**Mission Concept Template**

**1. Mission Overview**

* **Mission Statement**: Concise declaration of the mission's purpose (e.g., "Monitor Arctic sea ice to predict global sea-level rise by 2035").
* **Strategic Objectives**: High-level goals (e.g., "Provide real-time climate data to scientific communities").
* **Measures of Effectiveness (MoEs)**: Quantifiable success metrics (e.g., "Data accuracy ≥95%; latency ≤5 minutes").

**2. Stakeholder Analysis**

* **Stakeholder Identification** (**examples**):

|  |  |  |
| --- | --- | --- |
| **Role** | **Responsibility** | **Key Needs** |
| Climate Scientists | Data analysis | High-resolution, real-time ice data |
| Policy Makers | Regulatory decisions | Predictive analytics for legislation |
| Funding Agencies | Budget oversight | ROI metrics and milestone compliance |

* **Stakeholder Engagement Plan**: Communication frequency and methods.

**3. Operational Context**

* **Mission Environment**:
  + Physical (e.g., Arctic Ocean, satellite orbit).
  + Cyber (e.g., secure data transmission protocols).
  + Regulatory (e.g., international climate data-sharing agreements).
* **External Systems**:
  + Interactions with ground stations, existing satellites, or research vessels.
* **Constraints**:
  + Ethical (e.g., indigenous land rights), technical (e.g., bandwidth limits), or political.

**4. Capability Analysis**

* **Required Capabilities:**

|  |  |  |
| --- | --- | --- |
| **Capability** | **Rationale** | **Gap Analysis** |
| Real-time ice imaging | Track ice melt dynamics | Legacy satellites lack resolution |
| AI-driven predictions | Model future sea-level rise | No existing system integration |

* **Capability Dependencies**:
  + E.g., "Requires integration with NOAA’s historical climate database."

**5. Mission Architecture**

* **Mission Threads**:
  + *Example thread*: "Satellite captures data → Encrypts transmission → Ground station processes → Scientists access via web portal."
* **High-Level Architecture**:
  + **Diagram**: Use SysML block diagrams to show systems, subsystems, and interfaces.
  + **Key Interfaces**: Data formats, communication protocols (e.g., CCSDS).
* **System-of-Systems (SoS) Context**:
  + How constituent systems (e.g., satellites, ground networks) collaborate.

**6. Mission Scenarios**

* **Nominal Scenario**:
  + "Daily data collection → Automated processing → Alerts for ice breakup events."
* **Contingency Scenarios**:
  + "Satellite comms failure: Switch to backup ground station within 2 hours."

**7. Performance and Risk**

* **Key Performance Parameters (KPPs)**:
  + Data refresh rate, system uptime, error tolerance.
* **Risk Register:**

|  |  |  |
| --- | --- | --- |
| **Risk** | **Mitigation** | **Owner** |
| Sensor degradation in extreme cold | Redundant sensors; heated housings | Systems Engineer |

**8. Lifecycle Management**

* **Phasing**:
  + *Development*: Technology maturation (Year 1–2).
  + *Operations*: 10-year data-collection phase (Year 3–13).
  + *Disposal*: De-orbit plan compliant with UN space debris guidelines.
* **Evolution**:
  + "Upgrade AI models annually using operational data."

**9. Assumptions and Dependencies**

* **Assumptions**:
  + "Stable funding through 2030."
  + "International data-sharing treaties remain in effect."
* **Dependencies**:
  + "Relies on NASA’s Deep Space Network for data downlink."

**10. Verification and Traceability**

* **Traceability Matrix:**

|  |  |  |
| --- | --- | --- |
| **Mission Objective** | **Capability** | **Verification Method** |
| Predict sea-level rise | AI-driven analytics | Simulated ice-melt scenarios |

* **Validation Plan**:
  + Field tests with ice-penetrating radar.

**Recommended Representations**

* **Diagrams**:
  + *Mission Threads*: Activity/sequence diagrams.
  + *Architecture*: SysML block diagrams.
* **Tables**: For stakeholders, capabilities, risks, and traceability.
* **Narrative**: For scenarios, constraints, and lifecycle descriptions.

**Key Distinctions from Other Artifacts**

|  |  |  |
| --- | --- | --- |
| **Feature** | **Mission Concept** | **ConOps/OpsCon** |
| **Focus** | End-to-end mission outcomes | User workflows / technical operations |
| **Scope** | Mission as the system-of-interest | Single-system operations |
| **Primary Audience** | Mission planners, enterprise architects | Engineers, operators |

This template ensures rigorous mission alignment while providing actionable inputs for downstream engineering activities. Customize sections (e.g., cybersecurity, logistics) based on mission complexity.