor Workstation executes a retrieval command with a newly created or modifies a retrieval.

1. Record and Retrieval CSCI provides the User the ability to save retrieval with User selected name.
2. Record and Retrieval CSCI provides the User with the ability to save the new retrieval to a User specified location.
3. Record and Retrieval CSCI provides access to the new retrieval script to all web Users.

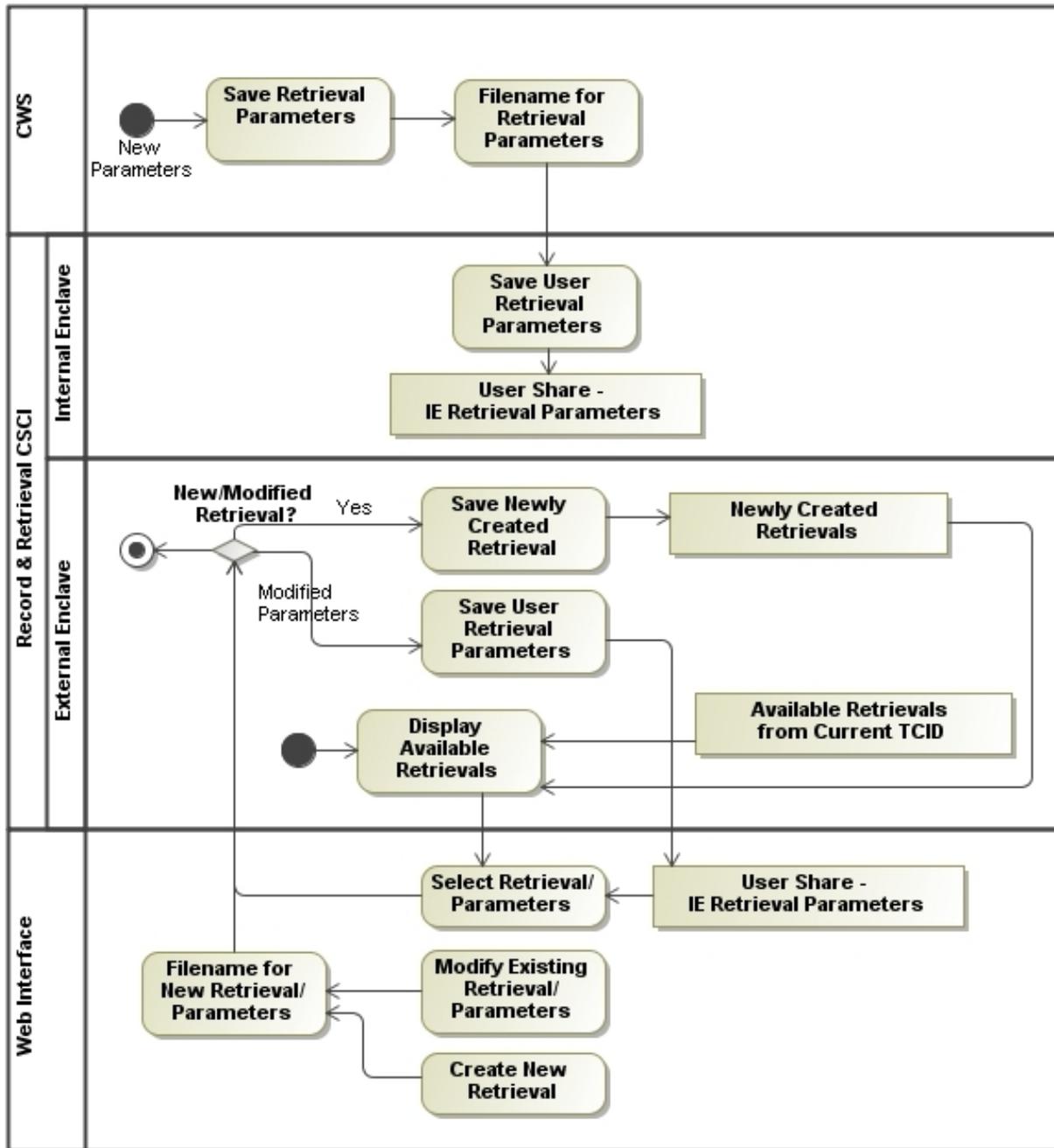


Figure 4.3.5-17 Manage Retrieval Scripts Activity Diagram

#### 4.3.5.5.3.2.5 RET02: Post Conditions

1. User saved parameters are saved for future use. The last used parameters for each retrieval are saved as default parameters to be used for the next retrieval by that User.

2. New or modified retrievals are saved and made available for use by all web Users through the Web interface. The last used parameters for each retrieval are saved as default parameters to be used for the next retrieval.

#### **4.3.5.5.3.2.6 RET02: Derived Requirements**

ALLOC1247
ALLOC1905
ALLOC1906
ALLOC2707
ALLOC2708
ALLOC631
ALLOC635
ALLOC636
ALLOC640
ALLOC641
ALLOC644

#### **4.3.5.5.3.3 RET03: Validate Retrieval Parameters/User**

This Use Case addresses the validation of retrieval parameters and the permission for User requesting retrieval to access the data/files requested. When a request is made for data that is restricted, and the requestor is not able to retrieve that data, the retrieval will be marked as “restricted” for those data items.

When an unprocessed data retrieval is requested, if any data element is marked as restricted, the entire packet is treated as restricted and cannot be viewed unless the requestor has permissions to view the restricted data.

#### **4.3.5.5.3.3.1 RET03: Requirements Addressed**

R.GE70203	STRQ1277
R.GE7065	STRQ419
R.GE7067	STRQ421
R.GE7439	STRQ1653
R.GE7480	STRQ428
R.GE7481	STRQ429
R.GE7499	STRQ434
R.GE7516	STRQ436
R.GE7633	STRQ49.1
R.GE7795	STRQ42.1
R.GE7807	STRQ936.1
R.GE7881	STRQ1655.1
R.GE7909	STRQ1203.1

#### **4.3.5.5.3.3.2 RET03: Assumptions**

- n/a

#### **4.3.5.5.3.3.3 RET03: Limitations**

- n/a

#### **4.3.5.5.3.3.4 RET03: Preconditions**

The R&R system is active and communicating.

#### **4.3.5.5.3.3.5 RET03: Basic Flow**

**Trigger A:** A retrieval command has been executed in the Internal Enclave.

1. The Record and Retrieval CSCI validates each retrieval parameter for validity and accuracy.
2. Record and Retrieval CSCI generates invalid parameter error message to the User for any parameter found to be invalid.
3. Common Services CSCI publishes the retrieval command.
4. Security CSCI provides Record and Retrieval CSCI the requestor's permissions.
5. Record and Retrieval CSCI, validates the User's roles after all parameters are found valid.
6. Record and Retrieval CSCI checks authorization for this user and restricts retrieval for the following conditions:
  - a. If a processed retrieval - user must have read permissions for each CUI requested, unauthorized CUIs left out of retrieval.
  - b. If a raw retrieval - user must have read permissions for all CUIs whose unprocessed data is in the DEM packet, unauthorized DEM packets are left out of retrieval (but marked as "omitted" in output.) Record and Retrieval CSCI checks DEM header for unprocessed data being requested. If any data is restricted in the C3I packet, the entire packet is restricted for retrieval and can only be retrieved by a User with the appropriate permission..
7. Record and Retrieval CSCI generates a security event to the IE Security CSCI for any restricted CUI requested by a User lacking the required permissions.
8. Record and Retrieval CSCI processes the command for CUI(s) which the User has valid roles.
9. Record and Retrieval CSCI sets status equal to valid.
10. Record and Retrieval CSCI terminates the retrieval only if all requested CUIs are restricted for the User.

**Trigger B:** A retrieval command has been executed in the External Enclave.

1. The Record and Retrieval CSCI validates each retrieval parameters for validity and accuracy.
2. Record and Retrieval CSCI generates invalid parameter error message to the User for any parameter found to be invalid.
3. Record and Retrieval CSCI, validates the User's roles after all parameters are found valid.
4. Record and Retrieval CSCI generate an error message to the User when a requested CUI(s) is restricted for this User.
5. Record and Retrieval CSCI checks authorization for this user and restricts retrieval for the following conditions:
  - a. If a processed retrieval - user must have read permissions for each CUI requested, unauthorized CUIs left out of retrieval.
  - b. If a raw retrieval - user must have read permissions for all CUIs whose unprocessed data is in the DEM packet, unauthorized DEM packets are left out of retrieval (but marked as "omitted" in output) Record and Retrieval CSCI processes the command for CUI(s) which the User has valid roles.
6. Record and Retrieval CSCI sets status equal to valid.
7. Record and Retrieval CSCI terminates the retrieval only if all requested CUIs are restricted for the User.

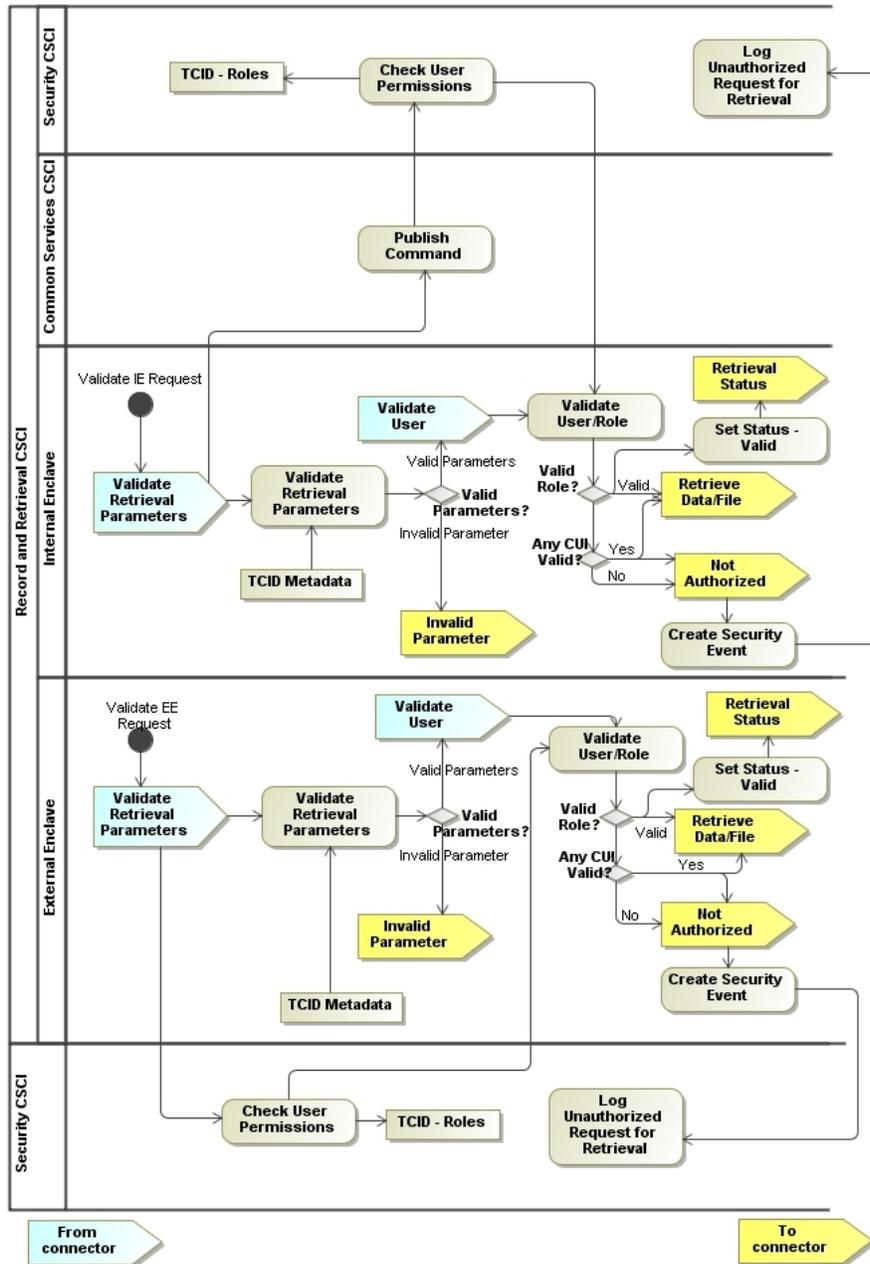


Figure 4.3.5-18 Validate Parameters/User Activity Diagram

#### 4.3.5.5.3.3.5.1 RET03: Post Conditions

1. Data parameters are validated for accuracy and only validated Users receive requested retrieval.

#### 4.3.5.5.3.3.6 RET03: Derived Requirements

ALLOC1247
ALLOC1463

ALLOC1910
ALLOC2782
ALLOC627
ALLOC631
ALLOC635
ALLOC642
ALLOC644
ALLOC802
ALLOC836

#### 4.3.5.5.3.4 RET04: Retrieving Data/Files

This Use case covers the actual retrieval of data and files as requested by the User. When a data retrieval request cannot be fulfilled, the data values not filled contain one of the following designations:

- Invalid – when data status value is Invalid, data value is out of spec or data source has failed status.
- Stale – when data status value is Stale, data value had not been updated within the expected timeframe
- Unavailable – when the data cannot be found because of a recording malfunction.
- Restricted – when data is tagged as restricted and the requestor does not have permissions to view the requested data.

#### 4.3.5.5.3.4.1 RET04: Requirements Addressed

R.GE7029	STRQ314
R.GE70450	STRQ1421
R.GE7065	STRQ419
R.GE7067	STRQ421
R.GE7439	STRQ1653
R.GE7441	STRQ397
R.GE7481	STRQ429
R.GE7498	STRQ433
R.GE7499	STRQ434
R.GE7516	STRQ436
R.GE7795	STRQ42.1
R.GE7808	STRQ937.1
R.GE7909	STRQ1203.1

#### **4.3.5.5.3.4.2 RET04: Assumptions**

- n/a

#### **4.3.5.5.3.4.3 RET04: Limitations**

- n/a

#### **4.3.5.5.3.4.4 RET04: Preconditions**

The R&R system has validated User's provided retrieval parameters and User Role as authorized to access data.

#### **4.3.5.5.3.4.5 RET04: Basic Flow**

**Trigger A:** Retrieval of LCS processed data is requested

1. Record and Retrieval CSCI uses retrieval command parameters to find the requested processed data.
2. Record and Retrieval CSCI sets status equal to retrieving.
3. While processing the retrieval, if an Abort Retrieval is received:
  - a. Record and Retrieval CSCI sets status equal to aborted.
  - b. Record and Retrieval CSCI stops retrieval of processed data..
  - c. Record and Retrieval CSCI sets the Stop Date/Stop Time of the retrieval to the date and time of the last retrieved data.
  - d. Record and Retrieval CSCI processes partial retrieval for output formatting.
  - e. Record and Retrieval CSCI sets Retrieval Status to Aborted.
  - f. Skip steps 4 & 5.
4. Record and Retrieval CSCI sets status equal to formatting.
5. Record and Retrieval CSCI processes data retrieved for output formatting.

**Trigger B:** Retrieval of LCS unprocessed data is requested

1. Record and Retrieval CSCI uses provided parameters to find the requested unprocessed data
2. Record and Retrieval CSCI sets status equal to retrieving.
3. While Record and Retrieval CSCI processes the retrieval, if an Abort Retrieval is received:
  - a. Record and Retrieval CSCI sets status equal to aborted.
  - b. Record and Retrieval CSCI stops retrieval of unprocessed data.
  - c. Record and Retrieval CSCI sets the Stop Date/Stop Time of the retrieval to the date and time of the last retrieved data.

- d. Record and Retrieval CSCI send partial retrieval for output formatting.
  - e. Record and Retrieval CSCI sets Retrieval Status to Aborted.
  - f. Skip steps 4 & 5.
4. Record and Retrieval CSCI sets status equal to formatting.
  5. Record and Retrieval CSCI processes data retrieved for output formatting.

***Trigger C:*** Retrieval of LCS file is requested

1. Record and Retrieval CSCI uses provided parameters to find the requested file
2. Record and Retrieval CSCI sets status equal to retrieving.
3. While Record and Retrieval CSCI processes the retrieval, if an Abort Retrieval is received:
  - a. Record and Retrieval CSCI sets status equal to aborted.
  - b. Record and Retrieval CSCI stops file retrieval.
  - c. Record and Retrieval CSCI sets Retrieval Status to Aborted.
  - d. Skip steps 4 & 5.
4. Record and Retrieval CSCI sets status equal to formatting.
5. Record and Retrieval CSCI will terminate the retrieval request.

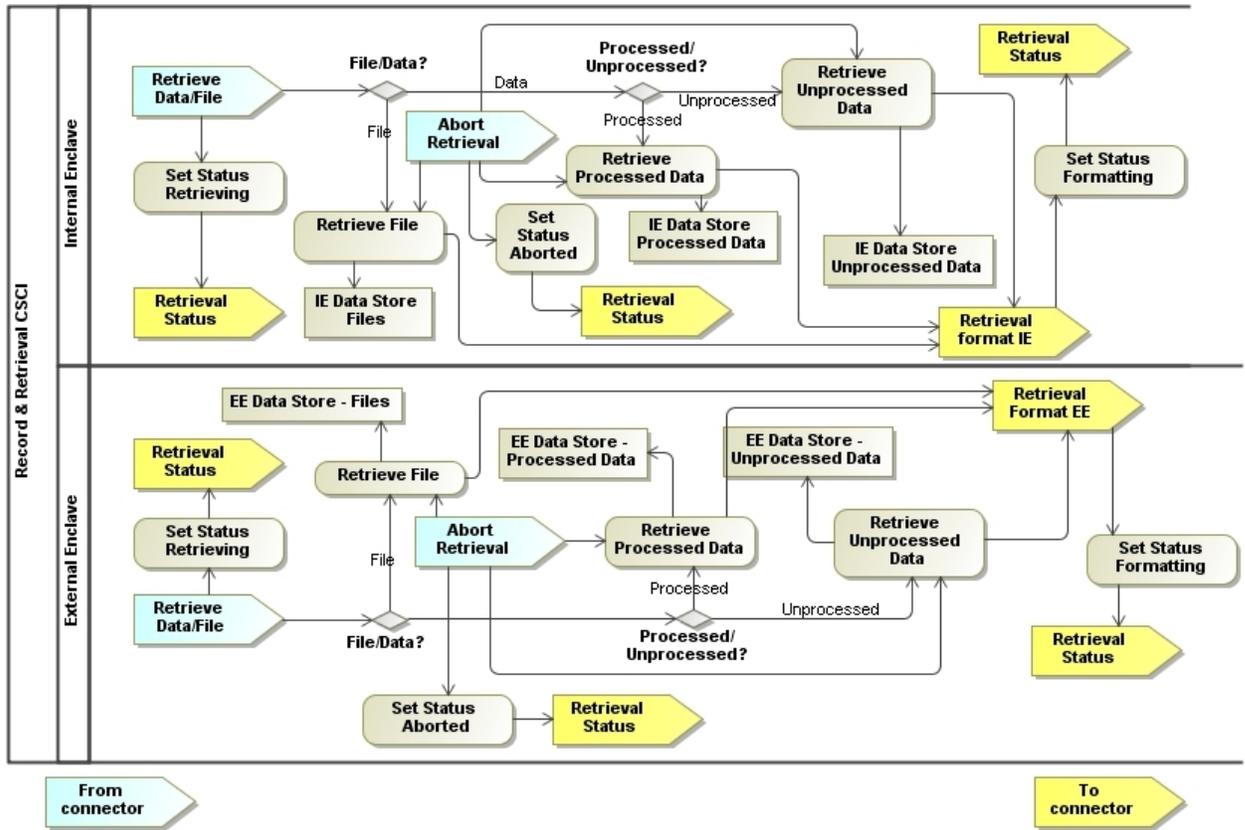


Figure 4.3.5-19 Retrieve Data/Files Activity Diagram

**4.3.5.5.3.4.6 RET04: Post Conditions**

1. Data or file is ready for format processing..

**4.3.5.5.3.4.7 RET04: Derived Requirements**

ALLOC1247
ALLOC1379
ALLOC2495
ALLOC2691
ALLOC2692
ALLOC2693
ALLOC2696
ALLOC2699
ALLOC2704
ALLOC2714
ALLOC2736
ALLOC2737
ALLOC2738
ALLOC2739

ALLOC2777
ALLOC2778
ALLOC2779
ALLOC2780
ALLOC2781
ALLOC2783
ALLOC600
ALLOC631
ALLOC632
ALLOC642

#### **4.3.5.5.3.5 RET05: Format IE Retrieval**

This Use Case covers the formatting of retrievals in the Internal Enclave. The retrieval is formatted per User request for return as a file, or Command PWS tabular display.

Web requests are delivered as a CSV file to be manipulated as necessary by the requester.

#### **4.3.5.5.3.5.1 RET05: Requirements Addressed**

R.GE70203	STRQ1277
R.GE7066	STRQ420
R.GE7067	STRQ421
R.GE7439	STRQ1653
R.GE7481	STRQ429
R.GE7483	STRQ402
R.GE7516	STRQ436
R.GE7643	STRQ59.1
R.GE7696	STRQ112.1
R.GE7795	STRQ42.1
R.GE7808	STRQ937.1
R.GE7901	STRQ1195.1
R.GE7909	STRQ1203.1
R.GE7910	STRQ1204.1

#### **4.3.5.5.3.5.2 RET05: Assumptions**

- n/a

#### 4.3.5.5.3.5.3 RET05: Limitations

- Users can only select a CSV file or tabular display directly from Record and Retrieval on a Command PWS. Graphic displays must be requested by User by using Plot Viewer.

#### 4.3.5.5.3.5.4 RET05: Preconditions

The R&R has completed the retrieval of requested files or data and is ready to deliver the retrieved data/file.

#### 4.3.5.5.3.5.5 RET05: Basic Flow

**Trigger A:** A tabular display request from Command PWS has been processed and ready for formatting.

1. Record and Retrieval CSCI generates table header information summarizing the retrieval parameter information:
  - a. Retrieval name
  - b. Retrieval Requester (name/role)
  - c. Time/date retrieval was requested
  - d. CUI name(s)
  - e. Retrieval start date/time
  - f. Retrieval end date/time or duration
2. Record and Retrieval CSCI marks unfilled data as Invalid, Stale, Unavailable, or Restricted as necessary.
3. Record and Retrieval CSCI combines the retrieval header information and tabular retrieval into a tabular display.
4. Record and Retrieval CSCI displays the tabular display on the User's Command Workstation.
5. Record and Retrieval CSCI sets status equal to complete

**Trigger B:** A tabular printout request from Command PWS has been processed and ready for formatting.

1. Record and Retrieval CSCI generates table header information summarizing the retrieval parameter information:
  - a. Retrieval name
  - b. Retrieval Requester (name/role)
  - c. Time/date retrieval was requested
  - d. CUI name(s)
  - e. Retrieval start date/time
  - f. Retrieval end date/time

2. Record and Retrieval CSCI marks unfilled data as Invalid, Stale, Unavailable, or Restricted as necessary.
3. Record and Retrieval CSCI combines the retrieval header information and tabular retrieval into a print ready file.
4. Record and Retrieval CSCI sends the print file to the Printer HWCI to be printed to the User's default printer.
5. Record and Retrieval CSCI sets status equal to complete

**Trigger C:** A file output request from Command PWS has been processed and ready for formatting.

1. Record and Retrieval CSCI generates header information for the CSV file summarizing the retrieval parameter information:
  - a. Retrieval name
  - b. Retrieval Requester (name/role)
  - c. Time/date retrieval was requested
  - d. CUI/file name(s)
  - e. Retrieval start date/time
  - f. Retrieval end date/time
2. Record and Retrieval CSCI marks unfilled data as Invalid, Stale, Unavailable, or Restricted as necessary.
3. Record and Retrieval CSCI creates a CSV file with the retrieval header information and retrieved data.
4. Record and Retrieval CSCI saves the CSV file to the User's share location.
5. Record and Retrieval CSCI sets status equal to complete

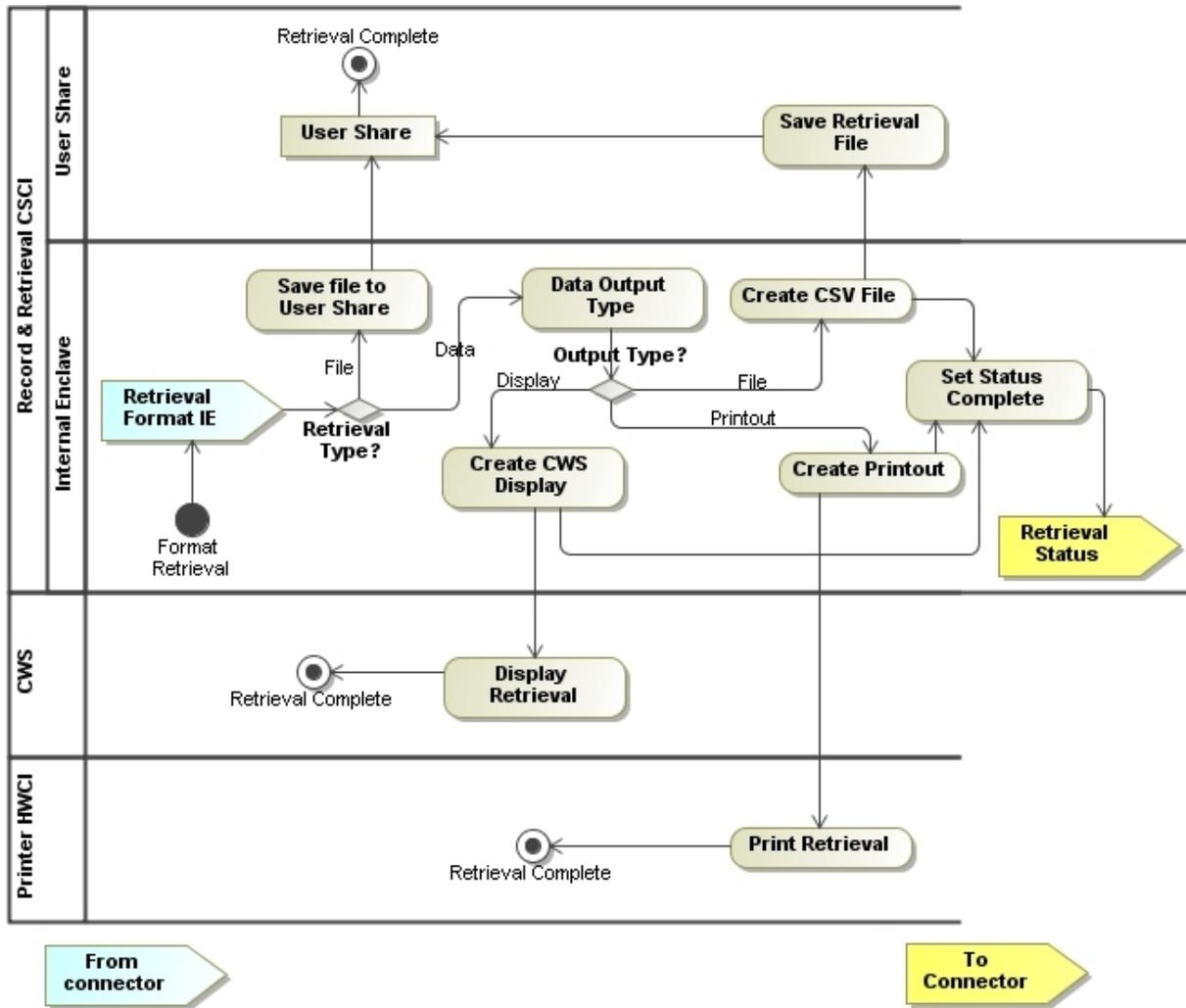


Figure 4.3.5-20 Format IE Retrieval Activity Diagram

**4.3.5.5.3.5.6 RET05: Post Conditions**

1. Data retrieval is delivered to the requester in the format requested.

**4.3.5.5.3.5.7 RET05: Derived Requirements**

ALLOC1072
ALLOC1247
ALLOC19
ALLOC1907
ALLOC1908
ALLOC2674
ALLOC2687
ALLOC2688
ALLOC2690

ALLOC2694
ALLOC2697
ALLOC2698
ALLOC2710
ALLOC2711
ALLOC2712
ALLOC2736
ALLOC2737
ALLOC2773
ALLOC2774
ALLOC2780
ALLOC2781
ALLOC2782
ALLOC2783
ALLOC627
ALLOC634
ALLOC642
ALLOC643
ALLOC838
ALLOC839
ALLOC956

#### **4.3.5.5.3.6 RET06: Format EE Retrieval**

This Use Case covers the formatting of retrieval initiated in the External Enclave.

##### **4.3.5.5.3.6.1 RET06: Requirements Addressed**

R.GE70203	STRQ1277
R.GE7067	STRQ421
R.GE7070	STRQ424
R.GE7480	STRQ428
R.GE7481	STRQ429
R.GE7483	STRQ402
R.GE7499	STRQ434
R.GE7643	STRQ59.1
R.GE7696	STRQ112.1
R.GE7795	STRQ42.1
R.GE7808	STRQ937.1
R.GE7881	STRQ1655.1
R.GE7909	STRQ1203.1
R.GE7936	STRQ1225.1

#### **4.3.5.5.3.6.2 RET06: Assumptions**

- n/a

#### **4.3.5.5.3.6.3 RET06: Limitations**

- External users can only select a CSV file or tabular display through a web retrieval. Graphic displays must be created by User tools manipulating a CSV file.

#### **4.3.5.5.3.6.4 RET06: Preconditions**

The R&R system has retrieved the requested data/files and ready for output to User.

#### **4.3.5.5.3.6.5 RET06: Basic Flow**

**Trigger A:** A file output request from an External User has been processed and ready for formatting.

1. Record and Retrieval CSCI provides Retrieval Parameter Information summary:
  - a. Retrieval name
  - b. Retrieval Requester (name/role)
  - c. Time/date retrieval was requested
  - d. CUI name(s)
  - e. Retrieval start date/time
  - f. Retrieval end date/time
2. Record and Retrieval CSCI marks unfilled data as Invalid, Stale, Unavailable, or Restricted as necessary.
3. Record and Retrieval CSCI adds retrieval parameters to the file as header information for identification.
4. Record and Retrieval CSCI adds retrieved data to the file in CSV format.
5. Record and Retrieval CSCI sends the CSV file to the requestor with a unique file name.
6. Record and Retrieval CSCI sets status equal to complete

**Trigger B:** A tabular display output request from an External System has been processed and ready for formatting.

1. Record and Retrieval CSCI provides Retrieval Parameter Information summary:
  - a. Retrieval name
  - b. Retrieval Requester (name/role)

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- c. Time/date retrieval was requested
  - d. CUI name(s)
  - e. Retrieval start date/time
  - f. Retrieval end date/time
2. Record and Retrieval CSCI marks unfilled data as Invalid, Stale, Unavailable, or Restricted as necessary.
3. Record and Retrieval CSCI Retrieval Parameters are added to tabular display for identification
4. Record and Retrieval CSCI sends the retrieved tabular display to the web interface.
5. Record and Retrieval CSCI sets status equal to complete.

**Trigger C:** An output request from an External System has been processed and ready for delivery of C3I formatted data file.

1. Record and Retrieval CSCI provides Retrieval Parameter Information summary:
  - a. Retrieval name
  - b. Retrieval Requester (name/role)
  - c. Time/date retrieval was requested
  - d. CUI name(s)
  - e. Retrieval start date/time
  - f. Retrieval end date/time
2. Record and Retrieval CSCI marks unfilled data as Invalid, Stale, Unavailable, or Restricted as necessary.
3. Record and Retrieval CSCI adds retrieval parameters as header information to retrieved C3I packets for identification
4. Record and Retrieval CSCI formats in C3I format.
5. Record and Retrieval CSCI sends the C3I file to the requestor with a unique file name to identify the retrieval.
6. Record and Retrieval CSCI sets status equal to complete

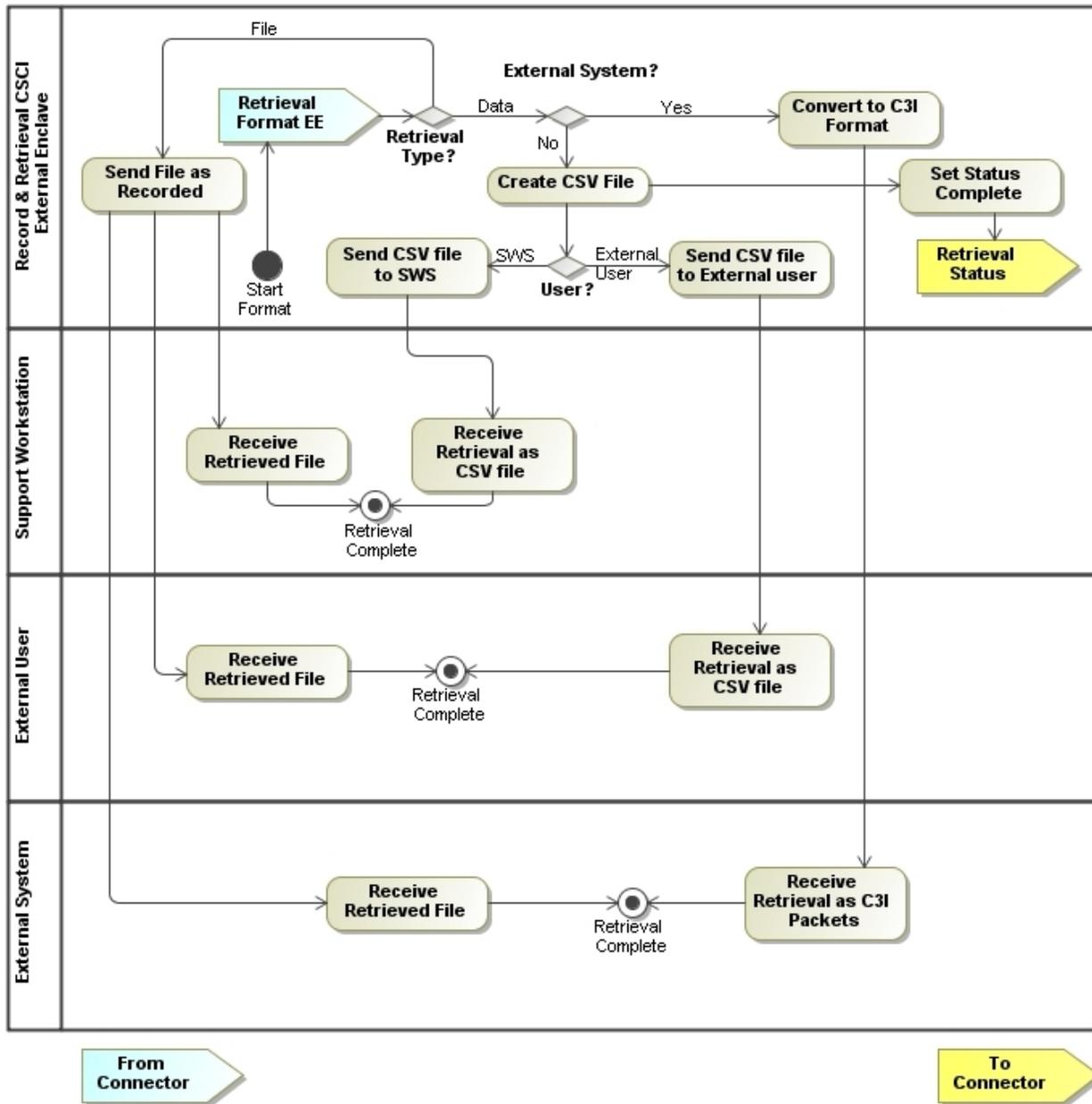


Figure 4.3.5-21 Format EE Retrieval Activity Diagram

#### 4.3.5.5.3.6.6 RET06: Post Conditions

1. Data retrieval is delivered to the requester.

#### 4.3.5.5.3.6.7 RET06: Derived Requirements

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ALLOC1072
ALLOC1247
ALLOC1319
ALLOC1906
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ALLOC2736
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ALLOC634
ALLOC639
ALLOC642
ALLOC802
ALLOC839

#### **4.3.5.5.3.7 Key Decisions and Rationale**

System Management ConEx needs to build a table of unavailable recorded data – due to recording issues – track timeframes when data is not available for retrievals.

Five(5) missions of recorded data are available for retrieval of historical data in the Internal Enclave. At the point that there are more than 5 missions recorded, analysis will determine if the Internal Record and Retrieval system is expanded to host additional missions, or if retrievals are accomplished by restoring data from the archives – off-line storage. Ten (10) missions of recorded data are available for retrieval of historical data in the External Enclave.

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