

SeaLion Mission Architecture

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Stakeholder Needs

The SeaLion Mission Architecture is guided by a series of stakeholder needs, listed below.

1.1: Primary Mission Objective A1

The SeaLion mission shall establish UHF communication link with Virginia ground station

1.2: Primary Mission Objective A2

The SeaLion mission shall establish S-Band communication link with MC3 ground station

1.3: Primary Mission Objective A3

The SeaLion mission shall successfully transmit “mission data” defined above to ground stations on the Earth.

1.4: Primary Mission Objective A4

The SeaLion mission shall adhere to CubeSat standards as per CDS Rev. 13

Reference:

- [CubeSat Design Specification Rev. 13](#)

1.5: Primary Mission Objective A5

The SeaLion mission shall validate the operation of the Impedance Probe (IP) as a primary payload in-orbit.

2.1: Secondary Mission Objective B1

The SeaLion mission shall provide a means to validate a Multi-spectral Sensor (Ms-S) in-orbit

2.2: Secondary Mission Objective B2

The SeaLion mission shall provide a means to validate a deployable composite structure (DeCS) in-orbit

3.1: Tertiary Mission Objective C1

The SeaLion mission shall qualify on-orbit the deployment and functioning of the newly developed UHF antenna system and its deployment.

3.2: Tertiary Mission Objective C2

The SeaLion mission shall qualify a CubeSat bus architecture for very-low Earth orbit (VLEO)

3.3: Tertiary Mission Objective C3

The SeaLion shall verify DeCS in-orbit behavior performance via accelerometer & temperature sensor data

User Stories

The SeaLion Mission Architecture's stakeholder needs are then used to identify a series of user stories which then lead to design decisions captured in data structure and activity definitions.

1: Ping Satellite

As a **Ground Station Operator** I want to **Ping satellite** so that I can **Establish communication link with satellite**.

Example:

Ping the satellite in order to establish UHF communication link with Virginia ground station

Derived From:

- [Primary Mission Objective A1](#)

2: View Satellite Health Data Packet

As a **Ground Station Operator** I want to **View satellite health data packet** so that I can **Validate that satellite is operating nominally**.

Example:

View satellite health data packet in order to validate the mission data of the IP and DeCS payloads

Derived From:

- [Primary Mission Objective A2](#)
- [Primary Mission Objective A3](#)
- [Tertiary Mission Objective C3](#)

2.1: Listen for Satellite Beacon

As a **Ground Station Operator** I want to **Open ground station beacon monitor** so that I can **View satellite health data packet**.

Example:

Open ground station beacon monitor to listen for satellite health data packet downlink

Derived From:

- [View Satellite Health Data Packet](#)

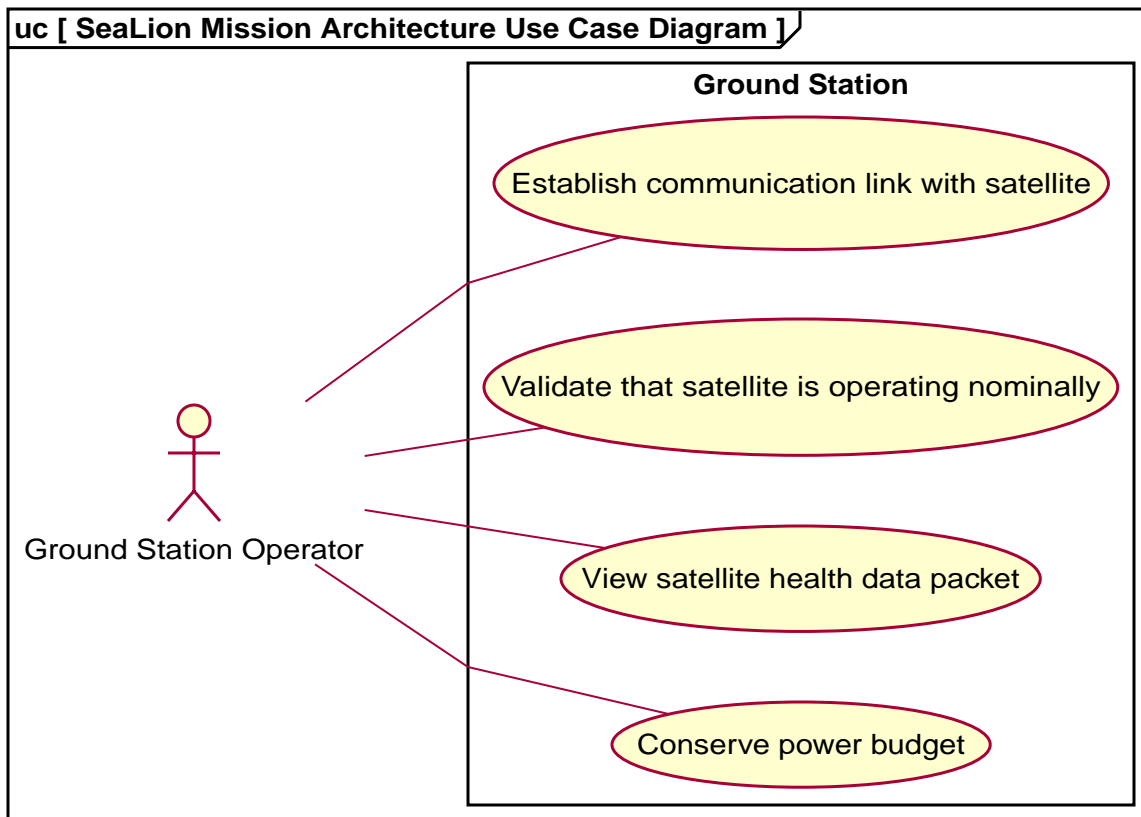
3: Update Beacon Rate

As a **Ground Station Operator** I want to **Update Beacon Rate** so that I can **Conserve power budget**.

Example:

Update beacon rate to transmit every 30 minutes to conserve power

User stories as Use Case Diagram



Data Structures

This section covers each data structure type in the **SeaLion Mission Architecture**.

Satellite Health Data Packet

Purpose: Data structure for satellite health data packet from ground station operator's viewpoint.

Satellite Health Data Packet Template

```

imu_gyro_x: {{imu_gyro_x}}
imu_gyro_y: {{imu_gyro_y}}
imu_gyro_z: {{imu_gyro_z}}
imu_magnetometer_x: {{imu_magnetometer_x}}
imu_magnetometer_y: {{imu_magnetometer_y}}
imu_magnetometer_z: {{imu_magnetometer_z}}
temperature_imu: {{temperature_imu}}
temperature_battery: {{temperature_battery}}
temperature_on_board_computer: {{temperature_on_board_computer}}
temperature_processor: {{temperature_processor}}
battery_voltage: {{battery_voltage}}
battery_current: {{battery_current}}
time_stamp: {{time_stamp}}
boot_count: {{boot_count}}
boot_time: {{boot_time}}
operational_status_of_equipment: {{operational_status_of_equipment}}
redundancy_status: {{redundancy_status}}
altitude_data: {{altitude_data}}
latitude: {{latitude}}
longitude: {{longitude}}

```

| Field | Type | Item Type | Description | Source |
|------------|-------|-----------|---|--------|
| imu_gyro_x | float | | The angular rate of the body with to respective to the x-axis in the IMU's reference frame. | |
| imu_gyro_y | float | | The angular rate of the body with to respective to the y-axis in the IMU's reference frame. | |
| imu_gyro_z | float | | The angular rate of the body with to respective to the z-axis in the IMU's reference frame. | |

| Field | Type | Item Type | Description | Source |
|-------------------------------|--------|-----------|--|--------|
| imu_magnetometer_x | float | | The magnetic field strength with respect to the x-axis in the IMU's reference frame. | |
| imu_magnetometer_y | float | | The magnetic field strength with respect to the y-axis in the IMU's reference frame. | |
| imu_magnetometer_z | float | | The magnetic field strength with respect to the z-axis in the IMU's reference frame. | |
| battery_voltage | float | | Voltage of the battery. Units in volts. | |
| battery_current | float | | Current draw of the battery. Units in milliamps. | |
| temperature_imu | float | | The temperature of the IMU. Units in Kelvin. | |
| temperature_battery | float | | The temperature of the battery. Units in Kelvin. | |
| temperature_on_board_computer | float | | The temperature of the on board computer. Units in Kelvin. | |
| temperature_processor | float | | The temperature of the processor. Units in Kelvin. | |
| time_stamp | string | | Time stamp of the last transmission. | |

| Field | Type | Item Type | Description | Source |
|---------------------------------|---------|-----------|---|--------|
| boot_count | integer | | Number of times the computer has rebooted. | |
| boot_time | string | | The time stamp when the computer last booted. | |
| operational_status_of_equipment | string | | The operation status of the equipment. | |
| redundancy_status | string | | The redundancy status of the satellite. | |
| altitude_data | float | | The altitude data of the satellite. | |
| latitude | float | | Latitude coordinate of the satellite. | |
| longitude | float | | Longitude coordinate of the satellite. | |

Table 1. Satellite Health Data Packet Specification

Derived From:

- [View Satellite Health Data Packet](#)