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

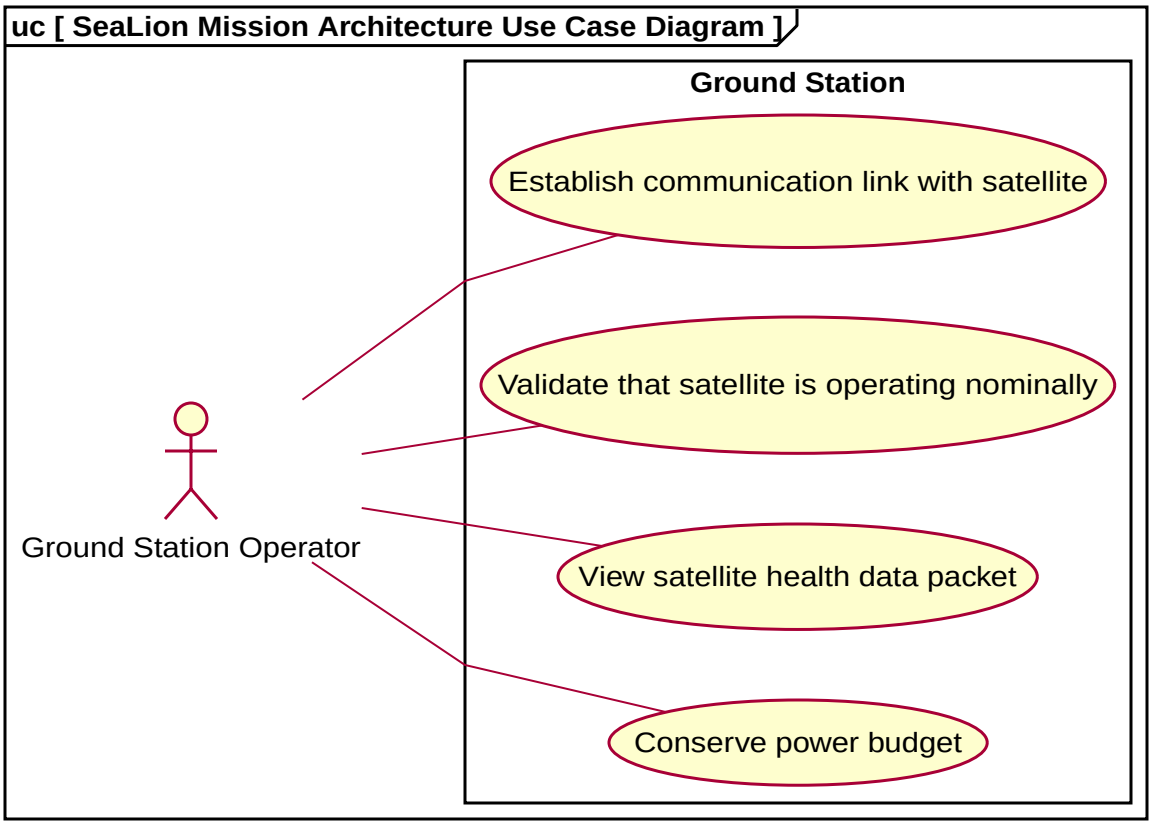
3: Update Beacon Rate

> 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}}
lattitude: {{lattitude}}
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.	
imu_magnetometer_x	float		The magnetic field strength with respective to the x-axis in the IMU's reference frame.	
imu_magnetometer_y	float		The magnetic field strength with respective to the y-axis in the IMU's reference frame.	
imu_magnetometer_z	float		The magnetic field strength with respective to the z-axis in the IMU's reference frame.	

Field	Type	Item Type	Description	Source
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. Untis in Kelvin.	
temperature_processor	float		The temperature of the processor. Units in Kelvin.	
time_stamp	string		Time stamp of the last transmission.	
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.	
lattitude	float		Lattitude 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