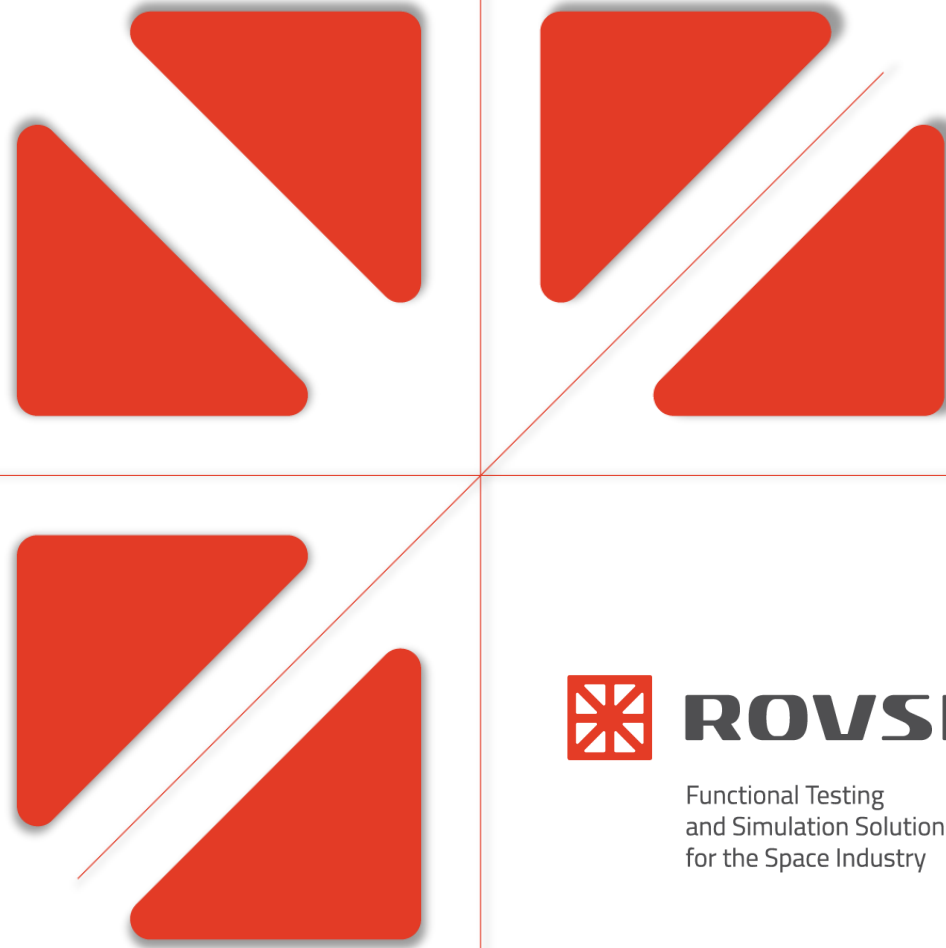


# DESI CC

4<sup>th</sup> June 2024

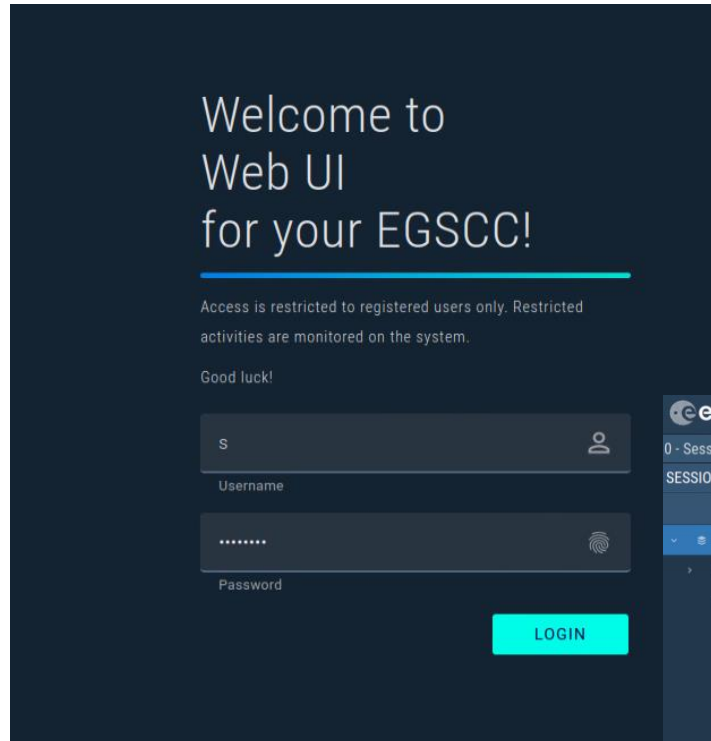


**ROVSING**

Functional Testing  
and Simulation Solutions  
for the Space Industry

# AGENDA

1. Introduction of project
2. Study Phase
3. EGS CC Integration
4. Conclusion



esa WEBUI unknown LOCALHOST:8443 Run-Time Management 11:59:50 LIVE MANAGE

0 - Session Browser 1 - SOB Browser 0 - Messages Log 1 - Acknowledged

SESSIONS

New session profile

- RovsingEGSE
  - mandcops\_20240528T140423
  - preparation\_20240528T140229

Messages Log

TIME	SEVERITY	MESSAGE
2024-05-31 11:59:39.753	INFO	User S User has joined session mandcops_20240528T140423
2024-05-31 11:59:39.747	INFO	User action performed by s: Join session 'mandcops_20240528T140423'
2024-05-31 11:59:39.728	INFO	User action performed by s: Trying to Join session 'mandcops_20240528T140423'
2024-05-31 11:59:33.270	INFO	User s logged in with Admin role
2024-05-31 11:59:30.726	INFO	User S User has logged in, failed login attempts, previous session: Web UI 192.168.160.1
2024-05-31 11:58:47.840	INFO	User S User has left session mandcops_20240528T140423

# Introduction Project. EGSE Common Core (EGS-CC)

## **What is EGS-CC?**

A new software framework developed for Spacecraft, AIT and Operations.

## **Development Status:**

Development completed, entering maintenance phase  
Collaborative effort led by ESA

## **Primary Aim:**

To create a standardized platform for Central Checkout Systems for AIT and Operational Mission Control Systems.

# Introduction Project. Rovsing EGSE Controller Features

## **EGSE Management:**

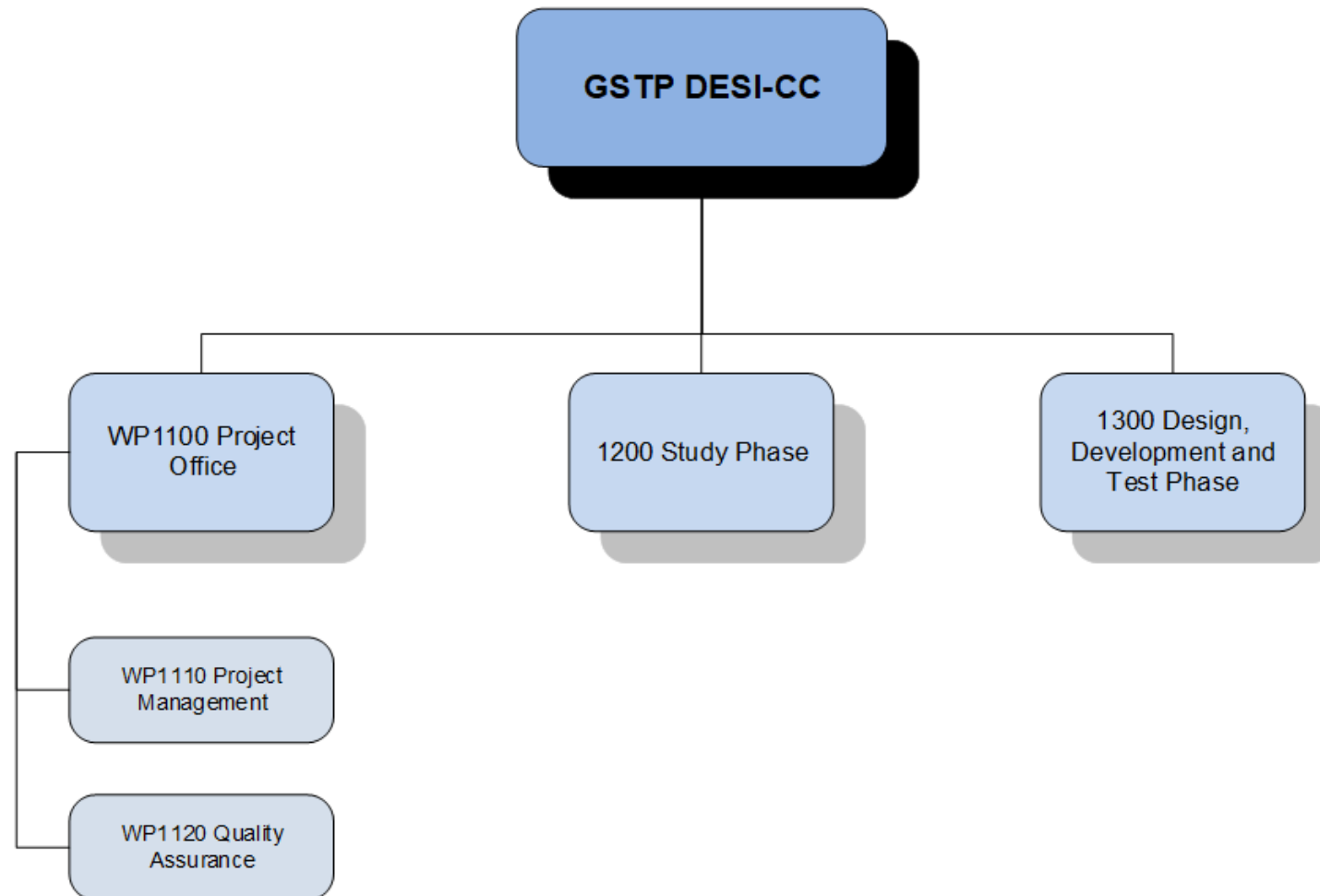
Manages Hardware Units: Efficient management of various subsystems.

Subsystem Examples: Umbilical Power, Battery Simulators, Solar Array Simulators,

## **Integrated Software Components:**

- Man-Machine Interface (MMI)
- CCS Interface
- Logger and Archive Modules
- Business Logic
- Hardware Adaptors
- Script Engine
- Reporting Module

# Introduction Project. Project Plan Overview



# Introduction Project. Timeline Overview



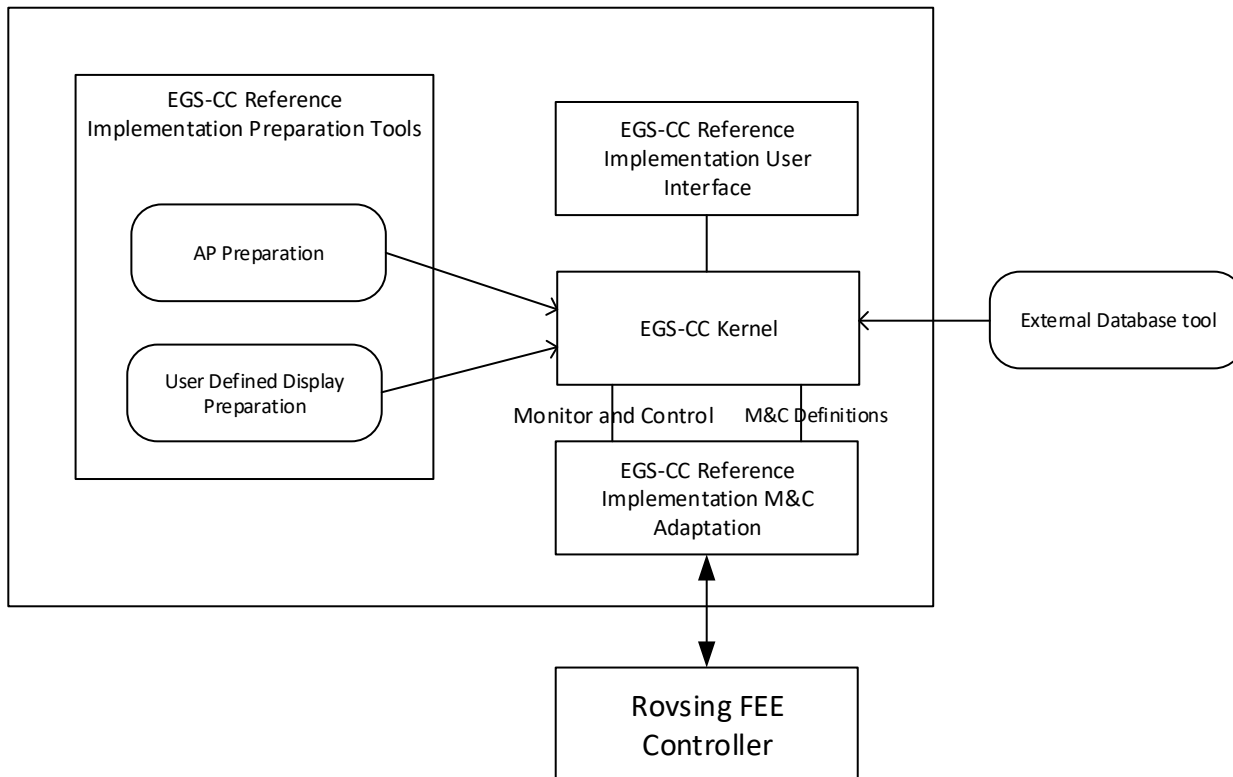
## Study Phase. Initial High-Level DESI-CC Goals

The initial high-level goals of DESI-CC were to integrate the Rovsing EGSE Controller software core to the EGS-CC software framework. Examples of potential application:

- Adaptation to EGS-CC native software interfaces
- Compatibility to EGS-CC Common Data model
- Harmonization of MMI look and feel
- Overall technology harmonization

# Study Phase Results

## Setup seen from Common core

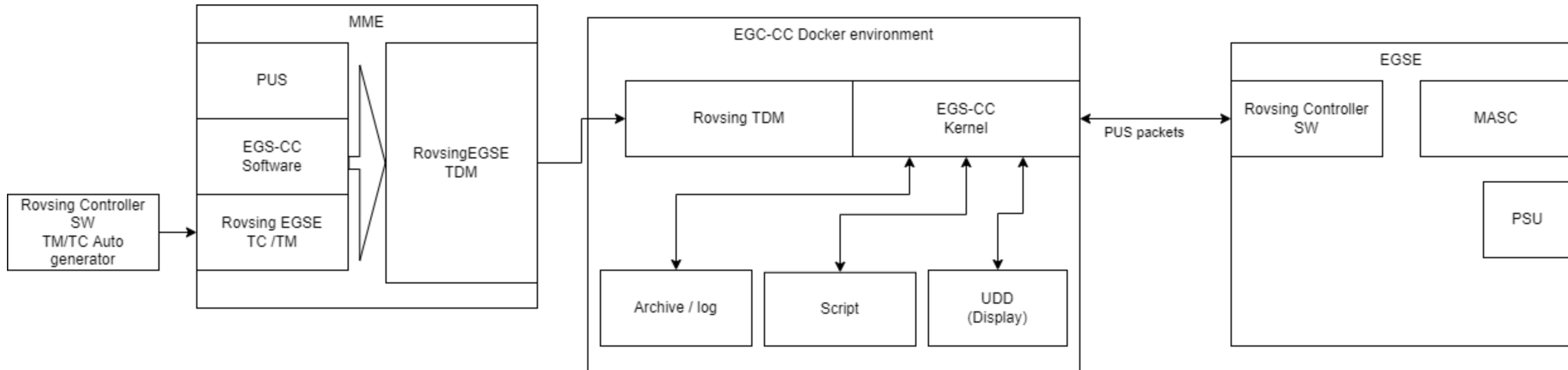


## First initial idea following with EGSE-CC:

- Define "EGS-CC Conceptual Data Model" in XTCE
  - Define TM/TC packets. Roving FEE Controller should be able to import these definitions for internal usage.
  - Create Displays.
  - Create Procedures/Scripts for Testing.
- Connect to Roving FEE Controller via the M&C Adaption component using EDEN/PUS protocol.
- Use EGS-CC for logging/archiving.
- Use EGS-CC for User Interface



# EGS CC Integration Diagram Overview



# EGS CC Integration Key Features Achieved

- 1. Import TM/TC in EGS-CC:** EGS-CC knows generic telecommands from the Rovsing Controller SW.
- 2. Connect to Rovsing FEE Controller via the M&C Adapters:** The EGS-CC test environment is sending telecommands and receiving telemetry from the Rovsing Controller SW.
- 3. Create Procedures/Scripts for Testing:** The EGS-CC can run test scripts reading telemetry from the Rovsing Controller SW and sending telecommands to it
- 4. Use EGS-CC for logging/archiving** The EGS-CC takes care of logging and archiving of all TM/TCs.
- 5. Utilize EGS-CC UDD for displays:** Use EGS-CC as a CCS to control the Rovsing Controller SW as a SCOE system. UDD displays represent SCOE Controller. Output is a set of UDD that is linked to the SCOE Controller TDM

# EGS CC Integration overall EGSCC UI

“Live” TM/TC in communication with the SCOE controller.

The screenshot displays the EGS CC Integration overall EGSCC UI. The top navigation bar includes the 'esa' logo, 'WEBUI unknown', 'LOCALHOST:8443', and a 'Control' dropdown menu. The main interface is divided into several sections:

- Activities Log:** A table showing the status of various activities. The table has columns for NAME, PROCESSING TIME, GENERATION TIME, EXTERNAL EXECUTION TIME, EARLIEST EXECUTION START TIME, STATE, and SOURCE ID. Three activities are listed, all with a state of 'COMPLETED\_SUCCESS'.
- ROVSING SCOE:** A detailed view of the SCOE controller interface, showing various status indicators and a log.

**Activities Log Table:**

NAME	PROCESSING TIME	GENERATION TIME	EXTERNAL EXECUTION TIME	EARLIEST EXECUTION START TIME	STATE	SOURCE ID
UMBRemoteMode#7375144809343746075	2024-06-03 09:58:47.236	2024-06-03 09:58:47.039	2024-06-03 09:58:47.048	2024-06-03 09:58:47.185	COMPLETED_SUCCESS	S - mandcops_20240531T124802Z 2024-06-03T08:53:04.7932Z
OpenCncLink#7375144809343746052	2024-06-03 09:58:21.785	2024-06-03 09:58:21.736	2024-06-03 09:58:21.746	2024-06-03 09:58:21.846	COMPLETED_SUCCESS	S - mandcops_20240531T124802Z 2024-06-03T08:53:04.7932Z
OpenCncLink#7375144809343746051	2024-06-03 09:58:12.525	2024-06-03 09:58:12.455	2024-06-03 09:58:12.473	2024-06-03 09:58:12.573	COMPLETED_SUCCESS	S - mandcops_20240531T124802Z 2024-06-03T08:53:04.7932Z

**ROVSING SCOE Interface:**

- Main Measured:** Voltage: 0.0 V, Current: 0.0 A, Power: 0 W.
- Main Status:** Output: ●, OV Triggered: ●, OC Triggered: ●.
- Battery Measured:** Charged Voltage: 0.0 V, Charged Current: 0.0 A, Charged Power: 0 W.
- Battery Status:** Output: ●, Triggered: ●.
- Health Monitor:** System Mode: REMOTE, Free Disk space: 124.2 GiB, Temperature: 0.0 C.
- Log:** Log filter: [ ] Min severity: INFO [v] pause [ ] Sort oldest first [ ]. Log entries include: 2024.06.03 11:58:47.562 INFO tc UMBLogMessage Mode Changed to REMOTE; 2024.06.03 11:58:47.508 INFO tc UMBRemoteMode; 2024.06.03 11:58:23.127 INFO tc UMBLogMessage CCS Client Connected; 2024.06.03 11:58:22.200 INFO tc UMBRemoteMode CCS Server got new connection from port 6010.

# EGS CC Integration MMI Features

**ROVSING ROVSING EGSE - UMB v. 01.08.00**

**Umbilical Subsystem**

**Main Power Supply**

Measured	Status	Set	Protection
Voltage: 0.0 V	Output: ●	Voltage: 0.0 V	Over Voltage Threshold: 120.0 V
Current: 0.0 A	OV Triggered: ●	Current: 0.0 A	Over Voltage Enabled: ●
Power: 0 W	OC Triggered: ●		Over Current Threshold: 30.0 A
			Over Current Enabled: ●

**Control**

Control	Protection
Enable PS	Enable/Disable OVP
Disable PS	Enable/Disable OCP
Set Voltage	Set OVP
Set Current	Set OCP
	Clear Protection

**Battery Charger**

Measured	Status	Set	Protection
Charged Voltage: 0.0 V	Output: ●	Voltage-End-of-Charge: 0.0 V	Threshold: 120.0 V
Charged Current: 0.0 A	Triggered: ●	Charge current limit: 0.0 A	Enable: ●
Charged Power: 0 W			

**Control**

Control	Protection
Enable PS	Enable/Disable OVP
Disable PS	Set OVP
Set Voltage	Clear Protection
Set Current	

**Discrete Interface**

	IPAC N	IPAC R		PCDU
1	open	open	1	open
2	open	open	2	open
3	open	open	3	open
			4	open

**Control**

Strap Control
Close IPAC
Close PCDU
Open IPAC
Open PCDU
HPC Control
Send HPC

**Health Monitor**

System Mode	Free Disk space	Temperature
LOCAL	125.0 GiB	0.0 C

**CCS-IF status**

Main Power Supply	connected
Battery Charger Power Supply	connected
MASC	connected
Main Second Level Protection	connected
Battery Charger Second Level Protection	connected

**Main Power Supply**

Measured	Set Value	Threshold	Status
Voltage	0	120000	Output Enable: on
Current	0	30000	OV Trigger: false
Power	0		OC Trigger: false
			OVP Enable: true
			OCP Enable: true

**System Status**

Relay Status	open
SLP Status	OK
System Mode	REMOTE
PS status	connected
SLP Status	connected

**Battery Charger**

Measured	Set Value	Threshold	Status
Voltage	0	120000	Output Enable: off
Current	0		OV Trigger: false
Power	0		OVP Enable: true

**System Status**

Relay Status	open
SLP Status	OK
System Mode	REMOTE
PS status	connected
SLP Status	connected

**Straps status**

	IPAC N	IPAC R	PCDU
1	open	open	1: open
2	open	open	2: open
3	open	open	3: open
			4: open

**HPC Pulse**

Send HPC

Close Relay

**EGSCC UDD**

## UMB SCOE SYSTEM

# EGS CC Integration MMI Features Main Power Supply

Status

Umbilical Subsystem

Main Power Supply

Measured	Status	Set	Protection
Voltage: 0.0 V	Output: ●	Voltage: 0.0 V	Over Voltage Threshold: 120.0 V
Current: 0.0 A	OV Triggered: ●	Current: 0.0 A	Over Voltage Enabled: ●
Power: 0 W	OC Triggered: ●		Over Current Threshold: 30.0 A
			Over Current Enabled: ●

Control

Control

Control	Protection
Enable PS	Enable/Disable OVP
Disable PS	Enable/Disable OCP
Set Voltage	Set OVP
Set Current	Set OCP
	Clear Protection

Status

Main Power Supply

	Measured	Set Value	Threshold	Status
Voltage	0	0	120000	Output Enable: on
Current	0	0	30000	OV Trigger: false
Power	0			OC Trigger: false
				OVP Enable: true
				OCP Enable: true

Control

Enable PS	Set Voltage	Set OVP	Enable OVP	Clear Prot
Disable PS	Set Current	Set OCP	Enable OCP	Close Relay

# EGS CC Integration MMI Battery Charger

Status

Umbilical Subsystem

Battery Charger

Measured	Status	Battery Charger Settings	OV Protection
Charged Voltage: 0.0 V	Output: ●	Voltage-End-of-Charge: 0.0 V	Threshold: 120.0 V
Charged Current: 0.0 A	Triggered: ●	Charge current limit: 0.0 A	Enable: ●
Charged Power: 0 W			

Control

Control

Control	Protection
Enable PS	Enable/Disable OVP
Disable PS	Set OVP
Set Voltage	Clear Protection
Set Current	

Status

Battery Charger

	Measured	Set Value	Threshold	Status	
Voltage	0	0	120000	Output Enable	off
Current	0	0		OV Trigger	false
Power	0			OVP Enable	true

Control

Enable PS	Set Voltage	Set OVP	Enable OVP	Clear Prot
Disable PS	Set Current			Close Relay

# EGS CC Integration MMI Umbilical Subsystem

### Umbilical Subsystem

## Status

Discrete Interface

	IPAC N	IPAC R		PCDU
1	open	open	1	open
2	open	open	2	open
3	open	open	3	open

## Control

Strap Control

- Close IPAC
- Close PCDU
- Open IPAC
- Open PCDU
- HPC Control
- Send HPC

## Status

### Straps status

	IPAC N	IPAC R		PCDU
1	open	open	1	open
2	open	open	2	open
3	open	open	3	open
			4	open

### HPC Pulse

## Control

- Open IPAC
- Close IPAC
- Open PCDU
- Close PCDU
- Send HPC
- Close Relay



# EGS CC Integration MMI System Status

Status

ROVSING ROVSING EGSE - UMB v. 01.08.00

**Galvanic Isolation Relays**

Main Power Status:  open  
Close Relays Open Relays

Battery Charger Status:  open  
Close Relays Open Relays

**Safety Link**

internal  external  
Reset Trigger

**Second Level Protection**

SLP	OVP1	OVP2	OCP1	OCP2	UVP	Status	Meas V	Meas C	Temp
Main	0.0 V	0.0 V	0.0 A	0.0 A	0.0 V	OK	0.0 V	0.0 A	0.0 C
Battery	0.0 V	0.0 V	0.0 A	0.0 A	0.0 V	OK	0.0 V	0.0 A	0.0 C

Reset

**Health Monitor**

System Mode	Free Disk space	Temperature
LOCAL	125.0 GiB	0.0 C

**CCS-IF status** available  
Main Power Supply connected  
Battery Charger Power Supply connected  
MASC connected  
Main Second Level Protection connected  
Battery Charger Second Level Protection connected

Status

Status

**System Status**

Relay Status open  
SLP Status OK

System Mode REMOTE  
PS status connected  
SLP Status connected

Status



# EGS CC Integration Key Features Achieved

## MME Model

### Mission Model

- ✓ mcmRoot [Controlled System Root]
  - > EGSCC\_Software [Monitoring Control Element]
  - > PUS [Monitoring Control Element]
  - ✓ RovingEGSE [Monitoring Control Element]
    - ✓ ParameterHealthHK [Monitoring Control Element]
      - > Telemetry Parameters
    - ✓ Script [Monitoring Control Element]
      - > Scripts
    - ✓ TC [Monitoring Control Element]
      - > Telecommand Packets
    - ✓ TM [Monitoring Control Element]
      - > Telemetry Packets
      - > Telemetry Parameters
    - ✓ parameterSLPHK [Monitoring Control Element]
      - > Telemetry Parameters
    - ✓ parameterUMBHK [Monitoring Control Element]
      - > Telemetry Parameters

## Telecommands

- ✓ TC [Monitoring Control Element]
  - ✓ Telecommand Packets
    - 🔥 UMBArchiveClose [Telecommand Packet] - Perform Function
    - 🔥 UMBAutotest [Telecommand Packet] - Perform Function
    - 🔥 UMBBatteryChargerClearProtection [Telecommand Packet] - Perform Function
    - 🔥 UMBBatteryChargerCloseRelays [Telecommand Packet] - Perform Function
    - 🔥 UMBBatteryChargerDisableOutput [Telecommand Packet] - Perform Function
    - 🔥 UMBBatteryChargerEnableOutput [Telecommand Packet] - Perform Function
    - 🔥 UMBBatteryChargerOpenRelays [Telecommand Packet] - Perform Function
    - 🔥 UMBBatteryChargerSetCurrent [Telecommand Packet] - Perform Function
    - 🔥 UMBBatteryChargerSetOVPStatus [Telecommand Packet] - Perform Function
    - > 🔥 UMBBatteryChargerSetOverVoltageThreshold [Telecommand Packet] - Perform Function
    - > 🔥 UMBBatteryChargerSetVoltage [Telecommand Packet] - Perform Function
    - 🔥 UMBCanDisable [Telecommand Packet] - Perform Function
    - 🔥 UMBCanEnable [Telecommand Packet] - Perform Function
    - 🔥 UMBCanLoopbackTest [Telecommand Packet] - Perform Function
    - 🔥 UMBClearSafetyLink [Telecommand Packet] - Perform Function
    - 🔥 UMBClearSecondLevelProtection [Telecommand Packet] - Perform Function
    - 🔥 UMBCloseStrapIPAC [Telecommand Packet] - Perform Function
    - 🔥 UMBCloseStrapPCDU [Telecommand Packet] - Perform Function
    - 🔥 UMBDisableHK [Telecommand Packet] - Perform Function
    - 🔥 UMBEnableHK [Telecommand Packet] - Perform Function
    - 🔥 UMBExecuteScript [Telecommand Packet] - Perform Function
    - 🔥 UMBExtendedSelfTest [Telecommand Packet] - Perform Function
    - 🔥 UMBIntervalHK [Telecommand Packet] - Perform Function
    - 🔥 UMBLocalMode [Telecommand Packet] - Perform Function

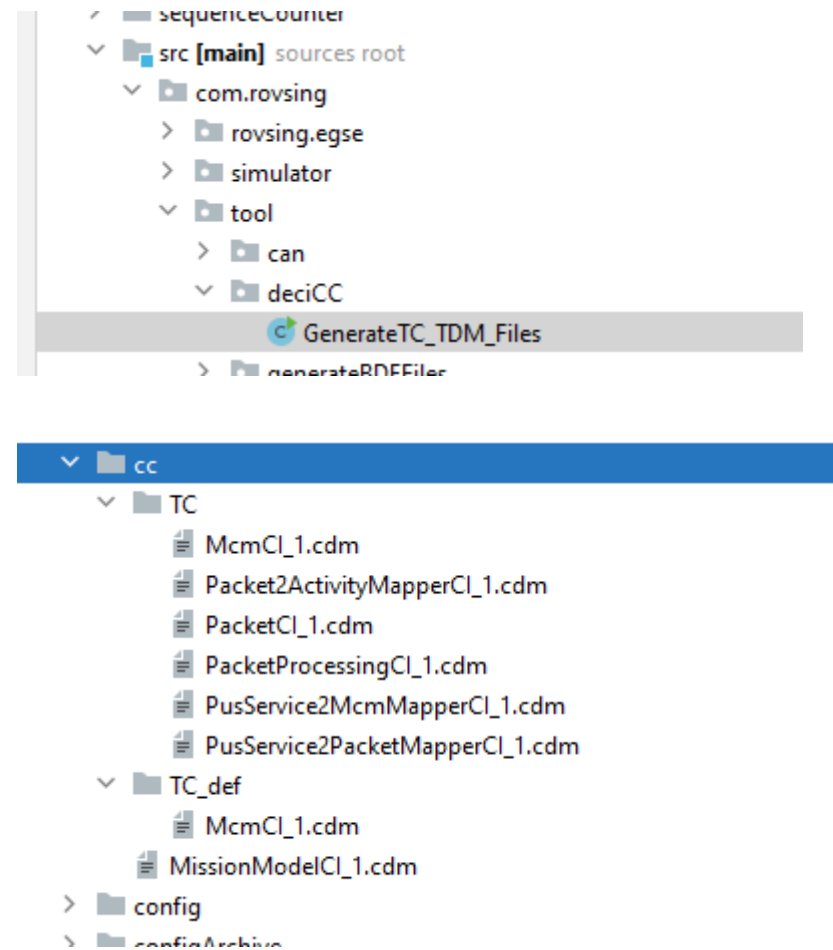
## Telemetries

- ✓ Telemetry Packets
  - 🔥 MessageEventReportErrorHigh [Telemetry Packet]
  - 🔥 MessageEventReportErrorLow [Telemetry Packet]
  - 🔥 MessageEventReportErrorMedium [Telemetry Packet]
  - 🔥 MessageEventReportNormal [Telemetry Packet]
  - 🔥 TelecommandAcceptanceFailure [Telemetry Packet]
  - 🔥 TelecommandAcceptanceSuccess [Telemetry Packet]
  - 🔥 TelecommandExecutionFailure [Telemetry Packet]
  - 🔥 TelecommandExecutionSuccess [Telemetry Packet]
  - 🔥 UMBHealthMonitorHousekeepingTelemetry [Telemetry Packet]
  - 🔥 UMBHousekeepingTelemetry [Telemetry Packet]
  - 🔥 UMBSLPHousekeepingTelemetry [Telemetry Packet]

# EGS CC Integration MiB import

## Key Points:

- Adding arguments to the telecomands manually
- Structure the housekeeping package correctly with parameters
- Generate specific arguments and parameters
- Unique IDs must be take into consideration when you generate new items



# EGS CC Integration Acceptance Test setup/configuration

1. Roving Controller Software
  - Setup C&C protocol or EDEN protocol.
2. DESI CC Software
  - EGSCC-Roving on Linux (Ubuntu)
3. Docker Setup
  - Linux PC (Ubuntu)
4. Mission Model Editor (MME)
  - Install Temurin 11

```
ovsing@desi-cc:~/egscc$ docker version
Client:
Version:           20.10.21
API version:       1.41
Go version:        go1.18.1
Git commit:        20.10.21-0ubuntu1~18.04.3
Built:             Thu Apr 27 05:50:21 2023
OS/Arch:           linux/amd64
Context:           default
Experimental:      true

Server:
Engine:
Version:           20.10.21
API version:       1.41 (minimum version 1.12)
Go version:        go1.18.1
Git commit:        20.10.21-0ubuntu1~18.04.3
Built:             Thu Apr 27 05:36:22 2023
OS/Arch:           linux/amd64
Experimental:      false
containerd:
Version:           1.5.9-0ubuntu1~18.04.2
GitCommit:
runc:
Version:           1.1.4-0ubuntu1~18.04.2
GitCommit:
docker-init:
Version:           0.19.0
GitCommit:
```

# Conclusion and Future Work

## Project Goal:

- To create an initial framework for the EGS-CC and Roving EGSE Controller.

## Potential Benefits:

- Standardization of AIT and operations.
- Enhanced efficiency and reliability.
- Improved interoperability across the industry.

## Industry Impact:

- Streamlined processes.
- Greater consistency in spacecraft testing and operations.

## Lessons learned:

- UDD editor is very time consuming
- MME need to be improve
- Complex system -> Clear and detail Documentation
- Easier to upload TDM in the EGS-CC and clone items

## Custom tools

- Simplify/streamline MIB -> TDM conversion, benefit magnified as this will be a recurring task

**ANY QUESTIONS OR COMMENTS?**

