Concept of Operations Risk Analysis

The purpose of the risk analysis is to identify each undesirable event that might affect the success of the mission and to assess the likelihood and consequence of occurrence. A Risk Reporting Matrix allows for the visualization of risk to mission success in terms of likelihood and consequence. The level of risk associated with each root cause is reported as low (green), moderate (yellow), or high (red).

| Level | Likelihood | Probability of Occurrence |
| --- | --- | --- |
| 1 | Not Likely | ~10% |
| 2 | Low Likelihood | ~30% |
| 3 | Likely | ~50% |
| 4 | Highly Likely | ~70% |
| 5 | Near Certainty | ~90% |

| Level | Associated Risk |
| --- | --- |
| 1 | Minimal or no consequence to technical performance |
| 2 | Minor reduction in technical performance or supportability, can be tolerated with little to no impact on the mission |
| 3 | Modest reduction in technical performance or supportability with limited impact on mission objectives |
| 4 | Significant degradation in technical performance or major shortfall in supportability; may jeopardize mission success |
| 5 | Sever degradation in technical performance; failure to meet mission objectives; will jeopardize mission success |

The level of likelihood of each root cause is established using the specified criteria in Figure X

FIGURE X: Levels of likelihood criteria

The level and types of consequences of each risk are established utilizing the criteria described in Figure X+1

figure X+1: Levels of consequence criteria

# Concept of Operations, Option 1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Likelihood |  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  | **I** |  | **III, V, VI** | **I, IV, VII** |
|  |  |  |  |  |
|  | Consequence | | | | |

Figure x+2: Conops 1 risk reporting matrix

## 1. Spacecraft Unable to Orient for Separation

Failure of the spacecraft to properly orient themselves for separation could lead to increased ΔV requirements for inspection stationkeeping. This risk can be mitigated by testing the pointing capabilities of the conjoined spacecraft on the ground prior to launch integration.

## 2. Spacecraft Unable to Separate

A failure of the separation mechanism to push the two spacecraft apart would result in mission failure. This risk can be mitigated by extensive ground testing of the separation mechanism under the expected environmental conditions in low Earth orbit.

## 3. Collision with Quarry Spacecraft during inspection Stationkeeping

A collision with the quarry spacecraft during inspection stationkeeping may result in damage to solar arrays, communication antennas, and external sensors, potentially impeding further progress.

## 4. Unable to Rendezvous with Quarry Spacecraft during Cooperative Rendezvous

Failure of the primary spacecraft to rendezvous with the quarry spacecraft from maximum stationkeeping distance with both GPS and visual aids active precludes any further rendezvous attempts.

## 5. Unable to Rendezvous with Quarry Spacecraft during Partial Non-Cooperative Rendezvous

Failure of the primary spacecraft to rendezvous with the quarry spacecraft from maximum stationkeeping distance with active GPS and without the benefit of visual aids precludes any further rendezvous attempts.

## 6. Unable to Rendezvous with Quarry Spacecraft during Non-Cooperative Rendezvous

Failure of the primary spacecraft to rendezvous with the quarry spacecraft from maximum stationkeeping distance without active GPS and visual aids precludes any further rendezvous attempts.

## 7. Collision with Quarry Spacecraft during Rendezvous from Maximum Stationkeeping Distance

A collision with the quarry spacecraft during rendezvous may result in damage to solar arrays, communication antennas, and external sensors, potentially impeding further progress.

# Concept of Operations, Option 2

figure x+3: conops 2 risk reporting matrix

## 1. Spacecraft Unable to Orient for Separation

Failure of the spacecraft to properly orient themselves for separation could lead to increased ΔV requirements for inspection stationkeeping. This risk can be mitigated by testing the pointing capabilities of the conjoined spacecraft on the ground prior to launch integration.

## 2. Spacecraft Unable to Separate

A failure of the separation mechanism to push the two spacecraft apart would result in mission failure. This risk can be mitigated by extensive ground testing of the separation mechanism under the expected environmental conditions in low Earth orbit.

## 3. Collision with Quarry Spacecraft during Phase I Docking Demonstration

A collision with the quarry spacecraft during docking demonstration may result in damage to solar arrays, communication antennas, and external sensors, potentially impeding further progress.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Likelihood |  |  |  |  |  |
|  |  |  |  |  |
|  |  | **III, IIX** |  |  |
|  | **I** |  | **V, X, XI** | **I, IV, VI, VII, IX** |
|  |  |  |  |  |
|  | Consequence | | | | |

## 4. Spacecraft Unable to Separate after First Docking Demonstration

Failure of the spacecraft to undock would preclude any further proximity operations. This risk is mitigated by extensive ground testing of the docking/undocking mechanisms under the expected environmental conditions of low Earth orbit.

## 5. Collision with Quarry Spacecraft during Inspection Stationkeeping

A collision with the quarry spacecraft during inspection stationkeeping may result in damage to solar arrays, communication antennas, and external sensors, potentially impeding further progress.

## 6. Unable to Rendezvous with Quarry Spacecraft during Cooperative Rendezvous

Failure of the primary spacecraft to rendezvous with the quarry spacecraft from maximum stationkeeping distance with both GPS and visual aids active precludes any further rendezvous attempts.

## 7. Collision with Quarry Spacecraft during Rendezvous from Maximum Stationkeeping Distance

A collision with the quarry spacecraft during rendezvous may result in damage to solar arrays, communication antennas, and external sensors, potentially impeding further progress.

## 8. Collision with Quarry Spacecraft during Second Docking Demonstration

A collision with the quarry spacecraft during docking demonstration may result in damage to solar arrays, communication antennas, and external sensors, potentially impeding further progress.

## 9. Spacecraft Unable to Separate after Second Docking Demonstration

Failure of the spacecraft to undock would preclude any further proximity operations. This risk is mitigated by extensive ground testing of the docking/undocking mechanisms under the expected environmental conditions of low Earth orbit.

## 10. Unable to Rendezvous with Quarry Spacecraft during Partial Non-Cooperative Rendezvous

Failure of the primary spacecraft to rendezvous with the quarry spacecraft from maximum stationkeeping distance with active GPS and without the benefit of visual aids precludes any further rendezvous attempts.

## 11. Unable to Rendezvous with Quarry Spacecraft during Non-Cooperative Rendezvous

Failure of the primary spacecraft to rendezvous with the quarry spacecraft from maximum stationkeeping distance without active GPS or visual aids precludes any further rendezvous attempts.