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Probabilistic Risk Assessment (PRA): Design Considerations for CEV

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Constellation Probabilistic Risk Assessment (PRA):

Design Consideration for CEV

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Preface

The Constellation Crew Exploration Vehicle (CEV) probabilistic risk assessment (PRA) discussed in report started as a part of the Smart Buyer Study involving preliminary designs for the CEV. It is both a pilot PRA, starting at the mission formulation stage for a multi-phased mission, and a risk assessment to understand the insights that can be gained from PRA and how these insights can be used to improve risk management (both for performance, LOM and safety, LOC). Parallel to this PRA, a study was chartered by the Constellation Program to assess the feasibility of several System Requirements Document (SRD) reliability requirements and launch availability for the CEV. This additional study is referred as TDS20[1].

Subsequently, it was recognized that an integrated PRA approach could be used for both evaluations and the two study teams joined together to model and assess the preliminary designs for the CEV. Since the two studies had different objectives and schedule constraints, a consistent modeling approach was developed and two variations of the PRA model were produced, one to provide quantitative results addressing the proposed reliability requirements and the other, to model systems and gain both qualitative and quantitative risk insights into the design of the CEV for a Lunar Sortie Mission. The PRA team worked together 1) to develop consistent modeling and data application approaches, where appropriate, and 2) to produce a PRA approach that can be used as a basis for an Agency-wide PRA for the entire life-cycle of the CEV.

The CEV PRA that was developed for the Smart Buyer Study is a high level integrated mission phase PRA of Formulation level preliminary designs. The purpose of the model is to gain risk insights that can be used to make decision involving hardware and operational alternatives and to perform preliminary risk trade studies. This PRA model will be revised as designs become more mature to gain additional insight into performance and safety that can improve the vehicle, adding details to the model as designs are certified for development and construction. At this stage (Formulation), the PRA model can also be used to verify compliance to reliability requirements and evaluate contractor submittals. This model will evolve into a complete detailed PRA of the as-designed and then as-built vehicle involving proposed mission profile(s) that can be used to support trade studies, operational decisions, and upgrade improvements as we gain flight experience for the duration of the program. Eventually, the PRA will be used to study disposal strategies as NASA moves to the next generation of space exploration systems.

We want to acknowledge Ralph Row and the Smart Buyer Team for providing the resources and information needed to conduct this evaluation. We want to also acknowledge the directed effort and timely results produced for the TDS20 Report by Mark Bigler, Bryan Fuqua, Bob Graber, Teri Hamlin, Joe Kahn, Samandar Roshan-Zamir, Clint Thornton and Paul Wilson and the efforts of Prince Kalia for conducting a reliability analysis of LAS[3] which was used in this study. This report draws on the information contained in TDS20 Report. Roger Boyer provided leadership in bringing these efforts together, in striving for a consistent model that can be used Agency-wide, in

managing the overall project and in interfacing with the numerous entities involved with making decision concerning CEV. It is our intent to transfer this model to the Constellation Program after our preliminary evaluations are complete to serve as the basis for subsequent CEV and Constellation PRAs.

Abstract

This report documents the pilot probabilistic risk analysis (PRA) performed for the NASA Smart Buyers Design Team during early 2006 for the Crew Exploration Vehicle (CEV) lunar sortie mission. The PRA methods used in this study follow the general guidance provided in the NASA PRA Procedures Guide for NASA Managers and Practitioners[4]. As such, phased-based event tree and fault tree logic structures are used to model a lunar sortie mission of the CEV – involving the following phases: launch of a cargo vessel and a crew vessel; rendezvous of these two vessels in low Earth orbit; transit to the moon; lunar surface activities; ascension from the lunar surface; and then return to the Earth surface. The analysis is based upon assumptions, logic models, preliminary system diagrams, and failure data that may involve large uncertainties or may lack formal validation. Furthermore, some of the data used were based upon expert judgment or extrapolated from similar components/systems. As the CEV design matures and additional information applicable to the PRA is developed, this information will be introduced into the models. Details of the analysis results are provided in this report to identify insights into the CEV risk drivers, trade and sensitivity study results, and the analyses of risk drivers. All logic models are included along with the basic event (more than 800) data contained within these models. Importance measures, such as the Fussell-Vesely, the risk increase ratio, and the risk reduction ratio are shown for key basic events. Also included are discussions of the system-level models and the assumptions behind those models. Lastly, the PRA model was used to determine changes in risk as system configurations or key parameters are modified. These trade and sensitivity studies provide holistic insights into features of the CEV as it pertains to the proposed lunar missions.

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Acronyms

AR&D	Automated Rendezvous and Docking
ATCS	Active Thermal Control System
BIU	Bus Interface Unit
CEV	Crew Exploration Vehicle
CaLV	Cargo Launch Vehicle
CCF	Common Cause Factor
CLV	Crew Launch Vehicle
CM	Crew Module
DAC	Design Analysis Cycle
DRM	Design Reference Mission
ECLSS	Environmental Control and Life Support System
EDS	Earth Departure Stage
EOI	Earth Orbit Injection
EPS	Electric Power System
ES	External Support
EVA	Extra Vehicle Activity
FDIR	Fault .Detection, .Isolation, .and .Recovery
FOM	Figure of Merit
GN&C	Guidance, Navigation and Control
GPS	Global Positioning System
INS	Inertial Navigation System
IVHM	Integrated Vehicle Health Management
Ka-Band	Ka Band Radio Frequency
LAS	Launch Abort System
LEO	Low Earth Orbit
LCD	Liquid Crystal Display
LIDAR	Light Detection and Ranging
LLC	Low Lunar Orbit
LOI	Lunar Orbit Insertion
LOM	Loss of Mission
LOC	Loss of Crew
MOV	Motor Operated Valve
LSAM	Lunar Surface Access Module
ME	Main Engine
MSFC	Marshall Space Flight Center
MMOD	Micro-Meteor and Orbital Debris
NASA	National Aeronautics and Space Administration
PCA	Pressure Control Assemply
PDS	Power Distribution System
PRA	Probabilistic Risk Assessment
PYRO	Pyrotechnic Device
RCS	Reaction Control System
RIR	Risk Increase Ratio

RRR	Risk Reduction Ratio
SAR	Search and Rescue
S-Band	S band Radio Frequency
SM	Service Module
SRB	Solid Rocket Booster
SRD	Safety Requirement Document
SSME	Space Shuttle Main Engine
SW	Software
TDS20	Evaluation of SRD Reliability/Probability/Statistics Requirement, TDS20Report (dated March 2006)
TLI	Trans-Lunar Injection
UHF	Ultra High Frequency

Executive Summary

This probabilistic risk assessment (PRA) was conducted for the Constellation Program and in particular, to gain insights into the design of a Crew Exploration Vehicle (CEV) for a Lunar Sortie Mission. The assessment was initiated as part of the Smart Buyer Study to gain an increased understanding of possible designs and trades associated with systems and operations for this mission. This effort was coordinated with the TDS20 Study ["Evaluation of SRD Reliability/Probability/Statistics Requirement", TDS20Report (dated March 2006)], initiated by the Constellation Program, to assessed the feasibility of establishing several Safety Requirements Document (SRD) reliability requirements associated with the probability of loss-of-mission (LOM) and loss-of-crew (LOC) for this mission. The two study teams worked together to address overall analysis scope and methods, mission event tree structure, system dependencies, success criteria, and basic event and component failure data.

The initial objectives of this study were to help optimize the Smart Buyer CEV design by conducting integrated assessments and trade studies among the systems and across the entire mission profile and provide information in support of the source selection process. The scope of this assessment is the CEV consisting of the Crew Module (CM), Service Module (SM) and Launch Abort System (LAS). This assessment does not include models for other mission vehicles or operations [Cargo Launch Vehicle (CaLV), Earth Departure Stage (EDS) and Lunar Surface Access Module (LSAM)]. For these vehicles and operations, data were derived from the ESAS Study.

The long-term objectives of this study are to:

- Provide insight into designs options needed to meet mission reliability requirements.
- Provide a framework to evaluate proposed contractor CEV designs.
- Provide a basis for the development of a complete detailed phased mission integrated PRA of proposed vehicles included in associated missions.
- Provide a quantitative model that can be used to support trade studies, operational decisions, and upgrade improvements throughout the program life-cycle.

Methodology and Modeling

This Constellation PRA utilizes a "phased" approach to decompose portions of the mission. As shown in Figure 1, the mission is covered by eight phases from launch to earth return. The mission phases are modeled using an event tree approach to model scenarios combined with fault tree analysis to model system failures. The undesirable outcomes addressed in this PRA are based upon figures of merit of interest for the CEV as stated in the request for proposals namely; Loss of Mission (LOM) and Loss of Crew (LOC):

- Loss-of-Crew (LOC) provides safety insight for conducting this mission and returning the crew safely to earth.
- Loss-of-Mission (LOM) provides insight on mission performance for a lunar sortie.

- These above two figures of merit are not mutually exclusive. A LOM end state results in an attempted return-to-Earth. If the abort or return-to-Earth and landing fail, the LOM leads to an LOC.

The system models in this PRA (fault trees) are consistent with the proposed design architecture associated with DAC-1A[4] as modified by the Smart Buyer Design Team process. The fault trees capture the conceptual train design and the interconnected nature of the various systems and subsystems both within a mission phase and across the mission profile. The inter-system Dependency Matrix developed in TDS20[1] was used to identify the operating condition of each system during each particular mission phase used in their event tree model. The operating condition for each system along with the definitions of LOC and LOM lead to the development of success criteria for each system.

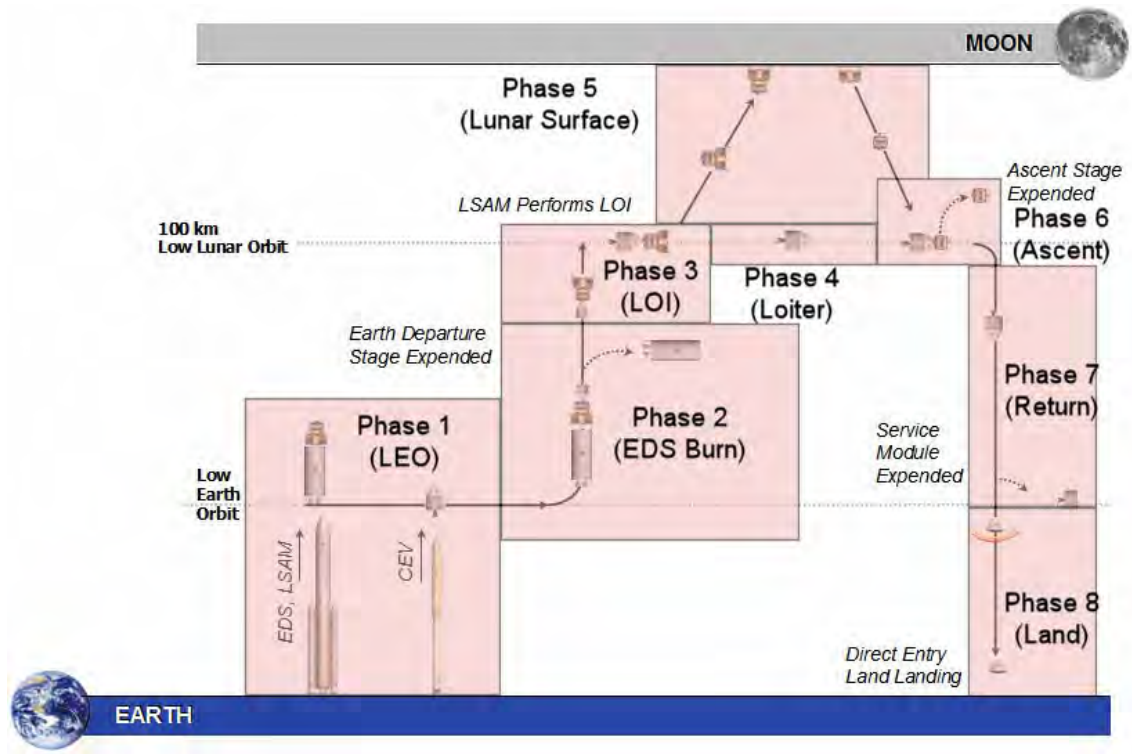


Figure 1. Mission phases for the lunar sortie crew with cargo.

The PRA model contains seven primary systems that perform the major functions for the DRM of a sortie to the lunar surface and return to earth:

- Propulsion including the main engine (ME), reaction control system (RCS), mechanical equipment (pumps, valves and controllers), and the propellant/helium tanks.
- Avionics system that receives inputs from the crew, sensors and external communications; perform navigation, guidance, and internal state calculations; and provides control and actuation signals.
- Electric Power System (EPS) including batteries, solar arrays and electrical distribution and control subsystems.

- Active Thermal Control System (ATCS) including heaters, coolers, condensate controller and mechanical equipment.
- Environmental Control and Life Support System (ECLSS) including oxygen tanks, pressure regulators, sensors and mechanical equipment.
- Launch Abort System (LAS).
- Pyrotechnic (PYRO) devices that affects component separation.

Results

The overall results of the PRA indicate that the mean probability of LOC is 0.017 with 5% and 95% uncertainties of 4.6E-05 and 0.071, respectively. The mean probability of LOM is 0.12 with 5% and 95% uncertainties of 3.7E-04 and 0.48, respectively. The overall mission probability and uncertainty for LOC and LOM are shown in Figure 2. The dominant contributors to LOC for the overall mission are given below. These contributors account for about 66% of the overall mean probability of LOC.

- During Phase 4 (CEV in lunar orbit) the CEV fails to stay in Lunar orbit and the crew fails to recover the CEV upon return from the Lunar surface (P=5.0E-03)
- During Phase 8 (Earth Landing) failure to recover the crew (search and rescue) after landing (P=2.6E-03)
- During Phase 8 (Earth Landing) common cause failure of 2 parachutes (out of 3) during deployment (P=9.8E-04)
- During Phase 8 (Earth Landing) the CM RCS fails to provide correct attitude and spin (P=9.0E-04)

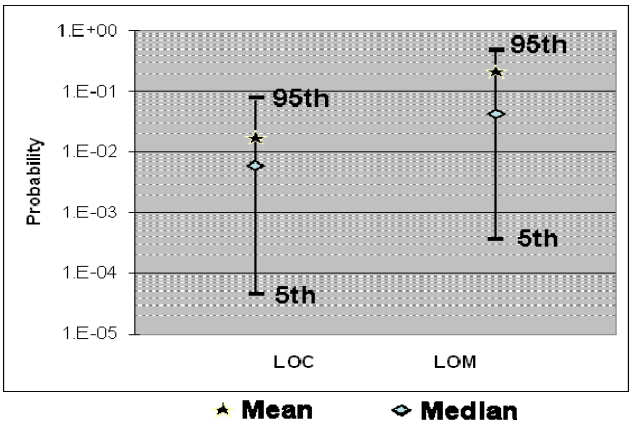


Figure 2. Overall Mission Probability and Uncertainty for LOC and LOM

The dominant contributors to LOM for the overall mission are given below. These contributors account for approximately 63% of the overall mean probability of LOM.

- During Phase 5 (Lunar Mission) unspecified failures occur and the crew fails to recover from those failures (P=3.5E-02)

- During Phase 1 (Two launches to Low Earth Orbit [LEO]) EDS fails to loiter in LEO (P=1.0E-02)
- During Phase 1 (Two launches to Low Earth Orbit [LEO]) LSAM fails to loiter in LEO (P=1.0E-02)
- During Phase 2 (Rendezvous of the CaLV and CEV) the EDS, LSAM, and CEV TLI burn fails (P=1.0E-02)
- During Phase 2 (Rendezvous of the CaLV and CEV) the EDS, LSAM, and CEV TLI mid-course correction burn fails (P=1.0E-02)

The mission phases with the largest contribution to mission LOC mean failure probability are:

- Phase 4, *CEV in Lunar Orbit*: 5E-03 (30%)
- Phase 8, *Earth Landing*: 5E-03 (30%)
- Phase 5, *Lunar Mission*: 5E-03 (30%)

The mission phases with the largest contribution to mission LOM mean failure probability are:

- Phase 5, *Lunar Mission*: 4E-02 (35%)
- Phase 1, *Two Launches to Low Earth Orbit (LEO)*: 4E-02 (34%)
- Phase 2, *Rendezvous of the CaLV and CEV*: 3E-02 (21%)

The relative contribution to LOC from each phase is shown in Figure 3

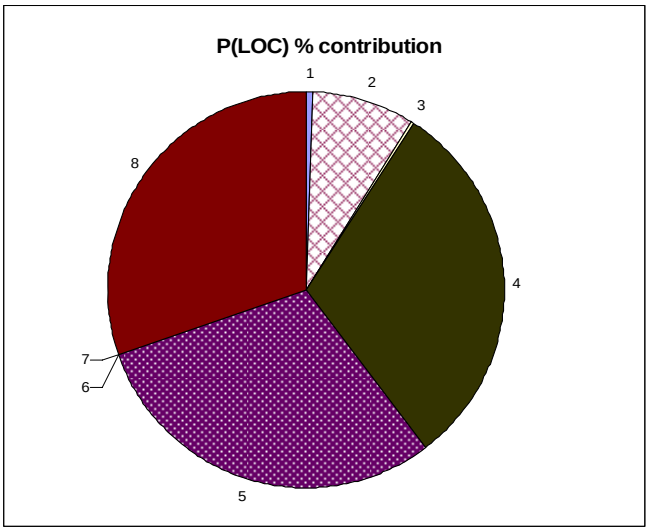


Figure 3. Relative Contribution to the Mean Probability LOC from each Phase

These results identify risk drivers that require further study to completely understand their failure contribution and to identify preventive and mitigative controls to reduce their contribution to LOC and LOM. The list of dominant risk contributors indicates what types of failures during which mission phases may require attention to manage mission risk. This contributor information is often referred to as risk insights, because it provides qualitative information (e.g., a description of combinations of mission failure events) as well as quantitative risk results. This type of information may suggest alternative system designs, operating modes, backups, and/or diverse methods to accomplish mission functions.

Trade and Sensitivity Studies

The following trade studies were performed to assess the impact that changes in design will have on P(LOC) and P(LOM):

- Removal of one (of two) strings of the ATCS
- Removal of one (of three) strings of the EPS
- Removal of one (of three) strings of the Avionics System
- Removal of the Launch Abort System during Phase 1 (Launch to Low Earth Orbit)
- Changes in the landing parachutes success criteria on both LOC and LOM

The following sensitivity studies were performed to assess the impact on the model results and the P(LOC) and P(LOM) to changes in model parameters:

- A decrease in the common cause factors (CCF)
- Removal of contribution of CCF events to LOC and LOM
- Failures of one ATCS string
- Failures of one EPS string
- Failure of one Avionics string
- Removal of LSAM events during Phase 5 on LOC
- Removal of LSAM, Lunar Loiter and Crew Recovery Events on LOC
- Removal of the CaLV contribution to LOM
- Removal of LSAM and CaLV events on LOM
- Credit for crew recovery actions for SM midcourse failures during Phase 7 (Return to Earth) on both LOC and LOM

Observations

The information generated by a PRA includes qualitative and quantitative results that support assessments to manage mission risk and provides different perspectives on risk drivers. The PRA for this study produced design level (formulation phase) risk related information on a Lunar Sortie Mission for the Constellation Program. As more design details become available, more complex risk assessment and management issues can be addressed by the PRA. Among these perspectives, assessments, and issues are:

- Assessment of compliance with SRD mission reliability requirements
- Identification of significant mission risk contributors

- Determination of the importance of events, systems, mission phases, etc to mission risk
- Support of trade studies
- Support mission development
- Assessment of the impact of external events
- Assessment of alternative or supplemental operating modes
- Assessment of alternative mission profiles
- Support for operational risk management
- Assessment of important precursors

1. Introduction

The purpose of this probabilistic risk assessment (PRA) for the Constellation Program is to gain insights into the design of a Crew Exploration Vehicle (CEV) for a Lunar Sortie Mission. This project was initiated as part of the Smart Buyer Study to gain an increased understanding of possible designs and trades associated with systems and operations for this mission. This PRA provides a means to evaluate, in an integrated manner, the proposed systems and postulated operations for a Crewed Mission to the Lunar Surface. A parallel project, initiated by the Constellation Program, assessed the feasibility of establishing several Safety Requirement Document (SRD) reliability requirements associated with the probability of loss-of-mission (LOM) and loss-of-crew (LOC) for this mission. Subsequently, the efforts to develop PRA models for these two studies were coordinated to address overall analysis scope and methods, mission event tree structure, system dependencies, success criteria, and basic event and component failure data. Therefore, this report uses information and data provided in "Evaluation of SRD Reliability/Probability/Statistics Requirement", TDS20Report (dated March 2006)[1].

The initial objectives of this study were to help optimize the Smart Buyer CEV design by conducting integrated assessments and trade studies among the systems and across the entire mission profile and to provide information in support of the source selection process. The scope of this assessment is the CEV consisting of Crew Module (CM), Service Module (SM) and Launch Abort System (LAS). This assessment does not include models for other mission vehicles or operations [Cargo Launch Vehicle (CaLV), Earth Departure Stage (EDS) and Lunar Surface Access Module (LSAM)]. For these vehicle and operations, data were derived from the ESAS Study [2]. The long-term objectives of this study are to:

- Provide insight into designs options needed to meet mission reliability requirements.
- Provide a framework to evaluate proposed contractor CEV designs.
- Provide a basis for the development of a complete detailed phased mission integrated PRA of proposed vehicles included in these missions.
- Provide a quantitative model that can be used to support trade studies, operational decisions, and upgrade improvements throughout the program life-cycle.

2. Methodology and Modeling

The CEV PRA utilizes a "phased" approach to decomposing portions of the mission. As shown in Figure 1, the launch to earth return is covered by following eight phases:

- *Phase 1 – Two launches to Low Earth Orbit (LEO).* The first launch is the Cargo Launch Vehicle (CaLV) consisting of a Lunar Surface Access Module (LSAM) and an Earth Departure Stage (EDS). The second launch is the Crew Launch Vehicle (CLV) which contains the CEV, consisting of a Crew Module (CM), a Service Module (SM), and a Launch Abort System (LAS).

- *Phase 2 – Rendezvous of the CaLV and the CEV.* The EDS is used (via a Trans-Lunar Injection or TLI burn), then expended, leaving the CEV and LSAM.

- *Phase 3 – Lunar-Orbit Insertion (LOI).* The LSAM performs the LOI for both the CEV and LSAM. All members of the CEV crew transfer to the LSAM and it undocks from the CEV.

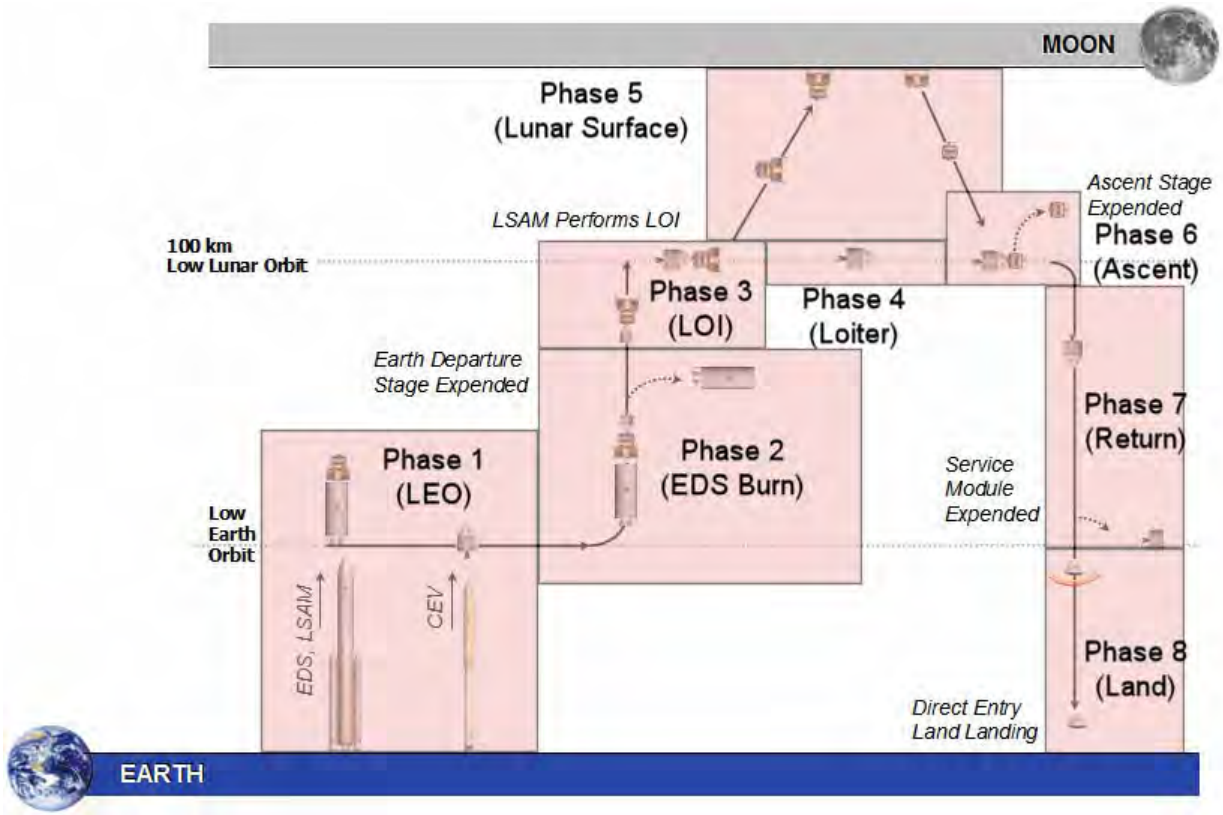
- *Phase 4 – CEV in lunar orbit.* The unmanned CEV remains in a lunar sortie, but will descend to a parking orbit during the seven-day lunar mission.

- *Phase 5 – Lunar mission.* The LSAM is used to descend to and ascend from the lunar surface. A typical lunar mission will last up to seven days.

- *Phase 6 – Re-crew CEV.* Following the LSAM ascent (the descent stage is left on the lunar surface), the crew docks with and transfer back to the CEV. The LSAM (ascent stage) is expended back to the lunar surface.

- *Phase 7 – Return to Earth.* The CEV returns to earth, where the SM is expended when no longer needed.

- *Phase 8 – Earth landing.* The CEV lands on the Earth with a direct entry and parachute-assisted land touchdown.

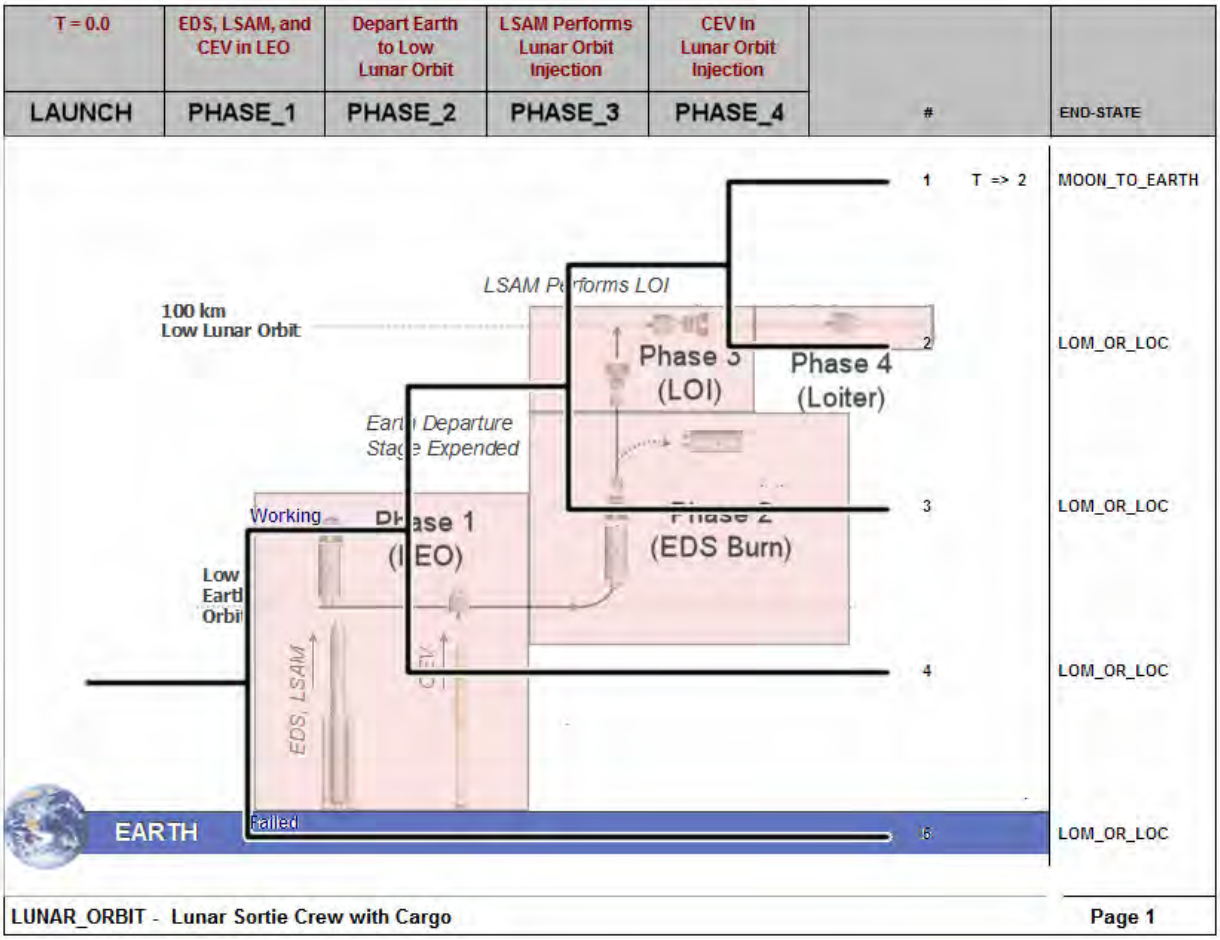


• Figure 1. Mission Phases for the Lunar Sortie Mission.

The lunar sortie mission phases are modeled in the event tree structure (as constructed in the SAPHIRE software, version 7.26) shown in Figures 2 and 3. As is common among these types of phased-mission event tree models, success of one phase leads to questioning the success likelihood of later phases. This scenario modeling method is illustrated via the sequential "up" (success) branches in the event tree. In the model logic, a successful completion of all event tree top events results in the mission advancing along the nominal mission profile and returning the crew safely to earth after completing a successful mission. However, each event tree top event also has the potential for failure ("down" branch). Failure during Phase 1, leads to the evaluation of the success of the Launch Abort System (LAS) which is also part of the CEV. Failures during a subsequent phase lead to evaluating return-to-Earth and landing strategies for that phase.

The undesirable outcomes that are represented in the SAPHIRE CEV PRA are based upon figures of merit of interest from the CEV request for proposals. Specifically, we modeled:

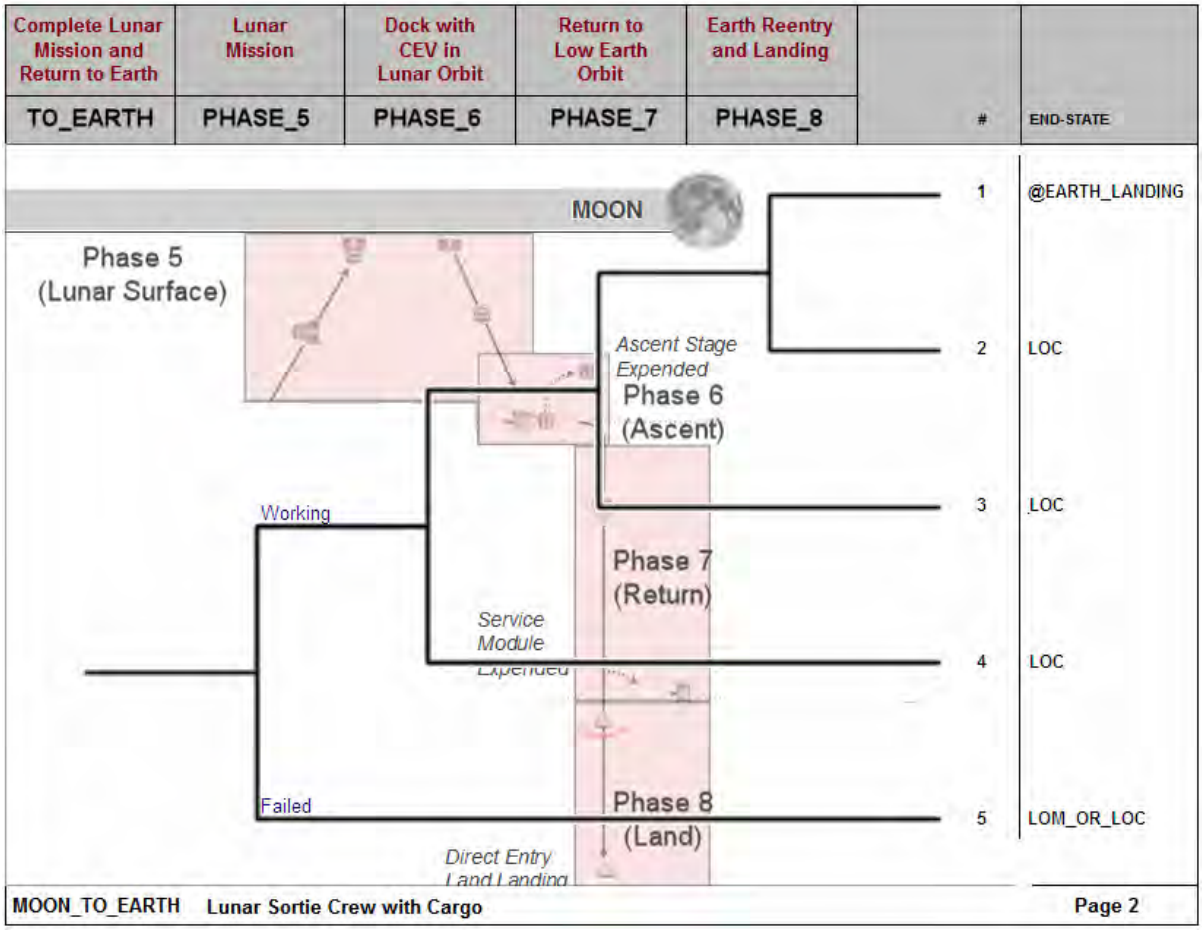
- Loss of Mission (LOM)
- Loss of Crew (LOC)



• Figure 2. Event Tree Representing Mission Phases from Launch to Lunar Mission.

Loss-of-Crew (LOC) provides an indication of the safety of conducting this mission and returning the crew safely to earth. Loss-of-Mission (LOM) provides an indication of meeting the mission objectives for a lunar sortie mission. These two FOMs are not mutually exclusive. A LOM end state results in testing abort, return-to-Earth and landing strategies for that phase in the mission. If an abort or return-to-Earth and landing fail, the LOM leads to LOC.

Loss-of-Mission is a function of the objectives of the mission and is tied to system operability. In this study, the mission objectives are defined as LSAM and CEV transit to LLO, LSAM transit to the lunar surface, and completion of operations on the lunar surface. Once the mission objectives are defined, the success criteria (operability states for the systems) for LOM are defined and the analysis conducted. Other mission objectives could be defined which will lead to changes in system success criteria for LOM that would reflect different mission objectives.



• Figure 3. Event Tree Representing Mission Phases from Lunar Mission to Earth Return

Since abort scenarios are modeled, LOC outcomes require both a failure during a phase leading to LOM and failure to abort or land except for Phases 6, 7 and 8. For Phase 1, abort failure involves evaluating the failure of the LAS (which is available up through EOI). For Phases 6, 7, and 8, failures can only lead to LOC since the lunar mission has been completed. However, catastrophic failures can occur in any phase that can lead to LOC. This is shown on Figures 2 and 3 via the "down" branches in the event trees leading to the end state of "LOM_OR_LOC" (where either can happen) or "LOC" (where only LOC is possible).

The evaluation of the failure branches is performed through linked fault trees. Each phase branch point is separated into a number of sub-phase events that are the top events of the fault trees used to determine both qualitative failure sequences for that fault tree top event and quantitative probability estimates. These sub-phase events for each portion of the lunar mission are shown in Table 1. These sub-phase events are the same as the event tree top events used in the TDS20[1] evaluation of the SRD Requirements.

• Table 1. Sub-phase events for each portion of the lunar mission.

Phase (duration in hours)	Sub-Phases	
1 (120.9)	1	CaLV (EDS & LSAM) First Stage (5 SSMEs) Launch
	2	CaLV First Stage Ascent
	3	CaLV SRB Separation
	4	CaLV Second Stage Ascent
	5	CaLV Second Stage Separation from EDS/LSAM
	6	CaLV EDS (3rd stage) Ignition
	7	CaLV Third Stage (EDS) Ascent
	8	CaLV Third Stage Shutdown/Orbital Insertion (EOI)
	9	EDS & LSAM Loiter in LEO
	10	CLV (5-Segment SRB) Launch with CEV (CM+SM+LAS)
	11	CLV First Stage Ascent
	12	CLV First Stage & Second Stage Separation
	13	CLV Second Stage (J2-S) Ignition
	14	CLV Second Stage Ascent
	15	LAS Jettison from CEV
	16	CEV (CM+SM) Separation from CLV Second Stage
	17	CEV Earth Orbit Insertion (EOI)
	18	CEV Rendezvous & Docking with EDS & LSAM
	19	CEV Rendezvous & Docking with ISS
2 (72.3)	20	EDS, LSAM, & CEV TLI Burn for LLO
	21	EDS, LSAM, & CEV TLI Mid-course Correction Burn
	22	EDS Separates from LSAM & CEV
3 (36.4)	23	LSAM & CEV Mid-course Correction Burn
	24	LSAM & CEV Burn to Slow Near LLO
	25	LSAM & CEV LLO Insertion
	26	Crew Transfers from the CEV to LSAM
	27	LSAM Separates from CEV
4 (168)		CEV Lunar Loiter
5 (170.2)	28	LSAM Powered Descent & Landing to the Lunar Surface
	29	Lunar Surface Mission
	30	LSAM Ascent Stage Ignition, Separation & Ascent
	31	LSAM Ascent Stage LLO Insertion
	32	LSAM Ascent Stage Plane Change Burn
6 (5.3)	33	LSAM Ascent Stage Rendezvous & Docking with CEV
	34	Crew Transfers from the LSAM Ascent Stage to CEV
	35	CEV Separates from LSAM Ascent Stage
7 (108)	36	CEV Burn for Earth
	37	CEV Mid-course Correction Burn
	38	CEV Separates from ISS
	39	CM Separates & Maneuvers away from SM
8 (1.8)	40	CM Entry
	41	CM Landing System Deployment
	42	CM Landing
	43	Crew Recovery

The fault tree logic under each sub-phase top event models the failure of systems required for successful completion of that event and thus failure of that phase in the mission profile. These system models are consistent with the proposed design architecture associated with DAC-1A[4] as modified by the Smart Buyer Design Team process. Since this systems architecture is for a preliminary design, the fault trees model the functional operation of the majors systems of the CEV represented by multi-string subsystems including major components at a somewhat high level. The fault trees do not model detail system designs nor do they model every component within a system. However, the fault trees do model the interconnected nature of the various systems and subsystems both within a mission phase and across the mission profile. The fault trees for the top level systems (e.g., PHASE_1 through PHASE_8, key support systems) are located in Appendix A. As designs mature and become ready for development, the systems models must be revised to represent the detailed designs associated with the complete CEV and its interactions with the other vehicles (CLV, EDS, LSAM) needed for the design reference mission (DRM) being analyzed.

The complete event tree linked fault tree model is analyzed to identify and quantify both catastrophic (non-recoverable, e.g., Loss of Crew) and non-catastrophic (Loss of Mission) failure probabilities, including uncertainty.

The Dependency Matrix developed in TDS20[1] was used to identify the operating condition of each system during each particular mission phase used in its event tree model. The operating condition for each system along with the definition of LOC and LOM lead to the development of success criteria for each system. This dependency matrix is applied to the fault tree top events for each of the eight phases used in this model. A discussion of the systems success criteria, fault tree modeling and assumptions used in the analysis is provided in the next section.

The CEV contains seven primary systems that perform the major functions for the DRM of a sortie to the lunar surface and return to earth. These systems are interdependent. The seven primary systems are:

- Propulsion including the main engine (ME), reaction control system (RCS), mechanical equipment (pumps, valves and controllers), and the propellant/helium tanks.
- Avionics system that receives inputs from sensors and external communications; perform navigation, guidance, and internal state calculations; and provide control and actuation signals.
- Electric Power System (EPS) including batteries, solar arrays and electrical distribution and control subsystems.
- Active Thermal Control System (ATCS) including heaters, coolers, condensate controller and mechanical equipment.
- Environmental Control and Life Support System (ECLSS) including oxygen tanks, pressure regulators, sensors and mechanical equipment.
- Launch Abort System (LAS).
- Pyrotechnic (PYRO) devices that affects component separation.

There are three additional systems: Software that performs internal state and guidance calculations; the Automatic Rendezvous and Docking System (AR&D); and External Support (ES) including data evaluation and information exchange, that also support the mission objectives. The interconnected dependency of the CEV systems is shown in Table 2. In this table, the GN&C portion of the Avionics System provides the guidance, navigation and control of the trajectory and course corrections, and the control function provides signal to control the functions of the CEV.

2.1. Success Criteria and Model Assumptions

The following model assumptions and success criteria where taken from TDS20[1] and modified to account for the fact that this analysis uses representative fault tree models of the major CEV systems and does not consider Crew Exchange or Cargo Missions to the ISS. The fault tree models for the systems are given in Appendix A.

General Assumptions

- This study includes the evaluation of the CEV (CM, SM and LAS), LSAM, EDS, and CaLV during the lunar sortie.
- Software failure was not included in the assessment. The unreliability of software is assumed to have a value of zero.
- Only select external initiators, such as radiation effects, were considered in the analysis.
- Thermal Protection System (TPS) failure was not considered to be significant to the failure of the CEV or CM upon entry as compared to other CEV failures. TPS failures were not considered in the assessment.
- Human recoveries as responses to failures are modeled within individual systems or during specific phases.
- Common-cause failures are modeled for all redundant systems.
- Catastrophic failures provide no chance for crew survival leading directly to LOC. Success of systems needed for an abort and landing result in LOM but not LOC. Failure of systems needed for a successful abort or landing during a return-to-Earth scenario result in LOC.
- After the lunar mission has been completed successfully (Phase 5), LOM is ignored and only LOC is considered. This assumption implies that the “mission” part of the lunar mission is complete during Phase 5.
- The CEV consist of the CM, SM and LAS. The CEV becomes the active command vehicle when coupled to the LSAM and/or EDS.
- The LSAM ascent pressure suits are capable of on-orbit EVA (in the event of a Contingency EVA Crew Transfer from LSAM to CEV).
- A maximum CEV loiter time in LLO consists of 7 earth days (168 hours).
- Aborts during the outbound trans-lunar coast phase can consist of either returning to Earth by circling the moon or by direct return. In the event the EDS and LSAM are still attached to the CEV, the order of jettison is: EDS then LSAM, then SM.

- All crew members descend to the lunar surface during the Lunar Surface phase of the mission and the CEV is left un-manned.

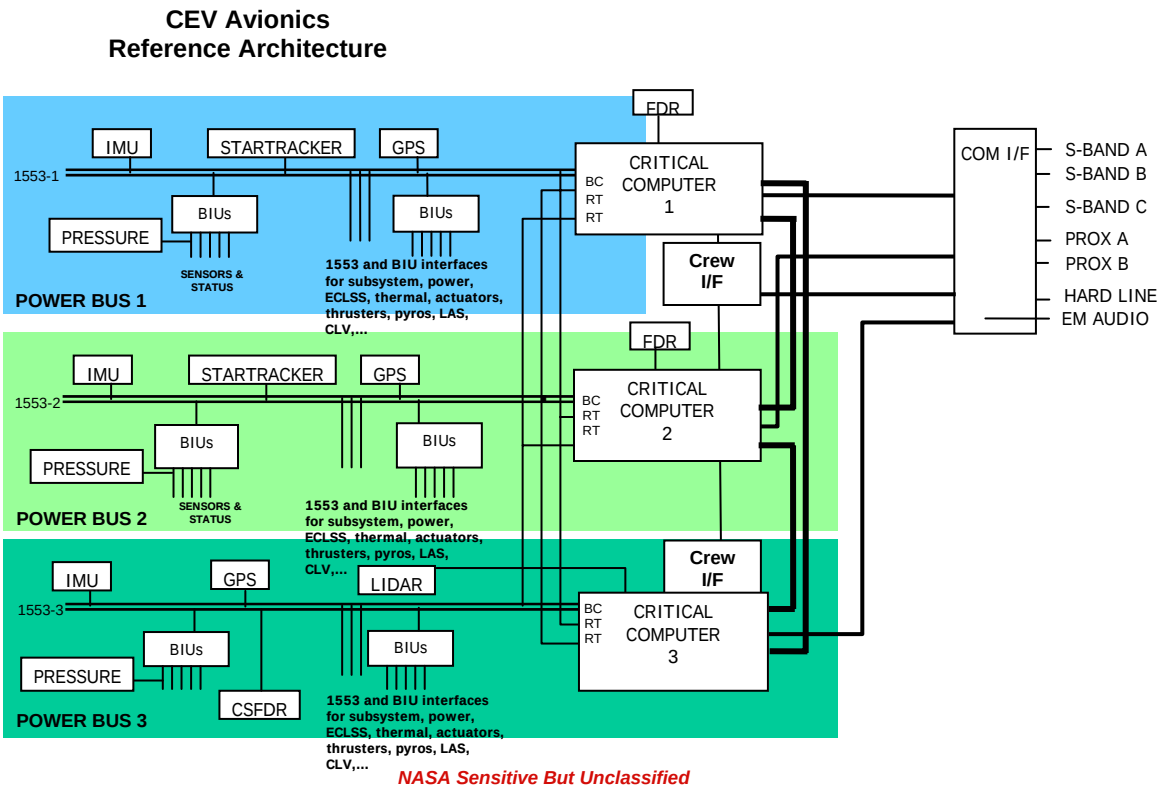
Avionics System

The Avionic System reference architecture is shown in Figure 4. Not all components shown in this figure were modeled. The modeling criteria and assumptions for the Avionics System are given below.

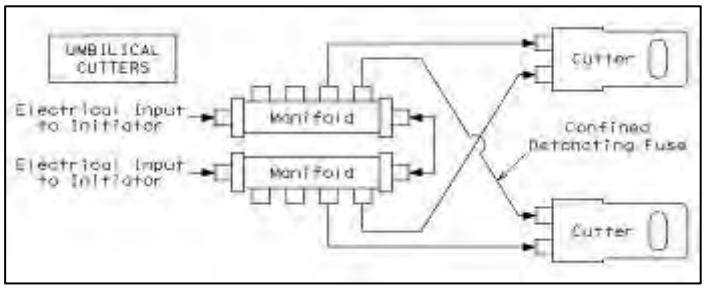
- The Avionics System is modeled as a three string (each 100%) system with cross ties between all strings. The primary function of the Avionics System, as modeled, is to receive input from three main sources: on-board sensors, ground and proximity communications equipment and the crew; and provide control and actuation signals to various other systems and equipment on the CEV, and the display of flight operations data to the crew. Control and actuation signals are provided to the EPS, Pyrotechnic Devices, ATCS, ECLSS, and the Propulsion System including the Reaction Control Systems (RCS).
- The components and subsystems modeled for the Avionic System are: sensors; bus interface units (BIUs) including sensor BIUs; the Ka-Band, S-Band and UHF communication subsystems; flight control computers; the digital audio subsystem; navigation equipment (INS/GPS/Star Tracker); the FDIR; the LIDAR for proximity ops; video displays; video guidance subsystem; LCD displays and controls; and hand controllers.
- Each Avionics string is supplied electric power from a separate electric power system (EPS) bus.
- Loss of Mission (LOM) is assumed to occur when two Avionics strings fail and only one string is left functional (i.e., 2-out-of-3 strings failed). However, after the lunar mission has been successfully completed (Phase 5), LOM is ignored with respect to avionics failure.
- Loss of Crew (LOC) is assumed to occur when all three Avionics strings fail (i.e., 3-out-of-3 strings fail). LOC is assumed to apply to all mission phases.
- The flight control computers and BIUs are assumed operational and required for all mission phases.

Pyrotechnic Devices (PYRO)

- A single pyrotechnic device was modeled. The model included a dual igniter circuits. Pyro initiation is provided through signals from two Avionics strings and power from two EPS buses. The Avionics system provides both an arming and firing signal to the Pyro, and closes breakers to the EPS providing electric power for ignition. A drawing of a pyrotechnic device used as an embilical cutter is shown in Figure 5.
- The single Pyro model is used for CEV separation from the Crew Launch Vehicle (CLV); separation of the LAS: separation of the Service Model (SM) from the Crew Module (CM) in preparation of entry; jettison of the TPS heat shield and deployment of the parachute system during entry, up-righting airbag deployment, and releasing the parachute system following CM landing.



• Figure 4 CEV Avionic Reference Architecture



• Figure 5 Pyrotechnic device used as an embilical cutter.

- Inadvertent Pyro firing was not modeled due to an assumed very low probability.
- Common cause Pyro failures were modeled for systems that use more than a single Pyro.

• Table 2. Interconnectivity Among Major CEV Systems

		Dependent Systems													
		Propulsion		Avionics				EPS electric power	ATCS active thermal control	ECLSS	SW	LAS launch abort	PYRO	AR&D	ES
		RCS	ME	Sensors	Control	GN&C	Comm.								
Support Systems															
Propulsion (CEV)	RCS														
	ME														
	Tanks	X	X												
Avionics	Sensors	X	X		X	X		X	X	X	X	X	X	X	X
	Control	X	X				X	X	X	X	X	X	X	X	
	GN&C	X	X	X	X						X	X	X	X	X
	Comm.	X	X		X	X		X	X	X	X	X	X	X	X
EPS		X	X	X	X	X	X			X	X	X	X	X	
ATCS					X	X		X		X	X				
ECLSS															
Software		X	X	X	X	X	X	X	X	X		X	X	X	
External Support							X			X	X	X		X	

AR&D = automated rendezvous and docking
ME = main engine
GN&C = Guidance, Navigation and Control
RCS = Reaction control system
EPS = Electric power system
Comm = Communication
SW = Software
Prop. = Propulsion
ES = External support
LAS = Launch Abort System

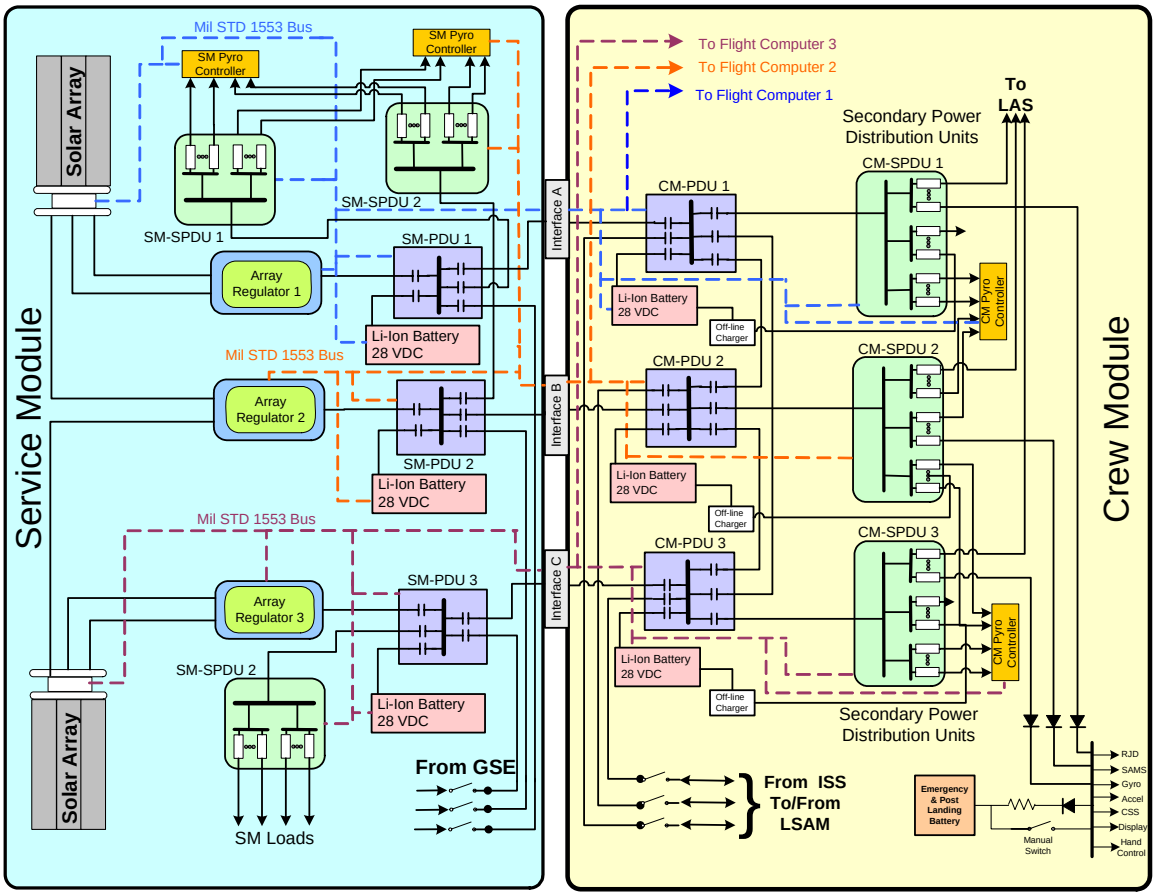
Electric Power System (EPS)

The EPS reference architecture for both the CM and SM is shown in Figure 6. Not all components shown in this figure were modeled. The modeling criteria and assumptions for the EPS are given below.

- The Electric Power Systems for both the service and crew modules (SM and CM) are modeled separately. Each of these systems is modeled as a three-string system with cross ties among all strings. The SM EPS supplies power to the CM EPS when these two vehicles are attached.
- Each SM EPS string model includes a power distribution system (PDS), a power control subsystem, and a single battery, and receives power from the duel solar arrays. Each SM string power control system receives a control signal from the Avionics to model the control of electric power for that string.
- Each CM EPS string model includes a PDS, a power control subsystem, and two batteries, and receives power from the associated SM EPS string. Each CM string power control system receives a control signal from the Avionics to model the control of electric power for that string. The model assumes that a single battery will supply sufficient electric power for that string power loads.
- For the purposes of this analysis, the success criteria for the CM EPS and SM EPS are treated separately:
  - Loss of Mission (LOM) is assumed to occur when two strings of the SM EPS fail and only one string including battery is operational or when only one solar panel fails. However, after the lunar mission is complete following Phase 5, the mission is assumed successful and LOM is not considered with respect to SM EPS power failure.
  - Loss of Crew is assumed to occur when all strings of the SM EPS fail. LOC for the SM EPS is not considered after the SM separates from CM following Phase 7.
  - Loss of Mission (LOM) is assumed to occur when two strings of the CM EPS fail and only one string including batteries is operational. However, after the lunar mission is complete following Phase 5, the mission is assumed successful and LOM is not considered with respect to CM EPS power failure.
  - Loss of Crew is assumed to occur when all strings of the CM EPS fail for any mission phase.
- Batteries, and the power distribution and control subsystems are assumed to be operational and required during all mission phases.
- Solar arrays are assumed to be required starting in Phase 2 and continuing through Phase 7.

Propulsion System/Reaction Control System

- Propulsion system failures of the EDS, CLV and LSAM are considered in this analysis, but are not modeled in detail via fault tree system models. Data for these failures are taken from the ESAS Study.



• Figure 6. EPS reference architecture for both the CM and SM

- The SM main engine system was not explicitly modeled via a fault tree for this analysis. Instead, two basic events (initial burn and mid-course correction) in the Phase 7 fault tree accounts for failure of the CEV burn to earth.
- The Reaction Control System (RCS) for both the SM and CM were model separately.
  - The SM RCS was modeled as a single jet with supply from the main engine fuel and oxidizer supply headers. The single SM RCS jet model includes two redundant igniters, a single igniter switch, fuel supply flow through two series MOVs and oxidizer supply flow through two series MOVs. The igniter actuation signals and power are supplied from the Avionics System via a BIU, and EPS, respectively.
  - The complete CM RCS was modeled. This model includes two redundant fuel tanks, two redundant oxidizer tanks, two redundant helium pressure tanks (one for fuel and one for oxidizer). Each fuel and oxidizer tank has an upper and lower heater. Each fuel tank has an MOV that connects it to the fuel header and each oxidizer tank has an MOV that connects it to the oxidizer header. Each helium tank has redundant sets of two isolation valves in series with an MOV. Each jet

has a control valve. Signals and power to the jet and the MOVs are from the Avionics System and EPS, respectively.

- The SM RCS is required for rendezvous and docking in Phases 2 and 6, for mid-course corrections in Phases 3 and 7, and for station keeping in Phase 4 (lunar loiter, when the CEV is unmanned). The CM RCS is required for attitude and spin control in Phase 8.
- Due to the low likelihood of propulsion system leaks in the fuel, oxidizer and the helium systems, tank failures due to leakage, fire and explosions were not considered in the RCS model.

The Shuttle PRA had data related to thruster failures. Events have been observed for two thruster failure events (a total of 6 events) and three thruster failure events (a single event) (out of about 40 total failure events). Using the definition of how to estimate a beta factor provided in NUREG/CR-5485[7] or NUREG/CR-5497[8], an estimate of the beta factor for the "fails off" failure mode of the RCS is 0.28.

The probability modeling for the RCS basic events used:

P(3 thrusters | one degree of freedom in one pod) => 3-of-4
= [4! / 3!(4-3)!] * P(3 fail | CCF) = 4 * 0.28 * P(one thruster fails)

From Shuttle data for a Thruster, RCS fails, the demand failure probability is:

8E-05/demand

Assume at most 10 demands per phase, or 10 * 8E-5 = 8E-4 /phase. Thus:

P(one thruster fails) = 8E-4

P(LOC | RCS failure) = 4 * 0.28 * 8E-4 = 9E-4

Structural Failures

- The likelihood of structural failure is considered the largest during the dynamic phases of the mission (ascent and entry). Therefore, the probability of structural failure leading to LOC is only considered during Phases 2 (launch) and 8 (Earth landing).

Human Reliability

- Human failures initiated on the ground are not considered in this assessment.
- The crew is “hands off” during nominal Ascent and Entry Phases, but may have a role during use of the LAS.
- Human recoveries as responses to failures are modeled within the individual systems.
- Docking and undocking will be preformed manually by the crew.

- The crew flies the CEV manually using direct visual cues during rendezvous proximity operations and mating with the target vehicle.
- The Earth entry trajectories will be performed nominally by the ground flight control team. The crew has the capability to perform these calculations but it is assumed that this will only be conducted in off-nominal situations. These situations are not modeled.
- The crew manually commands chute release shortly after touchdown, this is to avoid the potential for winds to drag the CM or tip the CM over. The probability that the crew fails to perform this action AND it results in LOC is considered to be insignificant compared to other CEV failures.

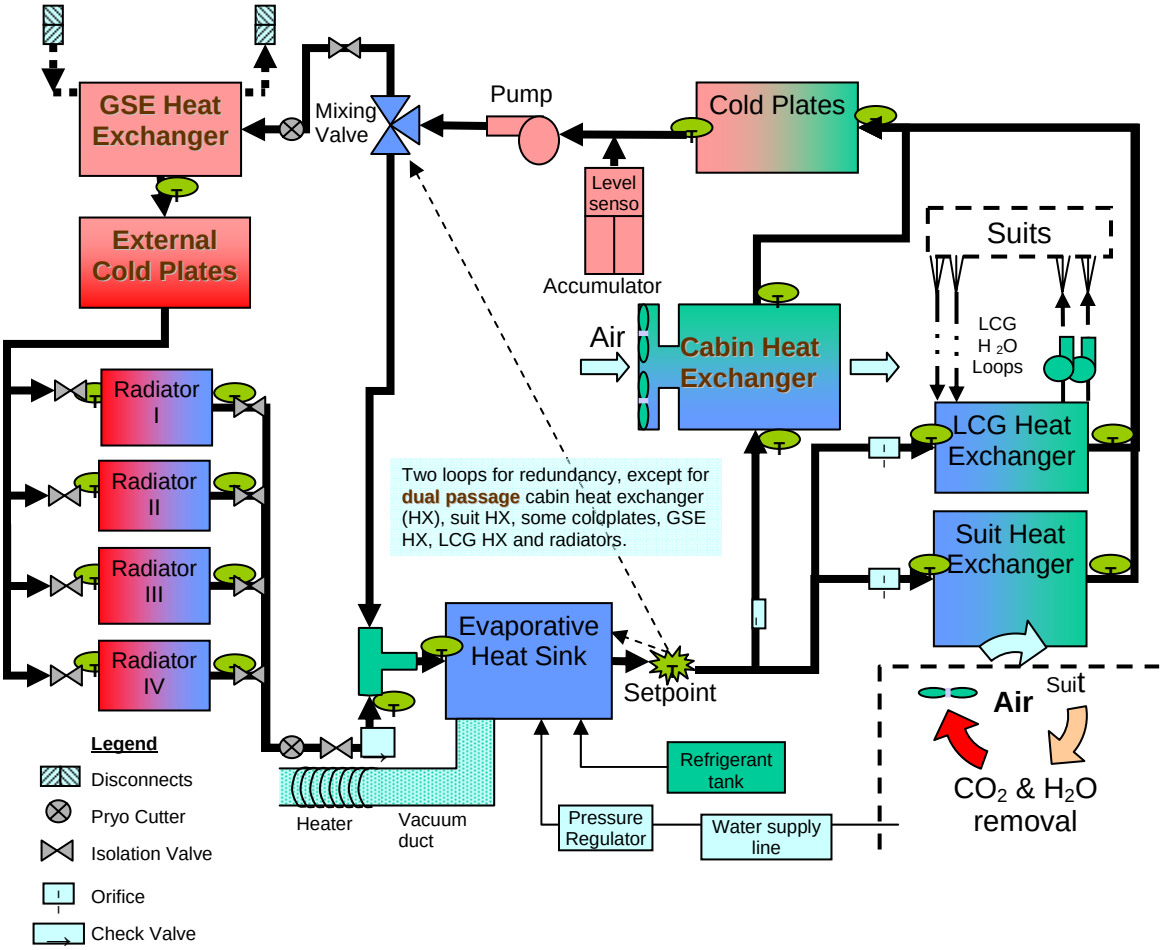
Active Thermal Control System (ATCS)

The ATCS reference architecture is shown in Figure 7. Not all components shown in this figure were modeled. The modeling criteria and assumptions for the ATCS are given below.

- The ATCS model consists of five fault trees that represent different functions of the ATCS system. The overlying fault tree models the capability of the ATCS to remove heat from various components. This fault tree models the ATCS as a two string system with a primary loop and the secondary loop. The major components of the primary loop include: a refrigerant tank (accumulator) and a single coolant circulation pump. The major components of the secondary loop include; a refrigerant tank (accumulator) and two coolant circulation pumps. Electric power to the pumps is provided by EPS and pump control signals are from the Avionics System. Four radiators, which are common to each loop, provide heat rejection. Heat rejection is assumed to be successful if two of the four radiators are functional.
- Each of the other ATCS fault trees model CM or SM temperature control or moisture control. The overlying fault tree provides coolant flow to each of these fault trees.
  - Cabin cooling including a primary and secondary heat exchanger with control signals from the Avionics System.
  - Cabin moisture control including primary and secondary evaporators with control signals from the Avionics System.
  - CM electronic equipment temperature control including a cold plate with control signals from the Avionics System.
  - SM electronic equipment temperature control including a cold plate with control signals from the Avionics System.

  The cabin temperature and moisture control are associated with the ECLSS system and the electronic equipment temperature control is associated with the Avionics System.
- The following failure criteria are assumed for Loss of Mission;
  - Loss of a single cooling loop
  - Loss of radiator cooling to either loop
- The following failure criteria are assumed for Loss of Crew
  - Loss of both cooling loops

- No heat sink available (loss of more than 2 radiators)
- Loss of the evaporative heat sink (the only heat sink following SM separation)
- Refrigerant tank rupture

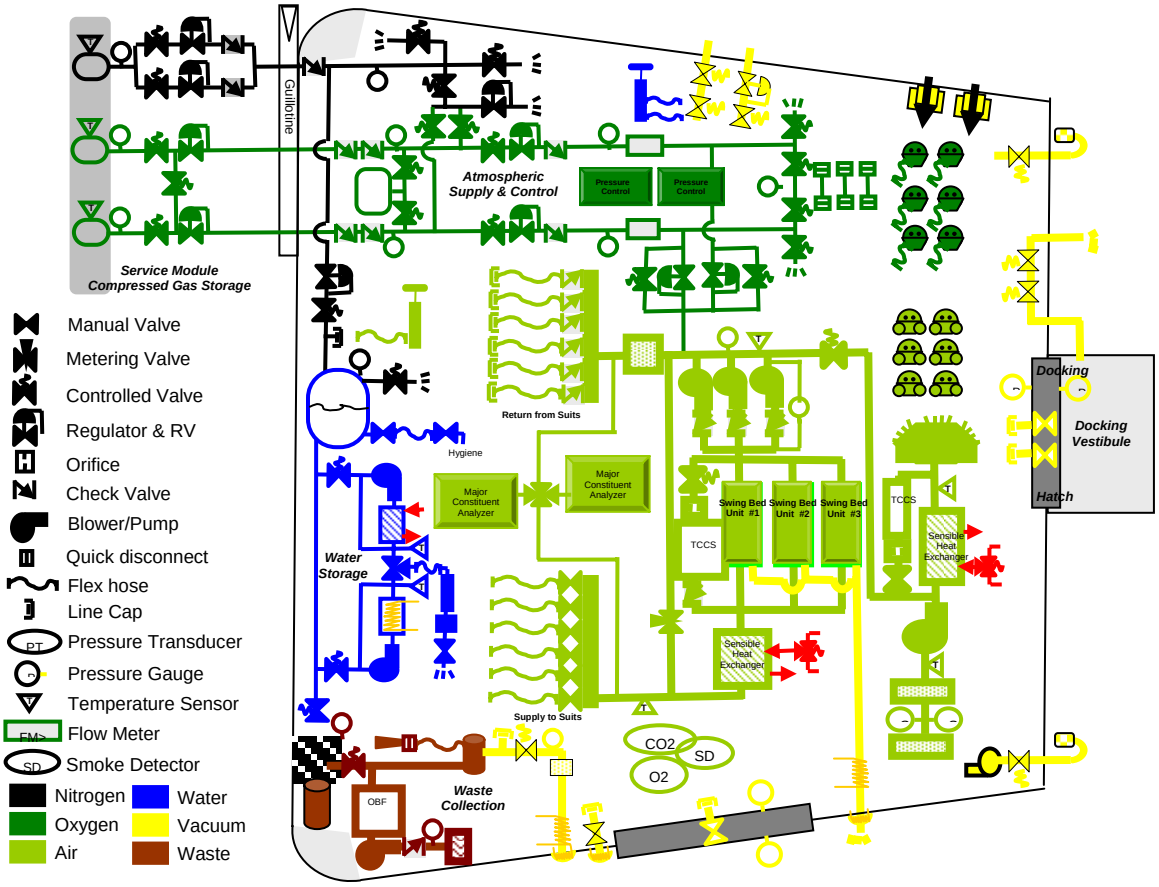


• Figure 7. CEV Reference Design ATCS

- Loss of cooling following SM separation (Phase 7) leads to LOC.
- Common cause failures are considered among the same component types.

Environmental Control and Life Support System (ECLSS)

The evaluation of the ECLS System used in this model draws upon on the evaluation contained in "Evaluation of SRD Reliability/Probability/Statistics Requirement," TDS20Report (dated March 2006). As such, detailed fault trees are not currently incorporated into the CEV PRA. Instead, the ECLSS is modeled via a single phase-specific basic event. A representation of the ECLS System is shown in Figure 8.



• Figure 8. Representation of the ECLS System

- The following ECLS systems are not included in the model:
  - Air lock (no air lock on CEV)
  - Seats/Restraints
  - Waste Collection System
  - Galley
  - Instrumentation and Sensors
- The following ECLS systems are included in the TDS20 model:
  - ECLS O_2 System including two redundant O_2 tanks, and storage and distribution system
  - ECLS N_2 System including two redundant N_2 tanks, and storage and distribution system
  - Atmosphere temperature/humidity control system
  - Atmosphere containment control system
  - Atmosphere control system
  - EVA umbilical system

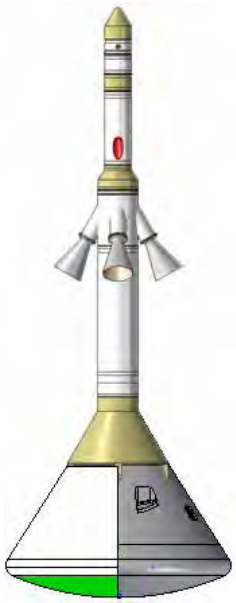
  - Water management /storage system
  - Fire suppression system
- The following failure criteria were assumed for Loss of Mission
  - Loss of Cabin Air Heat Exchanger
  - Loss of humidity control
  - Loss of Both Cabin Fans
  - Loss of use of either oxygen storage tanks or distribution systems
  - Loss of use of either nitrogen storage tanks or distribution system
  - Cabin leak
  - Loss of 2 of 3 CO2 removal beds
  - Loss of 2 of 3 fans associated with CO2 removal
  - Loss of Positive Pressure Relief (Depress Cabin)
  - Loss of Negative Pressure Relief (Depress Cabin)
  - Loss of PCA
- The following failure criteria were assumed for Loss of Crew
  - Pressurized Tank rupture (Oxygen / Nitrogen)
  - Loss of Cabin Fans and Liquid Cooled Garment
  - Oxygen leak resulting in fire
  - Loss of 3 of 3 CO2 removal beds
  - Loss of 3 of 3 fans associated with CO2 removal
  - Loss of oxygen accumulator for post SM separation
  - Loss of PCA and failure to manually control valves
- Assumed manual override available for Positive Pressure Relief and Negative Pressure Relief.
- Loss of Cabin pressure and failure of pressurized suit is considered to be insignificant compared to other failures.
- Loss of Cabin pressure and failure of the negative pressure relief is considered to be insignificant compared to other failures.
- Positive Pressure Relief and Negative Pressure Relief are designed similar to Shuttle. There is isolation capability for positive pressure relief and there is a cap on the negative pressure relief.
- Cabin leaks large enough to depressurize the cabin before the crew is able to respond and don protective equipment are assumed to be the result of structural failure, MMOD, over pressurization, or explosion and are not considered part of this system failure.
- The probability of a cabin leak is assumed to be higher than the probability of structural failure.
- For the evaporator, it is assumed that there is a diverse back-up fluid supply.
- Water management issues lead to loss of mission but it is considered to be insignificant compared to other failures because of ground monitoring and crew monitoring.
- Loss of use of the Oxygen Storage and Nitrogen Storage is assumed to be dominated by system leak, which include tank and piping leaks.
- Mission phases that were less than or equal to 1 hour were considered insignificant compared to other phases with respect to ECLSS and were not calculated unless there is a demand associated with the phase.

Landing System

The model for the landing systems considers both water and ground landings. The water landing portion of the fault tree model is activated via a house flag event.

- The landing system model includes the parachutes, airbag, and pyrotechnic devices for heat shield jettison, drogue and main chute deployment, and capsule up-righting airbag deployment for water landings.
- Parachute failure is assumed when two of three parachutes fail.
- The landing system is used in Phase 8 (explicitly) and in conjunction with the LAS during sequences involving aborts during Phase 1. During other phases, the landing system is required following failures that require the crew to return to Earth.
- During Phase 8 landing, the model includes CM failure, crew recovery failure (search and rescue), and landing system failure.
- Successful operation of the parachutes and other drag inducing systems during atmospheric decent will result is a safe landing for both a nominal and Emergency Ballistic entry of the CM.

Launch Abort System (LAS)



- The Launch Abort System is modeled after a reliability evaluation conducted as part the Smart Buyer effort from MSFC[3] and is considered during four periods in Phase 1:
    - Launch (pad abort)
    - First Stage Burn of the CLV
    - Second Stage Burn of the CLV
    - Low Earth Orbit (LEO) insertion

  The phase-dependent applicability for each of the LAS basic events are listed in Table 3. The full list of basic events for the PRA can be found in Appendix B.
- The LAS model for Launch abort includes:
    - Preoperational failures involving static discharge and lightning strikes
    - Premature LAS ignition
    - Structural failures of the motor case, tower and thermal shield
    - Failure of separation between the LAS and CM
    - LAS motor failures involving electrical, sensors, actuation and ignition
    - CM shield thermal failure
    - LAS initiation signal failure involving auto initiation; signal delay; range safety; initiation circuitry, computer and software; electrometric disturbances including lightning; and crew initiation
    - Motor performance failures.
- The LAS model for abort during the First Stage Burn includes the same events for the Launch abort LAS model except preoperational failures and includes an additional event due to a lightning strike.

- The LAS model for abort during the Second Stage Burn includes the same events during the First Stage Burn abort LAS model except events for electrometric disturbances including lightning are not considered for LAS initiation signal failure.
- The LAS model for abort during the Earth Orbit Insertion (EOI) includes the same events during the Second Stage Burn abort LAS model.

- Table 3. Sub-Phase Applicability for LAS Basic Events from Launch through LEO Insertion.

Basic Event Name	Event Description	Applicable?			
		Launch	1st To 2nd STAGE	2nd STAGE	LEO Insertion
LAS-SMS-CASE-OR-NOZZLE	Motor case or nozzle burn through or structural failure in first 2 sec	x	x	x	x
LAS-SMS-INSULATION	Insulation or TPS ablation causes shield thermal failure	x	x	x	x
LAS-SMS-LIGHTENING	Lightening (direct strike) causes premature operation	x	x		
LAS-SMS-MELTTHROUGH	Slag or hot debris causes shield melt through	x	x	x	x
LAS-SMS-MOTOR-ARMING	Both A and B PIC circuits report false arming	x	x	x	x
LAS-SMS-MOTOR-BKNO3	BKNO3 ignition delay or failure	x	x	x	x
LAS-SMS-MOTOR-CONNECT	Loose corroded or otherwise fault connection	x	x	x	x
LAS-SMS-MOTOR-IGNITER	Initiator igniter ignition delay or failure	x	x	x	x
LAS-SMS-MOTOR-MAIN	Main motor ignition delay or failure	x	x	x	x
LAS-SMS-MOTOR-MISWIRED	Miswired motor	x	x	x	x
LAS-SMS-MOTOR-SENSOR	Faulty sensor	x	x	x	x
LAS-SMS-MOTOR-SII	SII delay failure	x	x	x	x
LAS-SMS-MOTOR-SOFTWARE	Faulty software	x	x	x	x
LAS-SMS-MOTOR-WIRE	Wire damaged due to handling of flight dynamics	x	x	x	x
LAS-SMS-OP-ASYMMETRIC	Nozzle structural failure resulting in asymmetric thrust	x	x	x	x
LAS-SMS-OP-ATTITUDE	Vehicle in Wrong Abort Attitude		x	x	x
LAS-SMS-OP-GASLEAK	Hot gas leakage through inability to contain	x	x	x	x
LAS-SMS-OP-HIGHDYPRESS	Dynamic Pressure too High		x		
LAS-SMS-OP-HIGHRATE	Propellant burn rate too high (contamination)	x	x	x	x
LAS-SMS-OP-JOINT	Case or case component joint leak or burn through	x	x	x	x
LAS-SMS-OP-LOWBURN	Propellant energy or burn rate too low (contamination)	x	x	x	x
LAS-SMS-OP-NOZZLE	Nozzle failure resulting in loss of pressure or expansion ratio	x	x	x	x
LAS-SMS-OP-NOZZLELEAK	Nozzle internal joint leak	x	x	x	x
LAS-SMS-OP-PROSTRUCT	Main propellant grain inhibitor or bond structural failure	x	x	x	x
LAS-SMS-OP-ROLLRATE	Roll Rate Too High		x	x	x
LAS-SMS-PREIGN-MOTOR	Motor ignition (non-ignition string)	x	x	x	x
LAS-SMS-PREIGN-PIC	PIC failure in conjunction with spurious ignition signal to ignition string	x	x	x	x

Basic Event Name	Event Description	Applicable?			
		Launch	1st To 2nd STAGE	2nd STAGE	LEO Insertion
LAS-SMS-SEP-FORCE	Inadequate separation force	x	x	x	x
LAS-SMS-SEP-INFER	Component interference or snagging	x	x	x	x
LAS-SMS-SEP-PYRO	Pryo separation system failure (shaped charge explosion attachments)	x	x	x	x
LAS-SMS-SEP-VLOCK	Vacuum lock between modules	x	x	x	
LAS-SMS-SIG-AUTO	Signal auto initiated	x	x	x	x
LAS-SMS-SIG-BATT	Battery failure or low/loss of power	x	x	x	x
LAS-SMS-SIG-COMP	Faulty computer hardware	x	x	x	x
LAS-SMS-SIG-CREW-DELAY	Crew delayed in initiating abort	x	x	x	x
LAS-SMS-SIG-DISABLED	Auto-initiated abort disabled by crew or ground crew	x	x	x	x
LAS-SMS-SIG-ENVIRON	Environmental or background (RF EMI and ESD)	x	x		
LAS-SMS-SIG-LATE	Signal too late for successful abort	x	x	x	x
LAS-SMS-SIG-LIGHTENING	Lightening hit causes signal	x	x		
LAS-SMS-SIG-LOGIC	Faulty assessment of sensor voting logic	x	x	x	x
LAS-SMS-SIG-RANGE	Range safety signal initiated	x	x	x	x
LAS-SMS-SIG-SENSOR	Faulty sensor	x	x	x	x
LAS-SMS-SIG-SOFTWARE	Faulty software	x	x	x	x
LAS-SMS-SIG-WIRING	Faulty wiring or connection	x	x	x	x
LAS-SMS-STAB-CONTROL	Loss of RCS control function	x	x	x	x
LAS-SMS-STAB-PROPELLANT	Inadequate amount of RCS propellant	x	x	x	x
LAS-SMS-STAB-RCSCONTROL	Loss of RCS control	x	x	x	x
LAS-SMS-STAB-RCSTHRUST	Inadequate RCS thrust	x	x	x	x
LAS-SMS-STAB-STRUCT	Structural loading failure	x	x	x	x
LAS-SMS-STAB-THERMAL	Thermal failure from aero heating of LAS blast	x	x	x	x
LAS-SMS-STATIC	Static discharge causes premature operation	x			
LAS-SMS-STRUCT-THERMAL	Thermal weakening leading to structural failure	x	x	x	x
LAS-SMS-STRUCT-TOWER	Structural tower or attachments	x	x	x	x
LAS-SMS-STRUCTCM	Structural shield failure exposes CM	x	x	x	x
LAS-SMS-TERM-BATTERY	Battery failure or low / loss of power	x	x	x	x
LAS-SMS-TERM-INTERFER	Interference or shagging causing non-separation or out of control movement on CM	x	x	x	x
LAS-SMS-TERM-PYROSIGNAL	Pyro unit gets signal but fails to successfully fire	x	x	x	x
LAS-SMS-TERM-VACUUM	Vacuum holds components together	x	x		
LAS-SMS-TERM-WIRING	Wiring continuity	x	x	x	x
LAS-SMS-TIME-LOWTHRUST	Too low thrust to escape upset condition	x	x	x	x
LAS-SMS-TIME-MOTOR	Motor ignites but fails to complete thrust profile	x	x	x	x
LAS-SMS-TIME-WEIGHT	Over weight CM	x	x	x	x

Other Modeling Information

Basic event: LSAM-LSAM-FTO

For modeling failure to accomplish an activity, Bayesian PRA methods typically model the number of failures (or successes, if in availability space) in a specified number of trials as binomial. The parameter of interest in this model is **p**, the probability of failing to accomplish the activity. In this case, the likelihood function is the binomial distribution:

$$f(x \mid p) = \binom{n}{x} p^x (1-p)^{n-x}, \quad x = 0,1,\ldots,n.$$

The conjugate prior is a beta distribution, where the posterior distribution is also a beta distribution, with parameters α + x and β + n – x, where x is the number of failures and n is the number of trials. The mean of a beta distribution is the first parameter divided by the sum of the two parameters, so the posterior mean is

$$E(p) = \frac{\alpha + x}{\beta + n}.$$

To model lunar surface activities, we note that NASA has had 6 successful lunar missions out of 6 trials. Prior to collecting this information, estimates may have been made as to the success (or failure) probability. However, for our calculation, we did not collect information related to this estimate. Instead, we will assume that a Jeffreys noninformative prior represents this state of knowledge.

The Jeffreys noninformative prior is a beta distribution with both parameters equal to 0.5. Therefore, the posterior distribution will be beta(x + 0,5, n – x + 0.5). The posterior mean is then (x + 0.5)/(n + 1). Using our six trials, we can estimate the probability of a failure during the lunar activities as:

Posterior: P(failure during lunar activities) => beta(0.5, 6.5)

E[P(failure during lunar activities)] = 0.5/7 = 0.07

In the SAPHIRE CEV PRA model, the failure probability during lunar activities was set to a mean of 0.07 and the uncertainty was assigned to a beta distribution with β = 6.5.

Basic event: CEV-CREW-SOLAREVENT-LOC

To model a possible lethal radiation dose to the crew due to solar particle event during the lunar sortie mission, we used available NASA information related to these types of events. The report “Biological Response to SPE Exposures” by Wilson et al (1998)

contained probabilistic information useful in a PRA context. Within this report, two items related to solar events were discussed:

> *"…not exceeding the August 1972 event [potentially lethal] fluence level above 30 MeV on a one year mission near the next solar maximum is about 97 percent."*
>
> *"The risk of death in the pressure vessel is about 88 percent unless good medical practice is followed in which the risk is reduced to 9 percent."*

From this probabilistic information, we can estimate the probability that the crew experiences a lethal solar event during the lunar sortie mission using:

P(significant solar particle event | 1 year) = 1 – 0.97 = 0.03

P(death | medical treatment and inside vessel) = 0.09

Mission exposure fraction = 470 hr / 8760 hrs/year = 0.054

Consequently, assuming that good medical practices are followed and the crew will be inside the CEV during the event, the probability of the lethal event is:

P(death | solar particle event) = 0.03 * 0.09 * 0.054 = 1.5E-4 per mission

While no uncertainties are discussed in the Wilson et al (1998) report, we assume that the overall 1.5E-4 probability represents a mean value for this event.

Basic event: CEV-CREW-SOLAREVENT-LOM

To model a potentially disabling, but non-lethal, solar event during the lunar sortie mission, we again used the Wilson et al (1998) report and the following information:

P(significant solar particle event | 1 year) = 0.03

P(death | medical treatment and inside vessel) = 0.09

P(no death | medical treatment and inside vessel) = 1 – 0.09 = 0.91

Mission exposure fraction = 470 hr / 8760 hrs/year = 0.054

Consequently, assuming that good medical practices are followed and the crew will be inside the CEV during the event, the probability of the non-lethal event is:

P(no death | solar particle event) = 0.03 * 0.91 * 0.054 = 1.5E-3 per mission

While no uncertainties are discussed in the Wilson et al (1998) report, we assume that the overall 1.5E-3 probability represents a mean value for this event.

Common Cause Failure Modeling

For the redundant components in the CEV PRA, we modeled the probability of experiencing a common cause failure using the Multiple Greek Letter method. The Multiple Greek Letter method is an example of parametric common cause failure modeling that is an extension of the Beta Factor method. This method (as compared to the Beta Factor method) is used to explicitly account for higher order redundancies and to allow for common cause subgroups.

To illustrate the Multiple Greek Letter method used in the CEV PRA, the probability that a group of three components fail at the same time (due to independent failures, a common cause failure, or a combination of both) is

$$Q_{group} = Q_1^3 + 3Q_2Q_1 + Q_3$$

where Q_1, Q_2, and Q_3 are the probability that only one, two, or three components fail at the same time, respectively.

For the Multiple Greek Letter method, the Q values are defined as

$$Q_1 = (1 - \beta)Q_t$$
$$Q_2 = \frac{1}{2}\beta(1 - \gamma)Q_t$$
$$Q_3 = \beta\gamma Q_t$$

where β and γ are conditional probabilities of failure and Q_t is the total failure probability for a single component.

To represent the common cause failure terms, we used the Multiple Greek Letter module built into the software. This module requires as inputs the basic events representing the redundant components, the failure criteria, and the Multiple Greek Letter parameters. SAPHIRE then uses these inputs to calculate the probability of the common cause event. During sensitivity calculations, when one of the redundant components are failed (via a TRUE house event) SAPHIRE will automatically adjust the common cause failure probability to reflect the conditional probability that the remaining redundant components also fail. This automatic probability adjustment is reflected in some of the trade studies described later in this report.

3. Results

The overall results of the PRA indicate that the mean probability of LOC is 0.017 for a nominal mission with a 5% and 95% uncertainty of 0.000046 and 0.071, respectively. The mean probability of LOM is 0.12 for a nominal mission with a 5% and 95% uncertainty of 0.00037 and 0.48, respectively. The overall mission probability and uncertainty for LOC and LOM are shown in Figure 9.

These results are comparable to the results of the ESAS Study that estimated the probability of LOC as 0.041 and the probability of LOM as 0.074. This comparability is expected since this model used data derived from the ESAS Study for non-CEV related vehicles and operations. The similarity in quantitative results indicate that at this stage in the design with preliminary system models and data based on past space systems, the estimates of the probability of these FOMs are within these ranges. Note that estimating the probability of these FOMs is not the primary purpose of this study. The purpose of this study is to gain insight into the relative contributions that the mission phases, operations and systems have on the overall mission in order to evaluate both operational and physical design options and affect improvements.

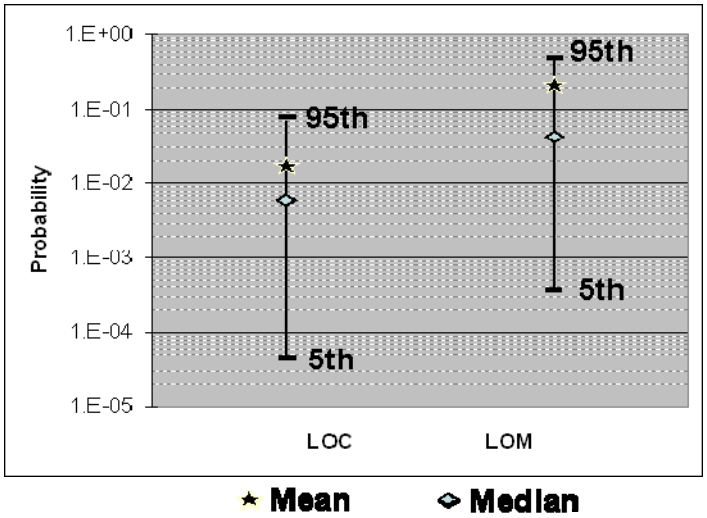
The mean probabilities of LOC and LOM for each mission phase are shown in Figures 10 and 11. The mean probability LOC and LOM with 5%, 50% and 95% uncertainty values for each mission phase is given in Table 4. It should be noted that following the completion of Phase 5, *Lunar Mission*; the analysis assumes that the mission is complete and only LOC is considered.

The cumulative mean probabilities for LOC and LOM are shown in Figures 12 and 13. The relative contribution to LOC from each phase is shown in Figure 14 and to LOM for each mission phase is shown in Figure 15. The mission phases with the largest contribution to mission LOC mean failure probability are:

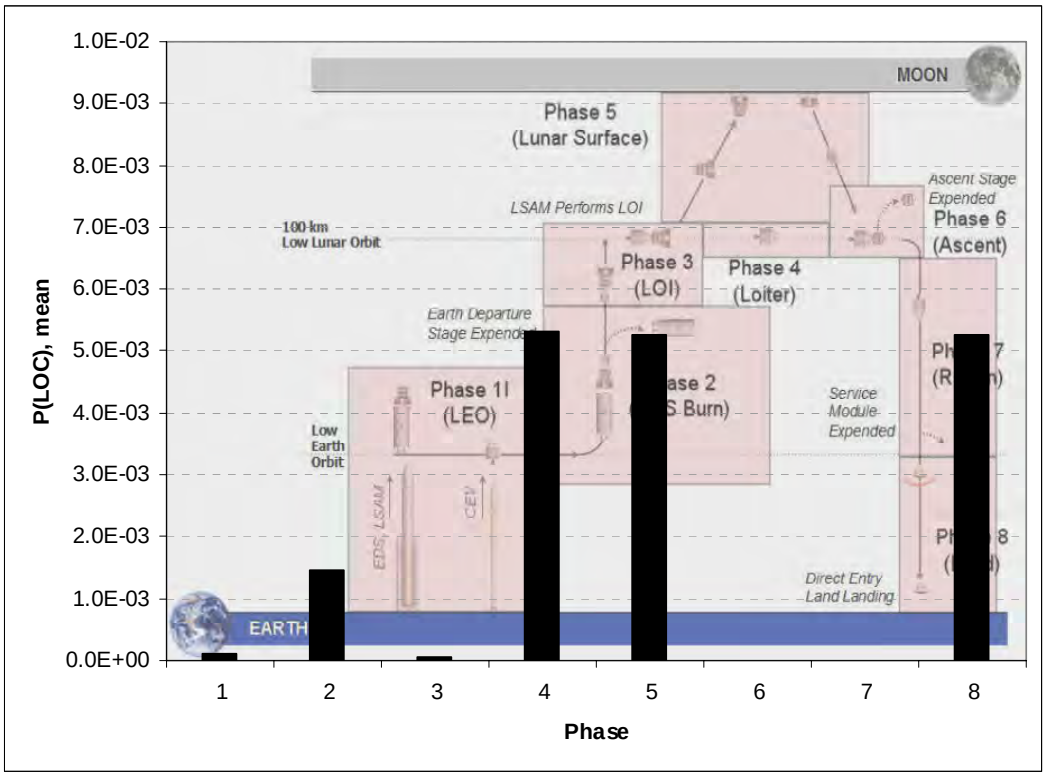
- Phase 4, *CEV in Lunar Orbit*: 5E-03 (30%)
- Phase 8, *Earth Landing*: 5E-03 (30%)
- Phase 5, *Lunar Mission*: 5E-03 (30%)
- Phase 2, *Rendezvous of the CaLV and CEV*: 1E-03 (8%)

The mission phases with the largest contribution to mission LOM mean failure probability are:

- Phase 5, *Lunar Mission*: 4E-02 (35%)
- Phase 1, *Two Launches to Low Earth Orbit (LEO)*: 4E-02 (34%)
- Phase 2, *Rendezvous of the CaLV and CEV*: 3E-02 (21%)
- Phase 4, *CEV in Lunar Orbit*: 8E-03 (6%)



- Figure 9. Overall Mission Probability and Uncertainty for LOC and LOM



• Figure 10. Mean Probability of LOC per Mission Phase

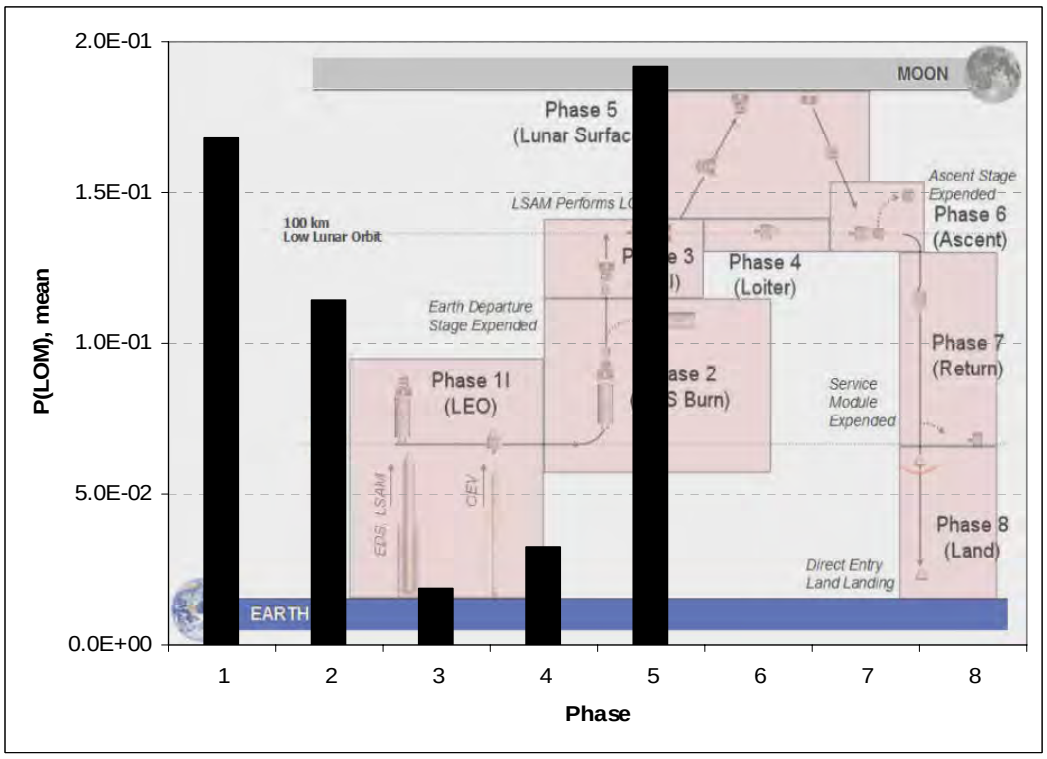


Figure 11. Mean Probability of LOM per Mission Phase

• Table 4. Probability of LOC and LOM for each Mission Phase (rounded to one significant digit)

Phase	LOC (probability)				LOM (probability)			
	5th	50th	mean	95th	5th	50th	mean	95th
1	2.E-07	3.E-05	1.E-04	4.E-04	1.E-04	1.E-02	4.E-02	2.E-01
2	3.E-06	4.E-04	1.E-03	6.E-03	5.E-05	7.E-03	3.E-02	1.E-01
3	2.E-08	6.E-06	5.E-05	2.E-04	9.E-06	1.E-03	4.E-03	2.E-02
4	5.E-06	9.E-04	5.E-03	2.E-02	2.E-05	3.E-03	8.E-03	3.E-02
5	2.E-06	8.E-04	5.E-03	2.E-02	6.E-05	8.E-03	4.E-02	2.E-01
6	4.E-09	1.E-06	1.E-05	5.E-05	na	na	na	na
7	4.E-09	8.E-07	7.E-06	3.E-05	na	na	na	na
8	1.E-05	2.E-03	5.E-03	2.E-02	na	na	na	na

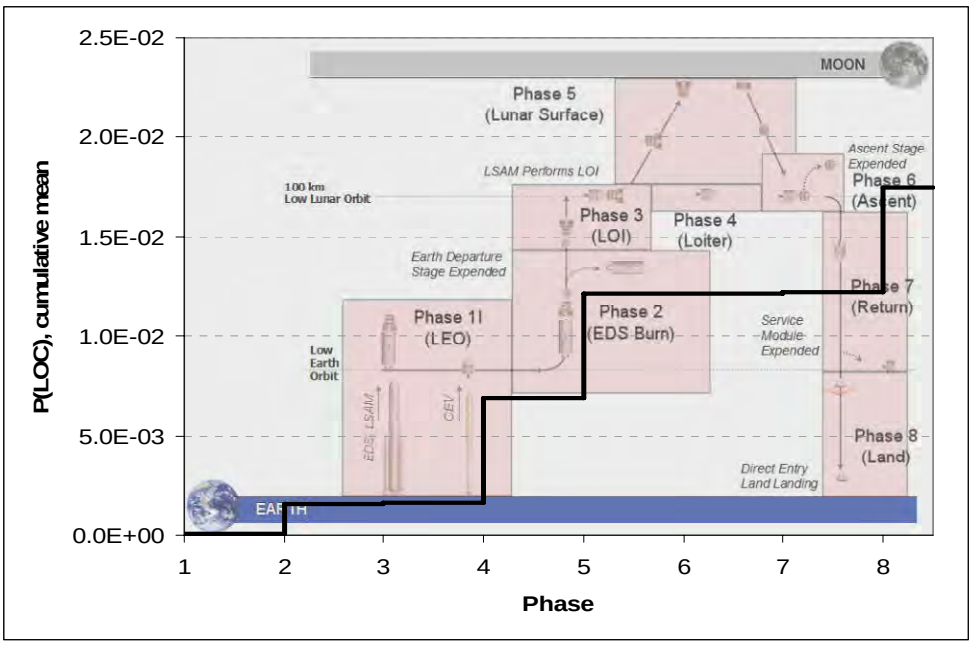
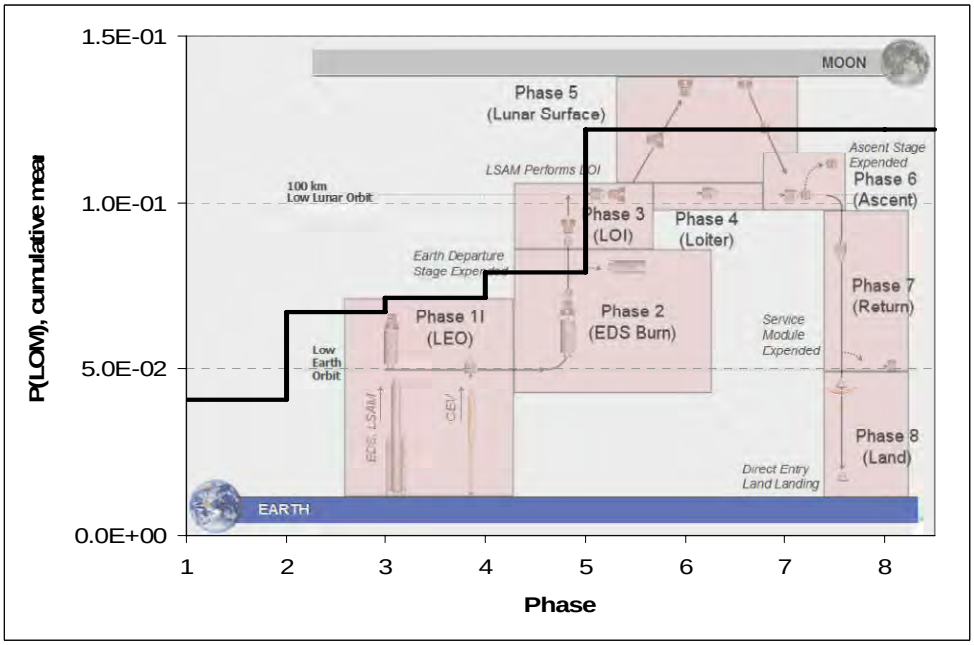
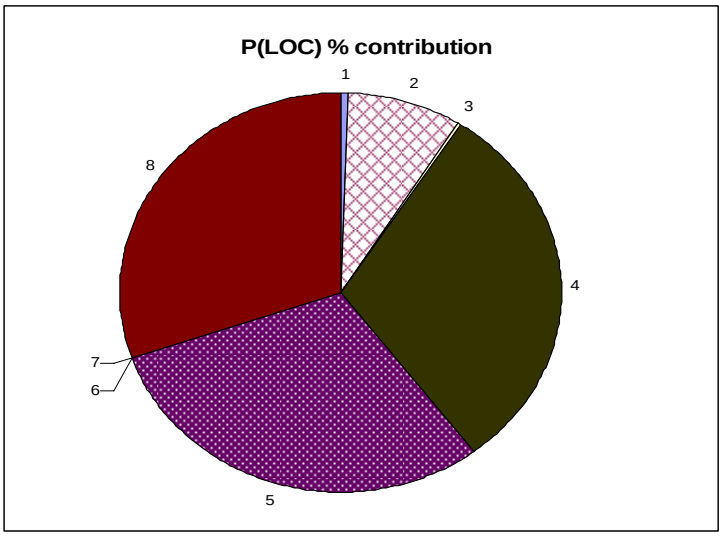


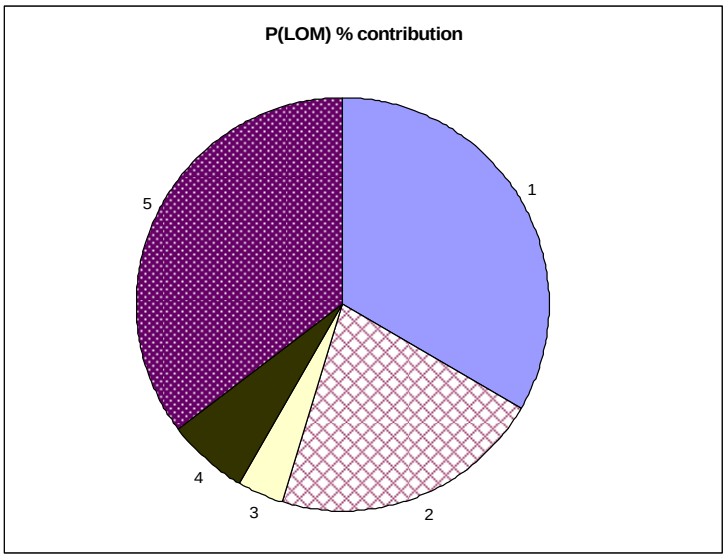
Figure 12. Cumulative Mean Probability of LOC



• Figure 13. Cumulative Mean Probability of LOM



• Figure 14. Relative Contribution to the Mean Probability LOC from each Phase



- Figure 15. Relative Contribution to the Mean Probability LOM from each Phase

3.1. Dominant Risk Contributors

The fault trees were evaluated to identify the combination of failures (cut sets) that could lead to the LOC and LOM outcomes. The failure combinations with the largest probability are identified as the dominant contributors to LOC or LOM. A list of the dominant contributors (cut sets) by mission phase are included in Appendix C.

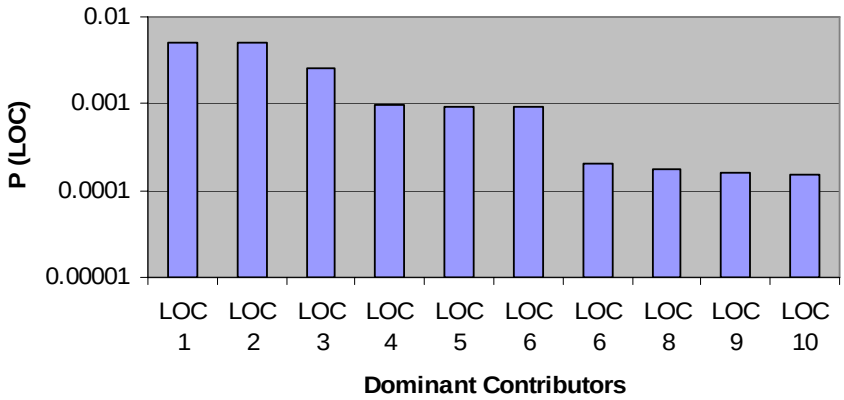
The dominant contributors to LOC for the overall mission are given below and shown in Figure 16. These contributors account for about 86% of the overall mean probability of LOC.

LOC 1 During Phase 5 LSAM fails on ascent from lunar surface (5.1E-003)
LOC 2 During Phase 4 (CEV in lunar orbit) the CEV fails to stay in Lunar orbit and the crew fails to recover the CEV upon return from the Lunar surface (P=5.0E-03)
LOC 3 During Phase 8 (Earth Landing) failure to recover the crew (search and rescue) after landing (P=2.6E-03)
LOC 4 During Phase 8 (Earth Landing) common cause failure of 2 parachutes (out of 3) during deployment (P=9.8E-04)
LOC 5 During Phase 8 (Earth Landing) the CM RCS fails to provide correct attitude and spin (P=9.0E-04)
LOC 6 During Phase 2 (Rendezvous of the CaLV and CEV) failure of the SM RCS results in failure of catastrophic rendezvous and docking (P=9.0E-04)
LOC 7 During Phase 8 (Earth Landing) a common cause failure of Avionics System results in failure to provide an arming signal for the Main Parachutes (P=2.0E-04)

LOC 8 During Phase 4 (CEV in lunar orbit) a common cause failure of the SM EPS power generation Solar array subsystem and the crew fails to recover the CEV upon return from the Lunar surface (P=1.8E-04)

LOC 9 During Phase 2 (Rendezvous of the CaLV and CEV) a common cause failure of the SM EPS power generation Solar Array subsystem (P=1.6E-04)

LOC 10 During Phase 2 (Rendezvous of the CaLV and CEV) Lethal dose to crew due to solar particle event (P=1.5E-04)



• Figure 16. Dominant Contributors to Overall Mission LOC

The dominant contributors to LOM for the overall mission are given below and shown in Figure 17. These contributors account for about 82% of the overall mean probability of LOM.

LOM 1 During Phase 5 (Lunar Mission) unspecified failures occur and the crew fails to recover from those failures (P=3.5E-02)

LOM 2 During Phase 1 (Two launches to Low Earth Orbit [LEO]) EDS fails to loiter in LEO (P=1.0E-02)

LOM 3 During Phase 1 (Two launches to Low Earth Orbit [LEO]) LSAM fails to loiter in LEO (P=1.0E-02)

LOM 4 During Phase 2 (Rendezvous of the CaLV and CEV) the EDS, LSAM, and CEV TLI burn fails (P=1.0E-02)

LOM 5 During Phase 2 (Rendezvous of the CaLV and CEV) the EDS, LSAM, and CEV TLI mid-course correction burn fails (P=1.0E-02)

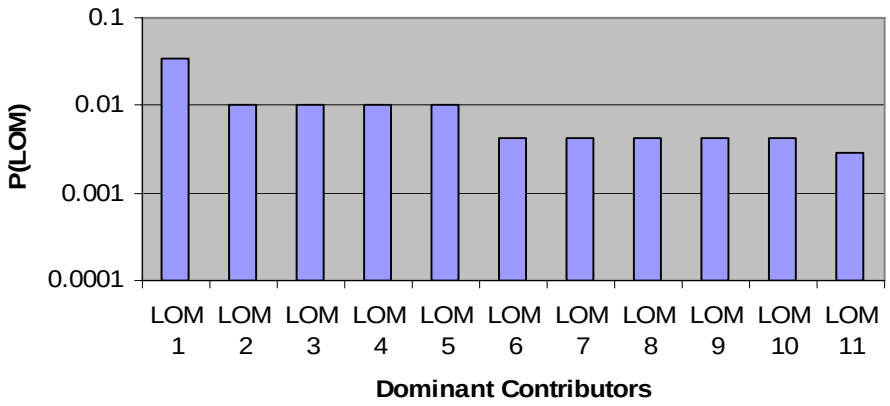
LOM 6 During Phase 1 (Two launches to Low Earth Orbit [LEO]) the CaLV third stage ascent fails (P=4.2E-03)

LOM 7 During Phase 1 (Two launches to Low Earth Orbit [LEO]) the CaLV third stage shutdown/orbital insertion (EOI) fails (P=4.2E-03)

LOM 8 During Phase 1 (Two launches to Low Earth Orbit [LEO]) the CaLV first stage ascent fails (P=4.2E-03)

LOM 9 During Phase 1 (Two launches to Low Earth Orbit [LEO]) the CaLV first stage (% SSMEs) fail to launch (P=4.2E-03)

LOM 10 During Phase 1 (Two launches to Low Earth Orbit [LEO]) the CaLV second stage ascent fails (P=4.2E-03)
LOM 11 During Phase 5 (Lunar Mission) there is no input to CEV from external communications (P=2.9E-03)



• Figure 17. Dominant Contributors to Overall Mission LOM

3.2. Importance Measure Results

Importance measures were developed for both the LOC and LOM outcome results based on the fault tree evaluation results. These importance measures are included in Appendix D and E. One of these measures was examined for each outcome to identify potential trade or sensitivity studies to be performed: Risk Reduction Ratio (RRR). The results of this evaluation are below.

RRR for LOC

The top seven events in order of importance based on RRR for LOC are:

- Failure to recover the crew given CEV failure in lunar loiter
- CEV fails to stay in LOI (coast)
- Failure of LSAM ascent stage
- Crew recovery fails after landing
- CCF of parachute 1, 2, or 3 during deployment
- Failure of CEV (SM) mid-course correction
- Failure mid-course correction recovery using CM RCS

The event “CCF of parachute 1, 2, or 3 during deployment” represents a common cause failure of the parachutes. It was chosen for both a trade and sensitivity study.

RRR for LOM

The event with the largest RRR is "Landing-system-works". This event is in the fault tree models to apportion the likelihood between LOM and LOC outcomes and is quantified by taking the complement of the likelihood of failure of the landing system. Because it showed up as the top RRR importance measure, a sensitivity study was done on its likelihood.

The second highest RRR is "Recovery actions fail during lunar landing surface activities". This event represents the failure of the crew to recover the mission while on the moon.

3.3. Trade Studies

Several trade studies involving system design options were completed to assess their impact on the probability of LOC and LOM. The trade studies include:

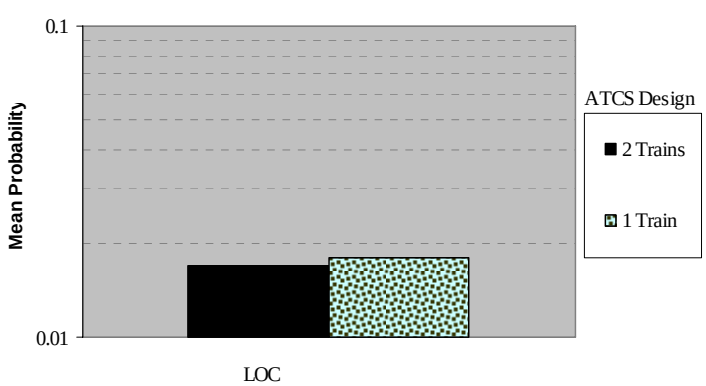
- Removal of one (of two) strings of the ATCS
- Removal of one (of three) strings of the EPS
- Removal of one (of three) strings of the Avionics System
- Removal of the Launch Abort System during Phase 1 (Launch to Low Earth Orbit)
- Changes in the landing parachutes success criteria on both LOC and LOM

The removal of a string in a multi-string system reflects the effects of potential design trades.

Removal of One ATCS String

The nominal ATCS is modeled with two redundant strings. Removing one ATCS string from the model simulates a CEV design with a single ATCS string. The comparison between a CEV with a single string ATCS and a two string ATCS is shown in Figure 18. As can be seen, there is a small effect on LOC (~5% increase) indicating that the single string ATCS is robust with respect to other contributors to overall mission LOC. With a one string ATCS, the dominant contributor to the mean probability of LOC are: CEV failures to stay in lunar orbit; failure to recover the crew after landing; and failure of the SM burn for return to Earth.

Under the model assumptions, LOM is not applicable. When LOC occurs from failure of the single ATCS string, a LOM also occurs. This result occurs because the model assumes that LOM results if one ATCS string (out of 2) fails.



• Figure 18. Comparison between One and Two String ATCS on Overall Mission LOC Mean Probability.

Removal of One EPS String and One Avionics String

The nominal Electric Power and Avionics Systems are modeled as three string systems with cross-ties among all strings. Removing one EPS string or one Avionic string from the model simulates a CEV design with a two string EPS or two string Avionics System. The assessment of this configuration shows there is little difference in the probability of LOC or LOM from its nominal value (< 1% increase in P(LOC) or P(LOM). A two string EPS or Avionics System is robust with respect to its contribution to these FOMs as compared to other contributors.

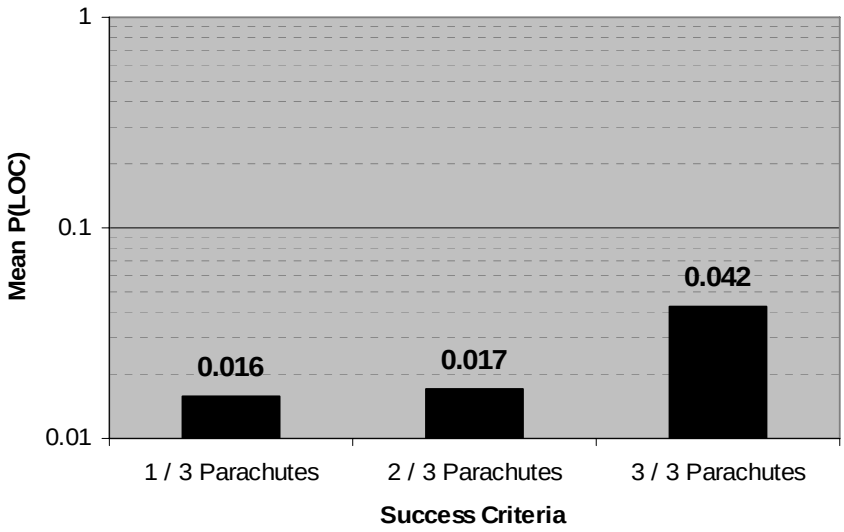
Removal of LAS

A trade study was performed that considered the removal of the LAS. This study is only pertinent to Phase 1, since the LAS is jettisoned prior to CEV injection into LEO. Assuming removal of the LAS increases the overall mission mean probability of LOC by a factor of about 2 (100%). This is a significant result. With the LAS, failures during Phase 1 leading to LOC contributes only about 0.6% to overall mission mean probability of LOC. Removal of the LAS results in increasing the mean probability of LOC for Phase 1 by a factor of about 170 and makes Phase 1 the dominant contributor to the overall mission P(LOC).

Changes in the Landing Parachutes Success Criteria

This trade study looks at the sensitivity of both the probability of LOC on the success criteria of the landing parachute system. The nominal success criterion is that two out the tree (2 / 3) parachutes must operate successfully to land the CM on the earth's surface without loss of crew. The trade study included changing the success criterion to a one out of three (1 / 3) parachutes and to a three out of three (3 / 3) parachutes that must operate successful to land the CM on the earth's surface without loss of crew. The results of the study are shown in Figure 19.

Inspection of Figure 19 shows that there is a small difference in the probability of LOC between assuming a one of three (1 / 3) and two of three (2 / 3) success criterion for the landing parachute system. However, there is a large difference in mean probability of LOC when assuming a three of three (3 / 3) success criterion, with an increase in the probability of LOC by a factor of about 2.5 over the two of three (2 / 3) criterion. This study indicate that the focus of future trades involving the landing parachute system should concentrate on the differences between the two out of three (2 / 3) and the three out of three (3 / 3) parachutes system as apposed to the differences between the one out three (1 / 3) and two out of three (2 / 3) parachute system.



• Figure 19. Comparison of the Sensitivity of the Probability of LOC to Landing Parachute Success Criterion

3.4. Sensitivity Studies

Sensitivity studies are performed to gain an understanding of how much the probability of LOC and LOM change with respect to changes in certain parameters or assumptions in the analysis. The sensitivity studies include:

- A decrease in the common cause factors (CCF) [beta, gamma] by a factor of two (to 0.05 and 0.25, respectively), a increase by a factor of two (to 0.2 and 1.0, respectively) and removal of the contribution of CCF events on both LOC and LOM
- Failures of one ATCS string during Phase 1 (Launch to Low Earth Orbit), Phase 4 (CEV in Lunar Orbit), and Phase 8 (Earth Landing)
- Failures of one EPS string during Phase 1 (Launch to Low Earth Orbit), Phase 4 (CEV in Lunar Orbit), and Phase 8 (Earth Landing)

- Failure of one Avionics string during Phase 1 (Launch to Low Earth Orbit), Phase 4 (CEV in Lunar Orbit), and Phase 8 (Earth Landing)
- Removal of LSAM events during Phase 5 on LOC
- Removal of LSAM, Lunar Loiter and Crew Recovery Events on LOC
- Removal of the CaLV contribution to LOM
- Removal of LSAM and CaLV events on LOM
- Credit for crew recovery actions for SM midcourse failures during Phase 7 (Return to Earth) on both LOC and LOM

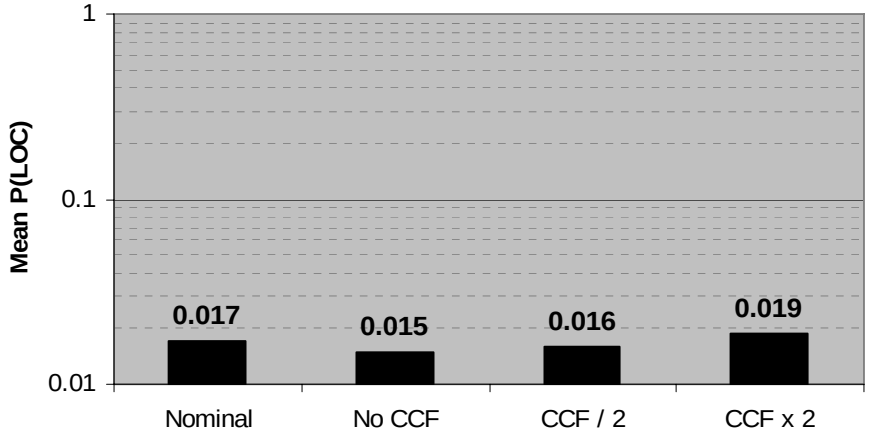
The failure of a string in a multi-string system gives an indication of the importance to the overall mission of the failure tolerance of that system.

Change in Common Cause Factors (CCF)

A sensitivity study was conducted to gain insight into the sensitivity of the FOMs to the common cause factors (CCF) (beta, gamma) used in the assessment. The study considered a reduction in the CCFs by a factor of two (to 0.05 and 0.25, respectively), an increase in the CCFs by a factor of two (to 0.2 and 1.0, respectively) and the removal of the contribution of CCF events on both LOC and LOM. The results of this sensitivity study are shown in Figure 20 for LOC.

Inspection of this figure indicates that the probability of LOC is not sensitive to the common cause factor used in the analysis. The probability of LOC changed from about -12% to +12%. The change in the CCFs had no effect on the probability of LOM.

The primary reason for this result is that both the probability of LOC and LOM are dominated by single failures. Additionally, several of these dominant contributors use ESAS data for a single event that represent several systems and failure modes. To gain additional insight, these collapsed events should be expanded, modeled and included in the overall analysis.



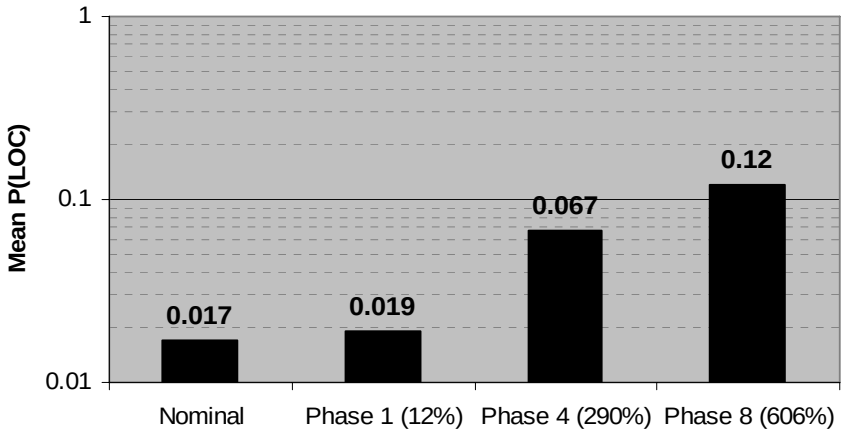
- Figure 20. Comparison of the Sensitivity of the Mission Probability of LOC to the CCF factors.

Failure of One ATCS String

A sensitivity study was conducted assuming the failure of one ATCS string during the three phases: Phase 1, *Launch to Low Earth Orbit*; Phase 4, *CEV in Lunar Orbit*; and Phase 8, *Earth Landing*. Since the ACTS is a two string system, this study provides operational insight concerning the importance to the overall mission probability LOC and LOM of the single failure tolerance requirement. A comparison of the change in probability of LOC from the failure of one ATCS for the three phases is shown in Figure 21.

If one ATCS string fails during Phase 1, there is a 12% increase in the probability of LOC from other failures including failure of the remaining ATCS string. For Phase 1, this would occur during abort, since failure of one ATCS string leads to LOM and requires a return of the crew. Following the failure of one ATCS string for Phase 4, the probability of LOC increases by a factor of about 4 (290%), and for Phase 8, by a factor of about 7 (606%).

These results reflect the conditional failure probability of the remaining ATCS string and operational events for these phases. Given a failure of one ATCS string, the conditional failure probability of the remaining string is represented by the common cause failures of the components in that string. The differences in the contribution for the different phases are primarily due to the operational differences during each phase. For Phase 1, failure of one ATCS string results in an abort where the remaining ATCS string need only continue to operate for a relatively short time and the probability of LOC reflects the operation of the LAS. In Phase 4, there is a relative long period (7 day) during which the remaining ATCS string must continue to operate. However, in this phase, credit is given for the crew to recover the CEV, which reduces the contribution of the failure of the remaining ATCS string. In Phase 8, failure of the remaining ATCS string leads directly to LOC without operation of the LAS or a crew recovery action.



• Figure 21. Comparison of the Failure of One ATCS String on Overall Mission Probability of LOC.

For the probability of LOM, failure of one ATCS string during Phase 1 and 4 leads directly to loss of mission, P(LOM)=1. This result occurs because the success criterion for ATCS, which reflects the design requirement, dictates that loss of one ATCS string leads to LOM and an immediate return of the crew. This result also provides a check on the model. Failure of one ATCS string during Phase 8 has no effect on LOM since the mission is assumed to be complete and LOM is not considered.

Failure of One EPS String and One Avionics String

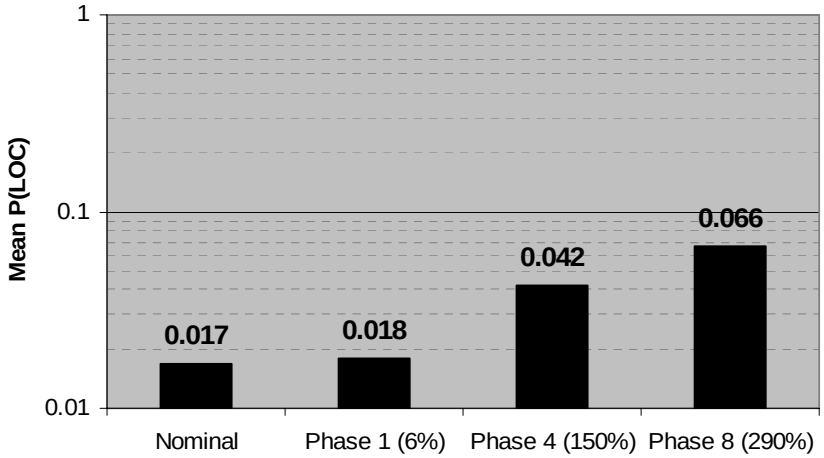
Two trade studies were conducted assuming the failure of one EPS string and one Avionics string during the three sequential phases: Phase 1, *Launch to Low Earth Orbit*; Phase 4, *CEV in Lunar Orbit*; and Phase 8, *Earth Landing*. Since these systems have three redundant strings, these trade studies provide insight concerning the importance to the overall mission probability of LOC and LOM of the two failure tolerance requirement.

A comparison of the change in the probability of LOC from the failure of one EPS string for the three phases is shown in Figure 22 and reflects the same dependence on operational events The failure of one EPS string does not have as big an impact as a failure of one ATCS string.

If one EPS string fails during Phase 1, there is a 6% increase in the probability of LOC and a negligible increase in the probability of LOM. Following the failure of one EPS string for Phase 4, the probability of LOC increases by a factor of about 2.5 (150%), and for Phase 8, by a factor of about 4 (290%).

Failure of one EPS string during Phase 1 has a negligible effect on the probability of LOM (<1%). For Phase 4, failure of one EPS string leads to an increase in the

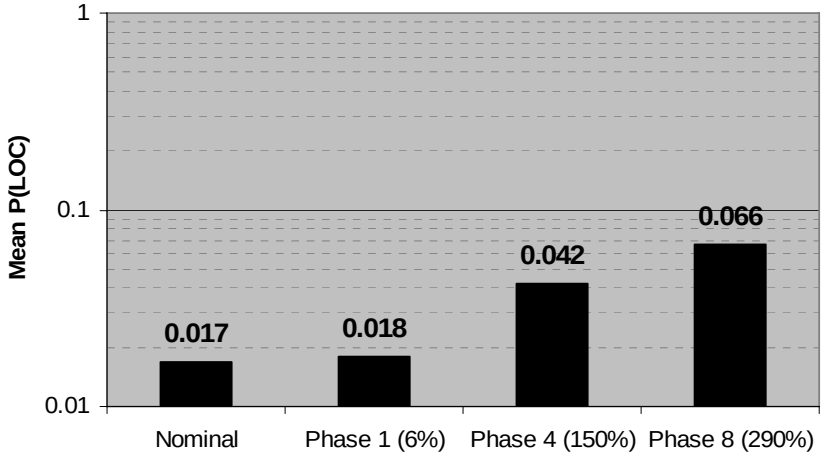
probability of LOM by a factor of about 2 (128%). Failure during Phase 8, there is no effect on LOM since the mission is assumed to be complete and LOM is not considered.



- Figure 22. Comparison of the Failure of One EPS String on Overall Mission Probability of LOC.

Assuming the failure of one Avionics string during the three phases: Phase 1, *Launch to Low Earth Orbit*; Phase 4, *CEV in Lunar Orbit*; and Phase 8, *Earth Landing*; has the same effect on the probability of LOC as the failure of one EPS string, as shown in Figure 23. The failure of one Avionic string also has the same effect on the probability of LOM as the failure of one EPS string.

These results occur because of the close coupling between the strings of EPS and Avionic System. The results also show the same conditional failure probability dependence on the remaining strings and operational dependence during the phases as was shown for the ATCS. However, since both the EPS and Avionic System have three strings, as compared to the two string ATCS, their impact on the probability of LOC and LOM significantly reduced.

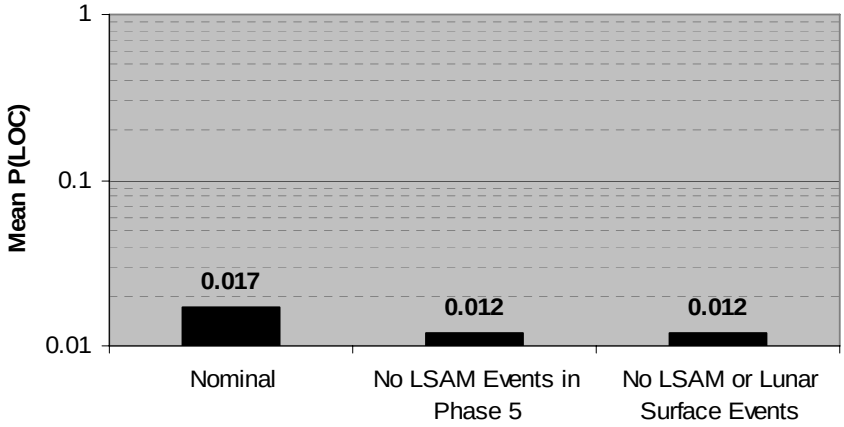


- Figure 23. Comparison of the Failure of One Avionics String on Overall Mission Probability of LOC.

Sensitivity of the Probability of LOC from the Removal of LSAM and Lunar Surface Events

Two studies were conducted to gain insight into the sensitivity of the probability of LOC to; 1) the removal of LSAM events and 2) the removal of LSAM and Lunar Surface Events. The LSAM events are associated with Phase 5; LSAM descent, lunar landing, lunar mission operations, lunar launch, ascent and insertion into LLO. The lunar surface events include actions performed by the crew while on the lunar surface to recover from failures in LSAM and events associated with Phase 4, while the CEV is un-crewed loitering in lunar orbit during the lunar mission. The results of these sensitivity studies are shown on Figure 24.

The removal of these events from the model is performed by setting their probabilities of failure equal to zero ($P_f = 0.0$). This sensitivity can be viewed as assuming that these events are successful and do not contribute to the probability of LOC. Removal of the LSAM events (Phase 5) results in the probability of LOC deceasing by about 29% (to 0.012) and removal of the LSAM and Lunar Surface Events results in the probability of LOC also decreasing by about 29%. This result indicates that the LSAM events are the major contributors to the probability of LOC for these phases (Phase 4 and 5) as would be expected since the crew is not in the CEV during Phase 4.

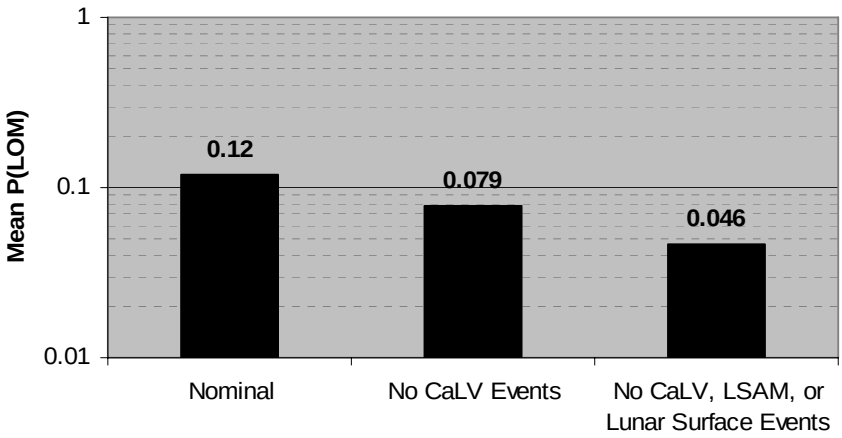


- Figure 24. Sensitivity of the Mission Probability of LOC on the Removal of LSAM and Lunar Surface Events

Sensitivity of the Probability of LOM on the removal of CaLV and LSAM Events

The Cargo Launch Vehicle (CaLV) and the Lunar Surface Access Vehicle (LSAM) are not part of the CEV and the data used to quantify these events were taken from the ESAS Study. The CaLV events are associated with Phase 1 and include 1st, 2nd and 3rd stage motor and separation events, and EDS and LSAM insertion and loiter events in LEO prior to rendezvous with the CEV. The LSAM event is associated with Phase 5 and discussed above. Two sensitivity studies were performed; 1) removal of CaLV events, and 2) removal of both CaLV and LSAM events. The results of these sensitivity studies are shown in Figure 25.

Inspection of this figure shows that the CaLV contribution to the probability of LOM is about 34% and the contribution of both the CaLV and LSAM events to the probability of LOM is about 62%.



• Figure 25. Comparison of the Sensitivity of the Mission Probability of LOM the Removal of CaLV and LSAM Events.

Credit for Crew Recovery Actions

Two sensitivity studies were performed by adding events in the model that take credit for crew recovery actions. One study added an event for the crew to recover from LSAM and CEV failures during Phases 4/5 and the other study added an event for the crew to repair the CEV from Service Module (SM) failures during the return to earth portion of the mission of Phase 7. The failure probability for these crew recovery events was estimated to be 0.1 [P_f (non-recovery) = 0.1]. Adding the crew recovery event to Phases 4/5 resulted in reducing both the probability of LOC and LOM by about 24% (to 0.013 and 0.091, respectively). Including crew recovery for SM failures during Phase 7 in the mission resulted in a negligible reduction in the probability of LOC (<1%). This event had no effect on the probability of LOM because the mission is assumed to be complete and LOM is not considered after Phase 5.

3.5. Comparison with SRD Requirements

The System Requirements Document (SRD) [5] reliability requirements for the CEV through all mission phases of a Lunar Sortie Mission are:

- The risk of Loss-of-Crew (LOC) through all Lunar Sortie mission phases due to failure of the CEV is not greater than 1 in 200 (TBR-002-091). [CV0195]

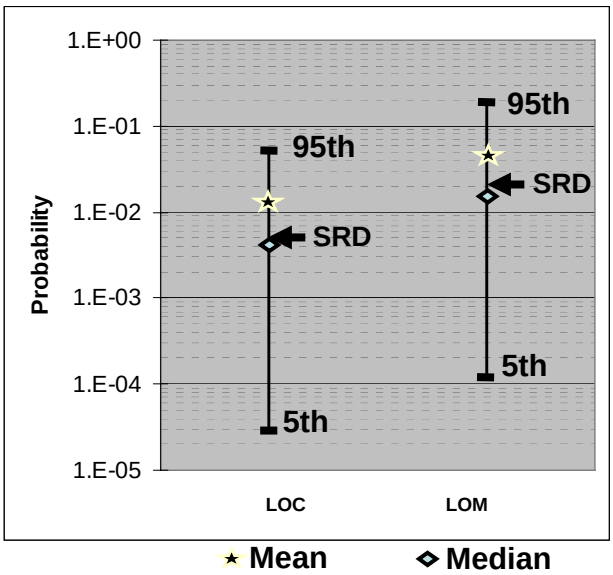
- The risk of a Loss-of-Mission (LOM) due to failure of the CEV is not greater than 1 in 50 (TBR-002-094). [CV0196]

For comparison to the result of this analysis, these requirements are better stated as the probability of LOC or LOM: 0.005 and 0.02, respectively. These probability requirements are per mission. That is, design the CEV and mission such that the probability of a loss-of-crew is not greater than 0.005 and the probability of loss-of-mission is not greater than 0.02.

The results of this assessment include contributions from non-CEV vehicles and operations on the overall probability of LOC and LOM. However, the sensitivity study that removed LSAM events from the model resulted in a probability of LOC of 0.012. The LSAM events are the only events in the model with a crewed vehicle that do not involve the CEV. The sensitivity study that removed both CaLV and LSAM events from the model resulted in a probability of LOM of 0.046. These events contribute to LOM but do not involve the CEV.

A comparison between the PRA results and the SRD requirement for LOC indicates that the PRA result is about a factor of 2.4 larger than the SRD requirement for LOC and that the PRA result for the probability of LOM is about a factor of 2.3 larger than the SRD requirement for LOM. These comparisons are shown on Figure 26 along with the uncertainty in the PRA results.

Given the preliminary design nature of the PRA models and the data used, these are not large differences. However, the PRA provides information that can be used to identify systems and components that are the dominant contributors to these probability results.



• Figure 26. Comparison of the PRA Results with the SRD Requirements

The PRA provides a listing of the accident sequences (cut sets) that lead to the end events, in this case LOC and LOM along with the probability of these accident sequences. This listing can be used to identify design or operation changes that will reduce the probability of LOC and LOM involving the CEV for the mission. For example, the dominant accident sequences (cut sets) for the probability of LOC are provided in Section 3.1, Dominant Risk Contributors. The accident sequences provided account for about 66% of the probability of LOC not attributed to LSAM events.

Inspection of these sequences indicates that the top two accident sequences are represented by data taken from the ESAS Study [CEV fails to stay in LOI (coast), Crew recovery fails after landing]. The other event (Recovery by Crew given failure of CEV in Lunar Loiter) uses a screening value to take credit for the possibility that the crew recovers the failed CEV prior to trans-earth departure. These two accident sequences account for about 63% of the probability of LOC. As the model and data are refined to include details to further define these accident sequences, a reduction in their probability by an order of magnitude (to 5.0E-004 and 2.6E-004, respectively) will reduce the overall probability of LOC to about 5.1E-003. This result is directly comparable to the SRD requirement of 5.0E-003 for LOC.

Further inspection of these accident sequences indicates that events involving the landing parachute system and the RCS are the next contributors. The landing parachute system sequence consists of a common cause failure of two of the three parachutes to properly deploy. These systems can also be the subject of trade studies to further reduce the probability of LOC.

4. Observations and Discussion

The PRA employed for this study produced design level (formulation phase) risk related information concerning a Lunar Sortie Mission for the Constellation Program. The information generated by the PRA includes qualitative and quantitative results that support assessments to manage mission risk and provides different perspectives on risk drivers. This PRA has produced information based on a formulation phase design which limits the robustness of these specific results. However, as more detail becomes available, additional management issues can be addressed by the PRA. Among these perspectives, assessments, and issues are:

- Assessment of compliance with SRD mission reliability requirements
- Identification of significant mission risk contributors
- Determination of the importance of events, systems, mission phases, etc to mission risk
- Support of trade studies
- Support mission development
- Assessment of the impact of external events
- Assessment of alternative or supplemental operating modes
- Assessment of alternative mission profiles
- Support for operational risk management
- Assessment of important precursors

While this PRA does provide all the types of information a PRA can produce, some examples in this report of the types of risk information to support these listed perspectives, assessments, and issues are indicated by Section references in this report. An “n/a” is used to indicate examples of the information produced by a PRA are that not in this report.

Assessment of Compliance with SRD Mission Reliability Requirements (See Section 3.4)

Because the PRA is an integrated model of mission systems and phases, it can be used to conduct studies to assess the ability of the hardware and mission design to meet overall requirements for LOC and LOM along with studying risk allocation schemes among the various phases and major components (CaLV, CLV, CEV, EDS and LSAM). In addition to studying risk allocation, this PRA can be used to track and manage the allocation as designs become more mature and the models are updated to reflect more details and better data. This information can be used to support assessments to reallocate requirements to meet overall mission requirements.

Identification of Significant Mission Risk Contributors (See Section 3.1)

The results of this PRA identify risk drivers that require further study to completely understand their failure contribution and to identify preventive and mitigative controls to reduce their contribution to LOC and LOM. The list of dominant risk contributors indicate what types of failures during which mission phases may require attention to manage mission risk. This information is often referred to as risk insights, because it provides qualitative information (e.g., a description of combinations of mission failure events) as well as quantitative risk results. This type of information may suggest alternative system designs, operating modes, back ups, and/or diverse methods for accomplishing mission functions.

Determination of the Importance of Events, Systems, Mission Phases, etc., to Mission Risk (See Section 3.2)

While the PRA provides risk insights on failure combinations that result in mission failure, it can generate indices (importance measures) that identify how important elements of the mission are to mission risk. These measures can be generated on many different levels of resolution including specific components, component types, system strings, systems, functions, etc. These measures can be used to identify trade studies, testing, maintenance, and mission planning activities to manage risk.

Support of Trade Studies (See Section 3.3)

Several trades have been provided in this PRA report. The impacts on risk are in the context of the entire system and mission evaluated. The results do not reflect changes in mission profile due to the trade studies, but the PRA has the structure to study these changes (operational studies). The PRA can support trades on similar strings versus dissimilar strings. The advantage of doing trades with the PRA model is that the interactions between systems are accounted for in the results. As more detail on the

Constellation Program system and mission designs becomes available, this aspect of the PRA result becomes more explicit.

Support Mission Development, (See Section 3.0)

While it is desirable to have detailed information to produce mission risk assessment results, a very powerful application of PRA is in supporting the mission design, development, and planning. This application is due to the ability to produce information about mission risk from a PRA to identify risk important components, systems, configurations, activities, and events. Even though some of this information is based on "pre-CEV design" data and assumptions; design solutions, configurations, requirements, and testing can be identified to manage risk during the development phases. Assumptions about systems or mission profiles used to support PRA development can become mission "requirements" if they are important for mission risk management.

Assessment of the Impact of External Events (See Section 3.4, Common Cause Factors)

System and component failure modes included in the PRA will change over time as we gain a better understanding of the flight environment for these systems, and model physical phenomena (explosion events) and external events. The impact of this understanding on the assessment of mission risk can be assessed using the PRA model. The assessment can be conducted by changing component failure modes, failure rates, including external events explicitly in the PRA (current model includes an event for solar flares), and CCFs.

Assessment of Alternative or Supplemental Operating Modes (See Section 3.4, Crew Recovery Actions)

The PRA can assess the impact on mission risk of alternative or supplemental operating modes in the context of when those actions may be required. This is important because the viability of those actions is impacted by the failures and conditions which required them. As more information on mission systems and profiles becomes available, the impact of the alternative modes can be more accurately assessed.

Assessment of Alternative Mission Profiles (See Sections 3.3 and 3.4)

The results of this PRA are dependent on the success criteria used. The quantification of LOM is based on current fault tolerant definitions. Success is defined as not violating fault tolerance criteria. In the trade study on ATCS, the risk of LOM was not calculated, because single fault tolerance criteria were violated. However, the PRA model can be used to assess the impact of different definitions for mission success. This ability to

produce PRA results for variations in success criteria can be extended to assess different mission profiles as well.

Support Operational Risk Management (See Section 3.4, Failure of One … String)

The PRA can support operational mission risk management by assessing the impact on mission risk of events that occur during the mission. The impact information can provide quantitative risk changes and identify current significant mission risk contributors and risk important systems and functions. This provides mission controllers with insight into what the increase in mission risk is; suggested work arounds, alternative mission profiles; and supports decisions on mission termination.

Identification of Data Needs (See Section 3.2)

The data used in this study will change as we gain a better understanding of the specific systems and components. This study started with data on systems similar to heritage systems and used historical data which is bias toward these heritage systems. Data on program specific systems will be used as it becomes available. The use of importance measures will support which data needs are most critical to providing a credible, robust assessment of mission risk.

Assessment of Important Precursors (n/a)

The PRA can be used to assess the risk significance of events that occur during design and further operational development. These events, referred to as precursors, are events that may indicate that risk is higher than estimated or is trending higher. When these events occur (during testing, experiments, or the mission), the PRA model is evaluated by including its impacts in the model (e.g., lost redundancy, failed component, increasing failure rate, change in success criteria, etc) and the risk results compared to the baseline estimates. In this way, events which significantly increase risk can be identified and measures to deal with them to manage risk identified.

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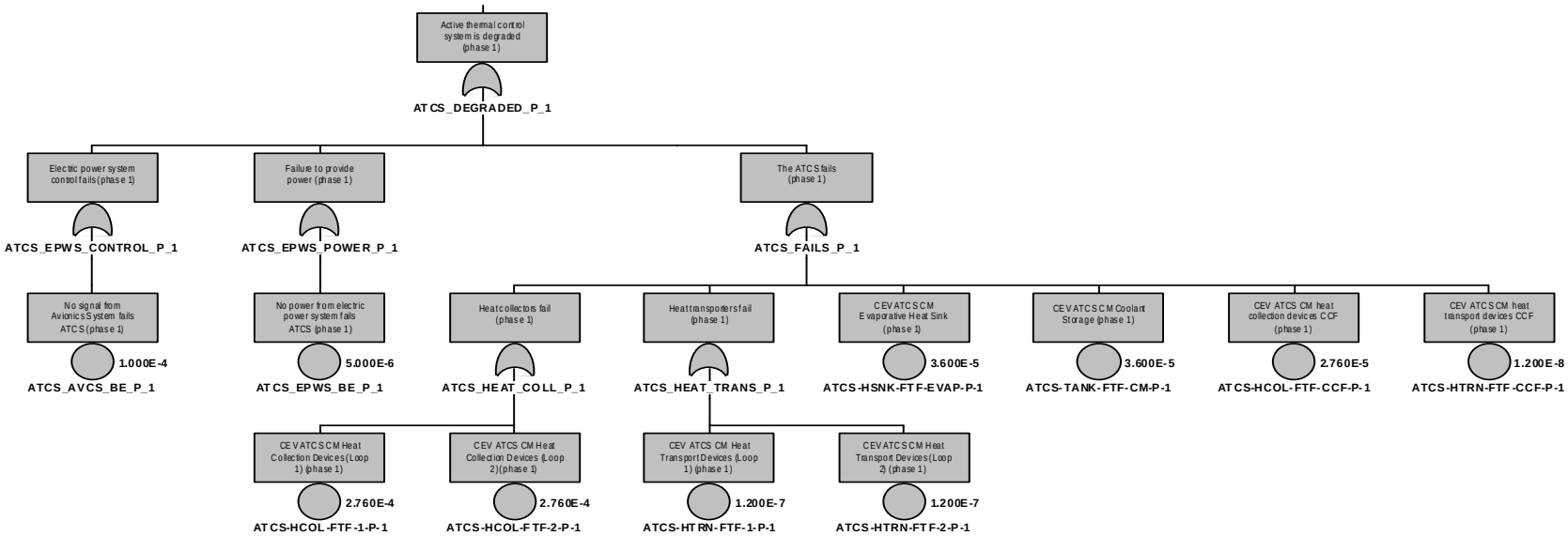
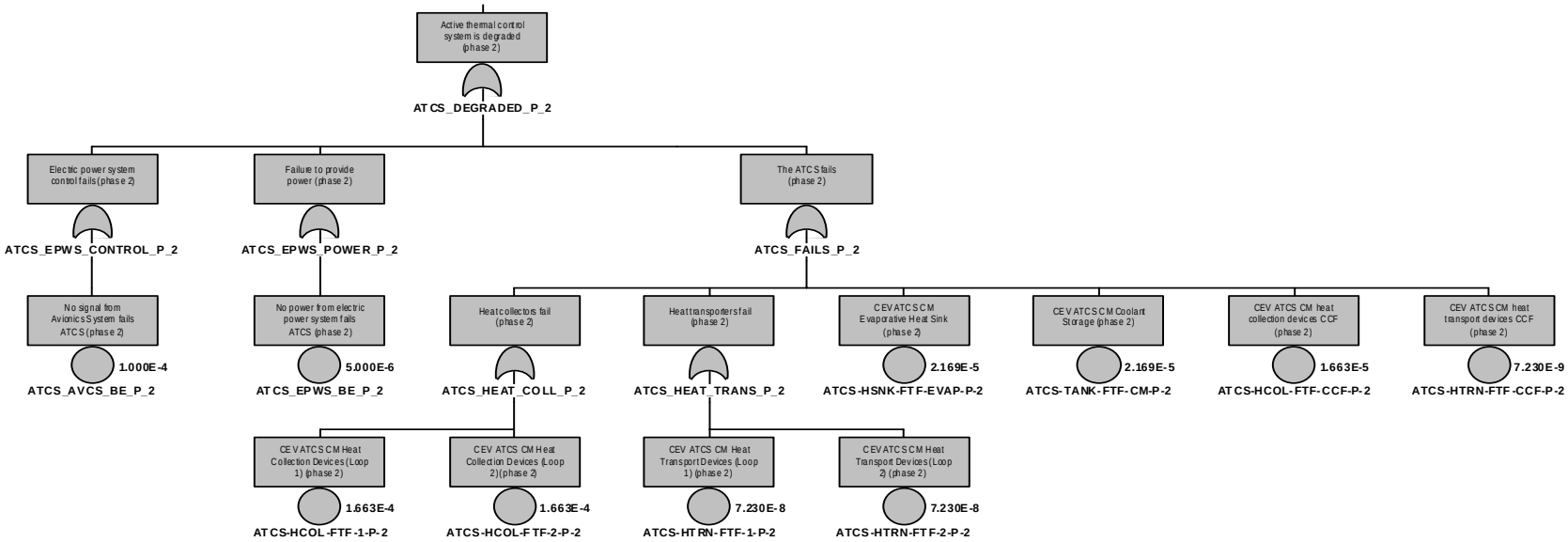
Appendix A – Fault Trees

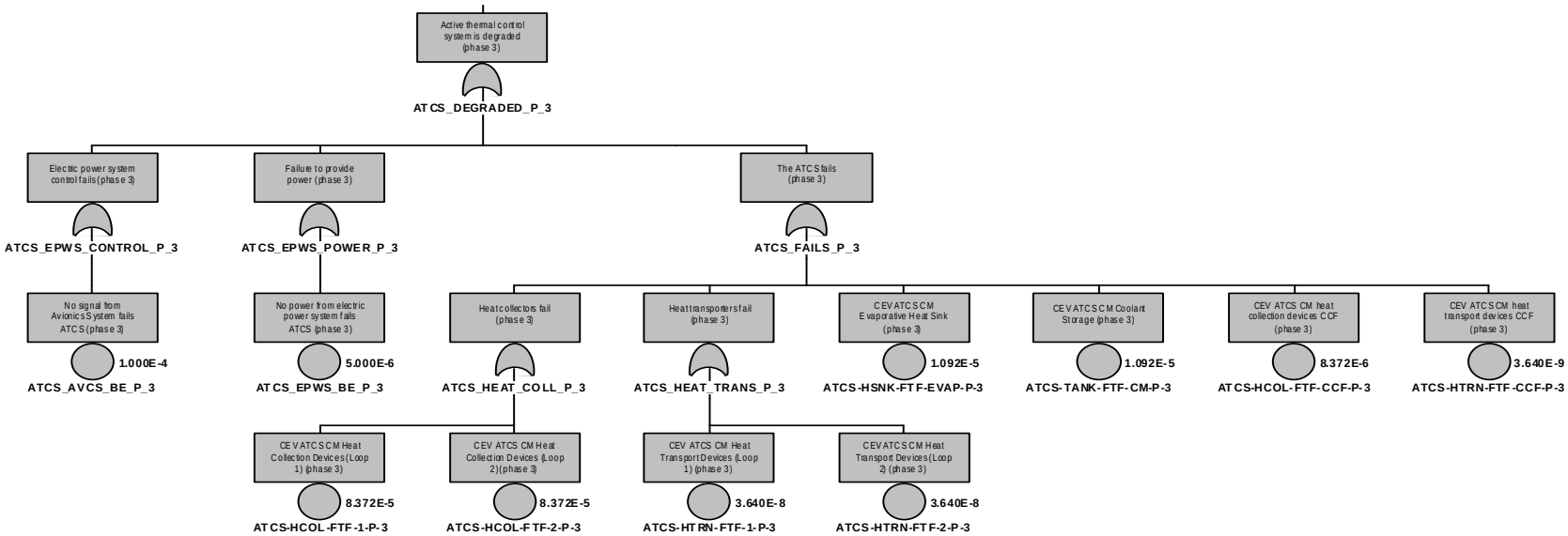
ATCS_DEGRADED_P_1 - Active thermal control system is degraded (phase 1)



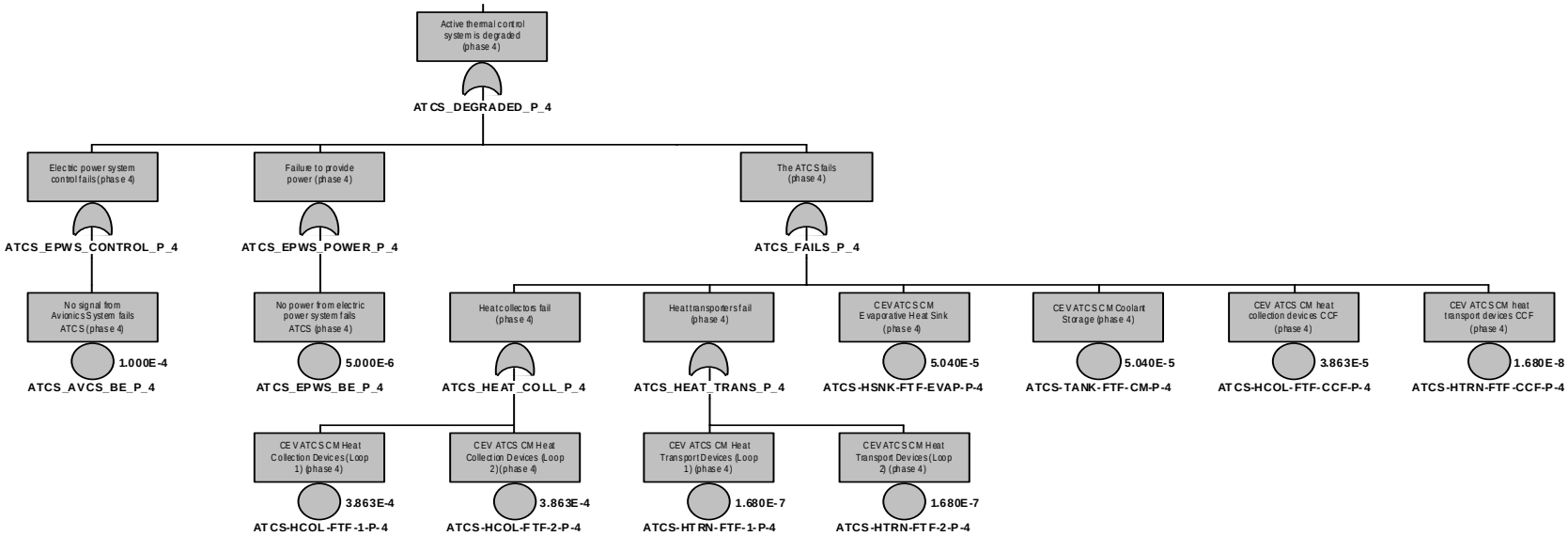
ATCS_DEGRADED_P_2 - Active thermal control system is degraded (phase 2)



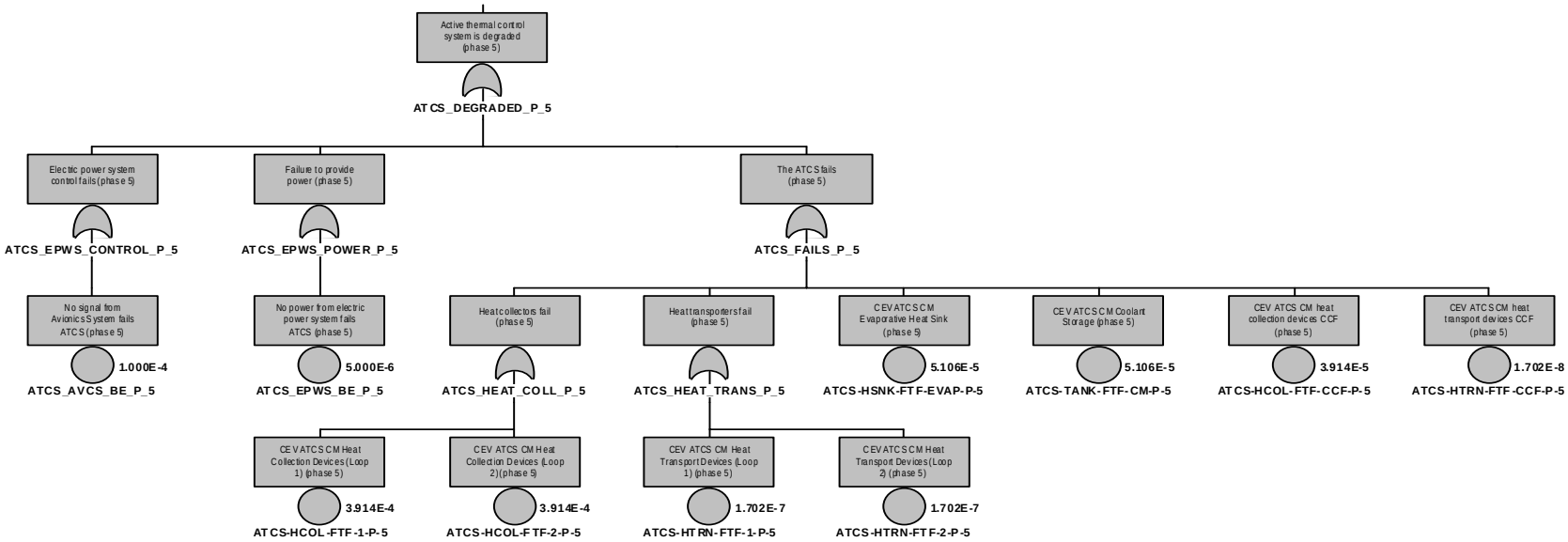
ATCS_DEGRADED_P_3 - Active thermal control system is degraded (phase 3)



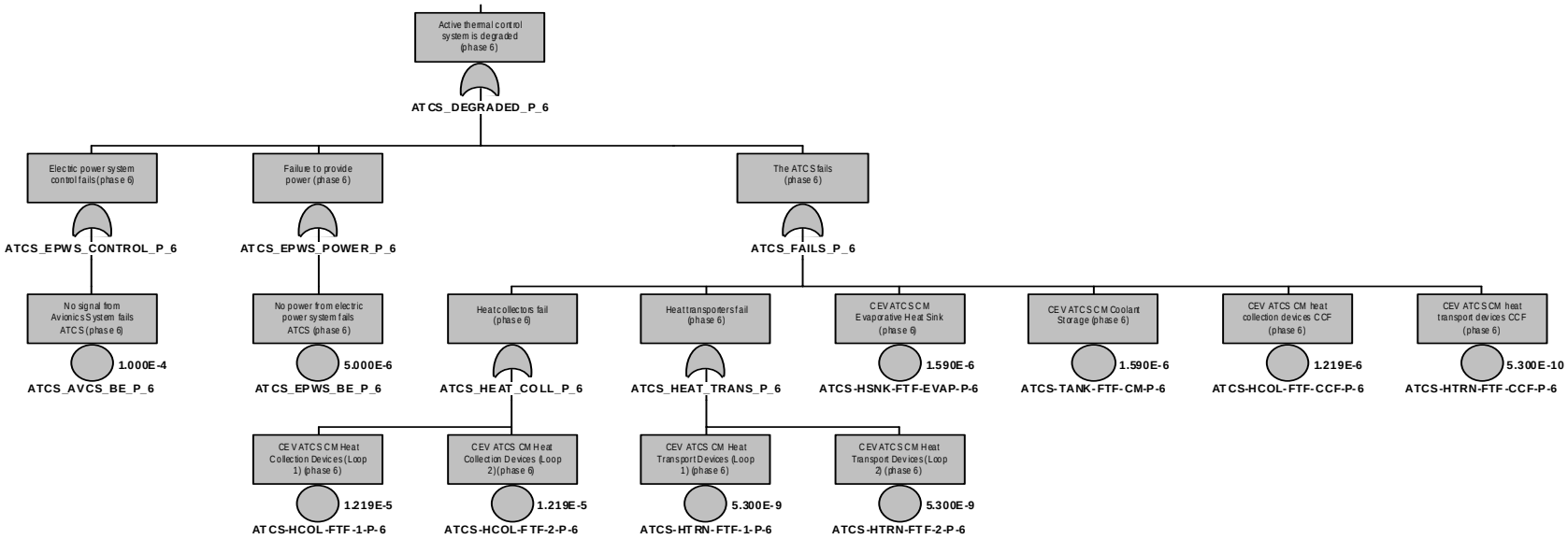
ATCS_DEGRADED_P_4 - Active thermal control system is degraded (phase 4)



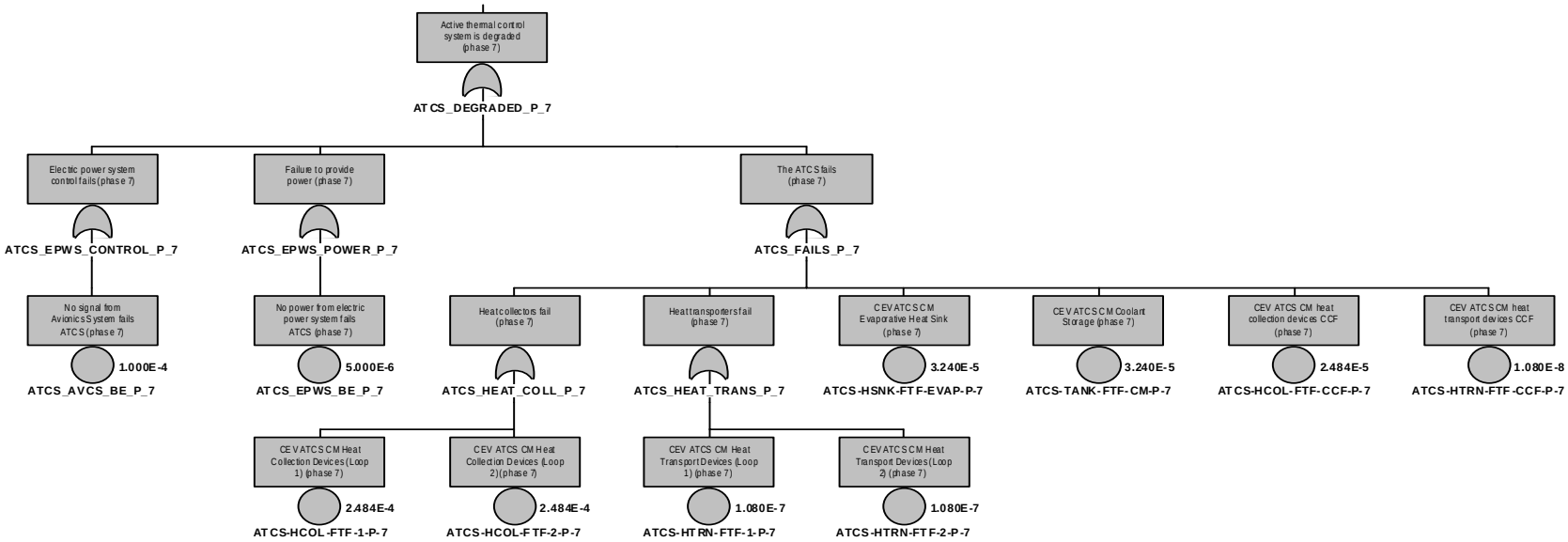
ATCS_DEGRADED_P_5 - Active thermal control system is degraded (phase 5)



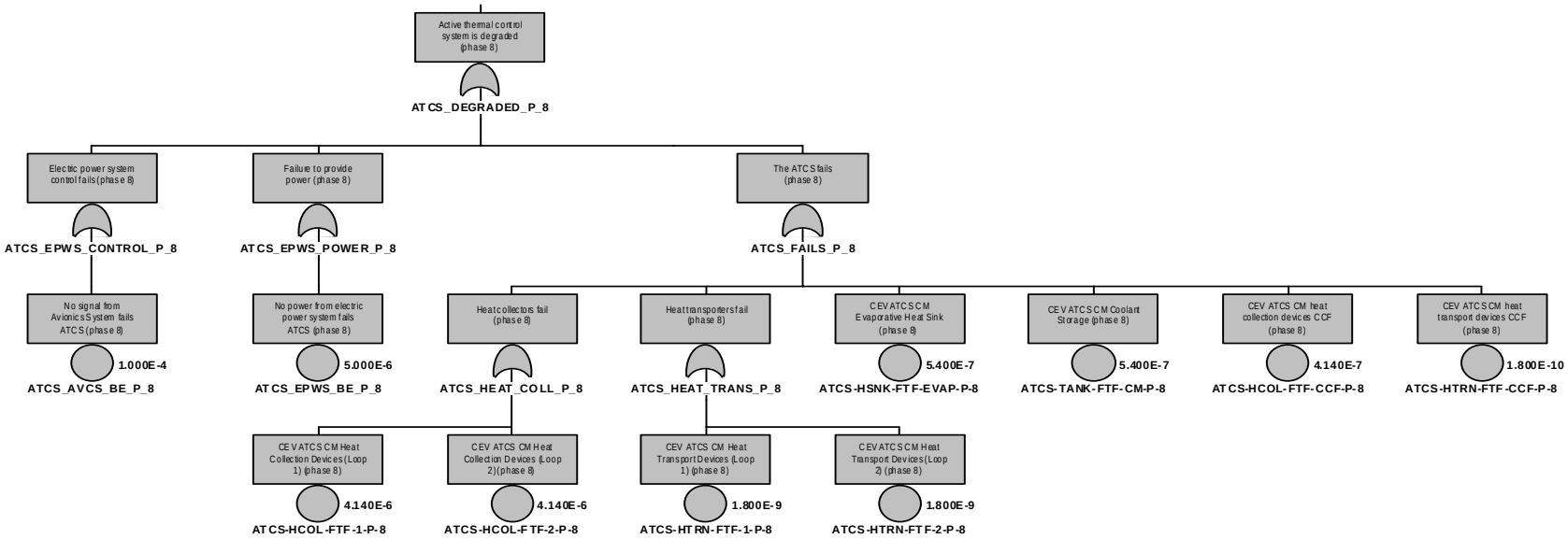
ATCS_DEGRADED_P_6 - Active thermal control system is degraded (phase 6)



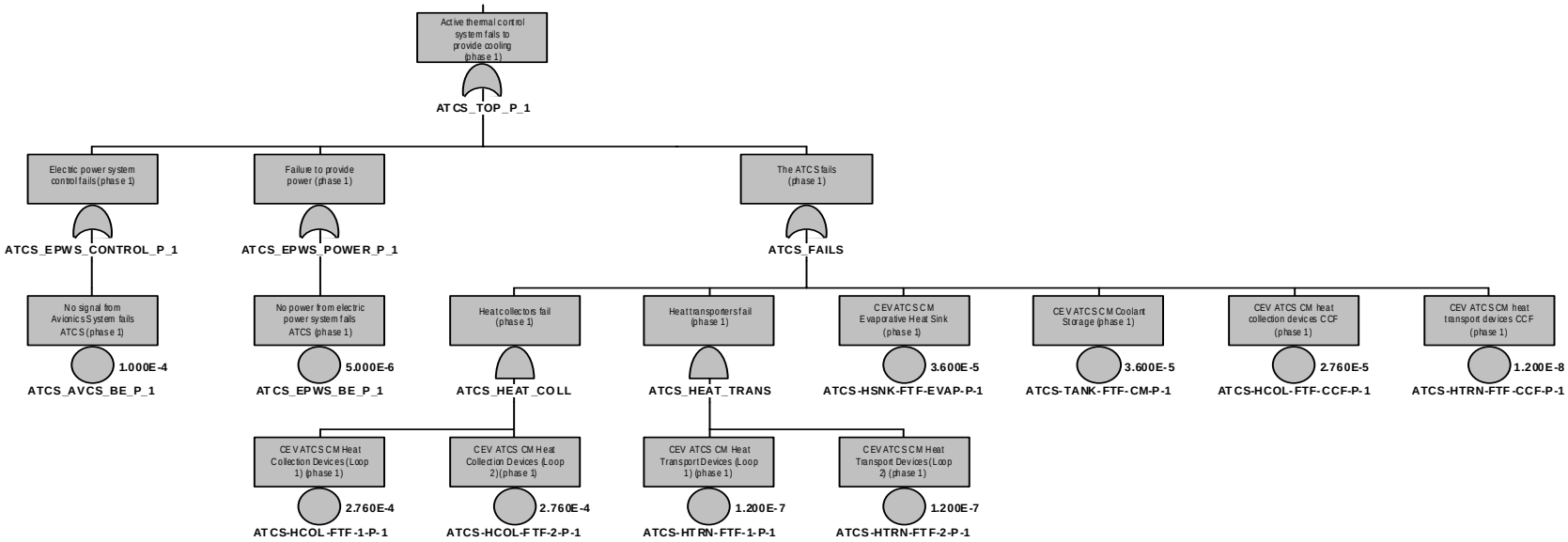
ATCS_DEGRADED_P_7 - Active thermal control system is degraded (phase 7)



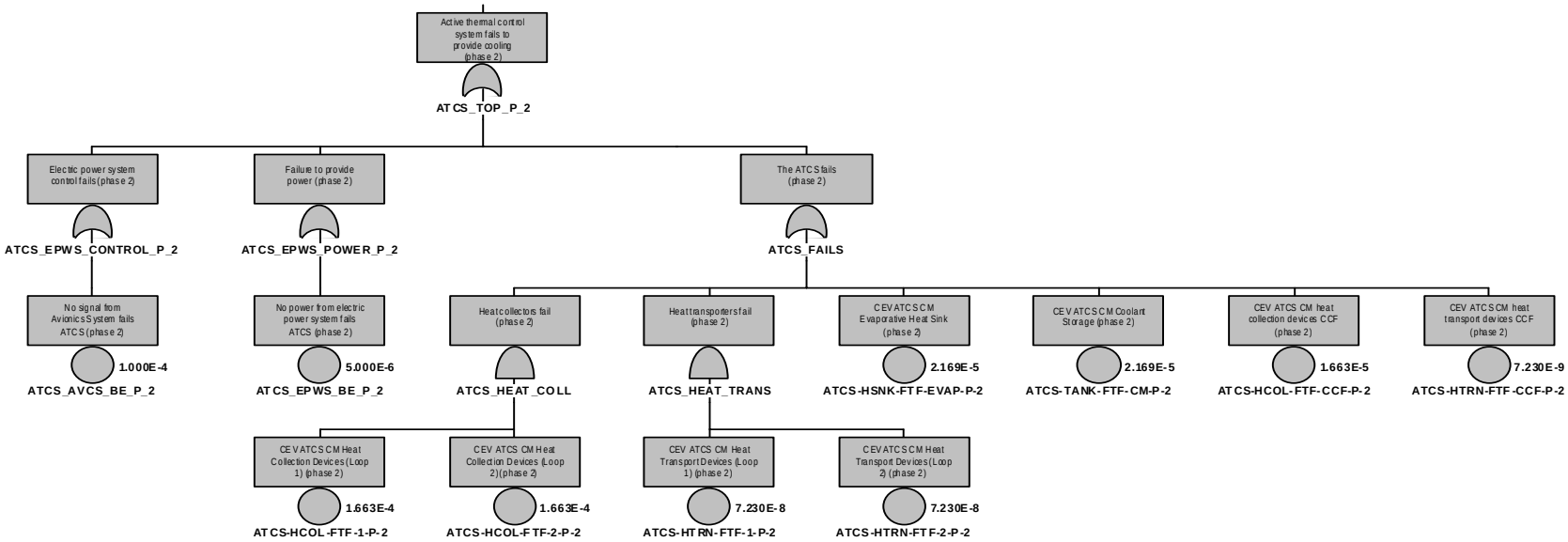
ATCS_DEGRADED_P_8 - Active thermal control system is degraded (phase 8)



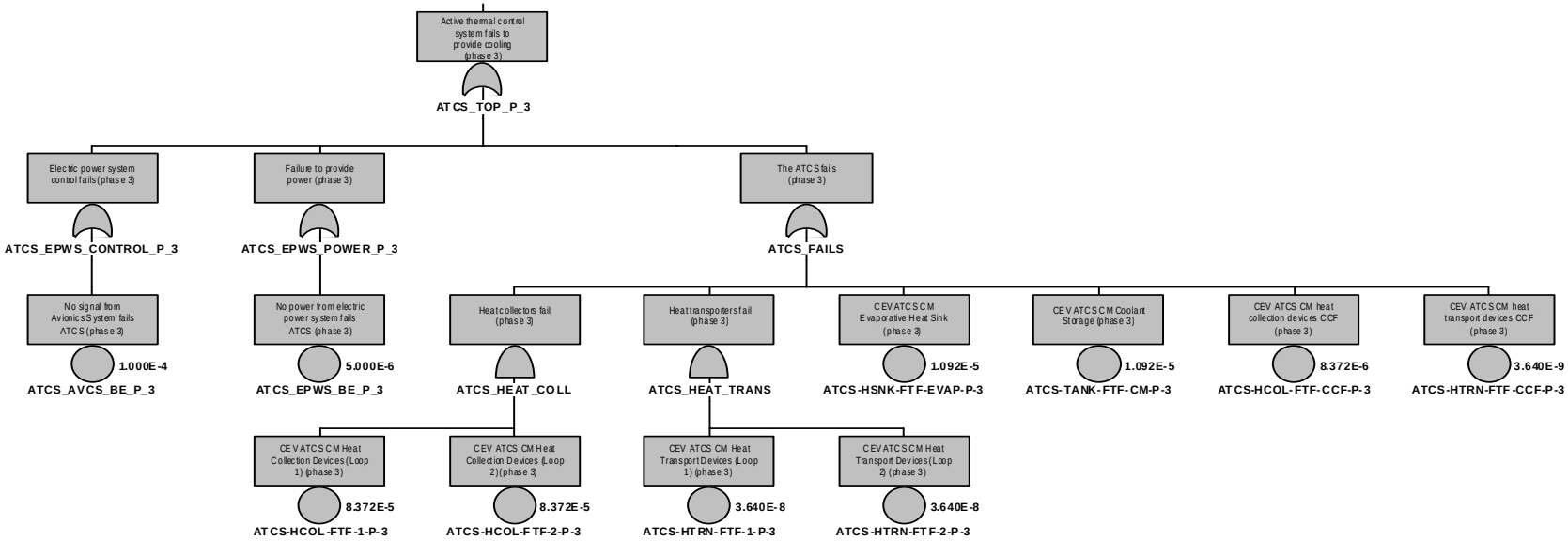
ATCS_TOP_P_1 - Active thermal control system fails to provide cooling (phase 1)



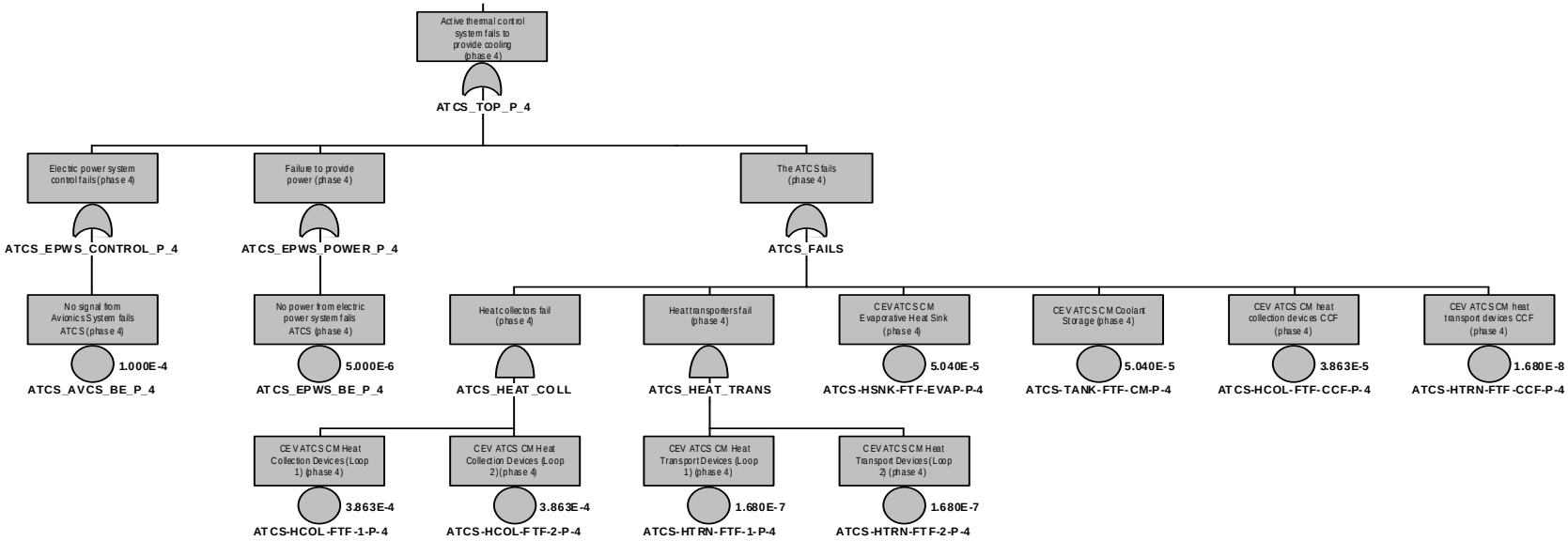
ATCS_TOP_P_2 - ATCS fails to provide cooling (phase 2)



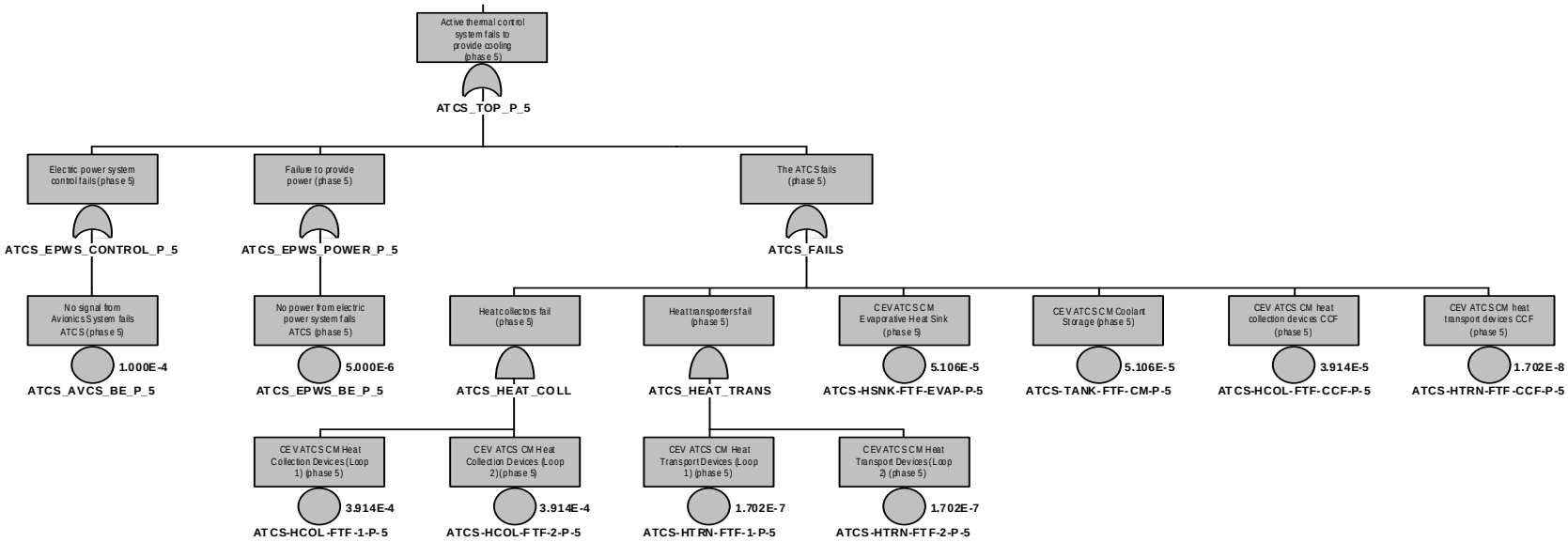
ATCS_TOP_P_3 - ATCS fails to provide cooling (phase 3)



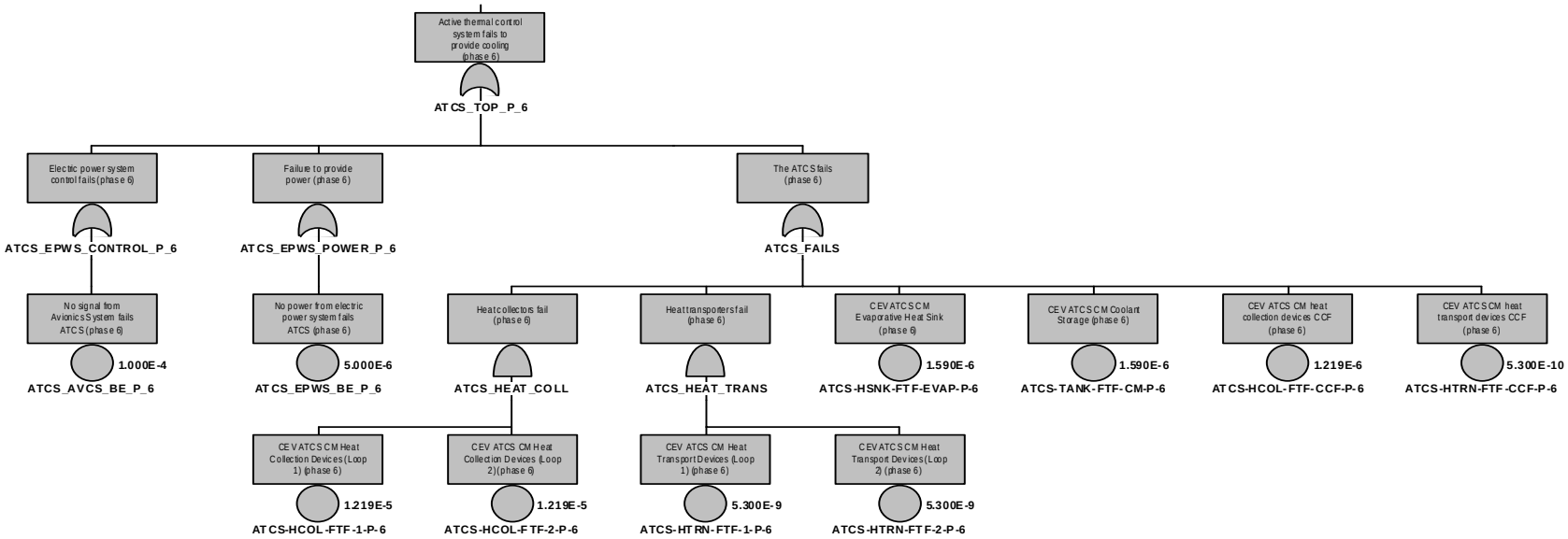
ATCS_TOP_P_4 - ATCS fails to provide cooling (phase 4)



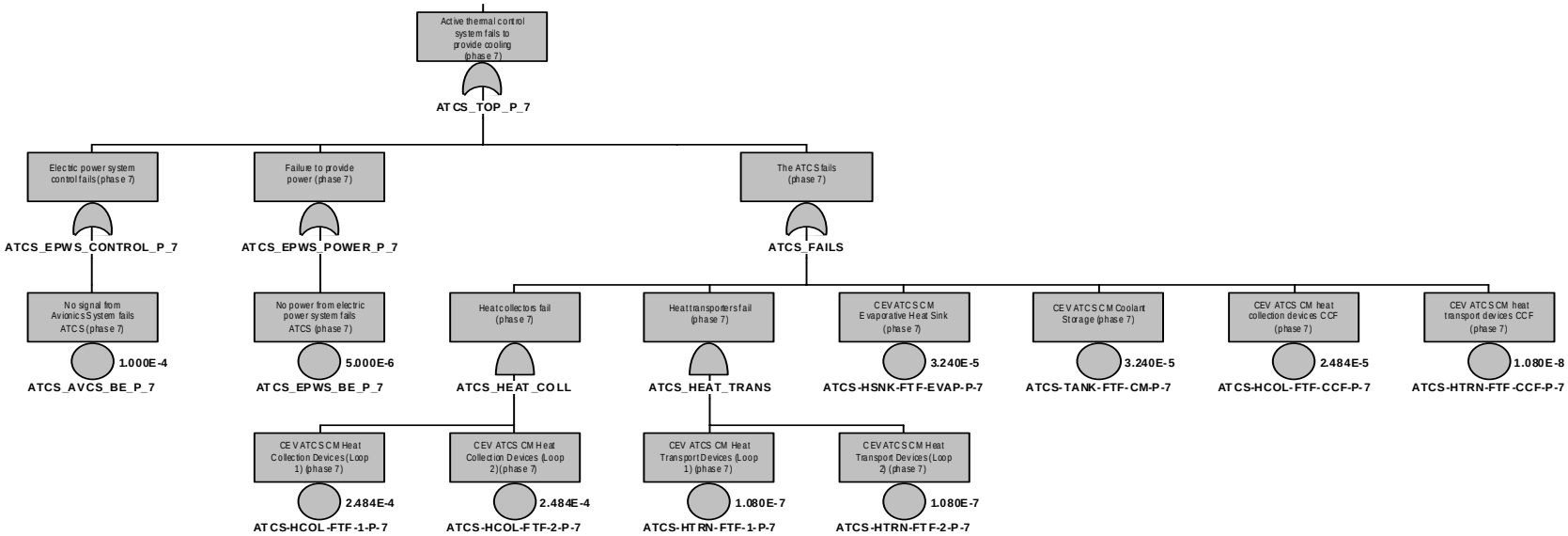
ATCS_TOP_P_5 - ATCS fails to provide cooling (phase 5)



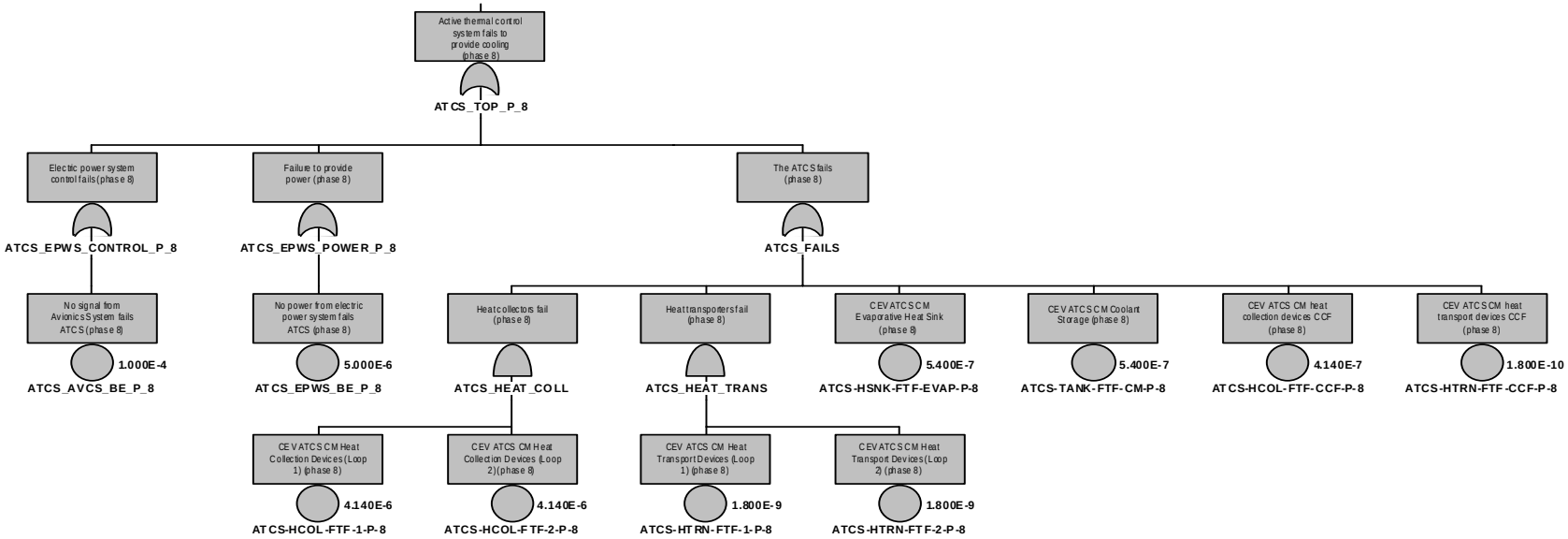
ATCS_TOP_P_6 - ATCS fails to provide cooling (phase 6)



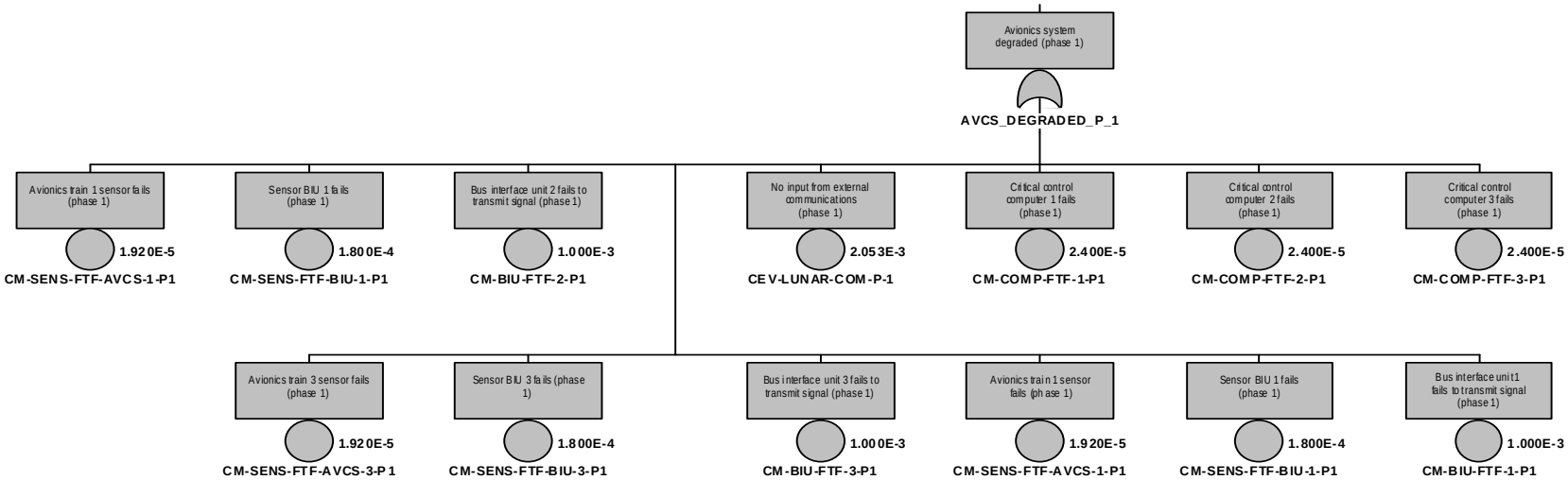
ATCS_TOP_P_7 - ATCS fails to provide cooling (phase 7)



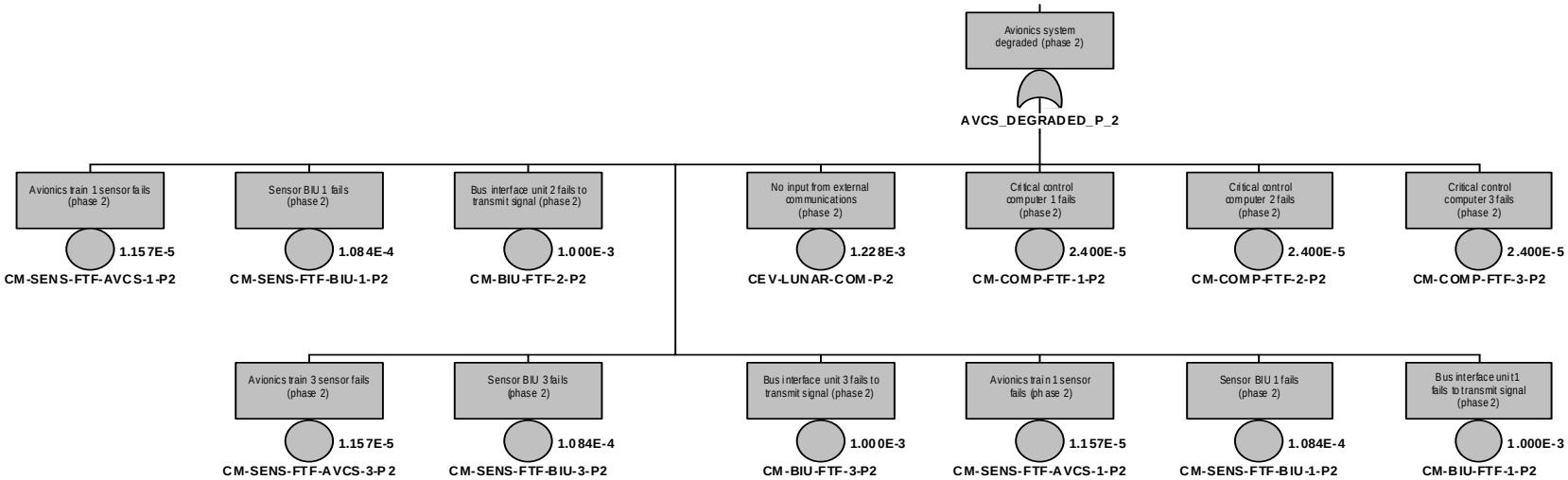
ATCS_TOP_P_8 - ATCS fails to provide cooling (phase 8)



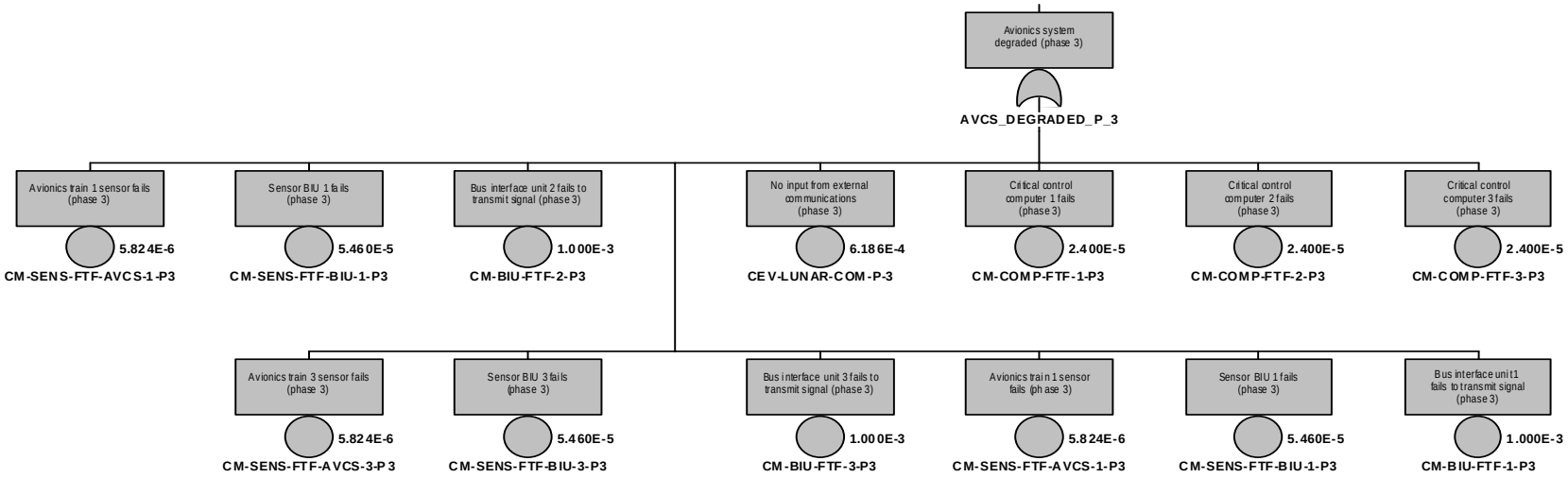
AVCS_DEGRADED_P_1 - Avionics system degraded (phase 1)



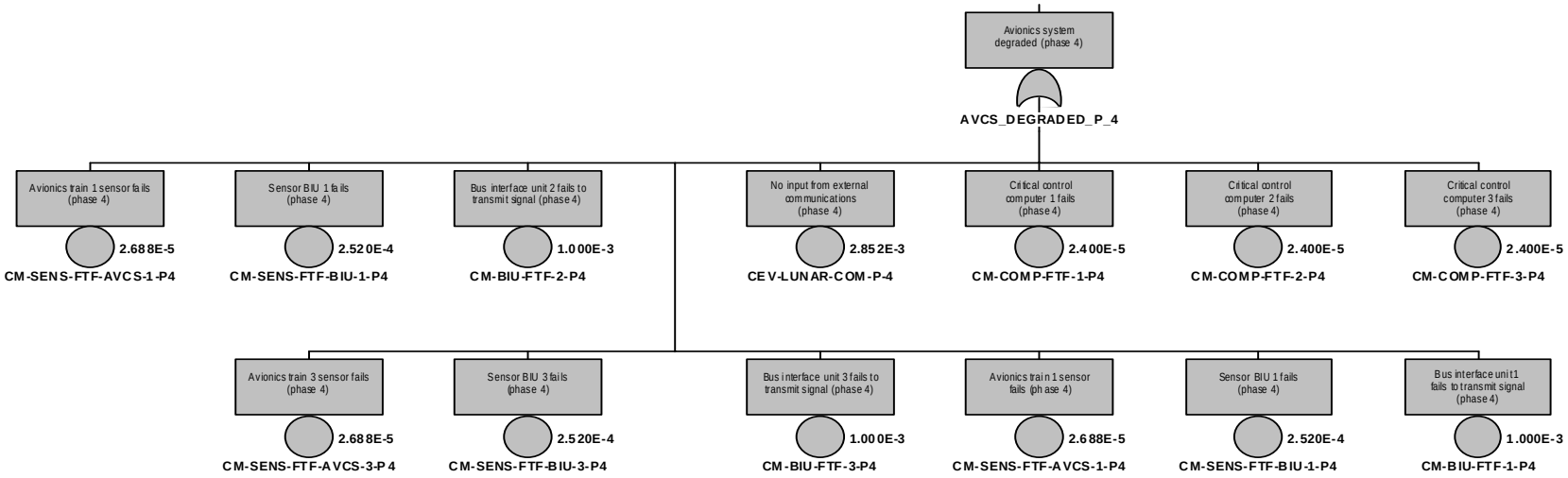
AVCS_DEGRADED_P_2 - Avionics system degraded (phase 2)



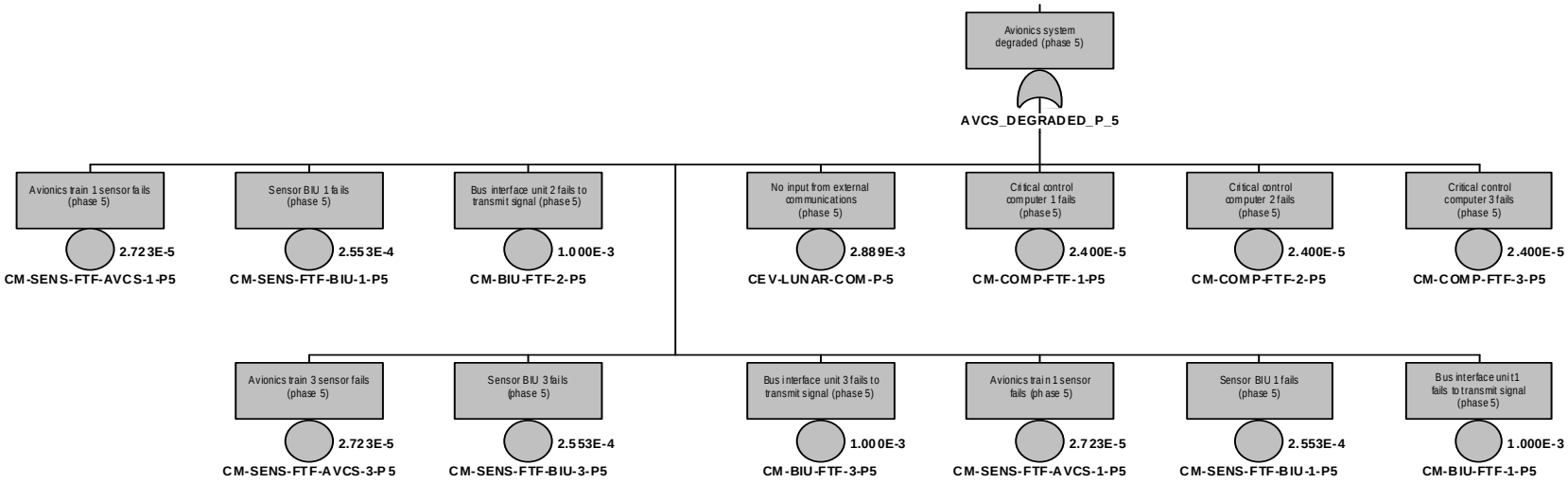
AVCS_DEGRADED_P_3 - Avionics system degraded (phase 3)



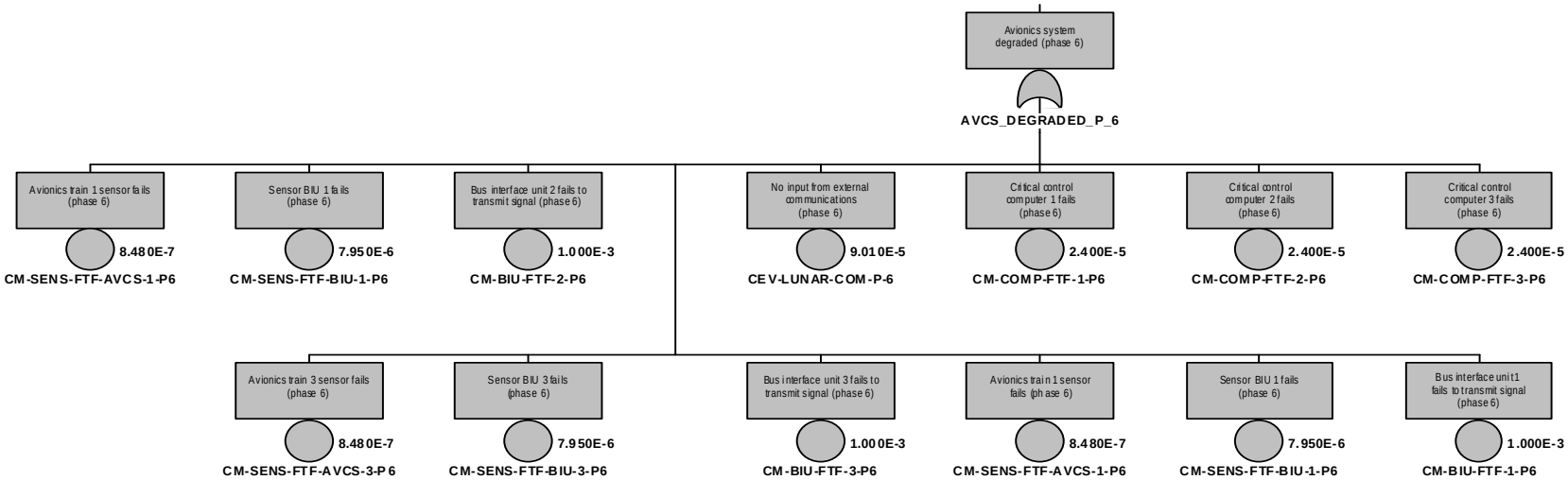
AVCS_DEGRADED_P_4 - Avionics system degraded (phase 4)



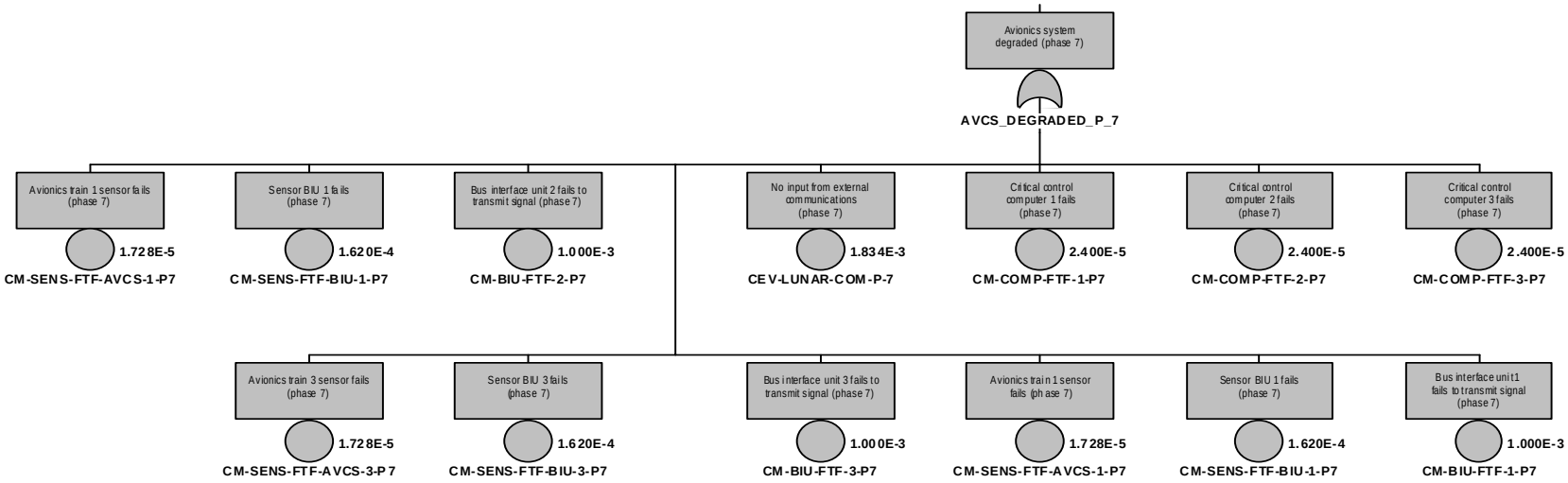
AVCS_DEGRADED_P_5 - Avionics system degraded (phase 5)



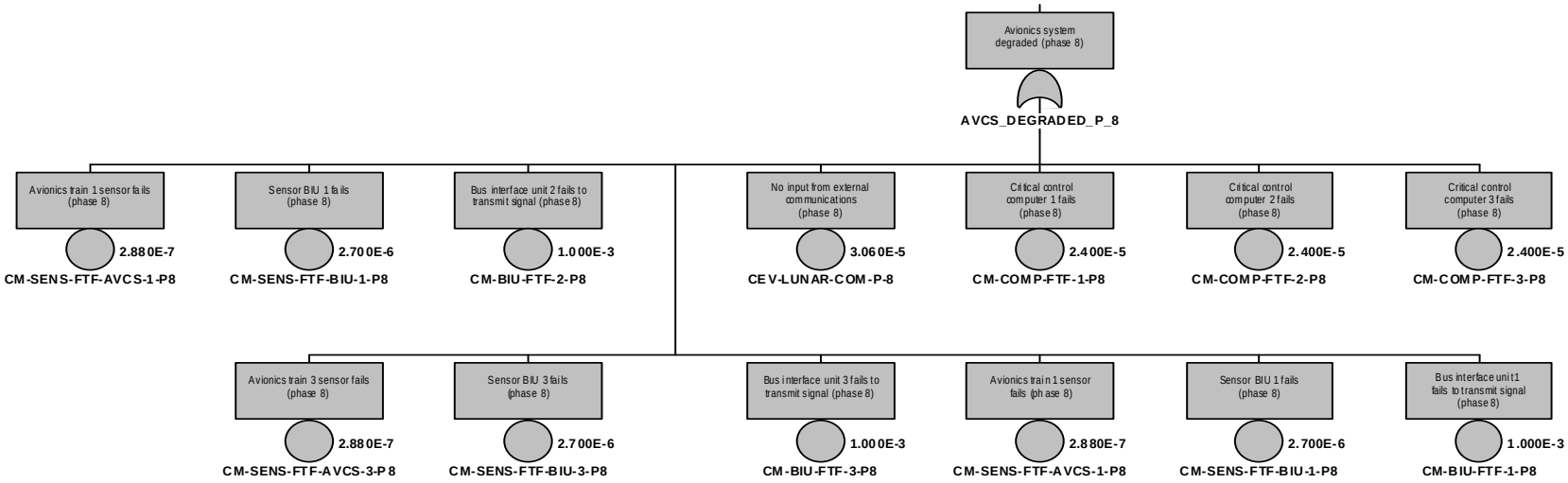
AVCS_DEGRADED_P_6 - Avionics system degraded (phase 6)



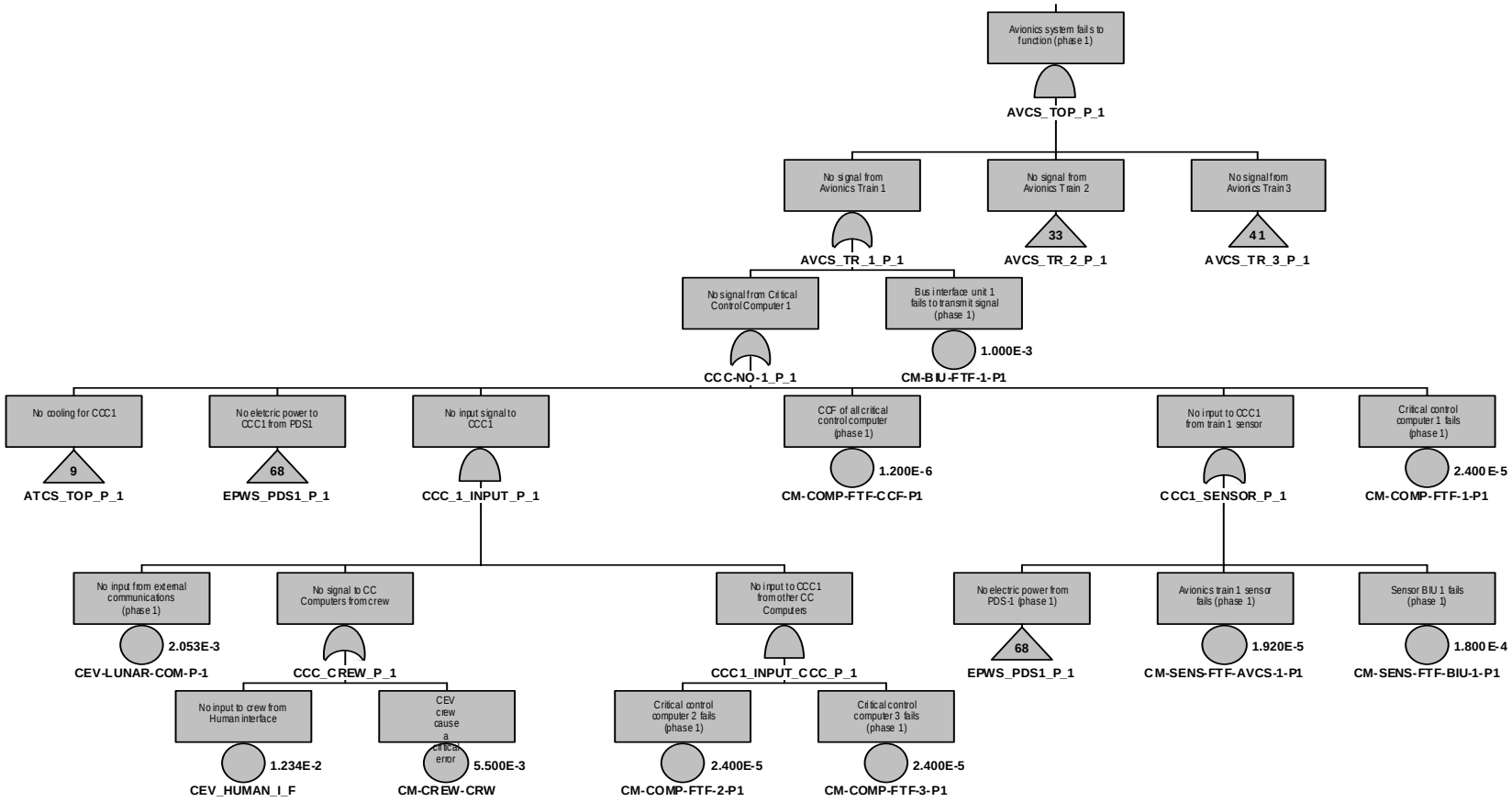
AVCS_DEGRADED_P_7 - Avionics system degraded (phase 7)



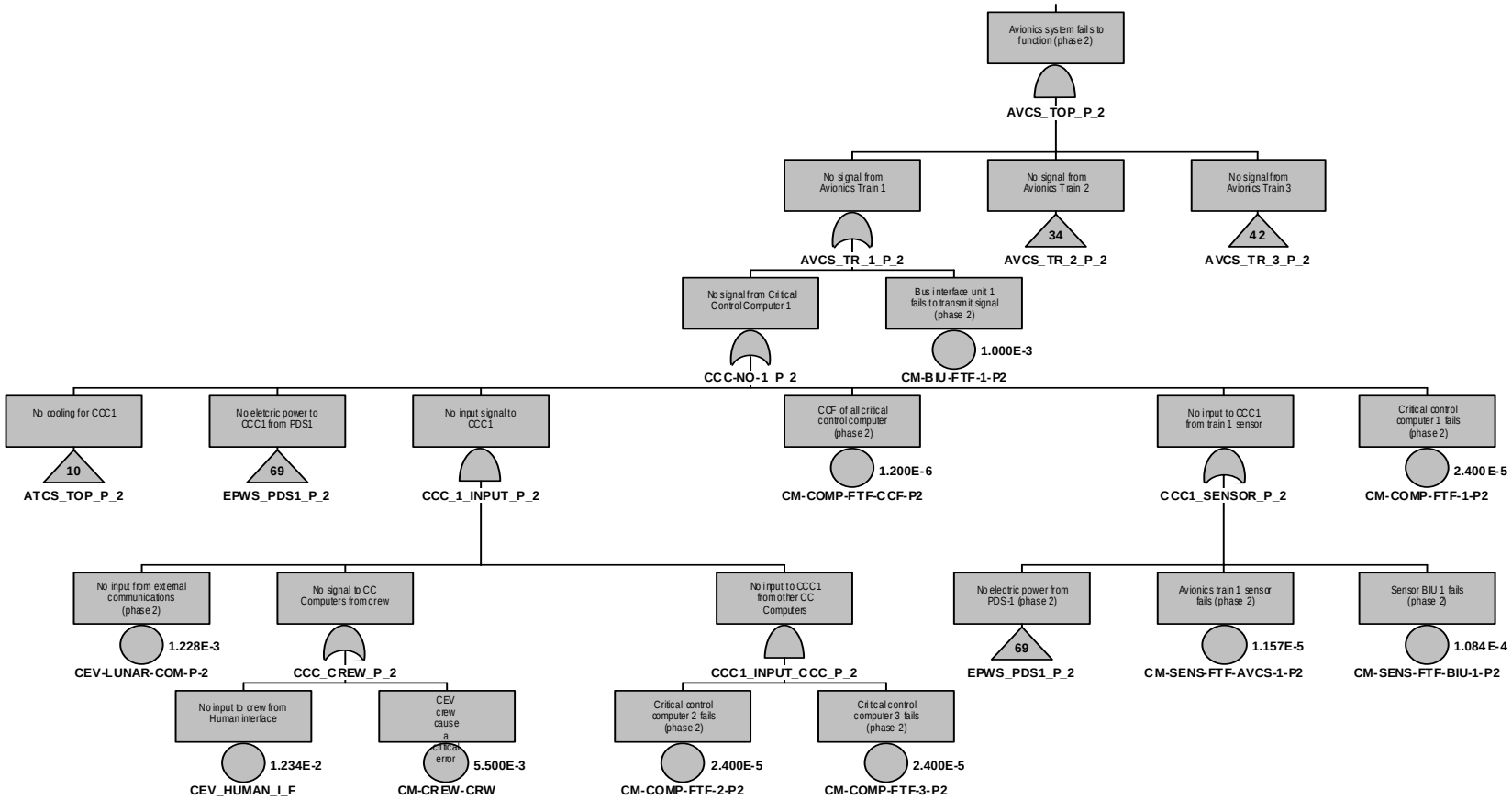
AVCS_DEGRADED_P_8 - Avionics system degraded (phase 8)



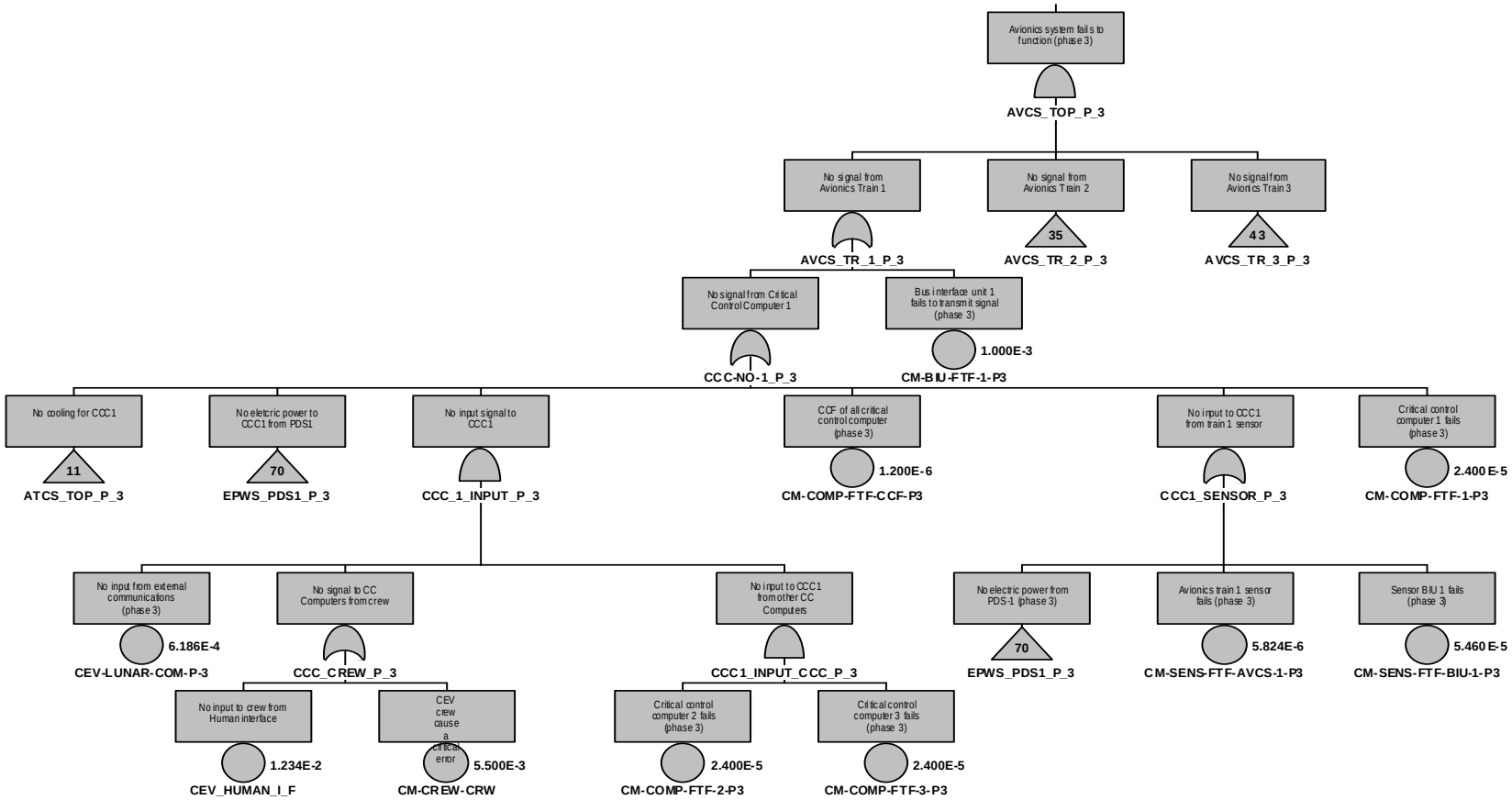
AVCS_TOP_P_1 - Avionics system fails to function (phase 1)



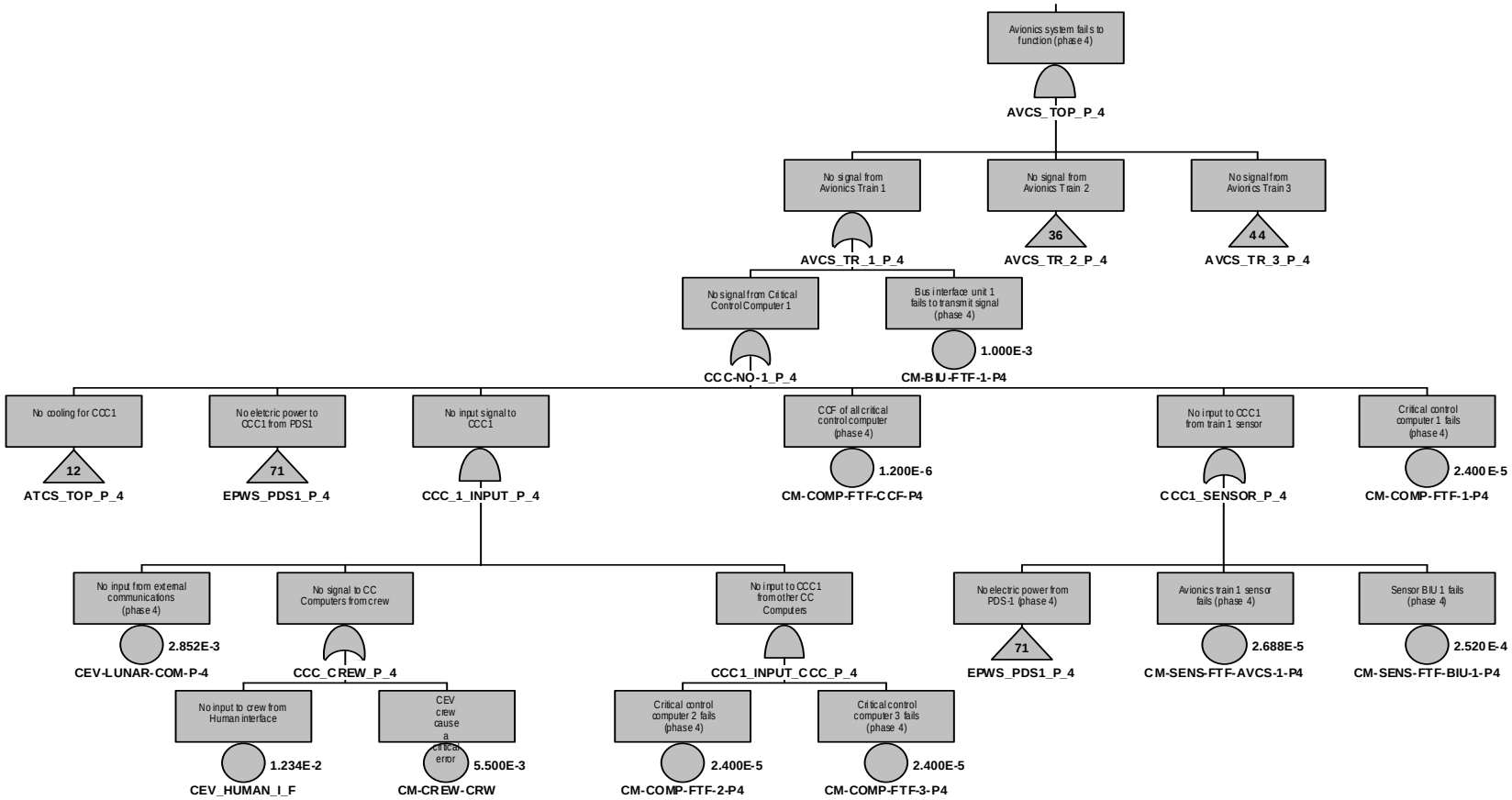
AVCS_TOP_P_2 - No signal from Avionics System (phase 2)



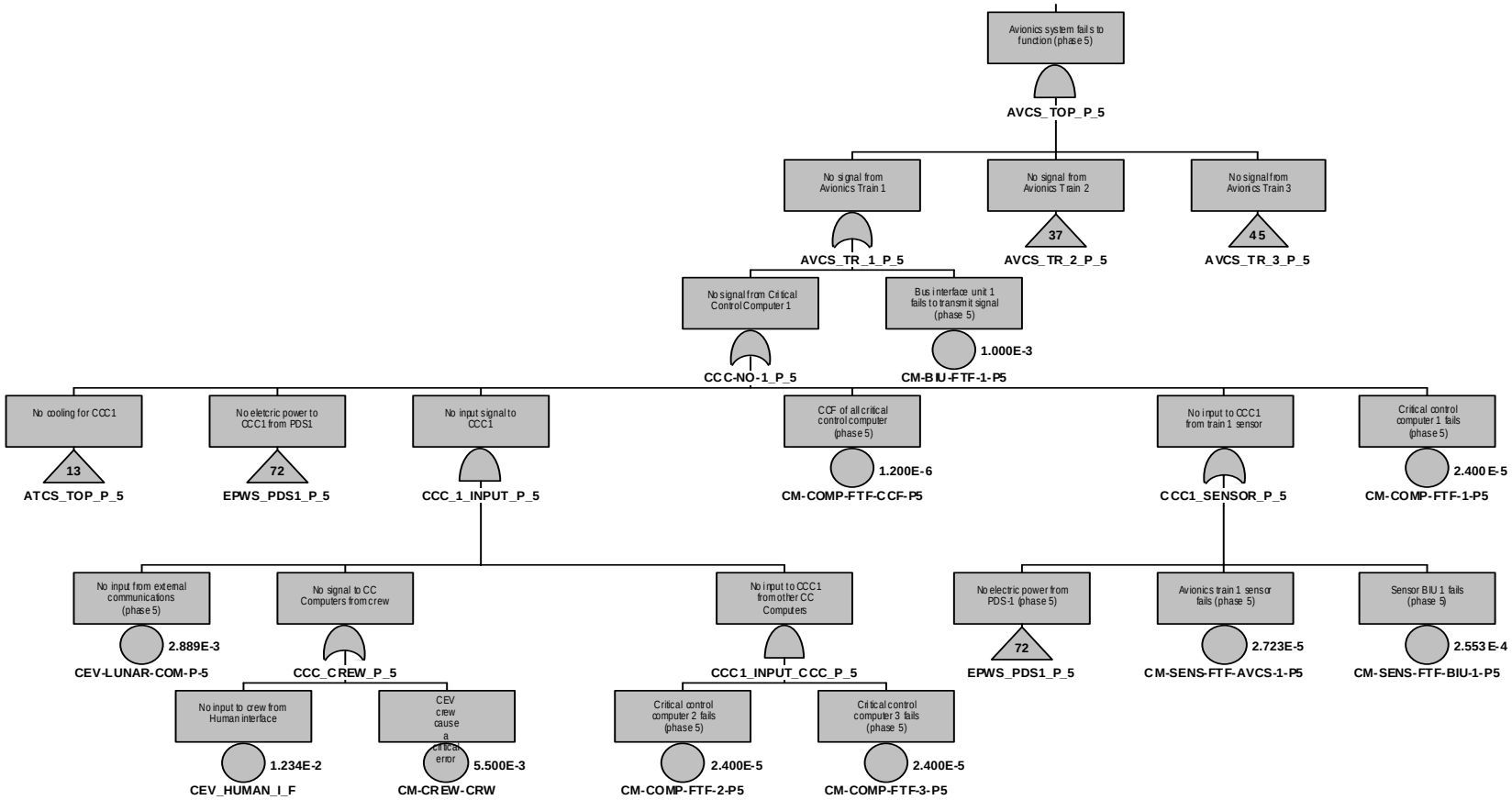
AVCS_TOP_P_3 - No signal from Avionics System (phase 3)



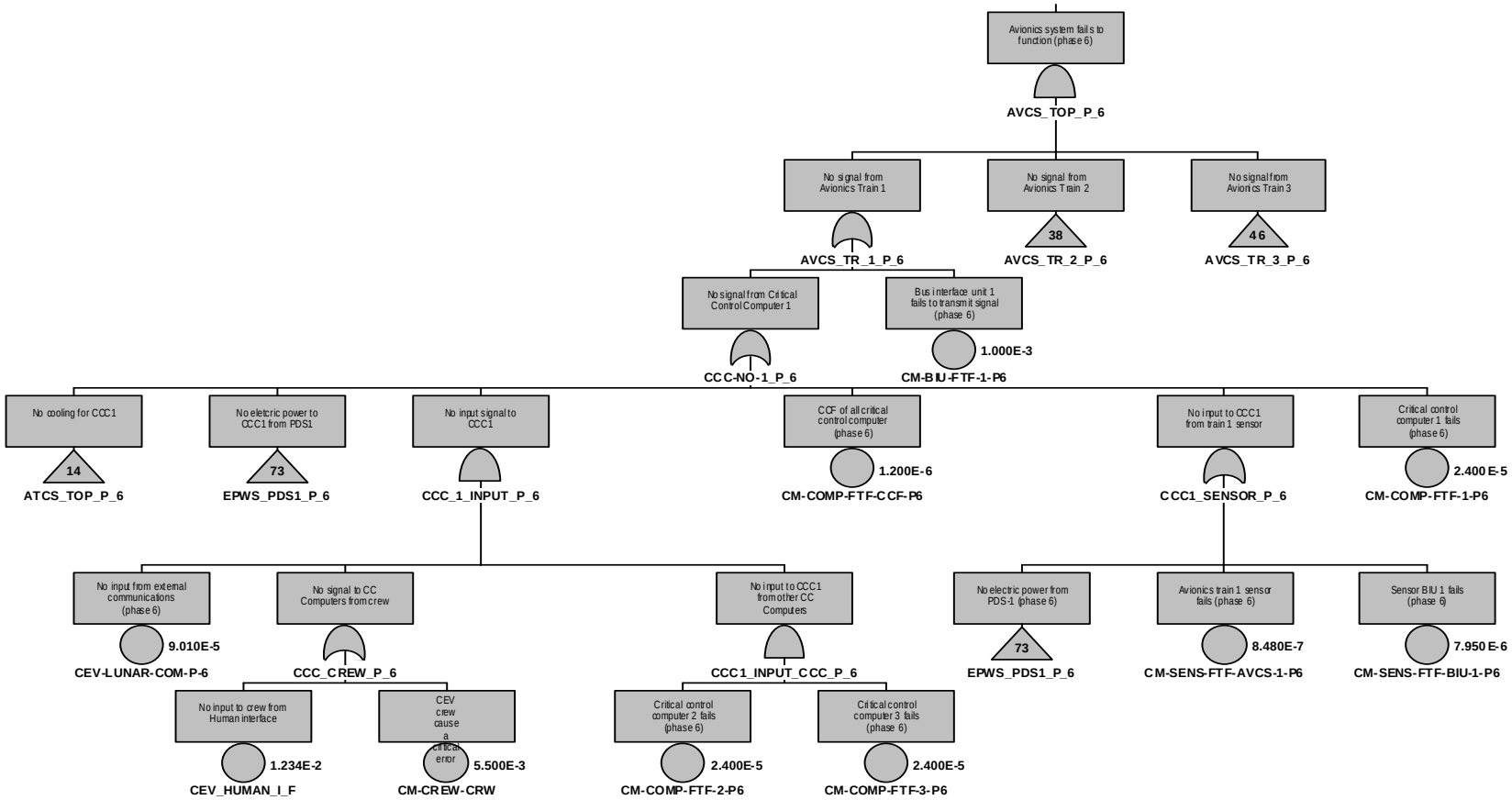
AVCS_TOP_P_4 - No signal from Avionics System (phase 4)



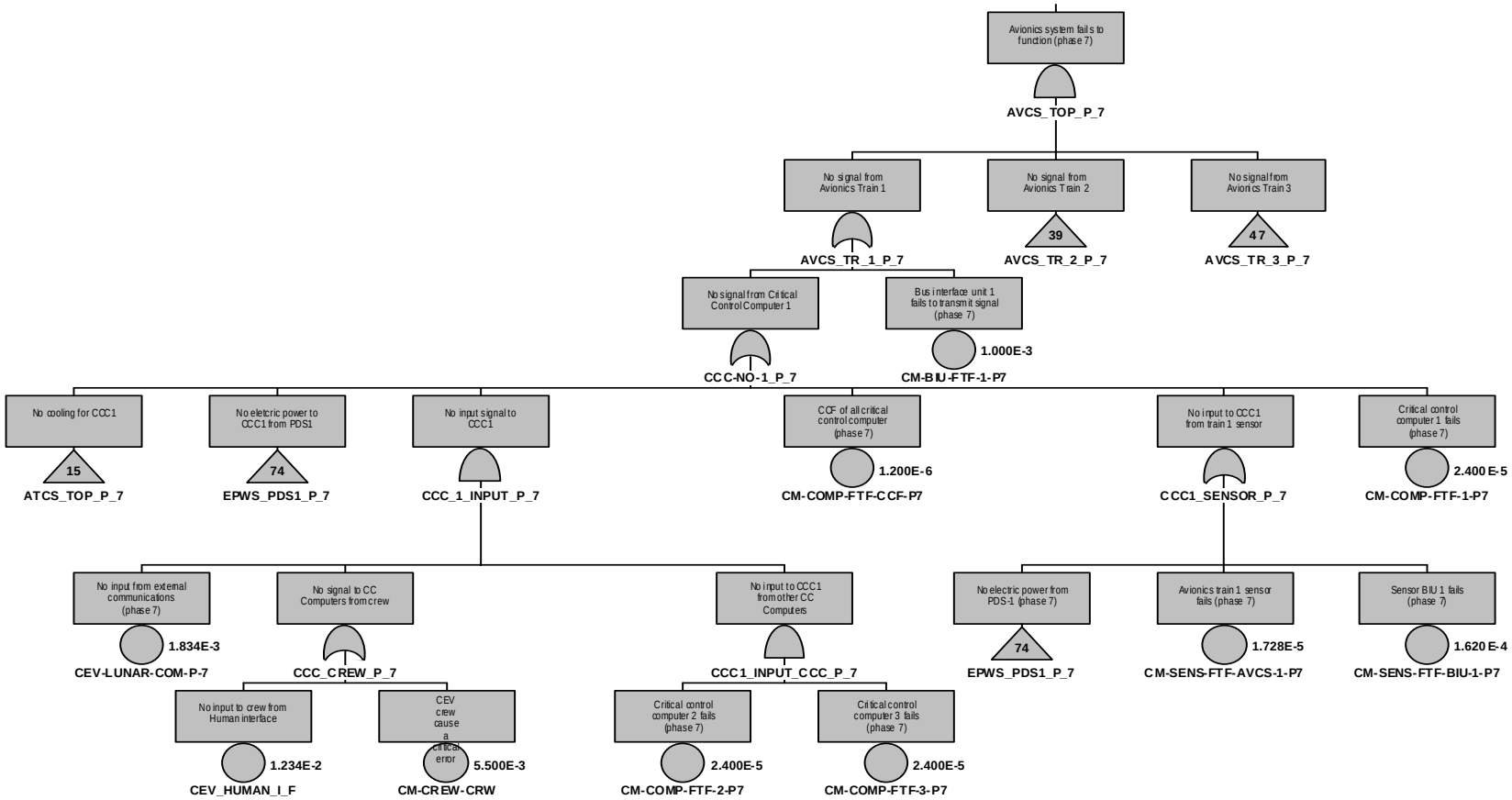
AVCS_TOP_P_5 - No signal from Avionics System (phase 5)



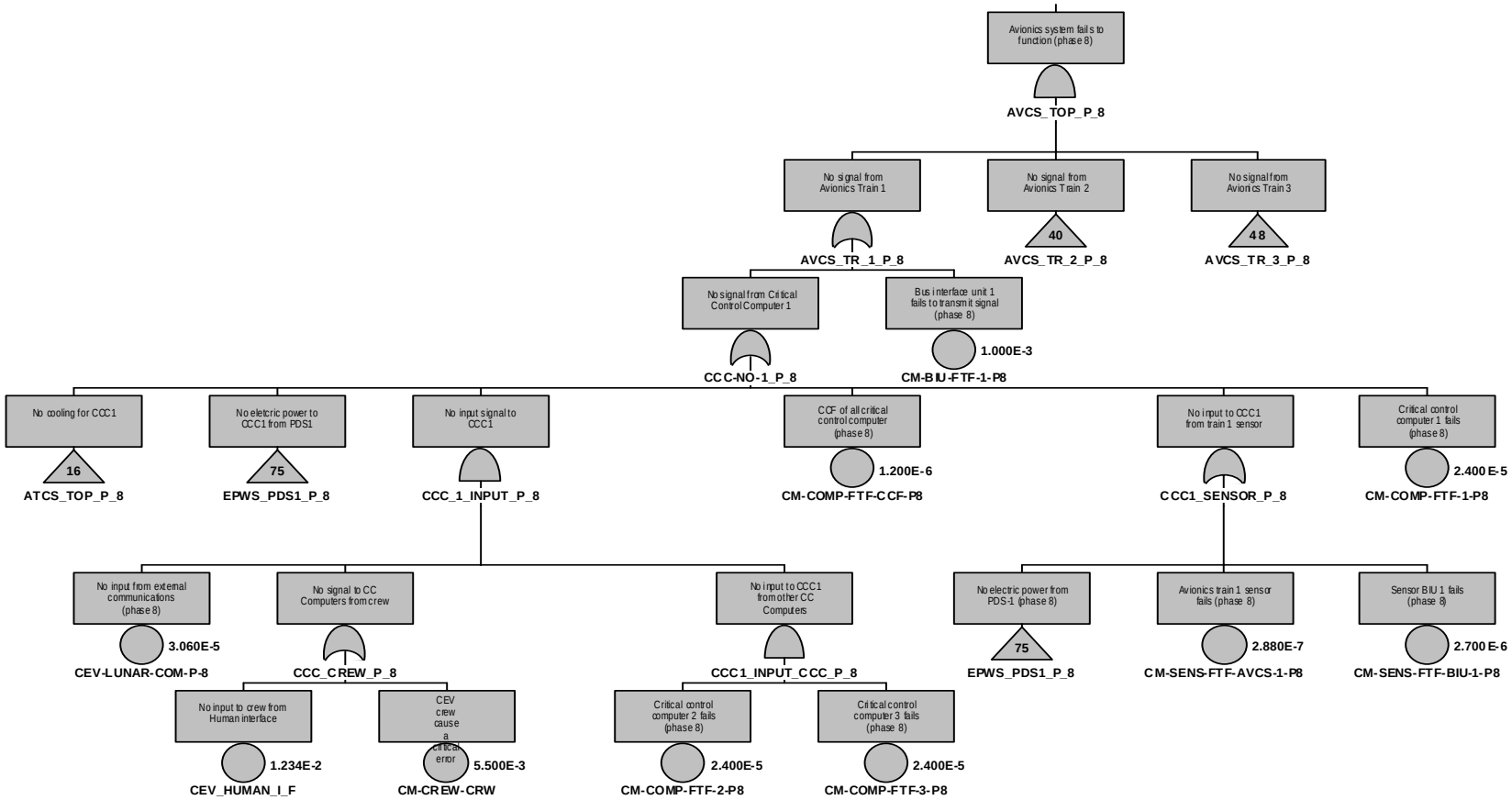
AVCS_TOP_P_6 - No signal from Avionics System (phase 6)



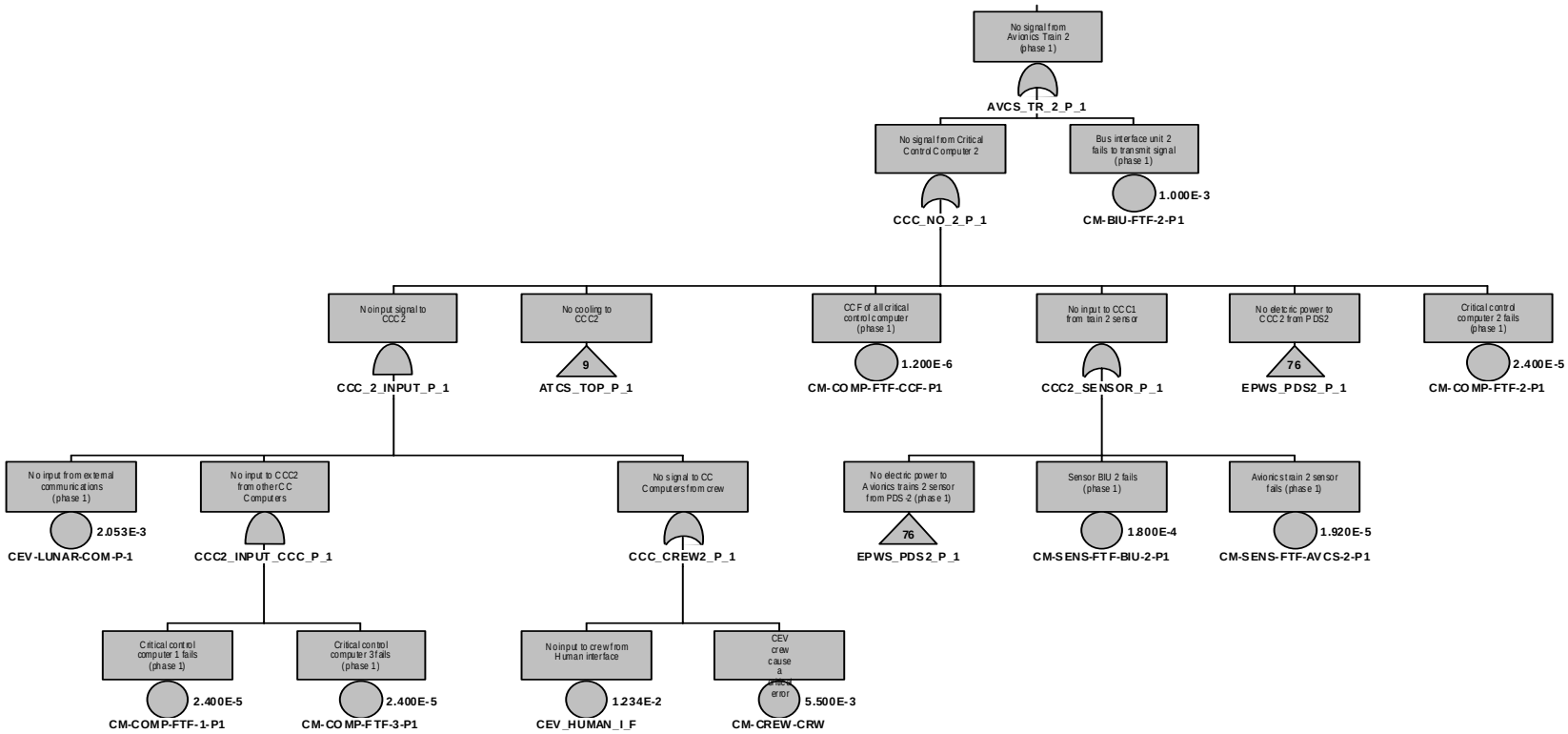
AVCS_TOP_P_7 - No signal from Avionics System (phase 7)



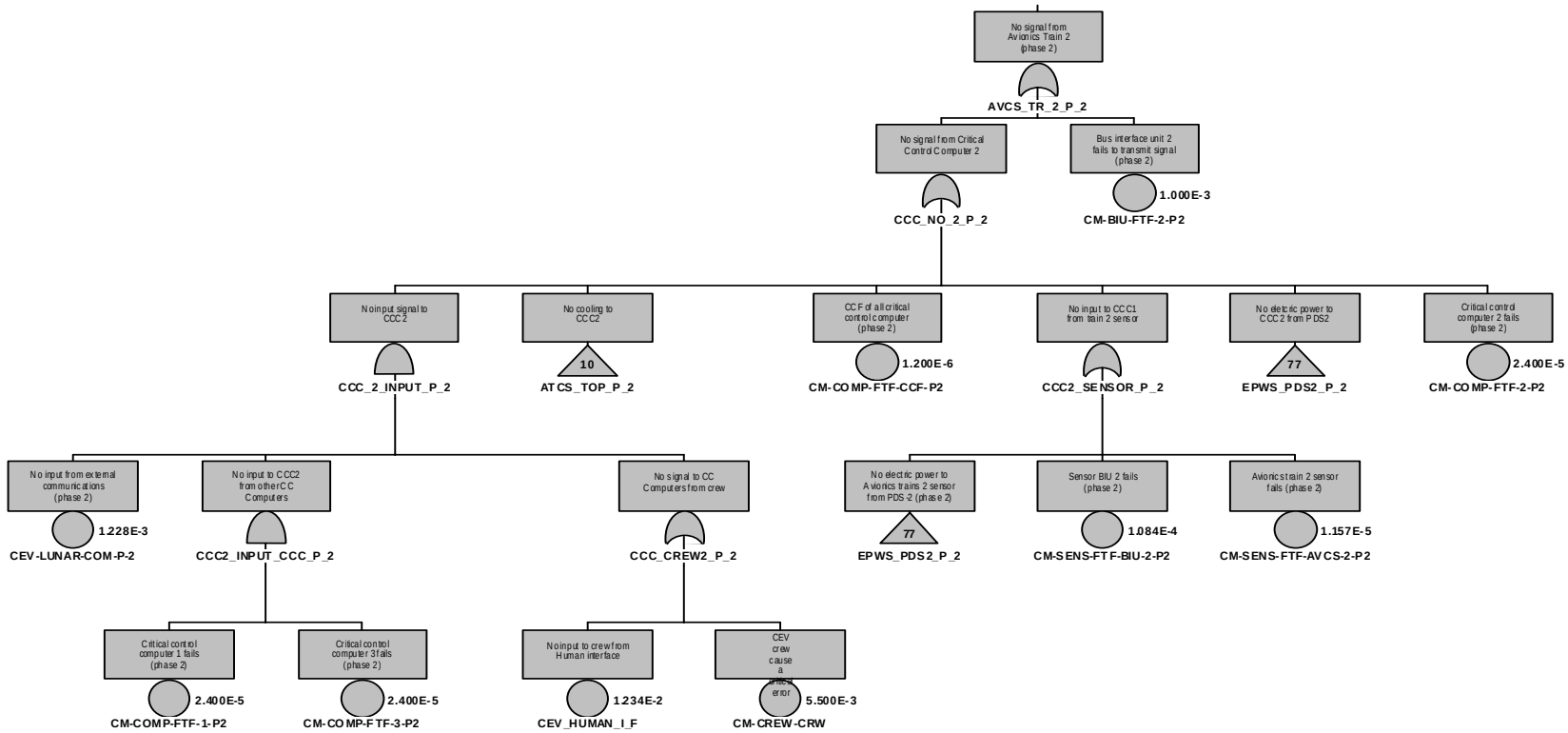
AVCS_TOP_P_8 - No signal from Avionics System (phase 8)



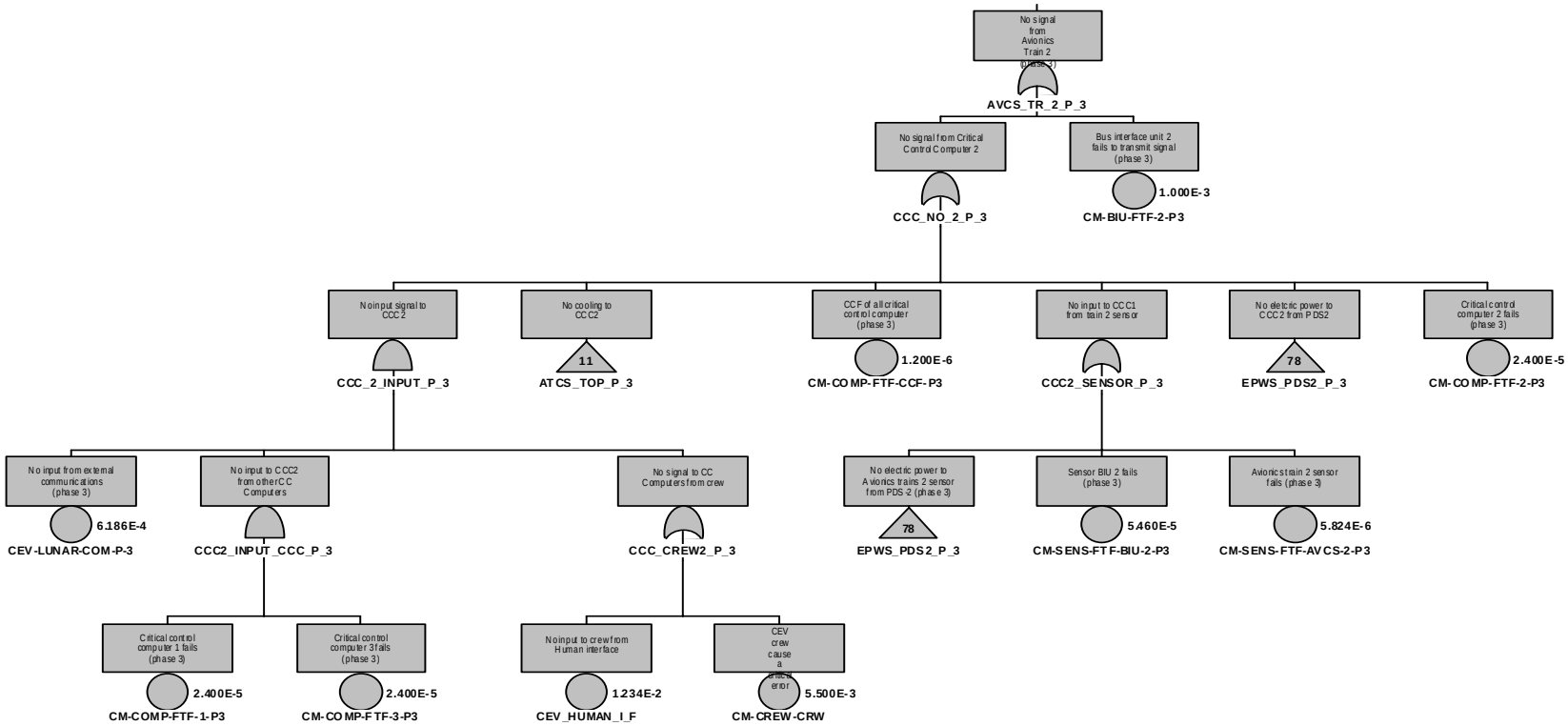
AVCS_TR_2_P_1 - No signal from Avionics Train 2 (phase 1)



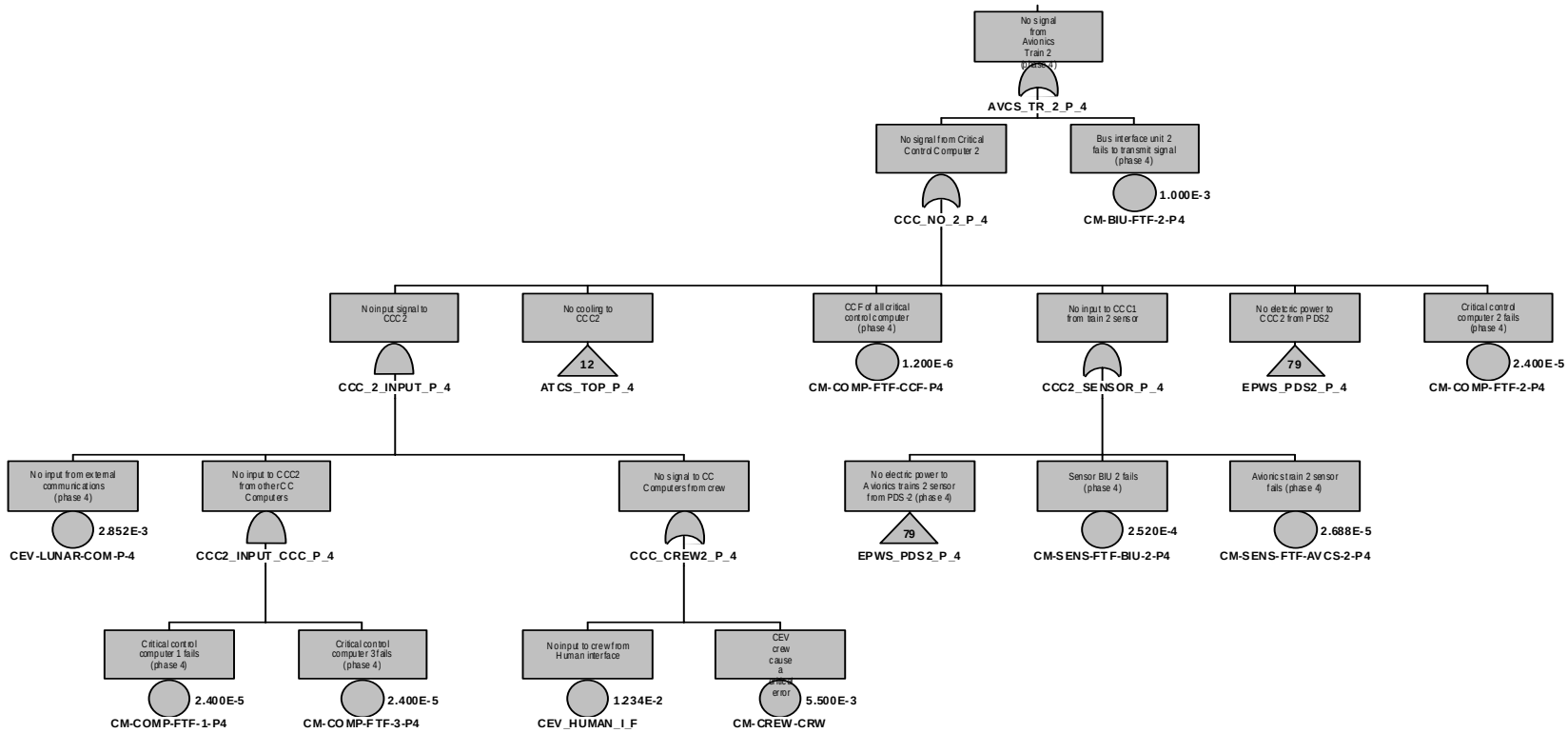
AVCS_TR_2_P_2 - No signal from Avionics Train 2 (phase 2)



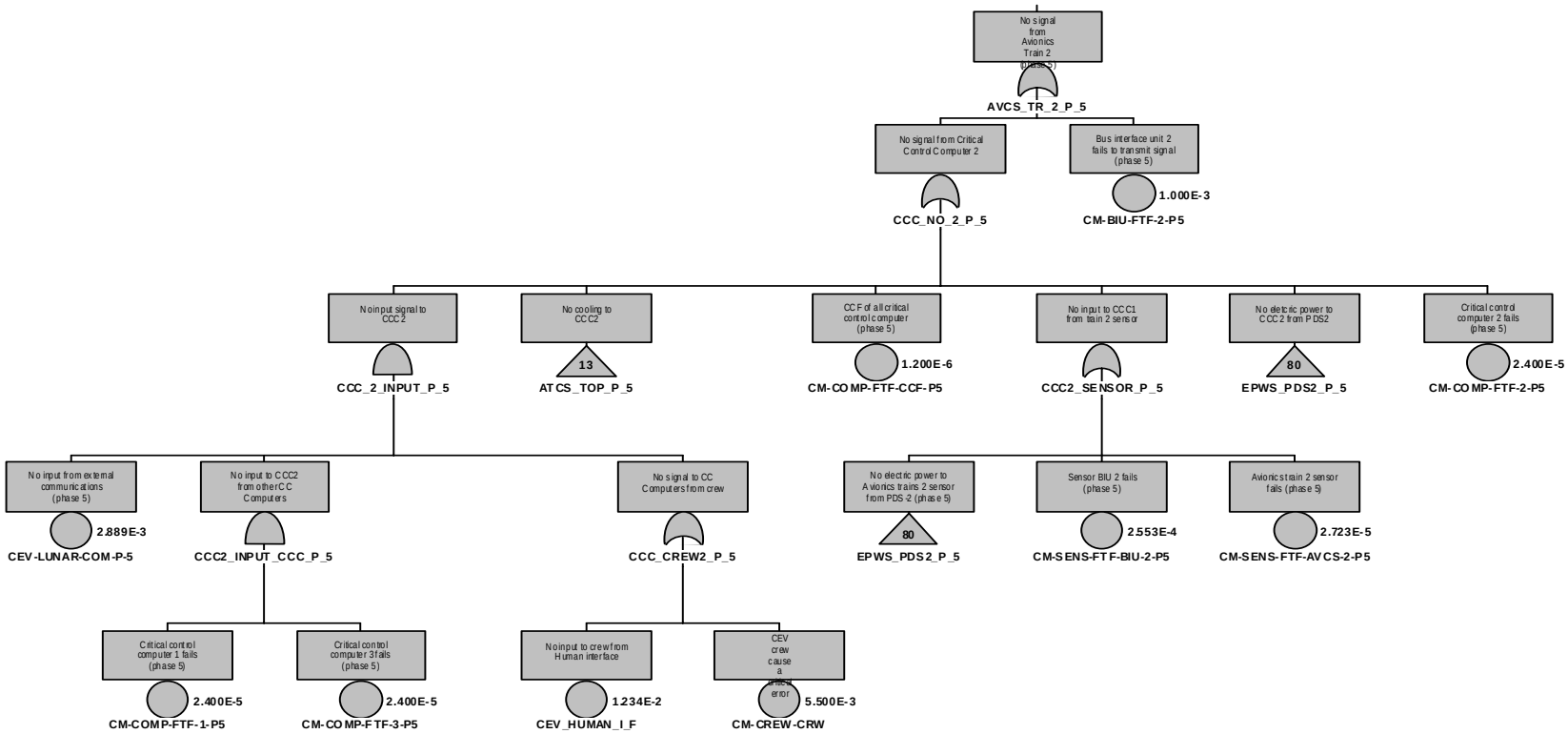
AVCS_TR_2_P_3 - No signal from Avionics Train 2 (phase 3)



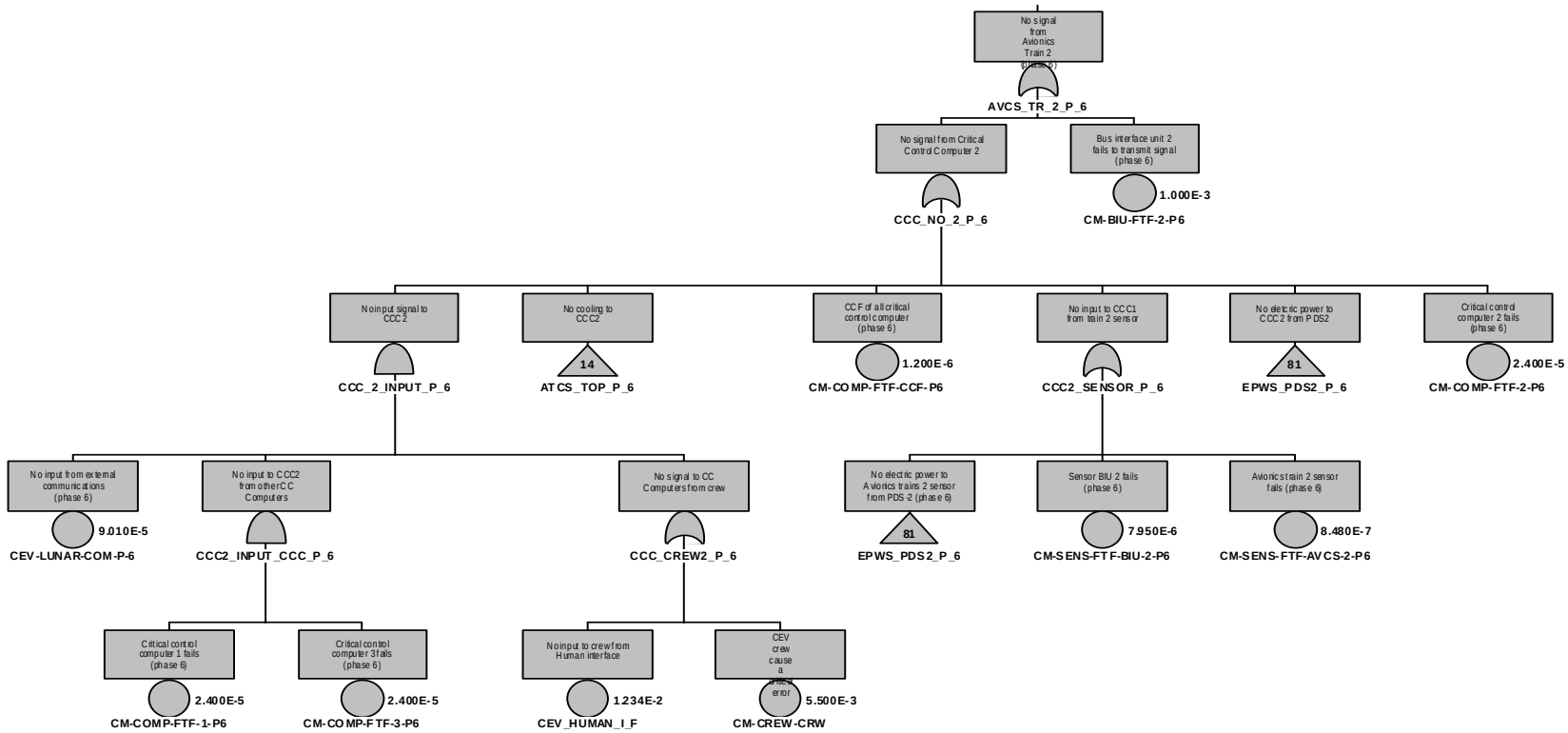
AVCS_TR_2_P_4 - No signal from Avionics Train 2 (phase 4)



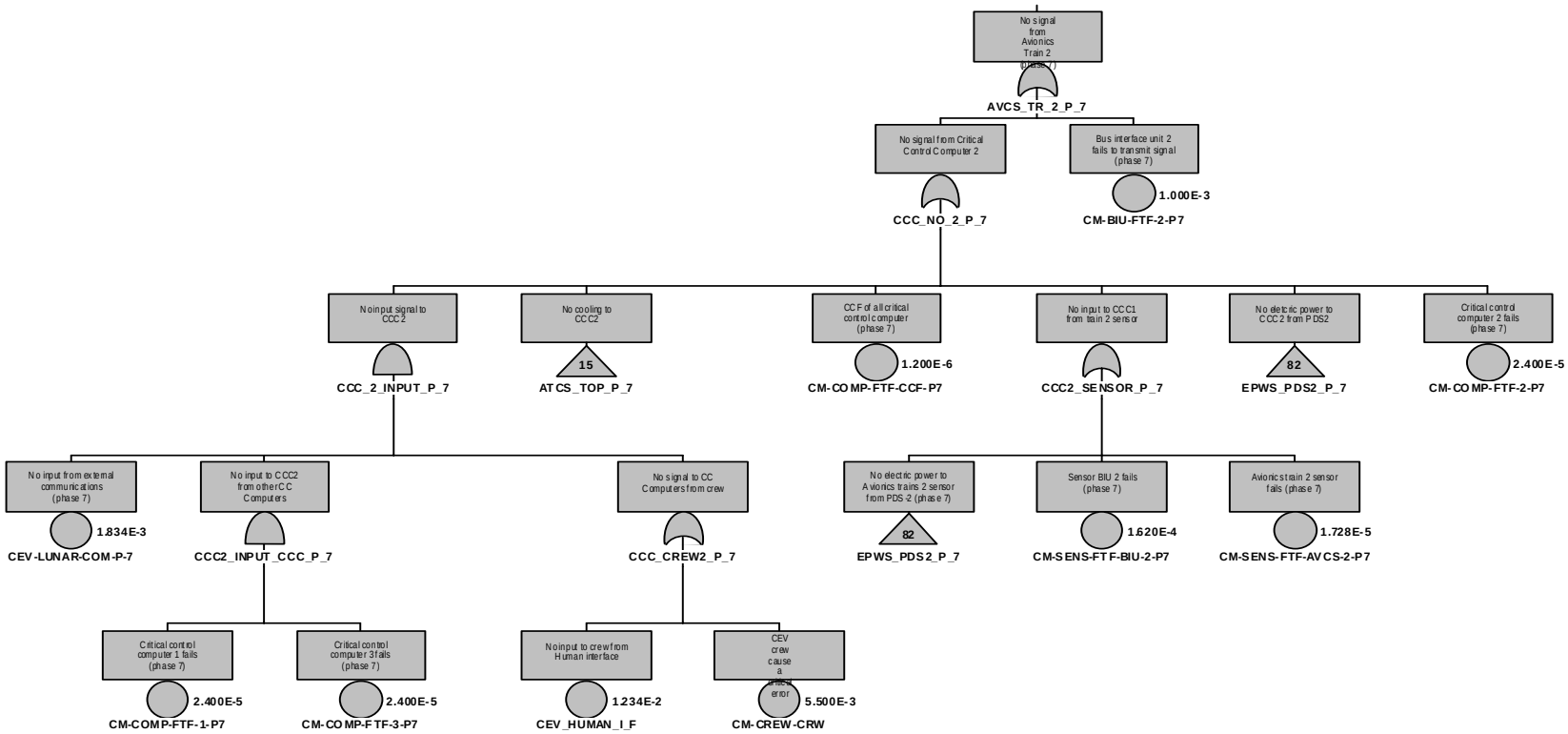
AVCS_TR_2_P_5 - No signal from Avionics Train 2 (phase 5)



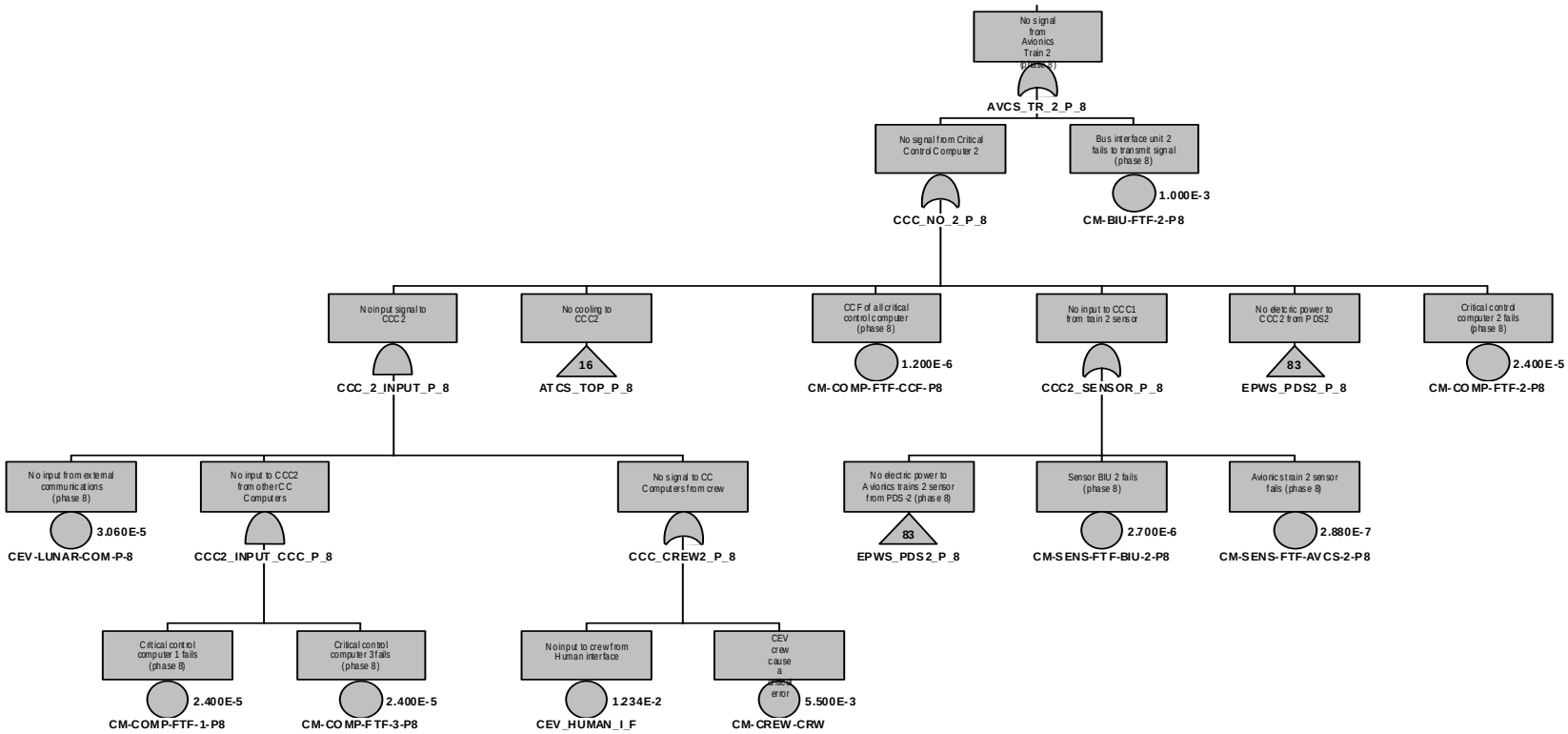
AVCS_TR_2_P_6 - No signal from Avionics Train 2 (phase 6)



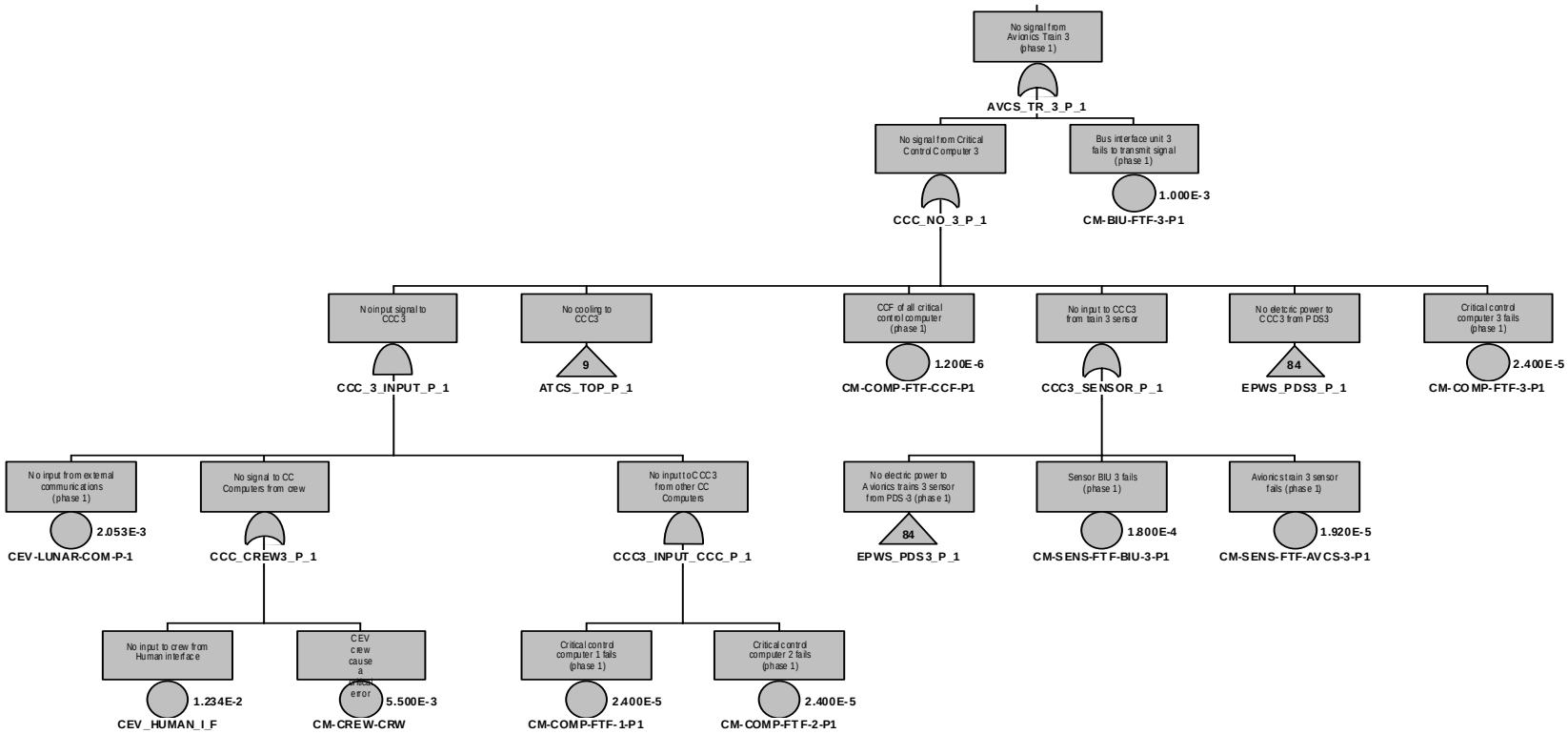
AVCS_TR_2_P_7 - No signal from Avionics Train 2 (phase 7)



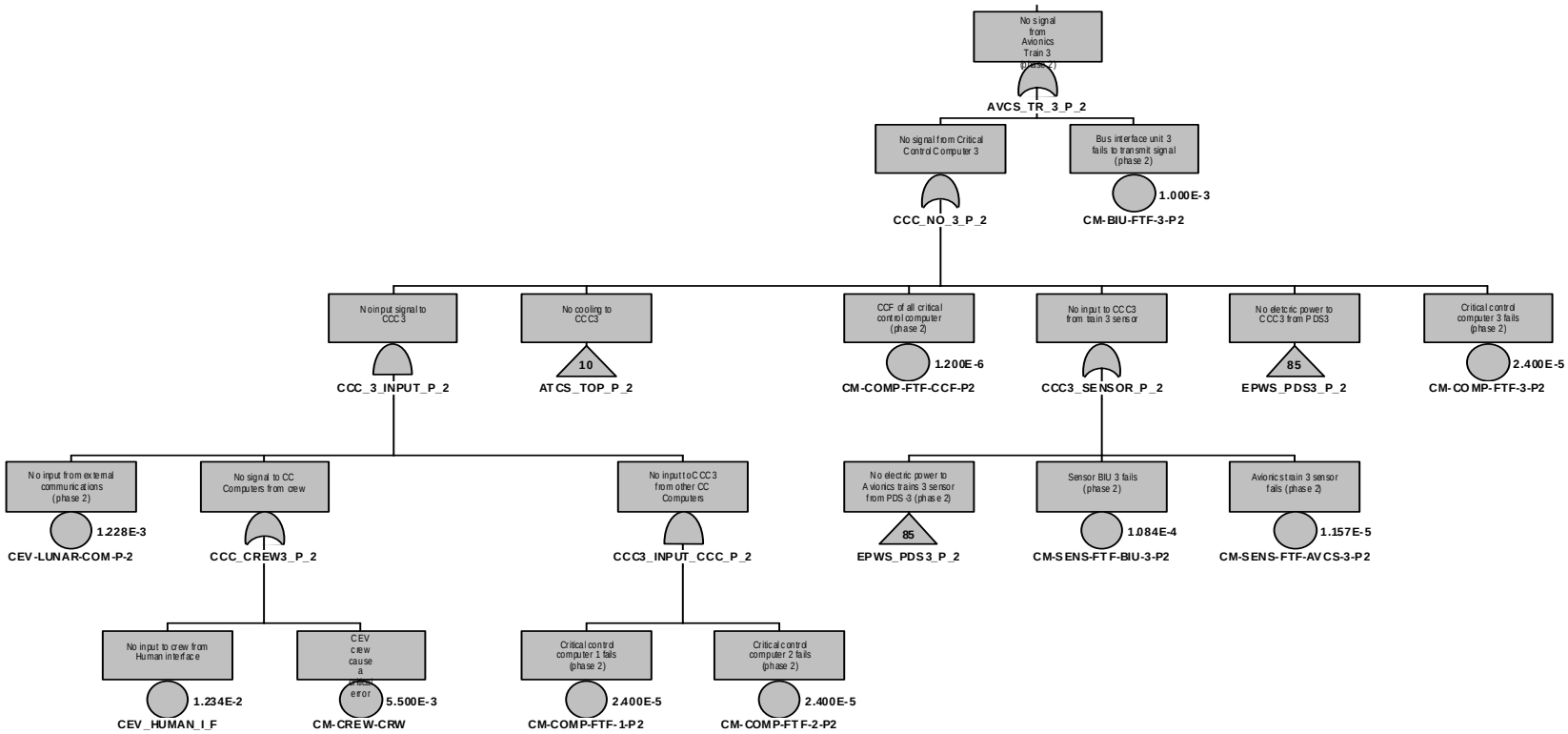
AVCS_TR_2_P_8 - No signal from Avionics Train 2 (phase 8)



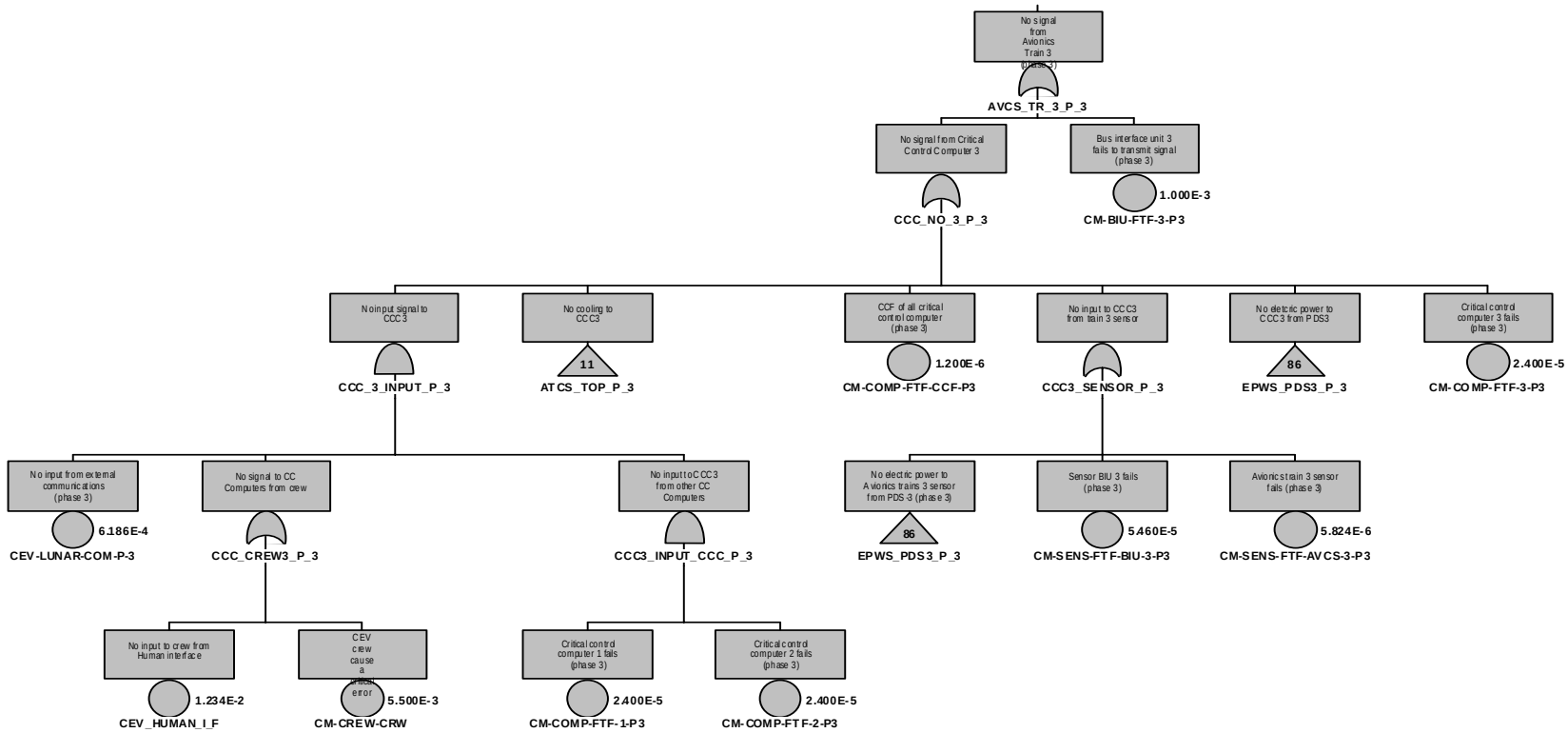
AVCS_TR_3_P_1 - No signal from Avionics Train 3 (phase 1)



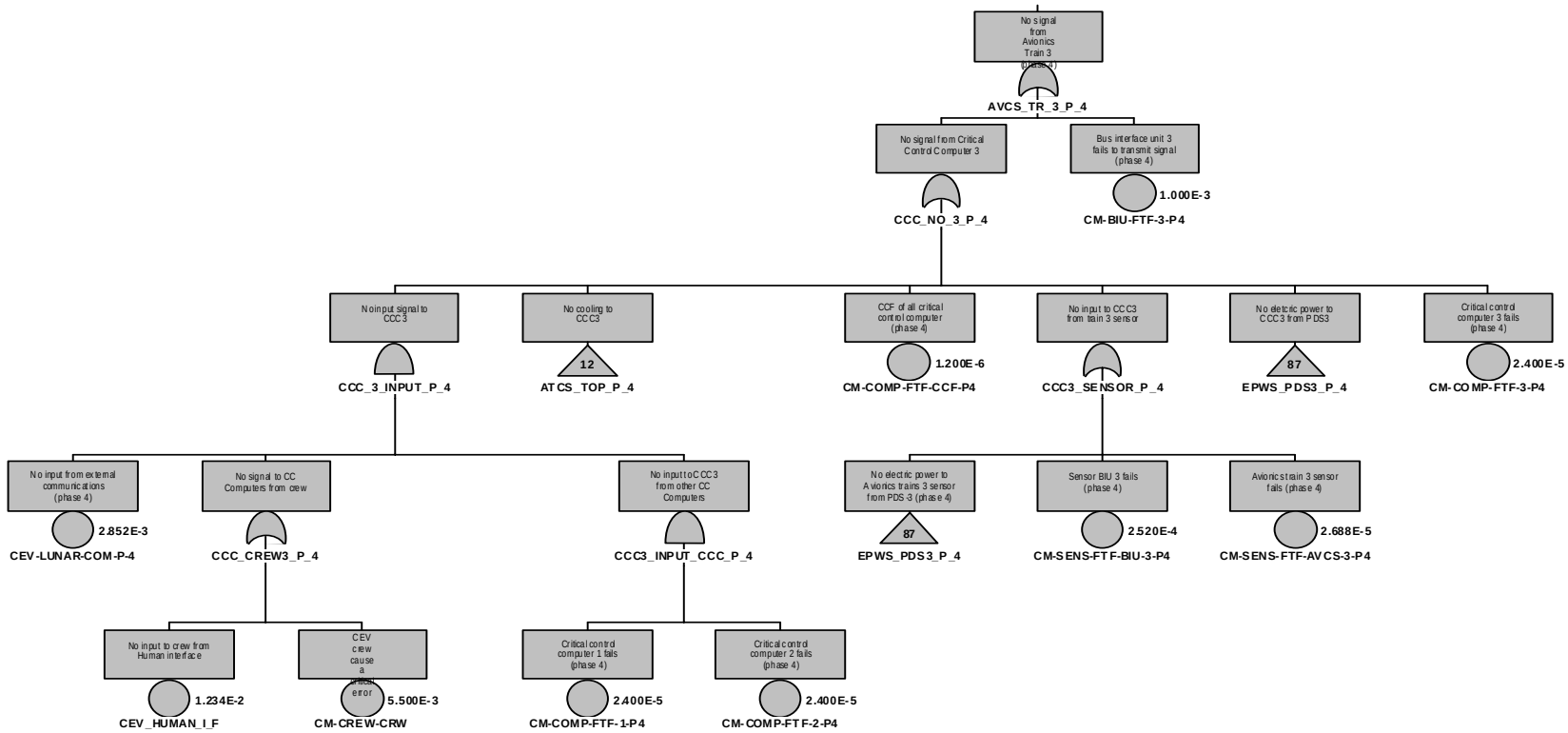
AVCS_TR_3_P_2 - No signal from Avionics Train 3 (phase 2)



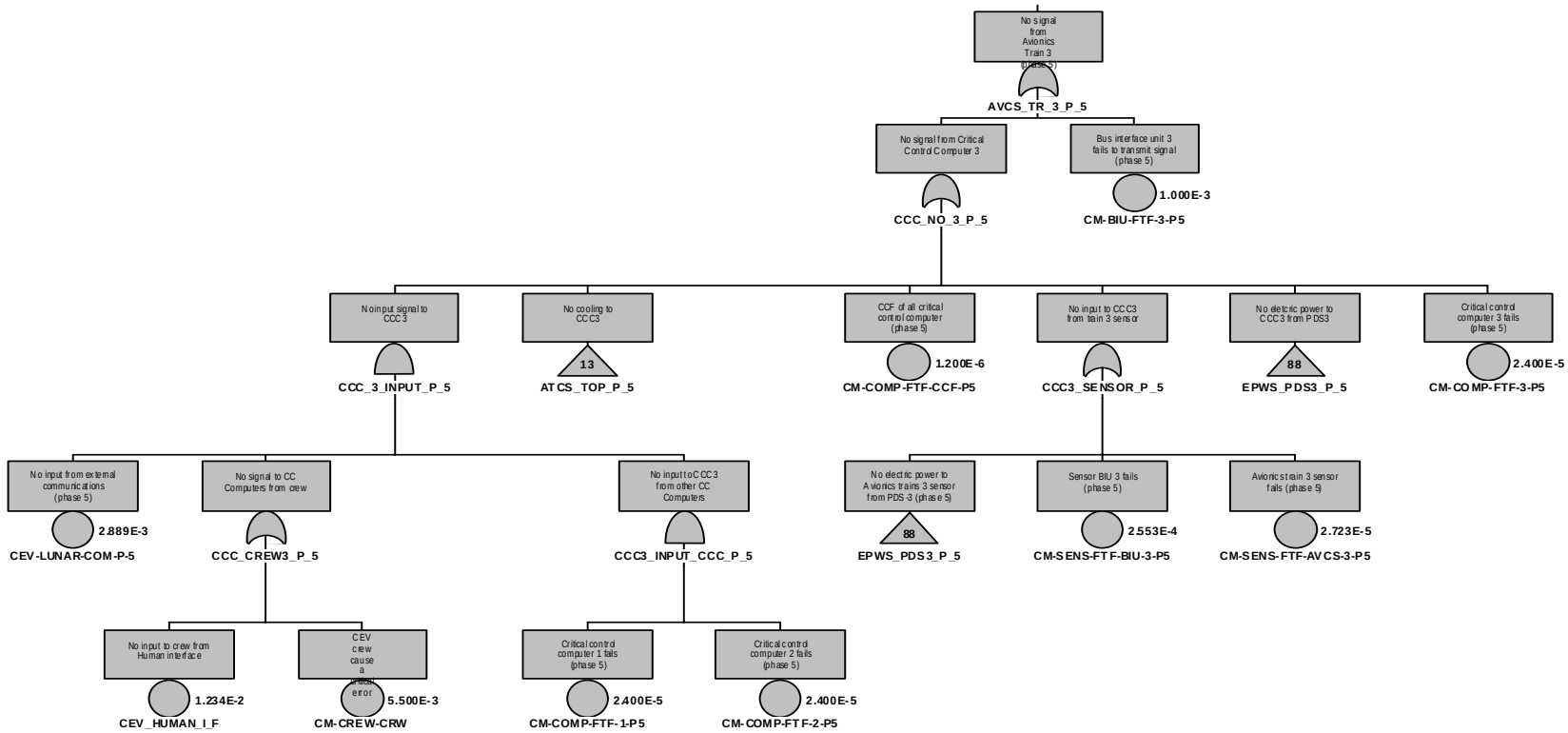
AVCS_TR_3_P_3 - No signal from Avionics Train 3 (phase 3)



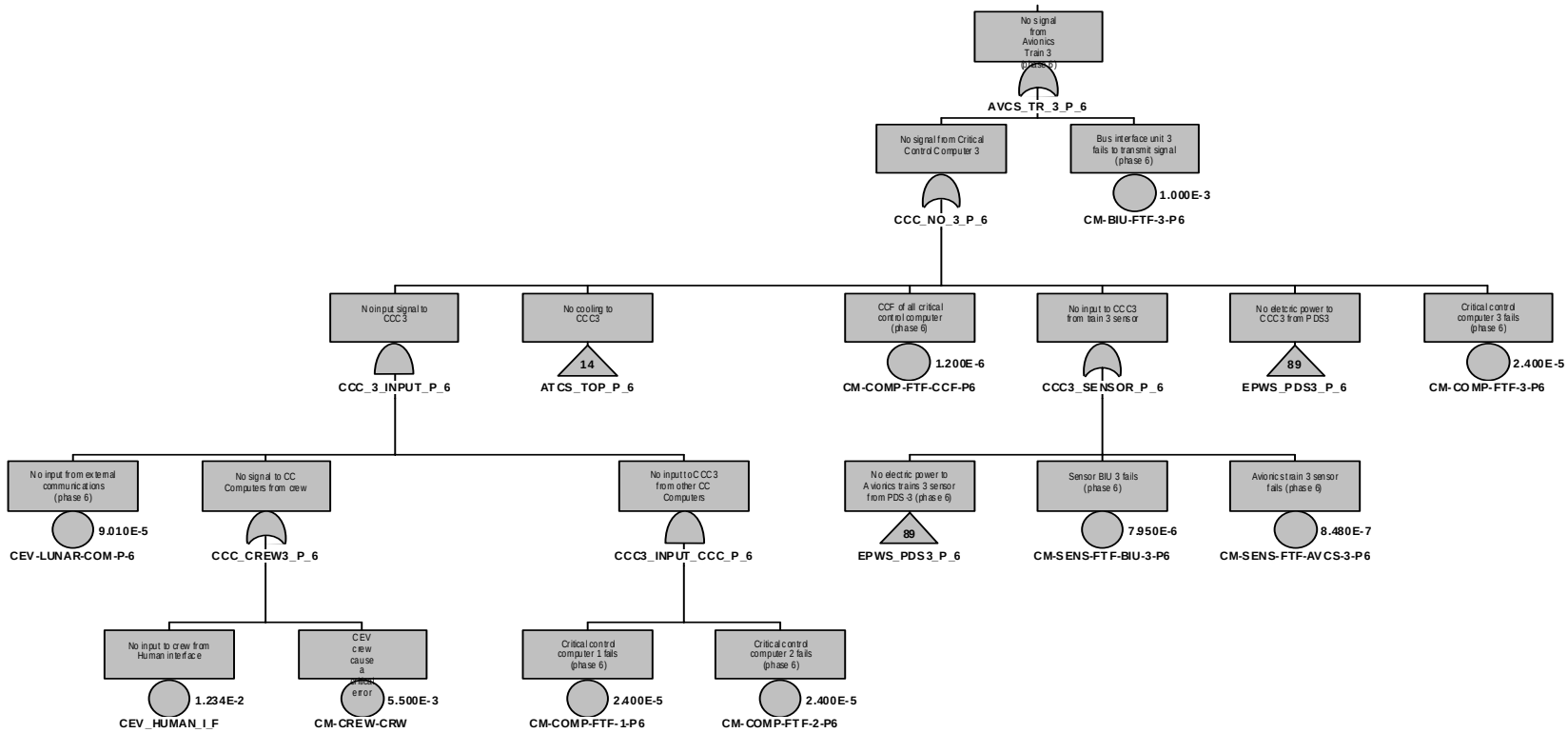
AVCS_TR_3_P_4 - No signal from Avionics Train 3 (phase 4)



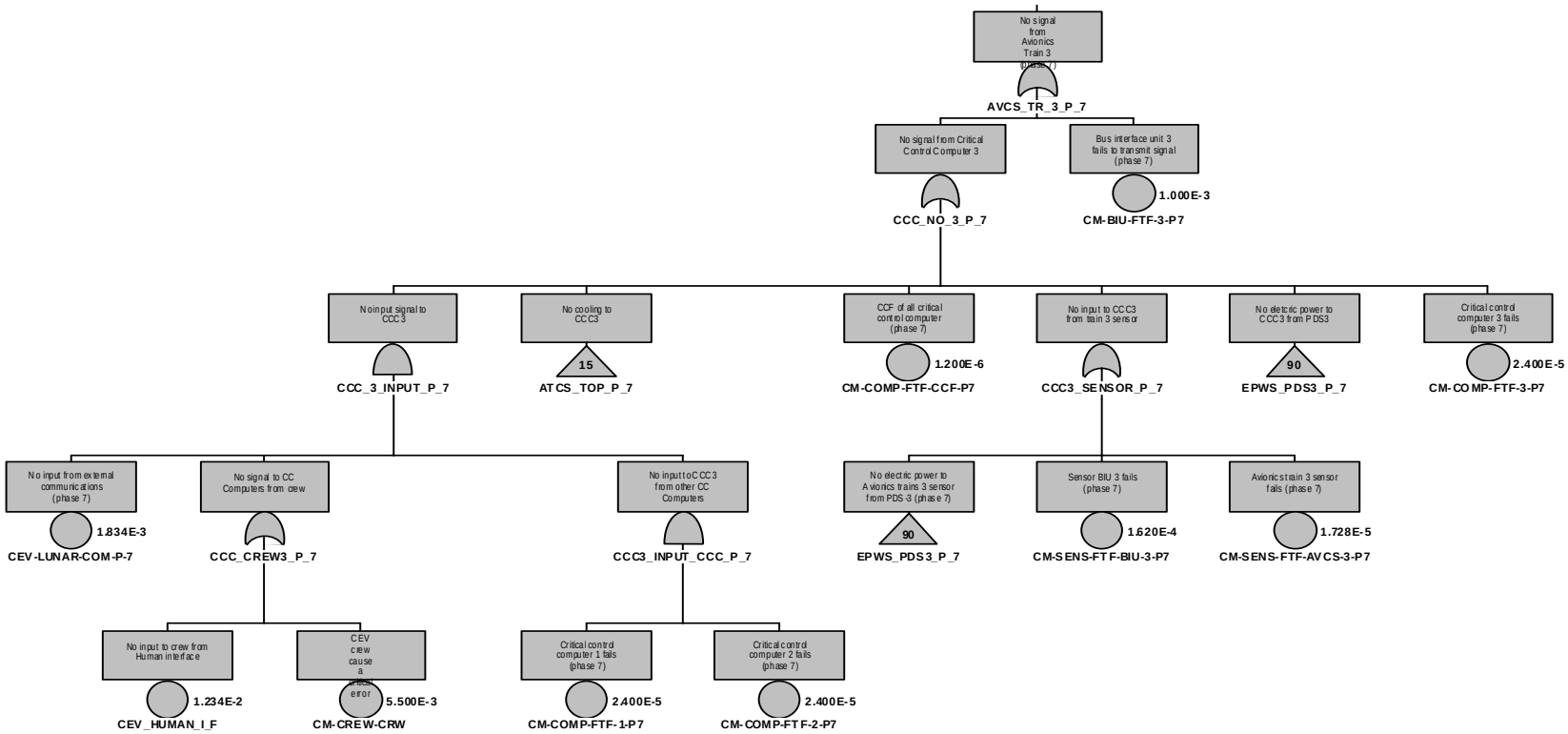
AVCS_TR_3_P_5 - No signal from Avionics Train 3 (phase 5)



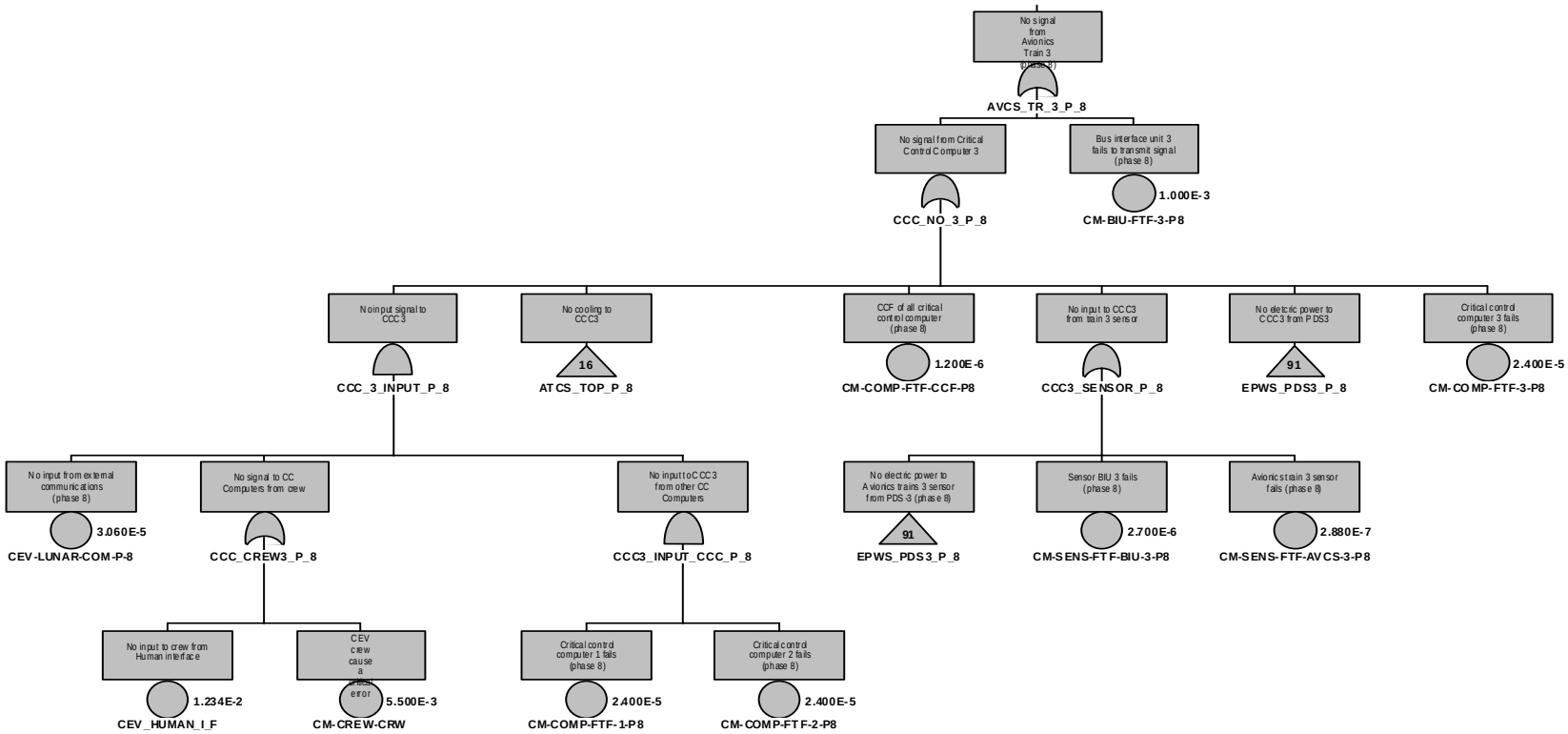
AVCS_TR_3_P_6 - No signal from Avionics Train 3 (phase 6)



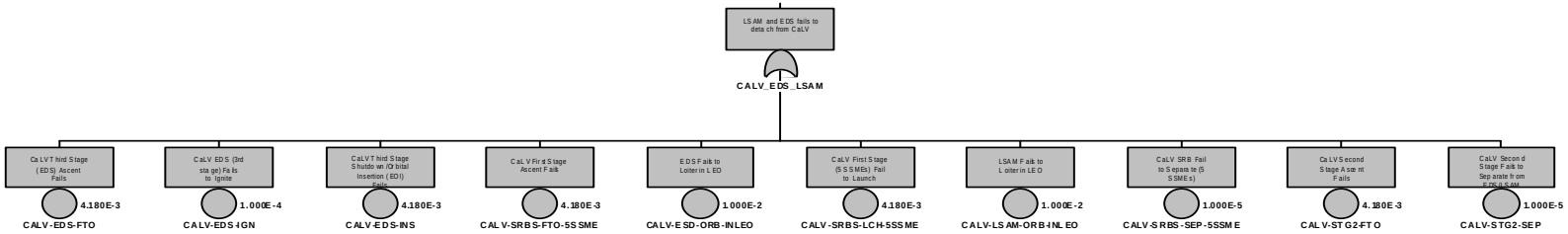
AVCS_TR_3_P_7 - No signal from Avionics Train 3 (phase 7)



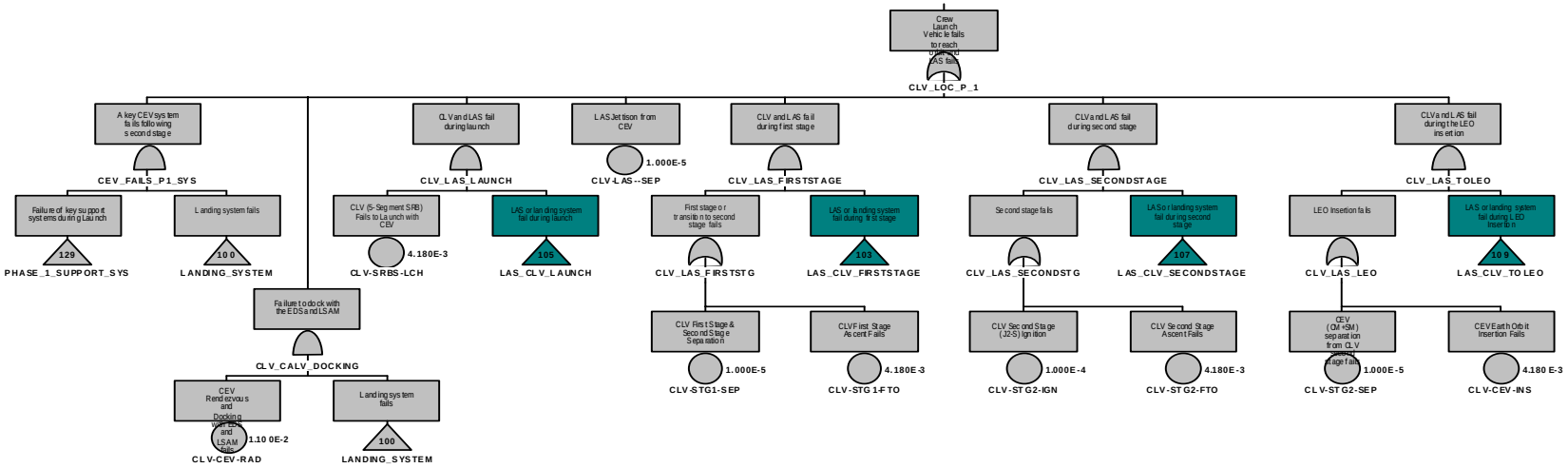
AVCS_TR_3_P_8 - No signal from Avionics Train 3 (phase 8)



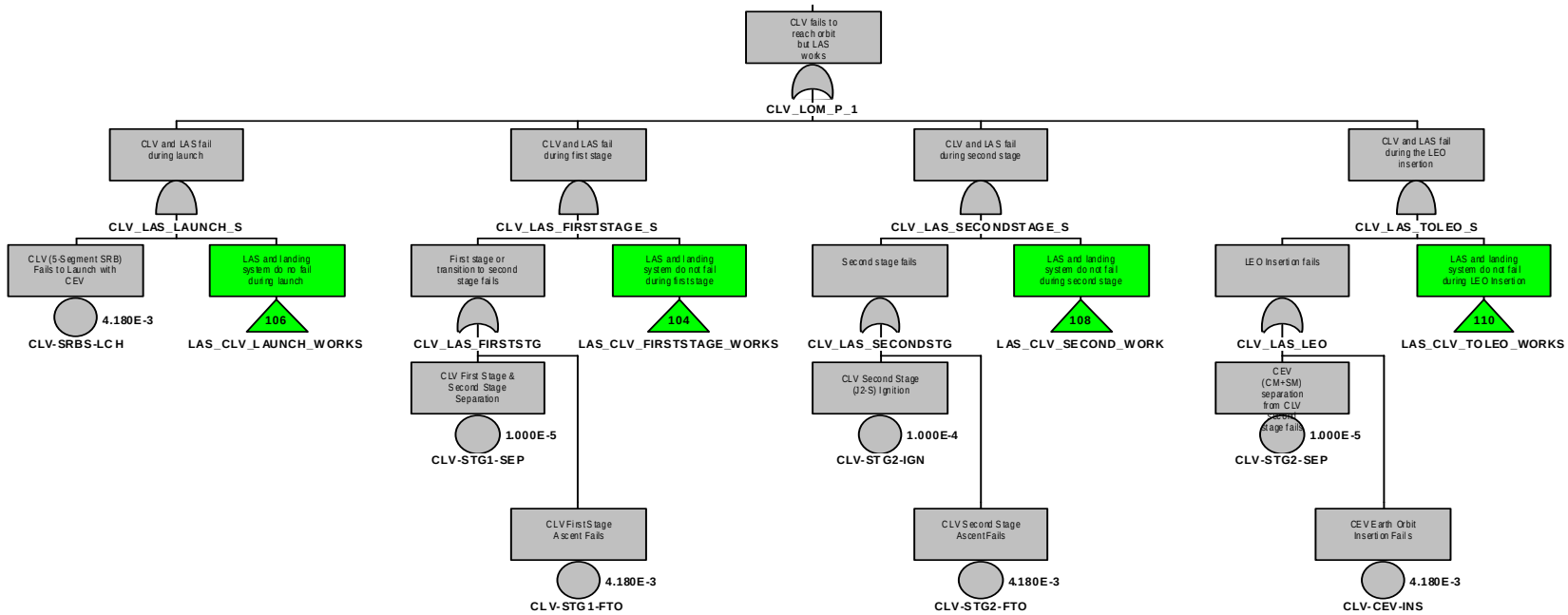
CALV_EDS_LSAM - EDS/LSAM Fail to Reach Orbit



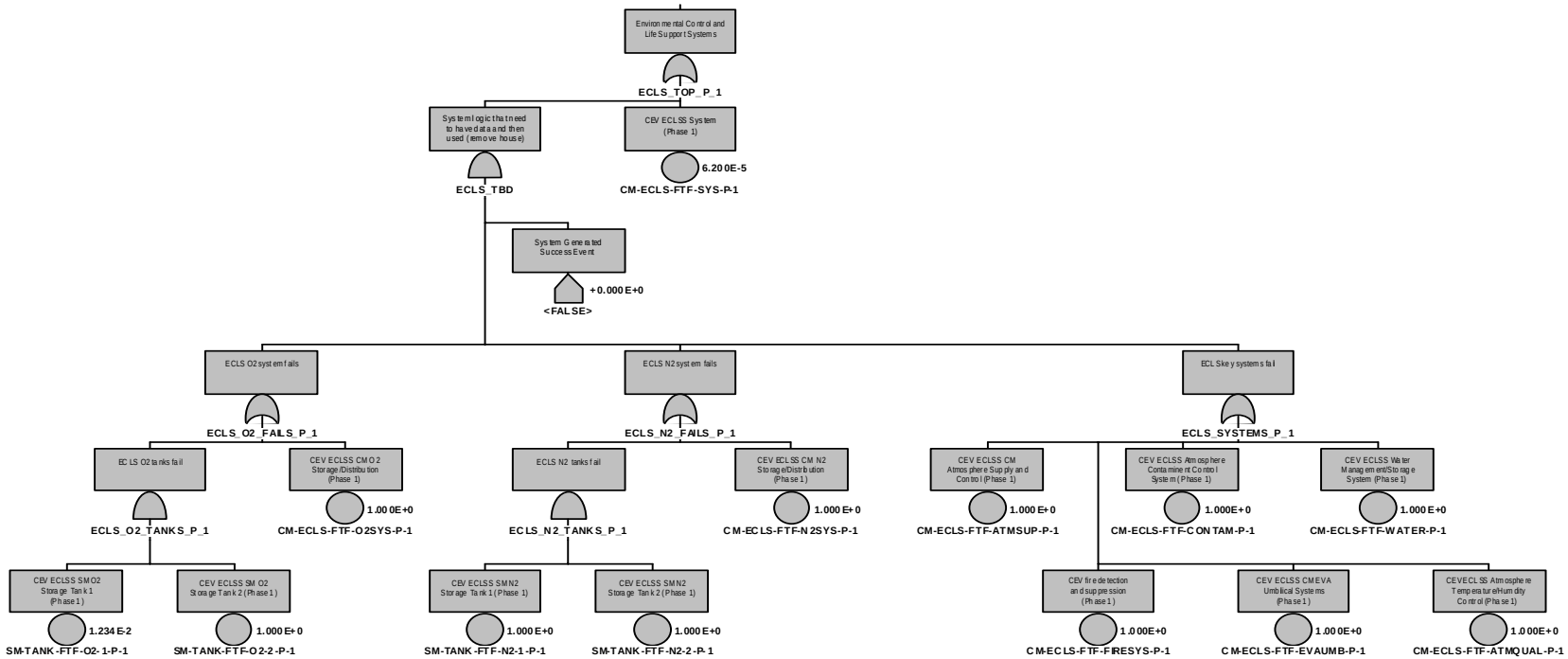
CLV_LOC_P_1 - Crew Launch Vehicle Fail to Reach Orbit and LAS fails



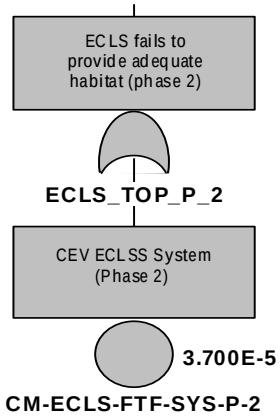
CLV_LOM_P_1 - CLV fails to reach Orbit but LAS works



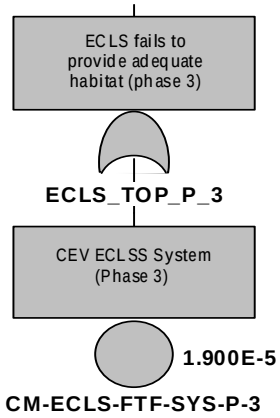
ECLS_TOP_P_1 - ECLS fails to provide adequate habitat (phase 1)



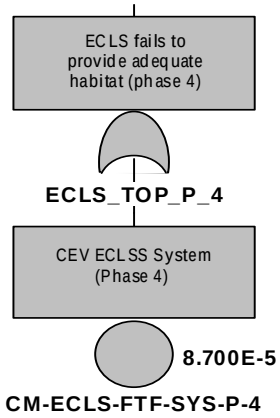
ECLS_TOP_P_2 - ECLS fails to provide adequate habitat (phase 2)



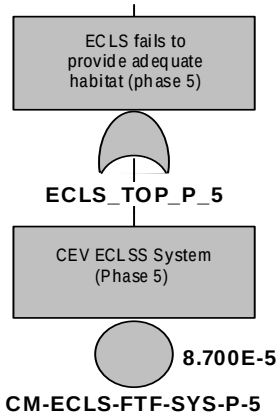
ECLS_TOP_P_3 - ECLS fails to provide adequate habitat (phase 3)



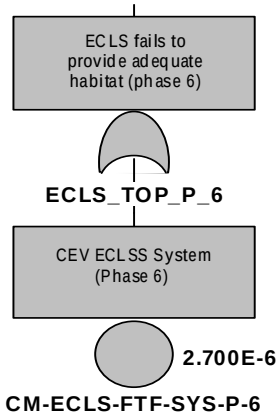
ECLS_TOP_P_4 - ECLS fails to provide adequate habitat (phase 4)



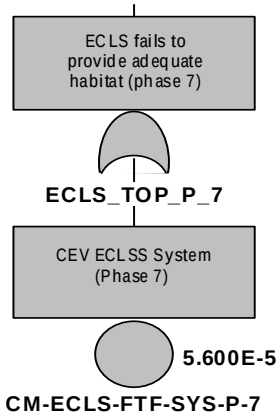
ECLS_TOP_P_5 - ECLS fails to provide adequate habitat (phase 5)



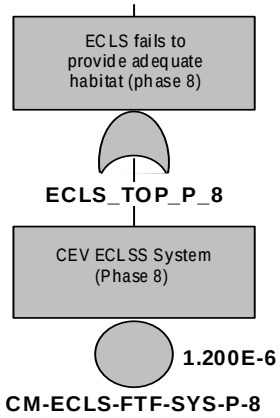
ECLS_TOP_P_6 - ECLS fails to provide adequate habitat (phase 6)



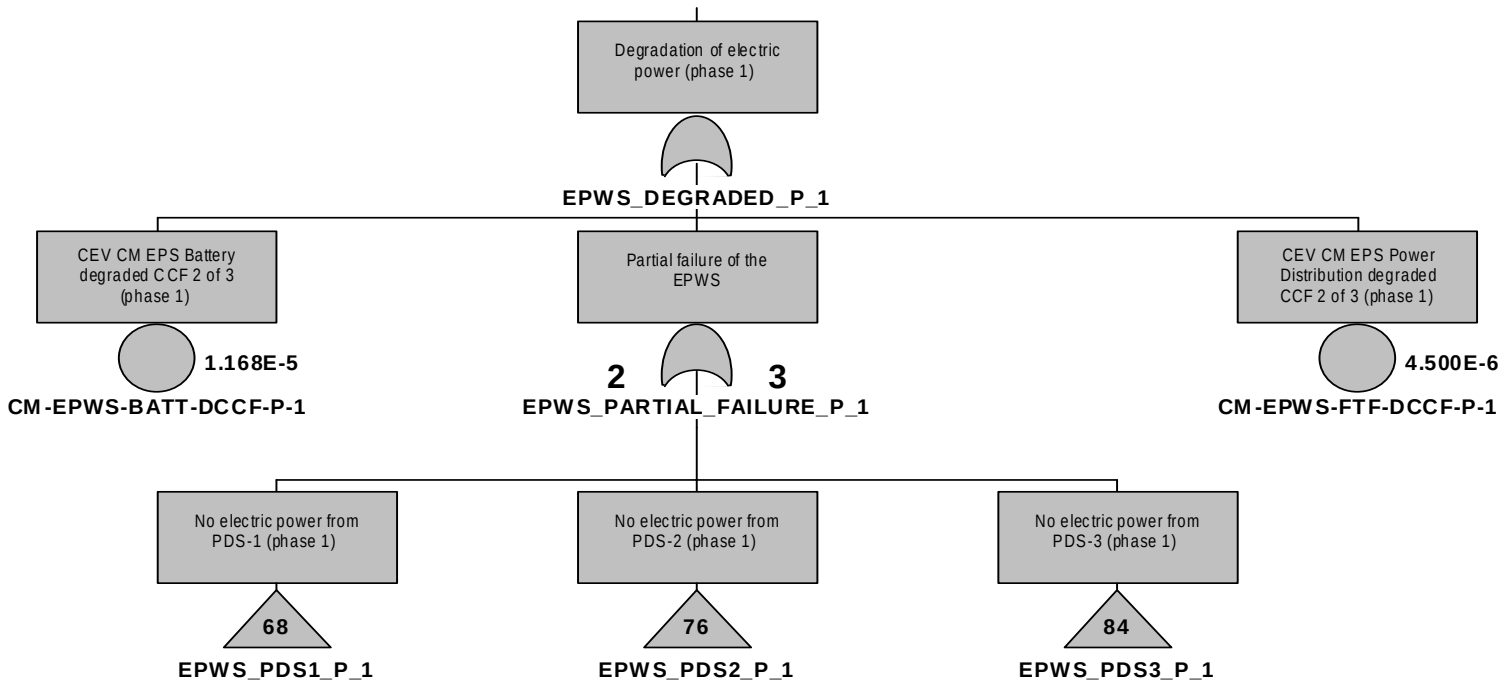
ECLS_TOP_P_7 - ECLS fails to provide adequate habitat (phase 7)



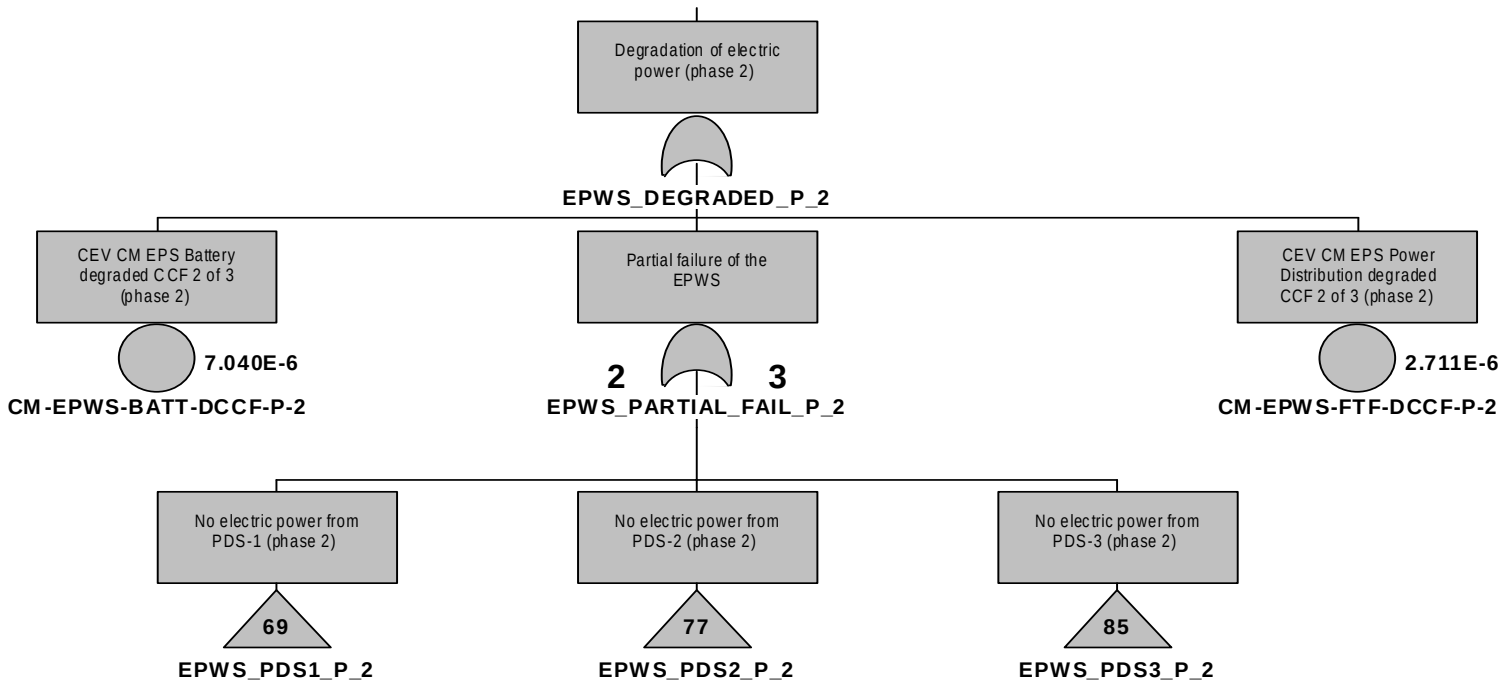
ECLS_TOP_P_8 - ECLS fails to provide adequate habitat (phase 8)



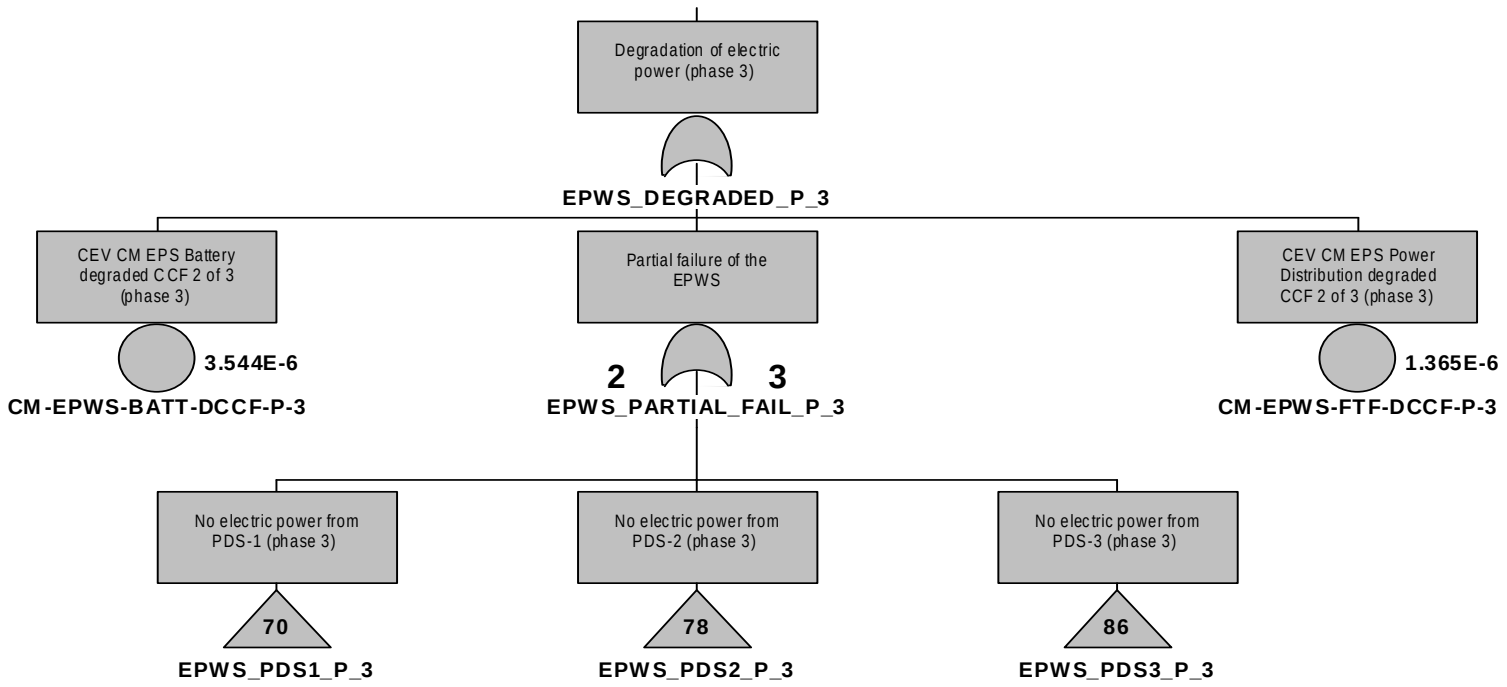
EPWS_DEGRADED_P_1 - Degradation of electric power (phase 1)



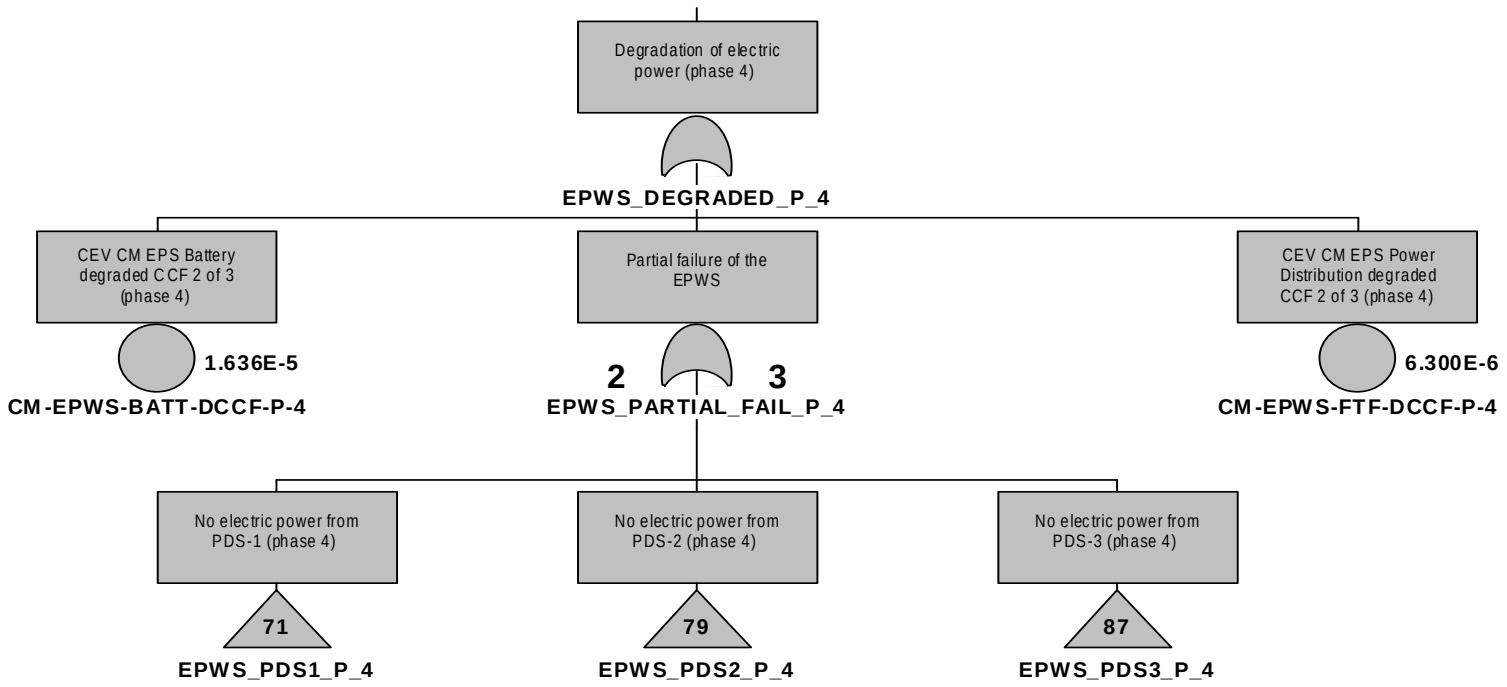
EPWS_DEGRADED_P_2 - Degradation of electric power (phase 2)



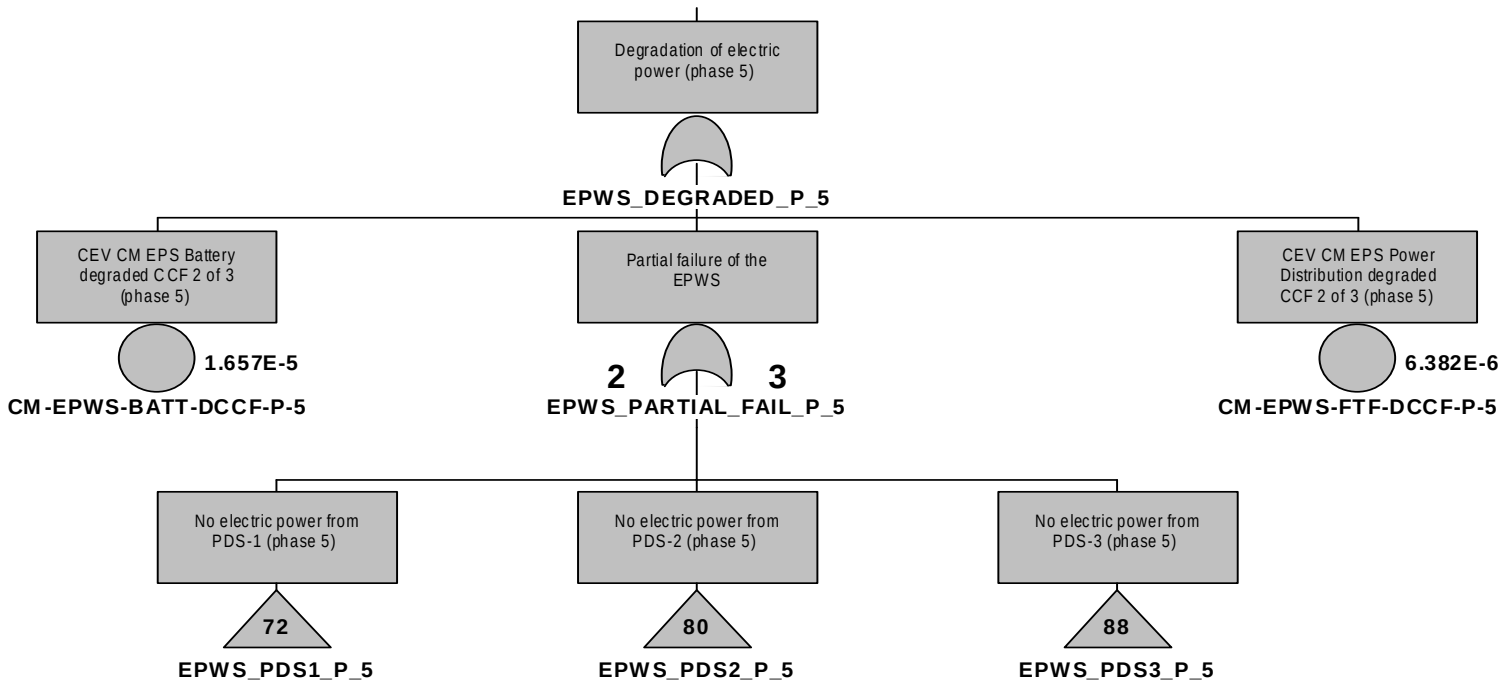
EPWS_DEGRADED_P_3 - Degradation of electric power (phase 3)



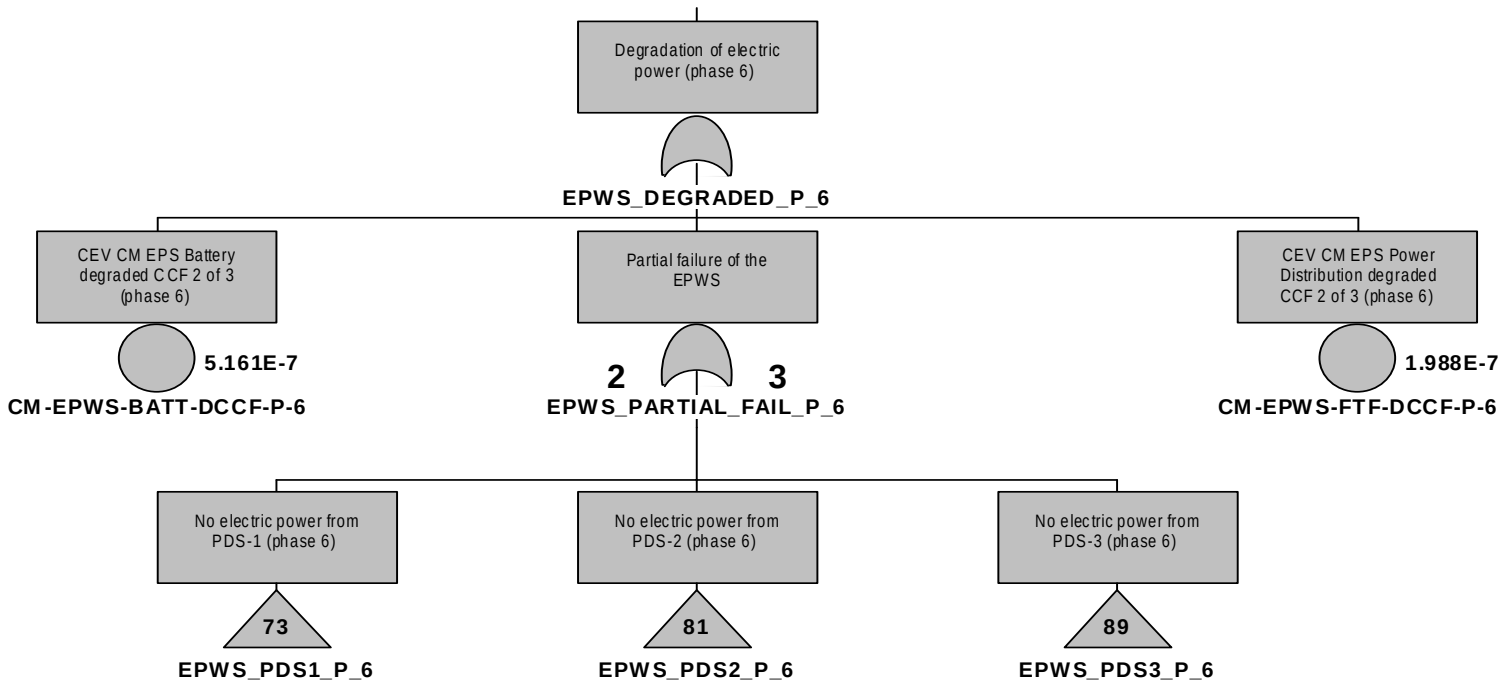
EPWS_DEGRADED_P_4 - Degradation of electric power (phase 4)



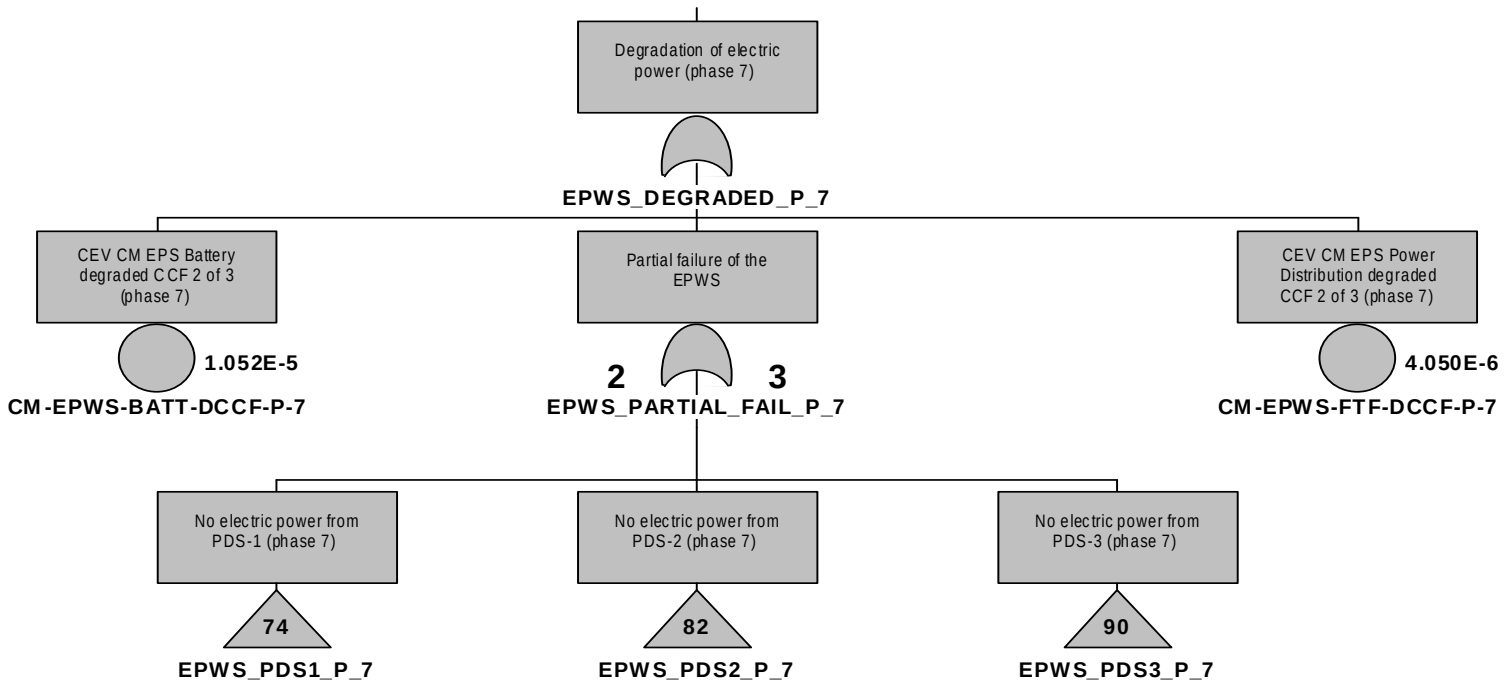
EPWS_DEGRADED_P_5 - Degradation of electric power (phase 5)



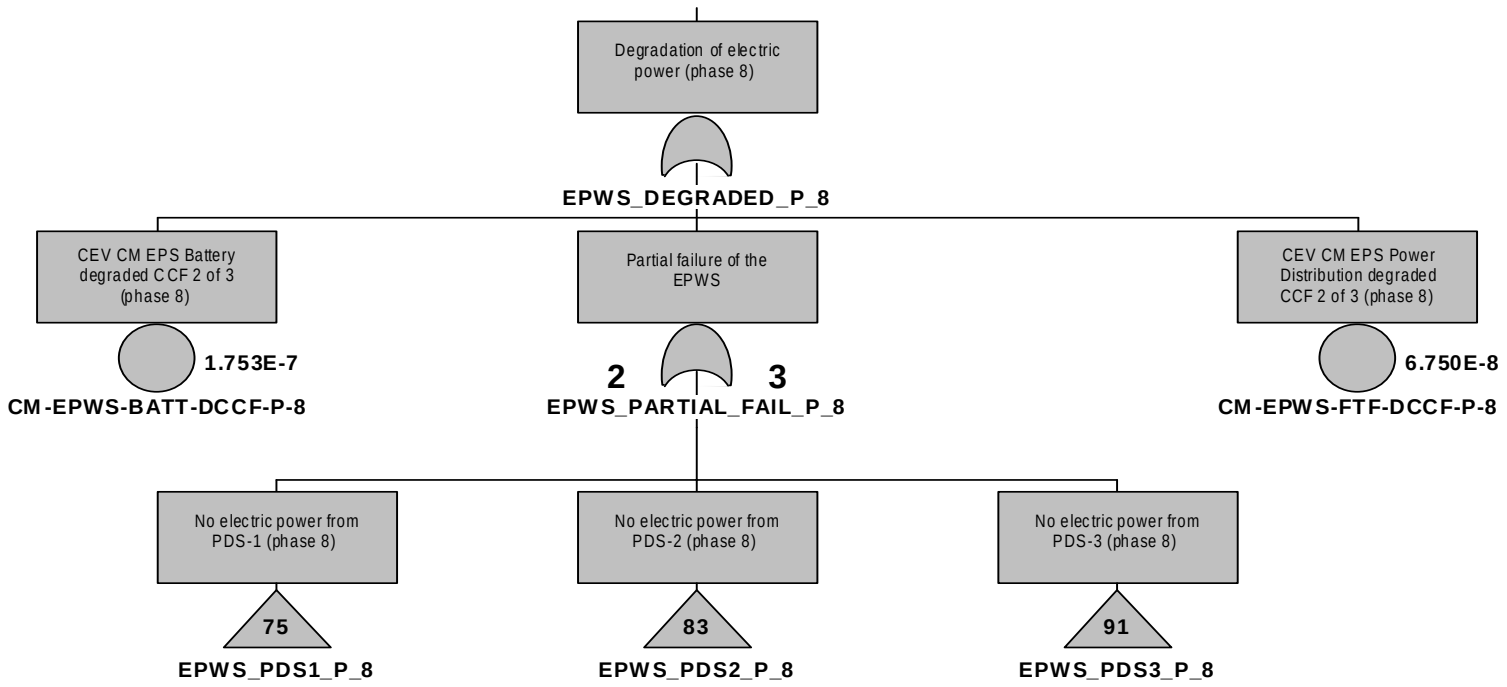
EPWS_DEGRADED_P_6 - Degradation of electric power (phase 6)



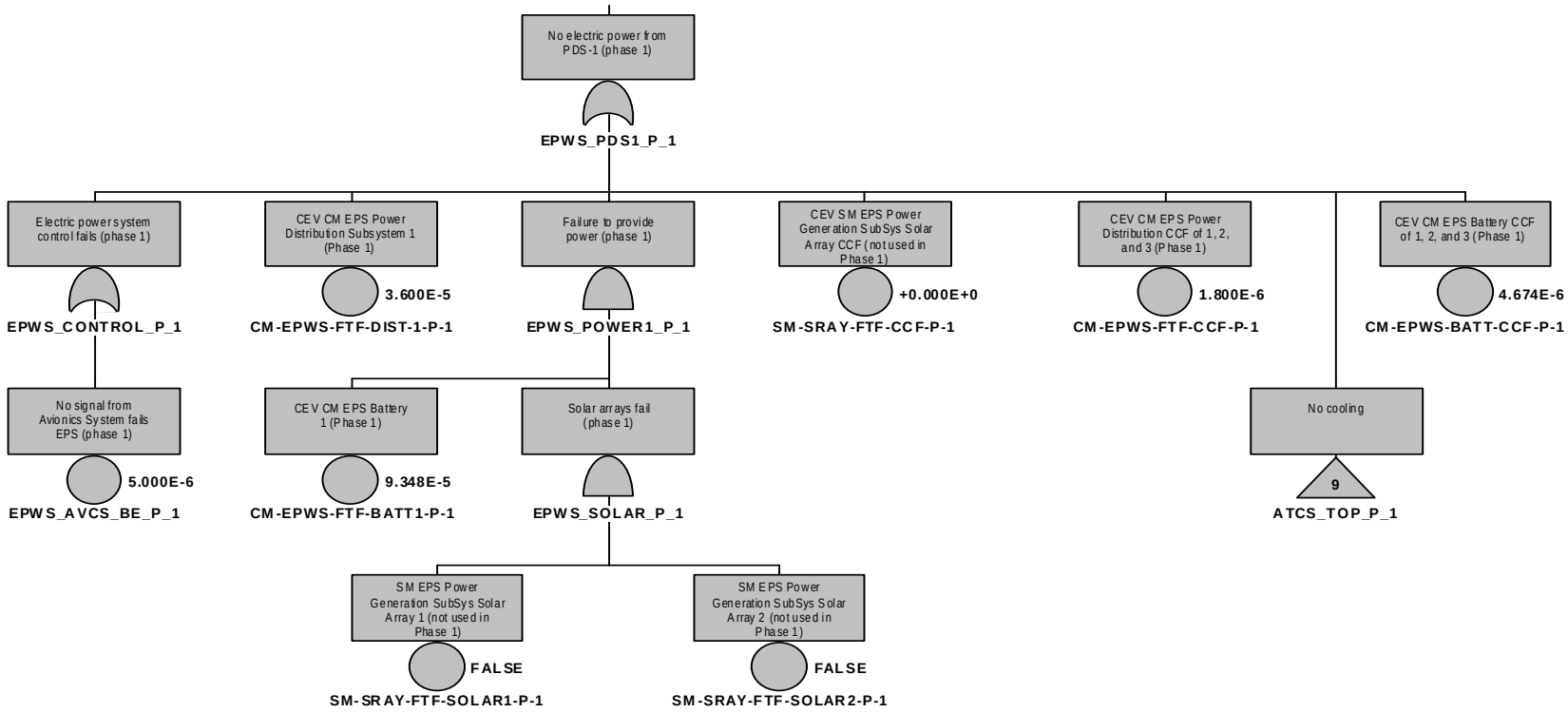
EPWS_DEGRADED_P_7 - Degradation of electric power (phase 7)



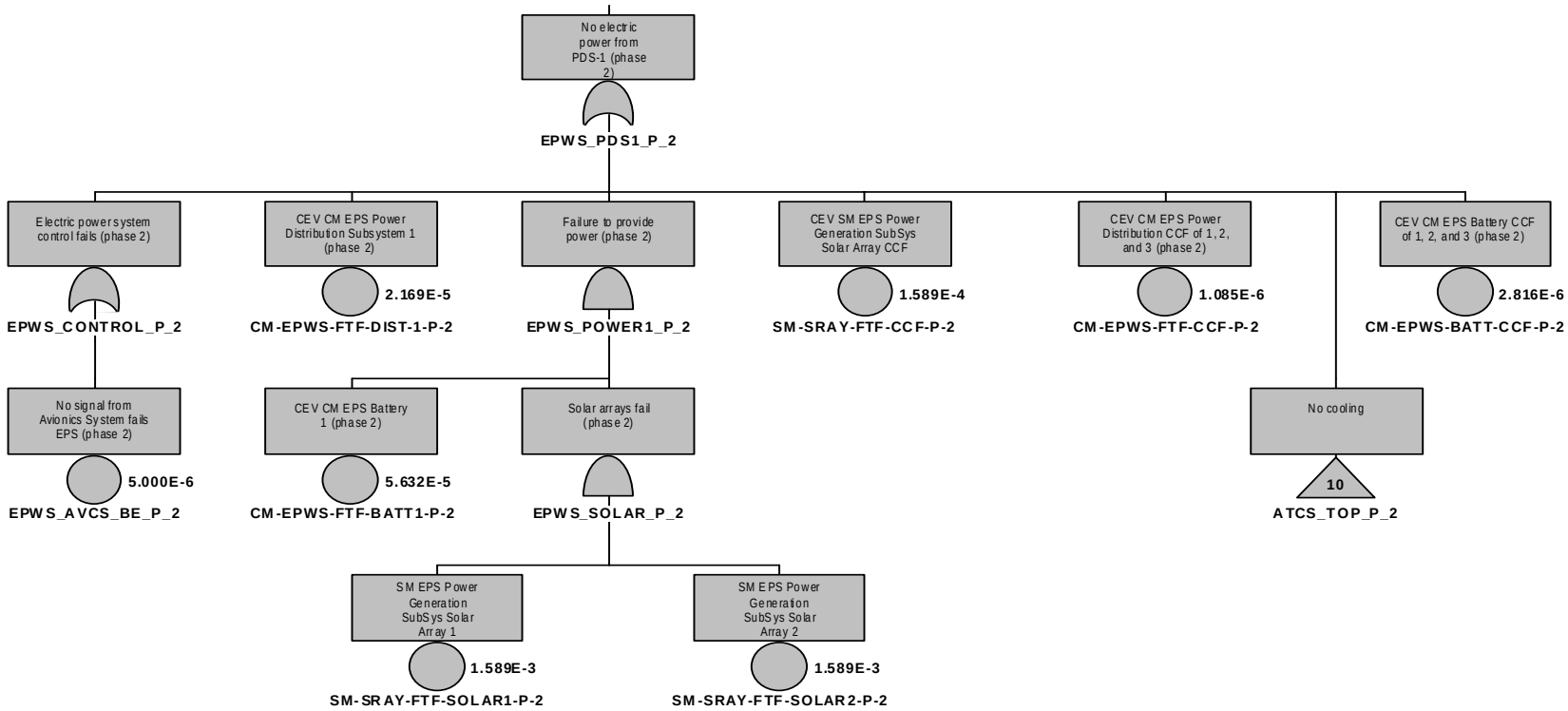
EPWS_DEGRADED_P_8 - Degradation of electric power (phase 8)



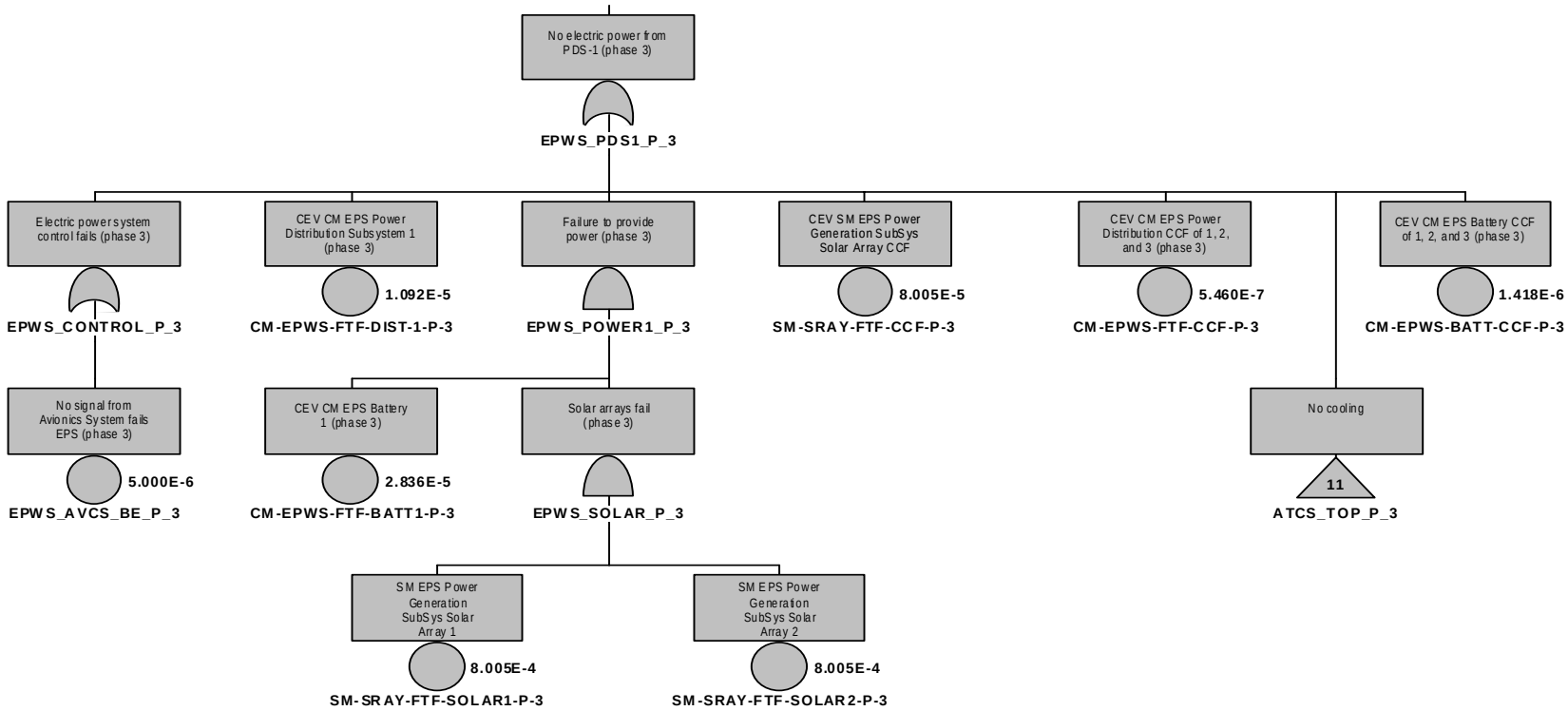
EPWS_PDS1_P_1 - No electric power from PDS-1 (phase 1)



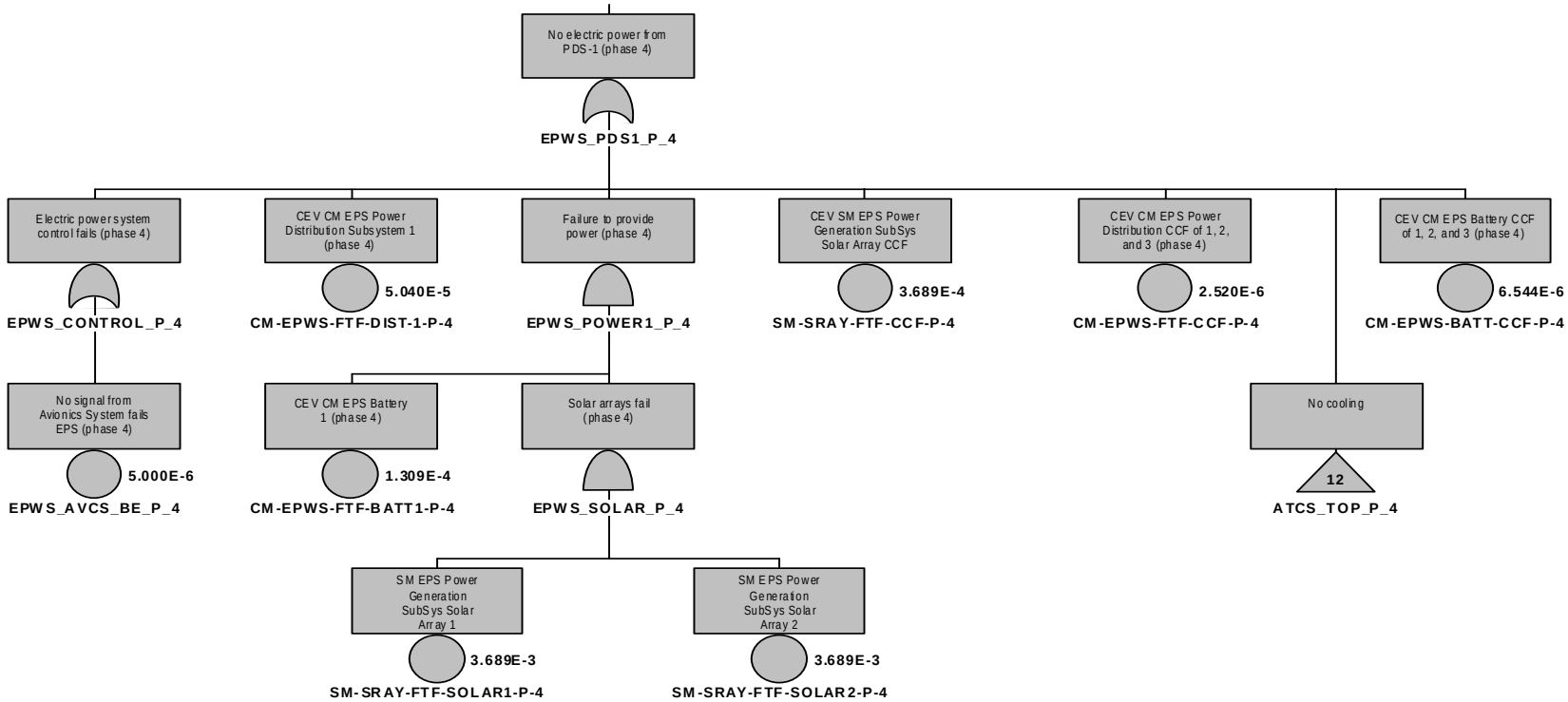
EPWS_PDS1_P_2 - No electric power from PDS-1 (phase 2)



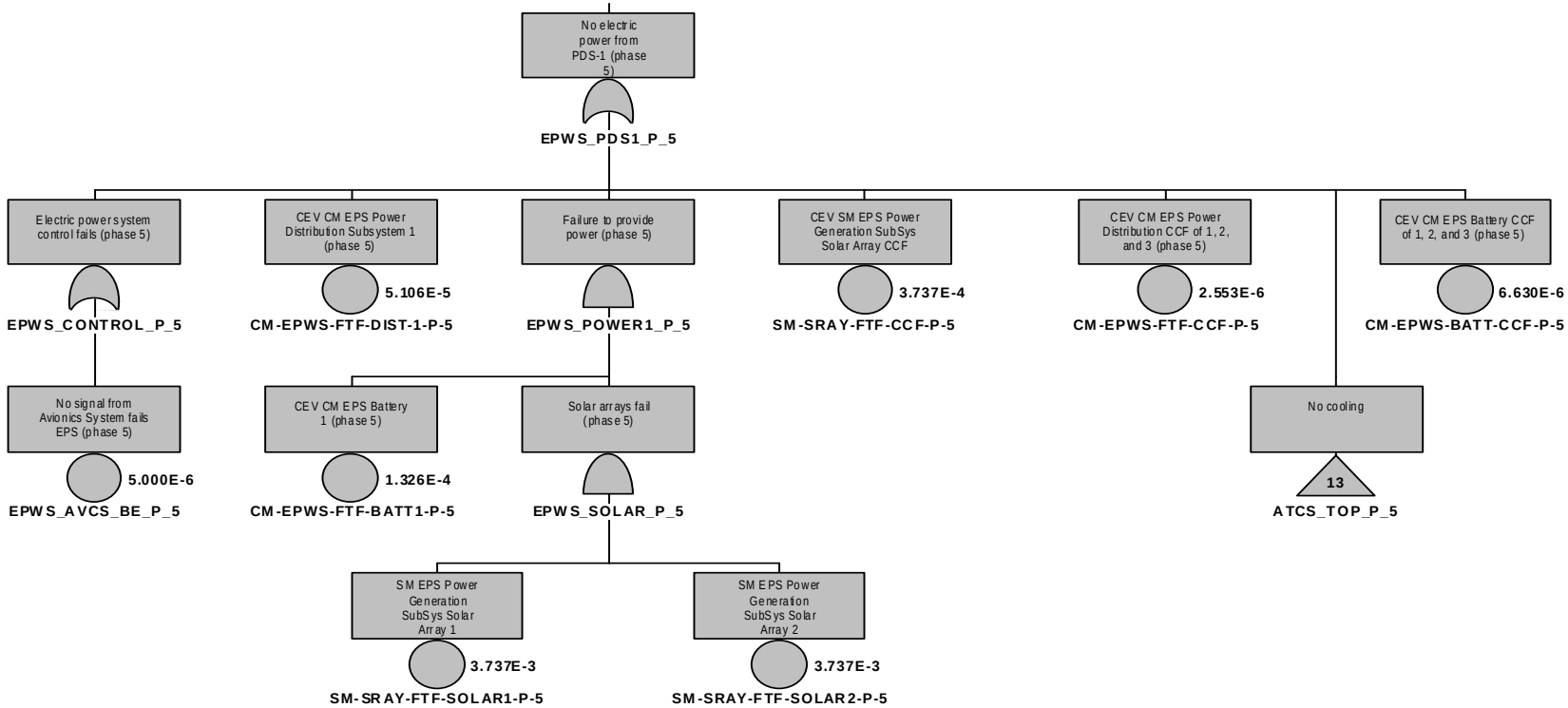
EPWS_PDS1_P_3 - No electric power from PDS-1 (phase 3)



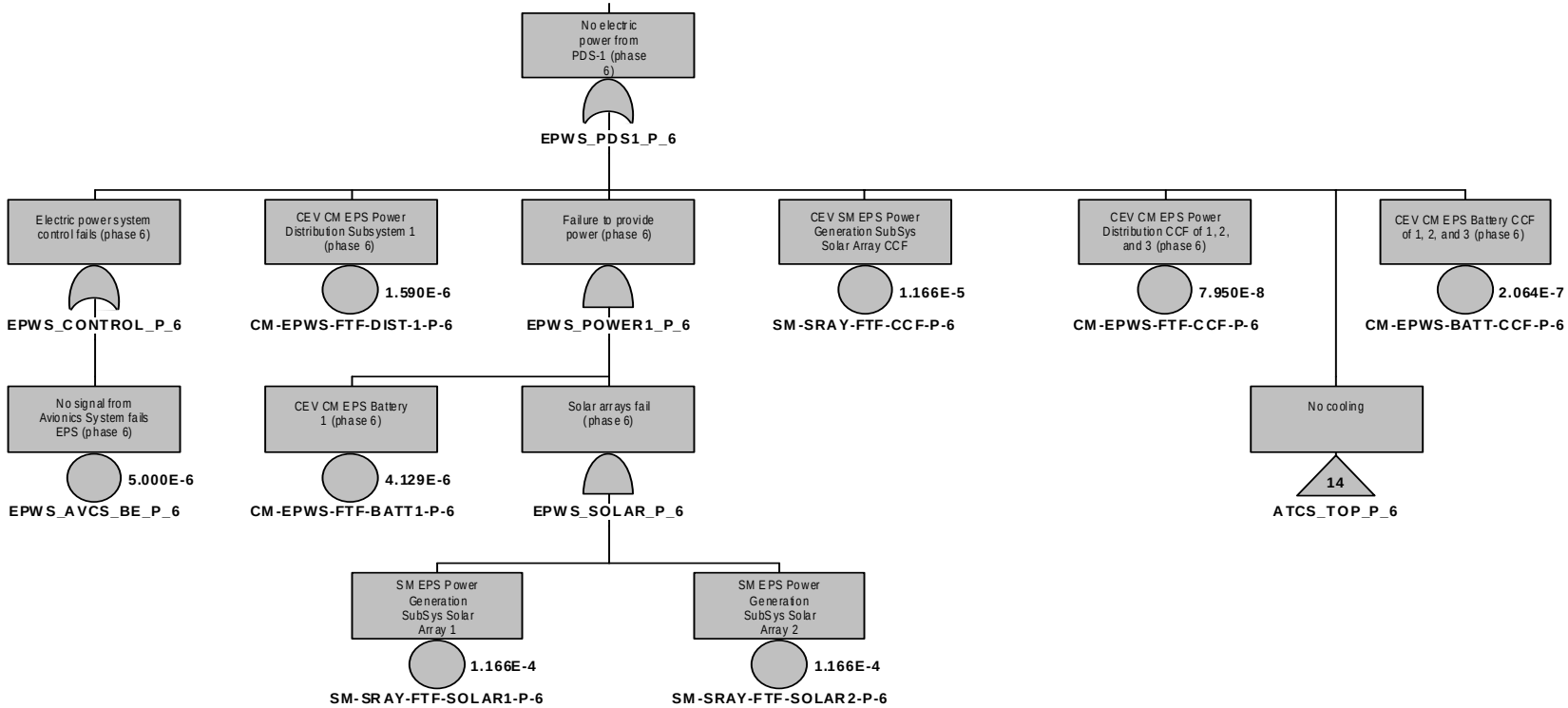
EPWS_PDS1_P_4 - No electric power from PDS-1 (phase 4)



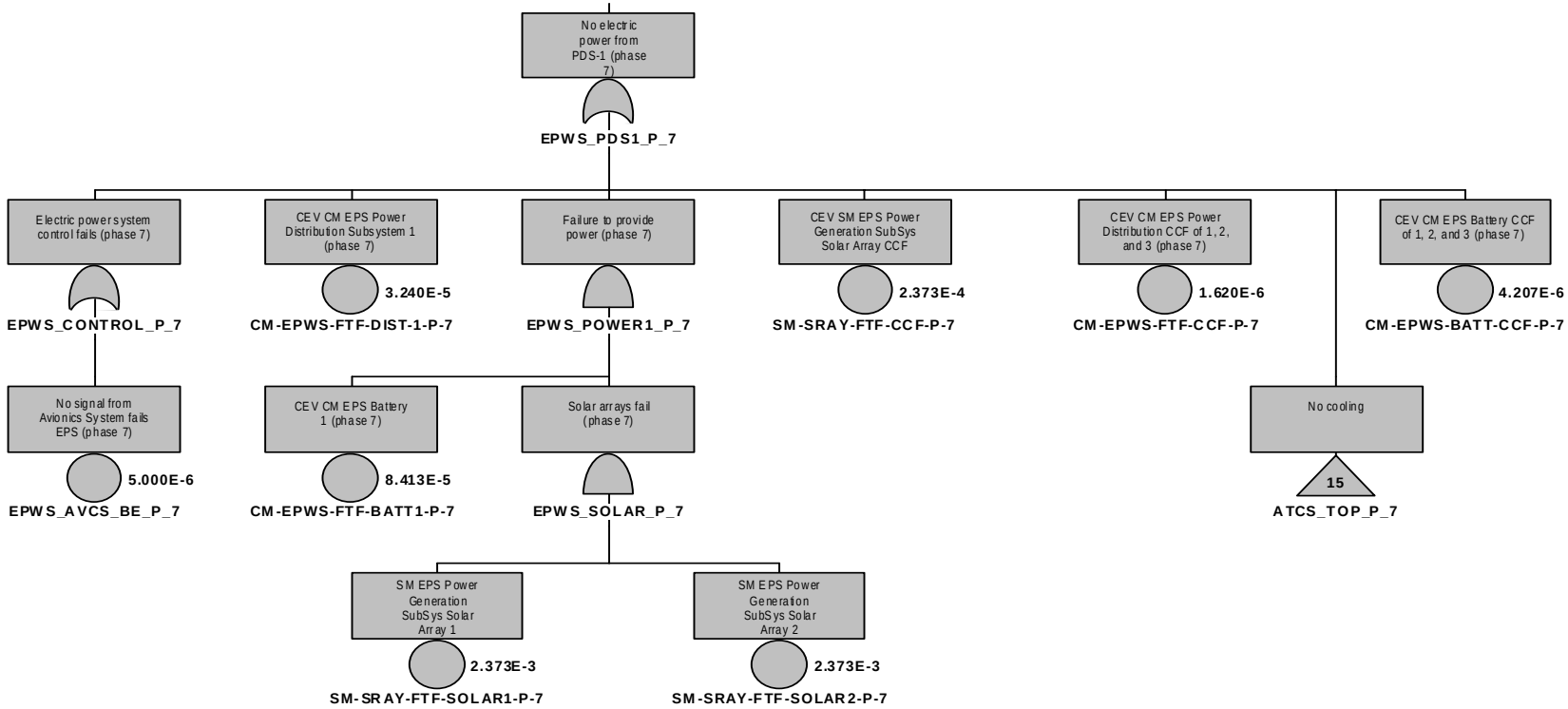
EPWS_PDS1_P_5 - No electric power from PDS-1 (phase 5)



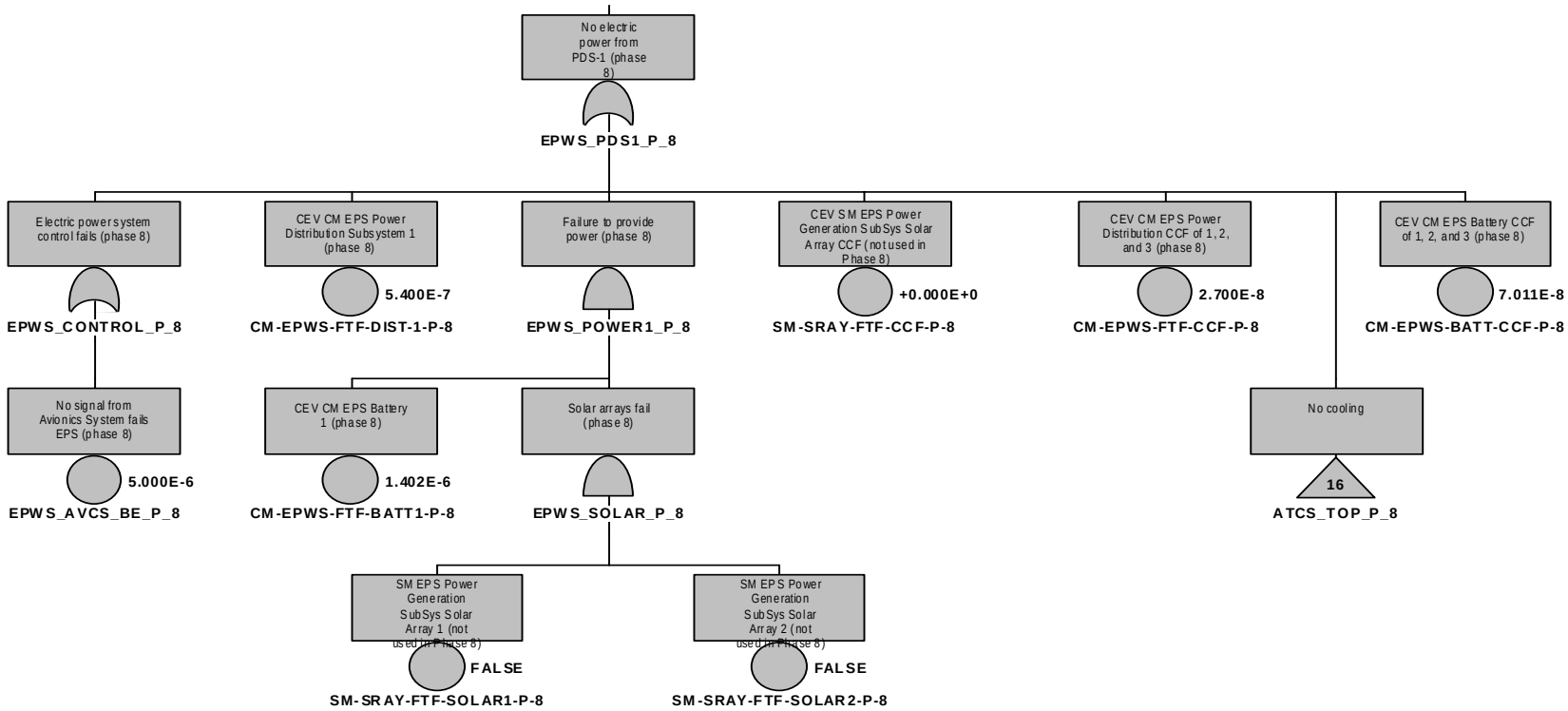
EPWS_PDS1_P_6 - No electric power from PDS-1 (phase 6)



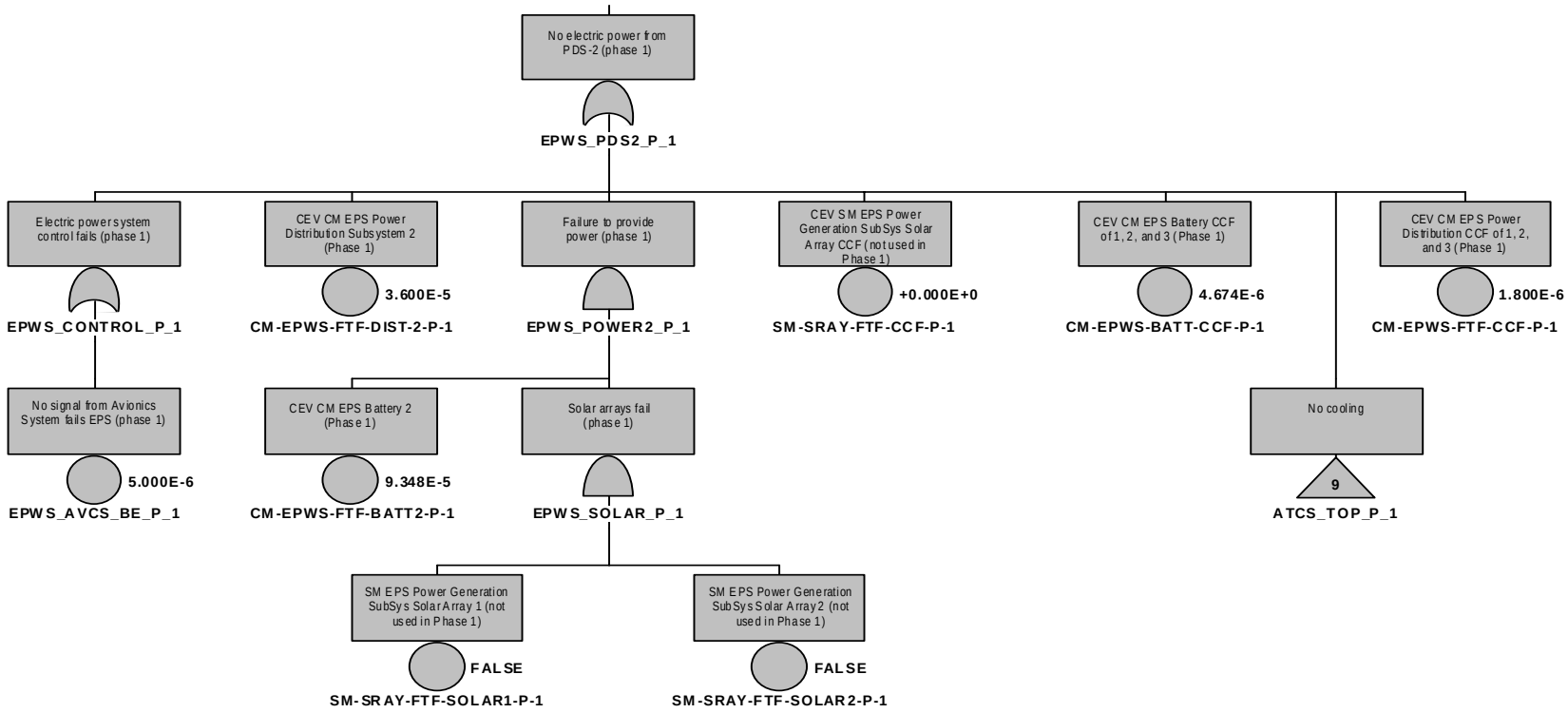
EPWS_PDS1_P_7 - No electric power from PDS-1 (phase 7)



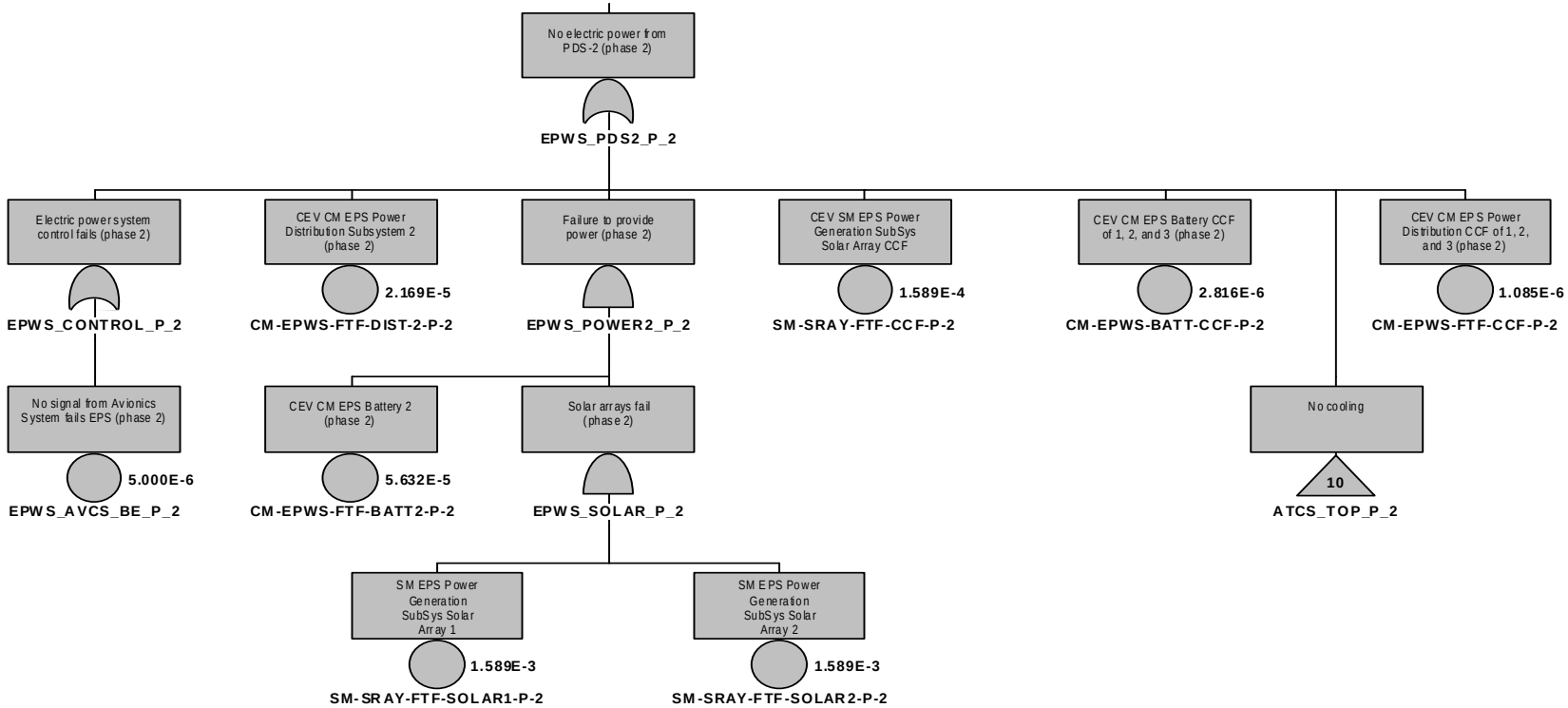
EPWS_PDS1_P_8 - No electric power from PDS-1 (phase 8)



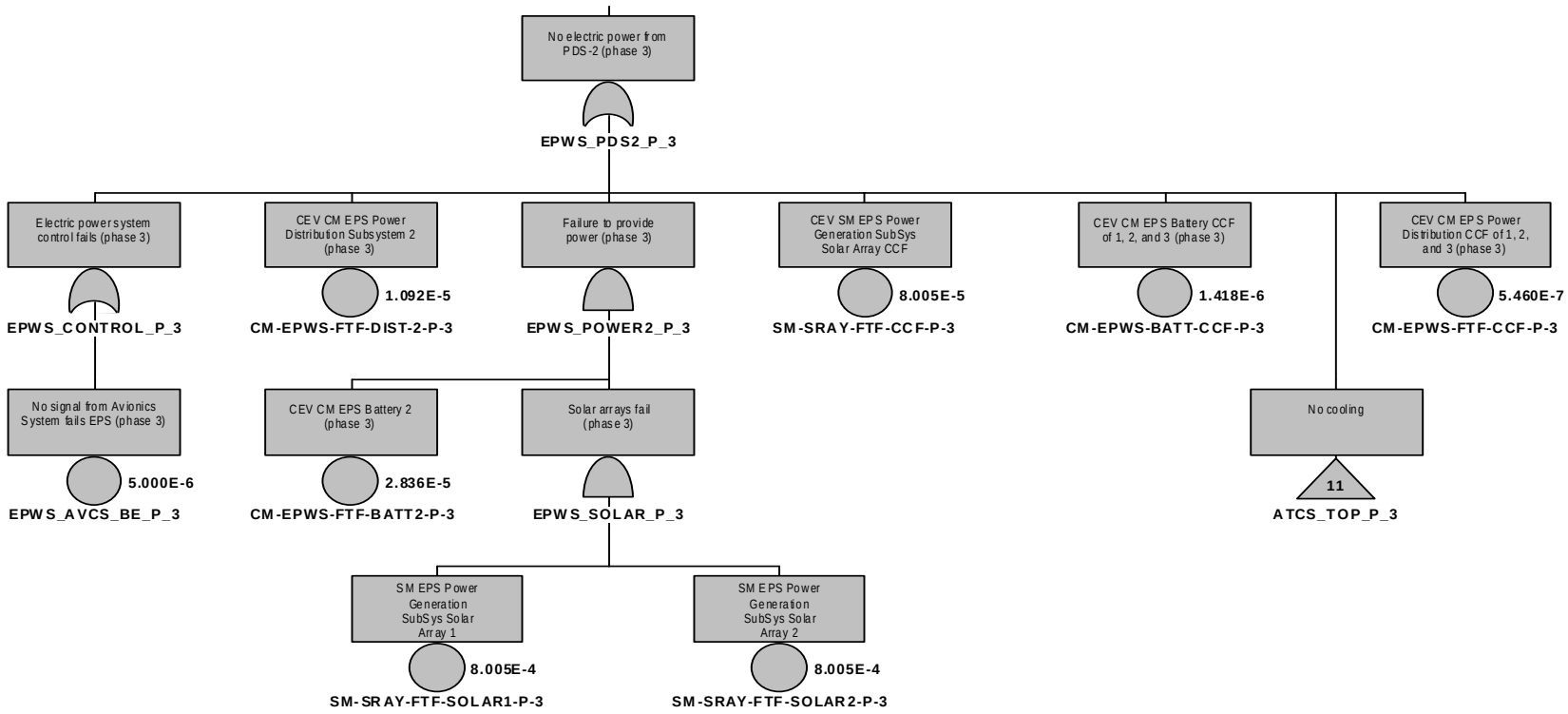
EPWS_PDS2_P_1 - No electric power from PDS-2 (phase 1)



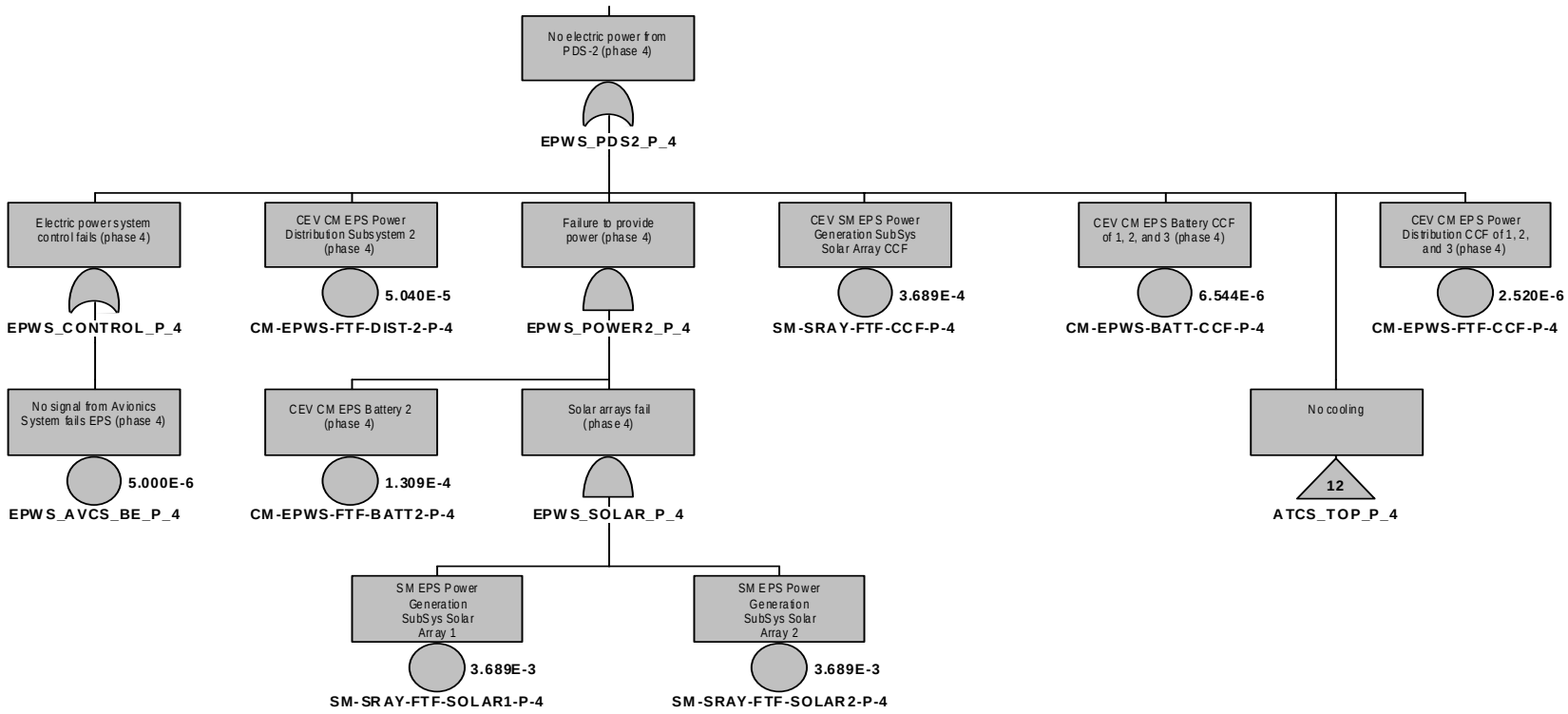
EPWS_PDS2_P_2 - No electric power from PDS-2 (phase 2)



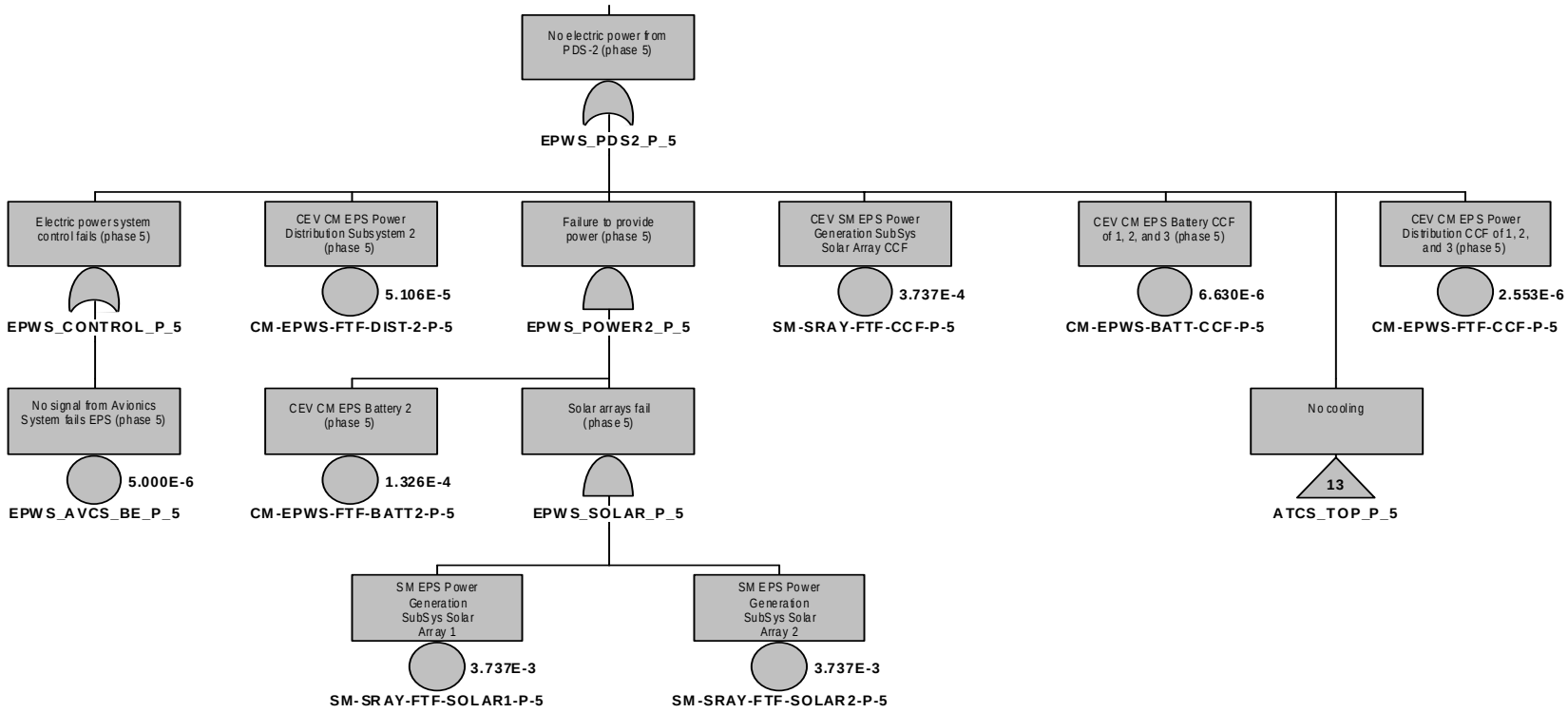
EPWS_PDS2_P_3 - No electric power from PDS-2 (phase 3)



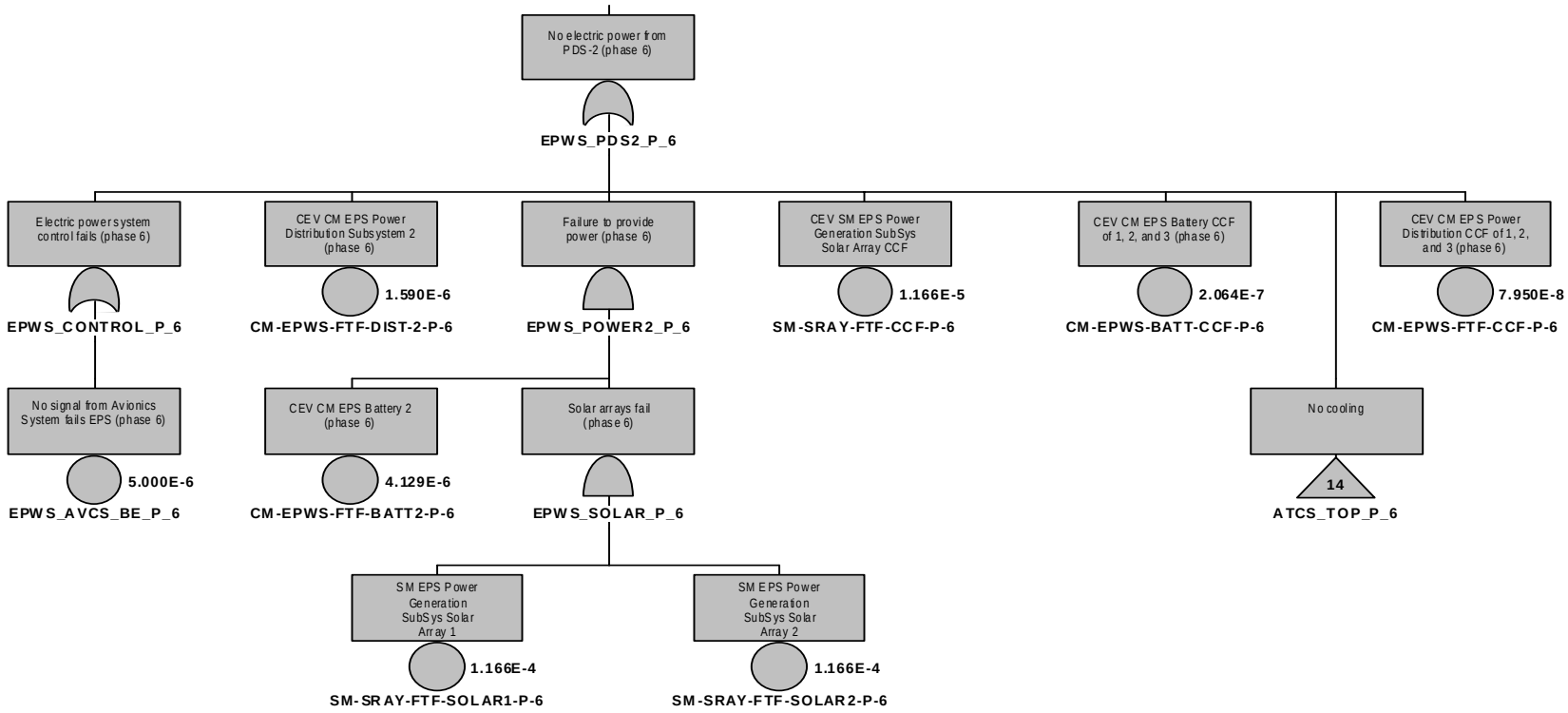
EPWS_PDS2_P_4 - No electric power from PDS-2 (phase 4)



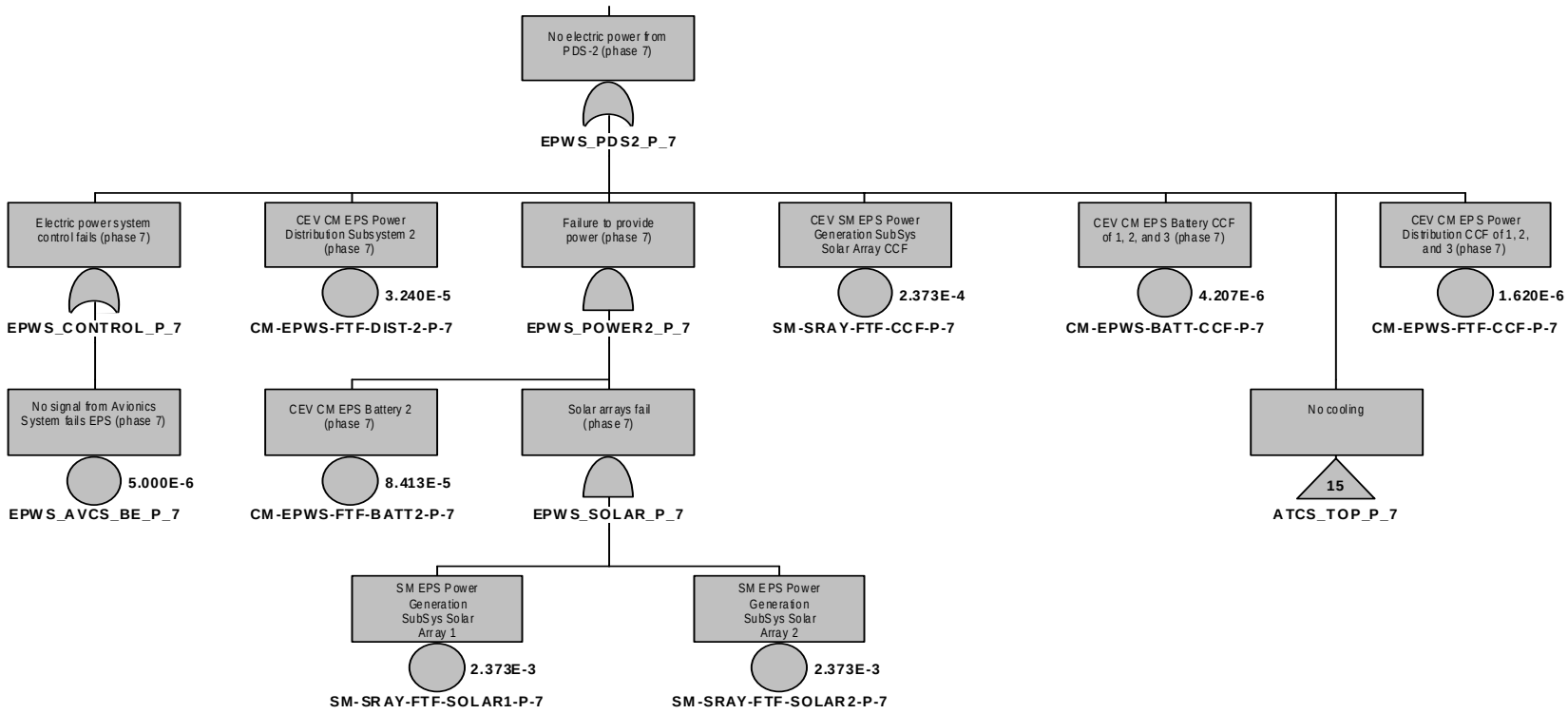
EPWS_PDS2_P_5 - No electric power from PDS-2 (phase 5)



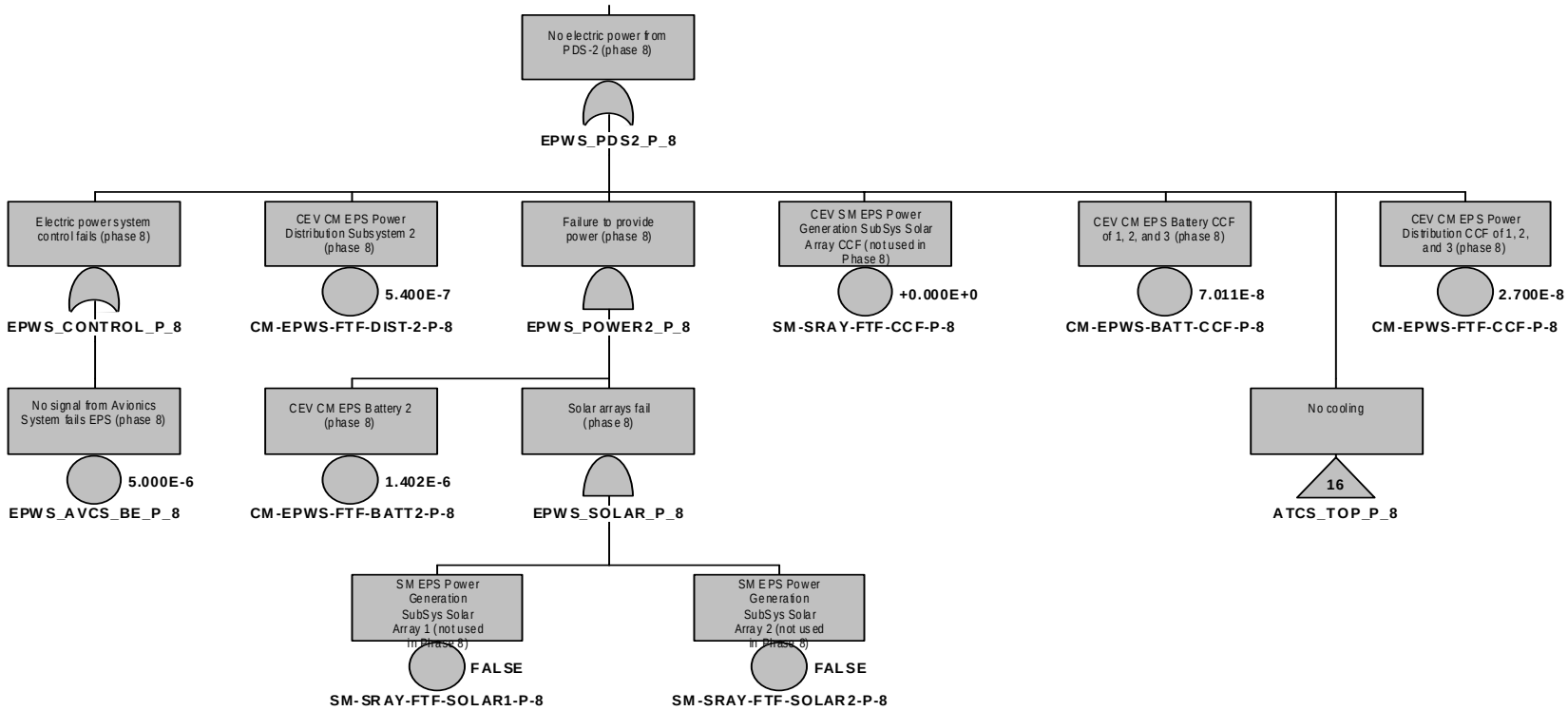
EPWS_PDS2_P_6 - No electric power from PDS-2 (phase 6)



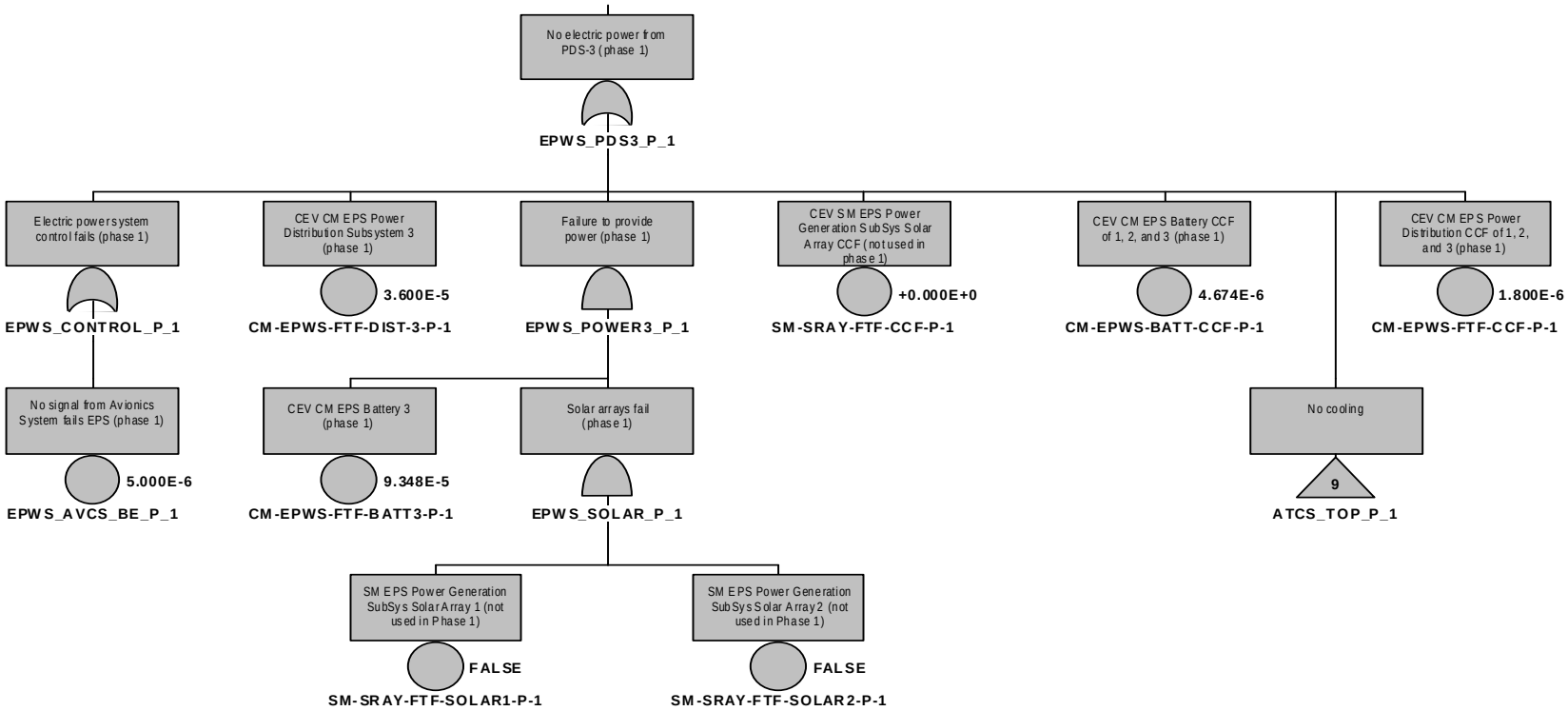
EPWS_PDS2_P_7 - No electric power from PDS-2 (phase 7)



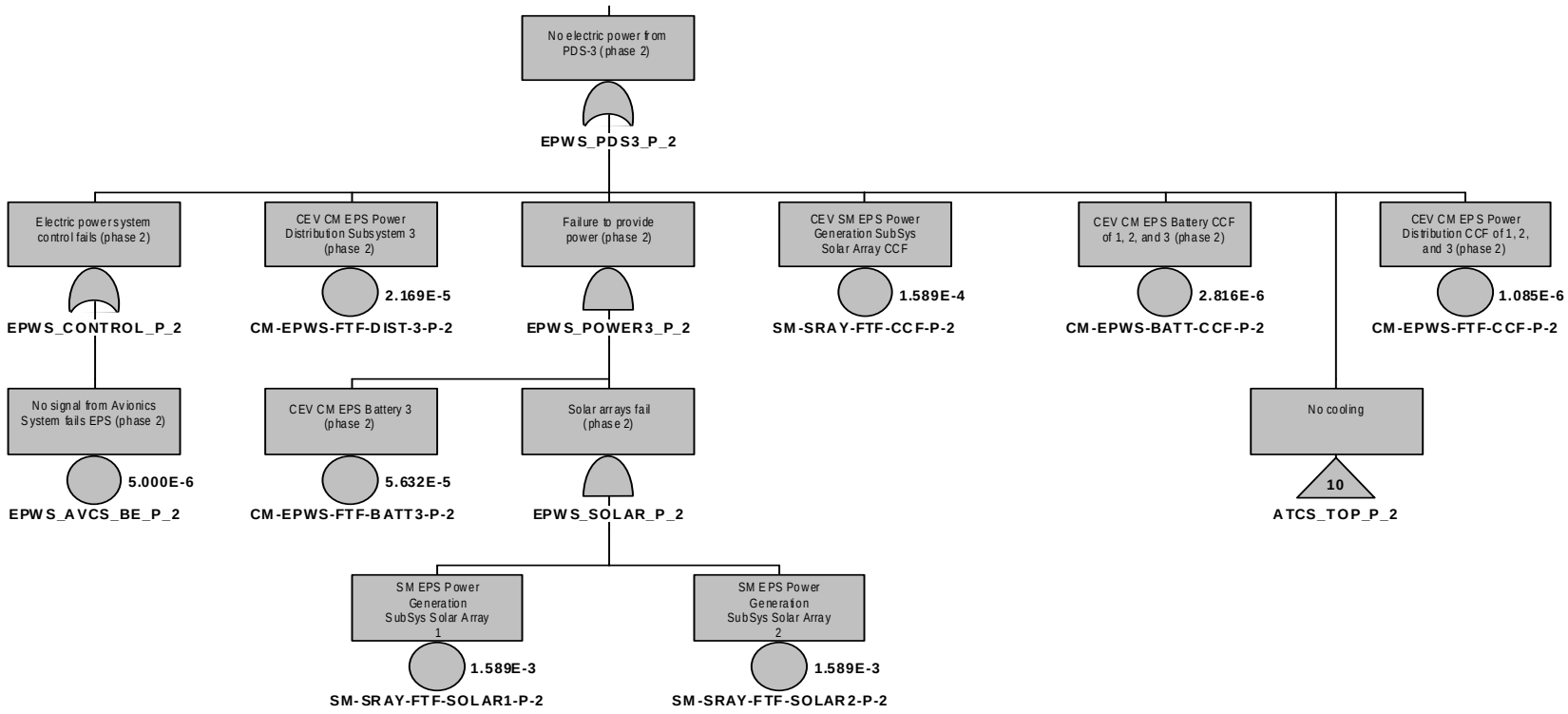
EPWS_PDS2_P_8 - No electric power from PDS-2 (phase 8)



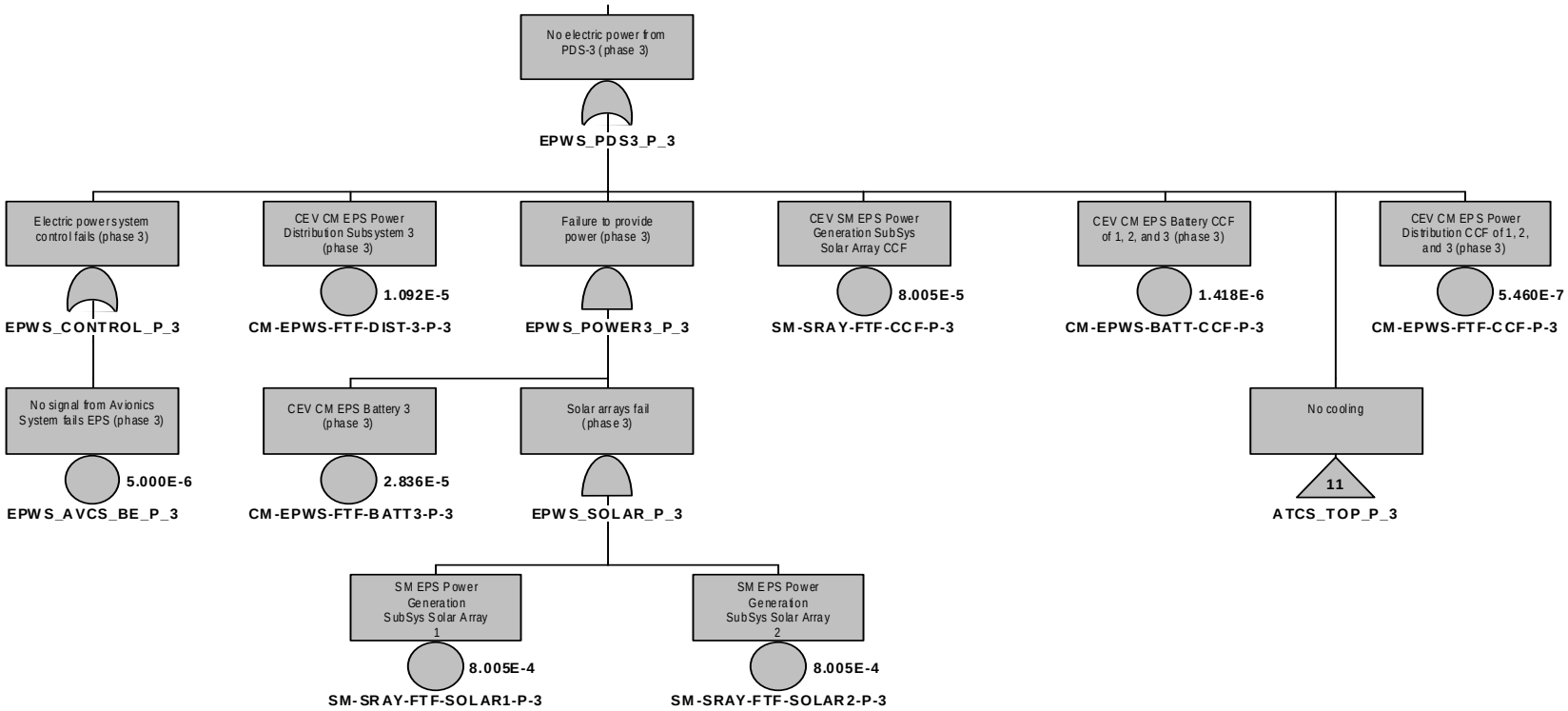
EPWS_PDS3_P_1 - No electric power from PDS-3 (phase 1)



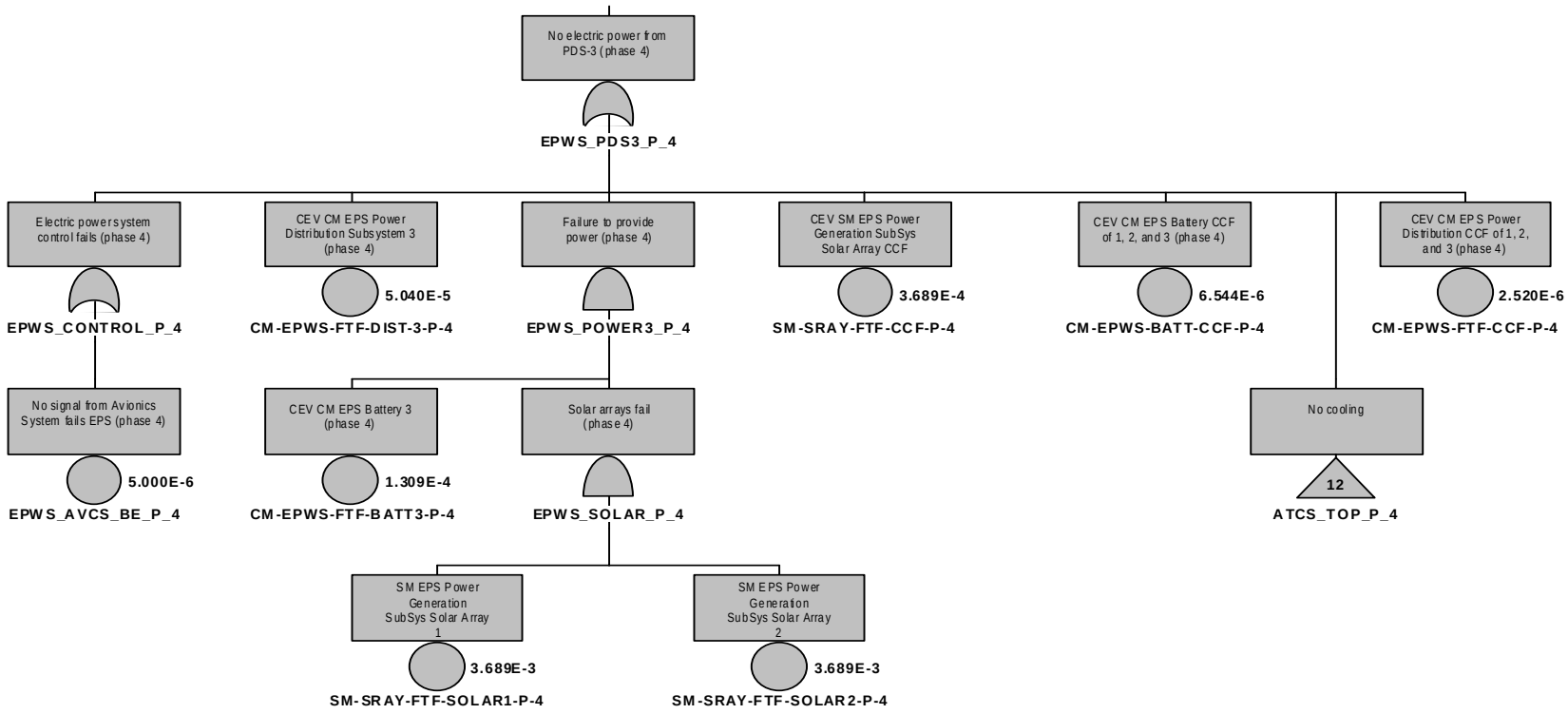
EPWS_PDS3_P_2 - No electric power from PDS-3 (phase 2)



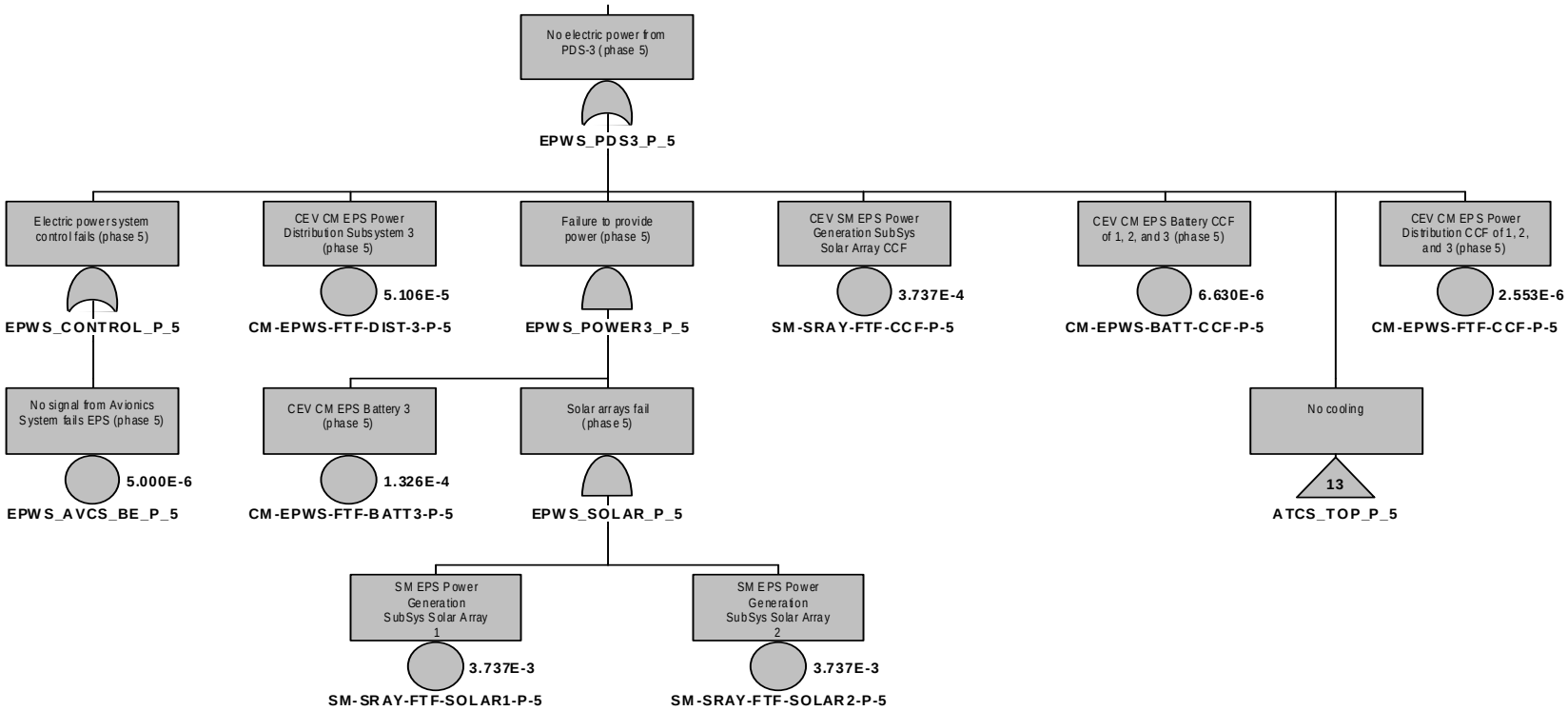
EPWS_PDS3_P_3 - No electric power from PDS-3 (phase 3)



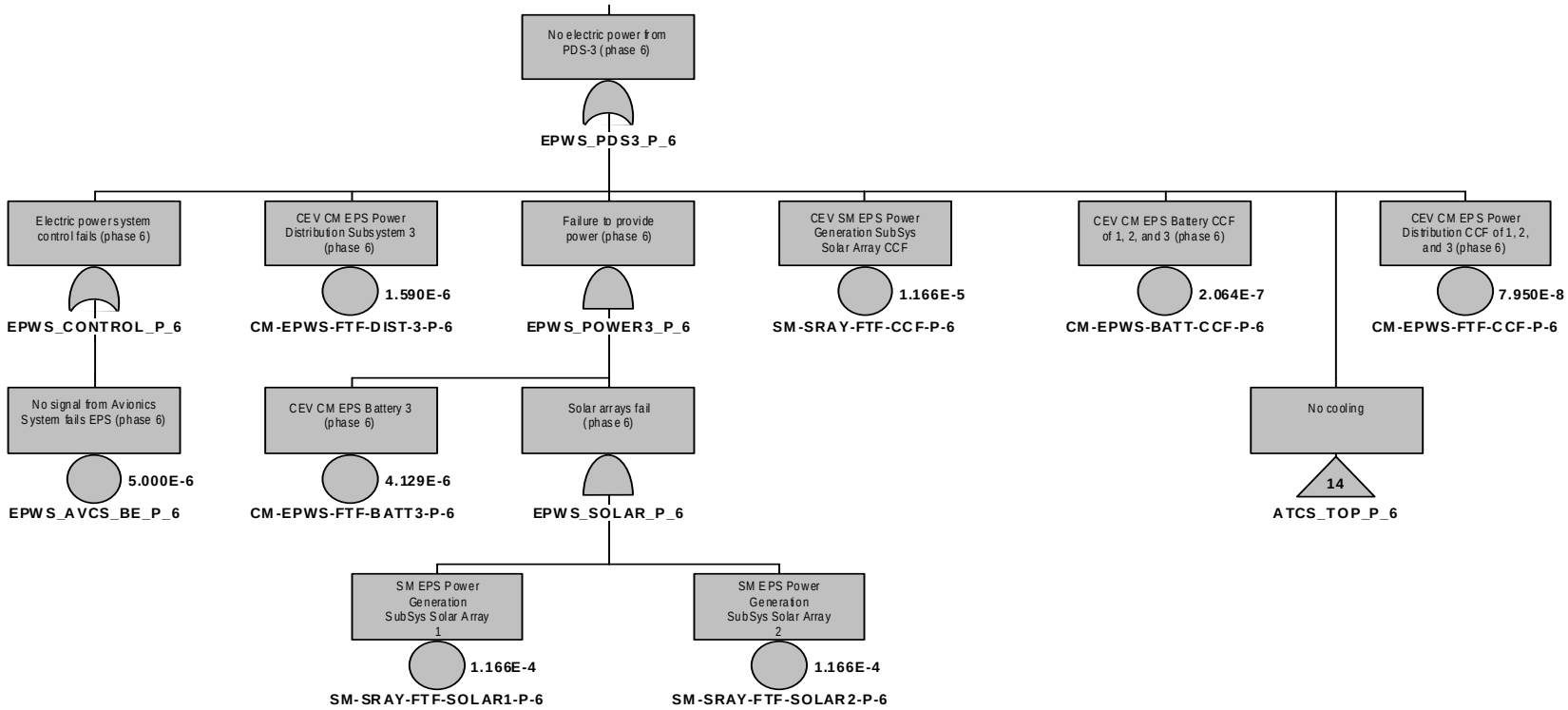
EPWS_PDS3_P_4 - No electric power from PDS-3 (phase 4)



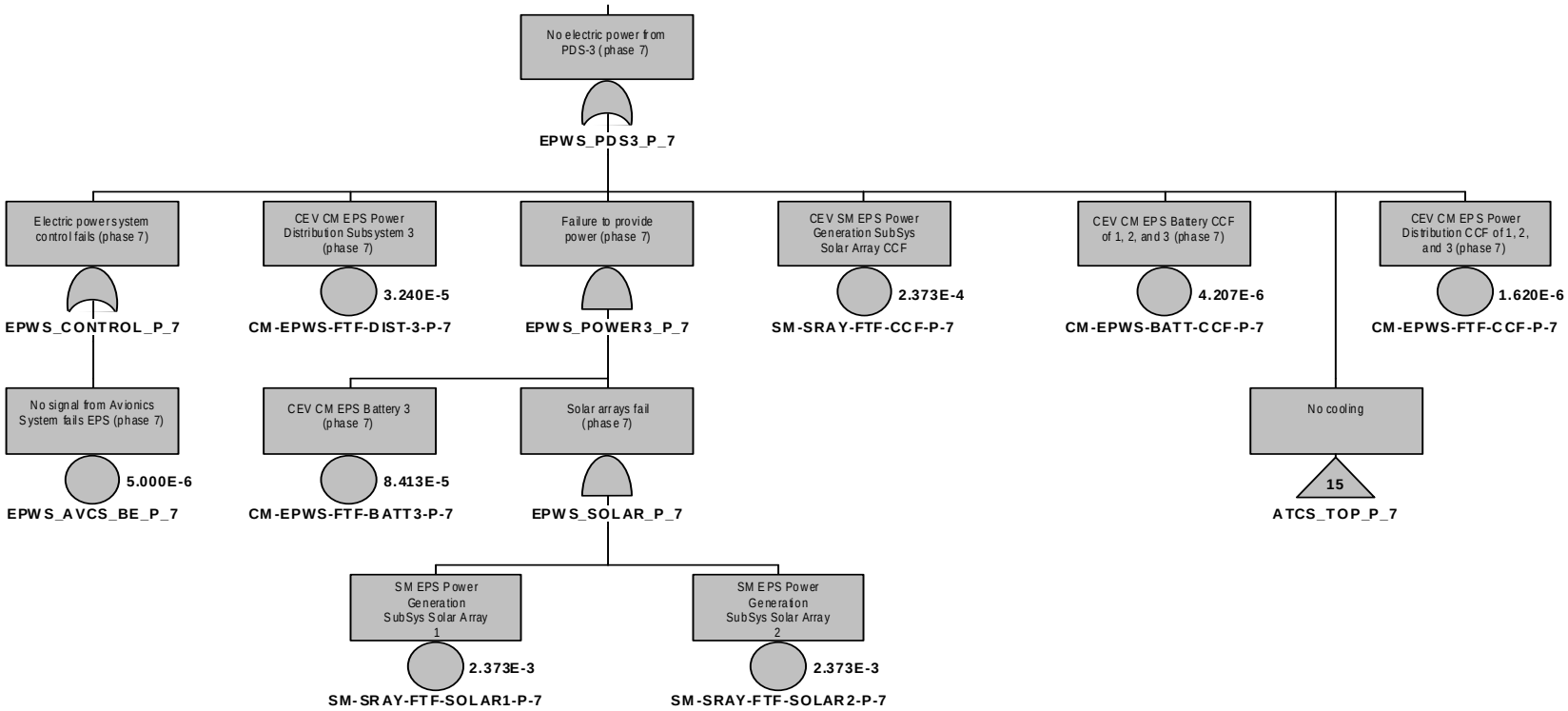
EPWS_PDS3_P_5 - No electric power from PDS-3 (phase 5)



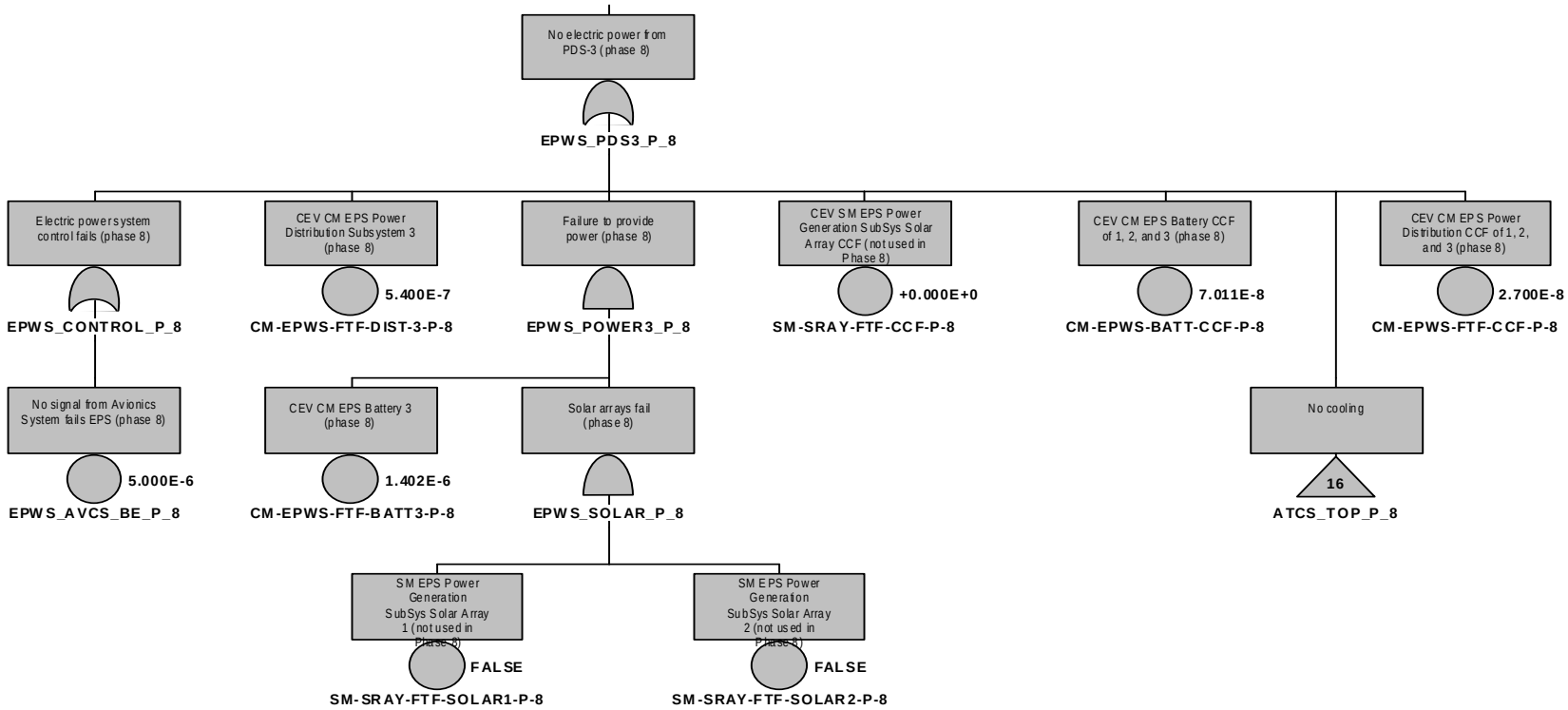
EPWS_PDS3_P_6 - No electric power from PDS-3 (phase 6)



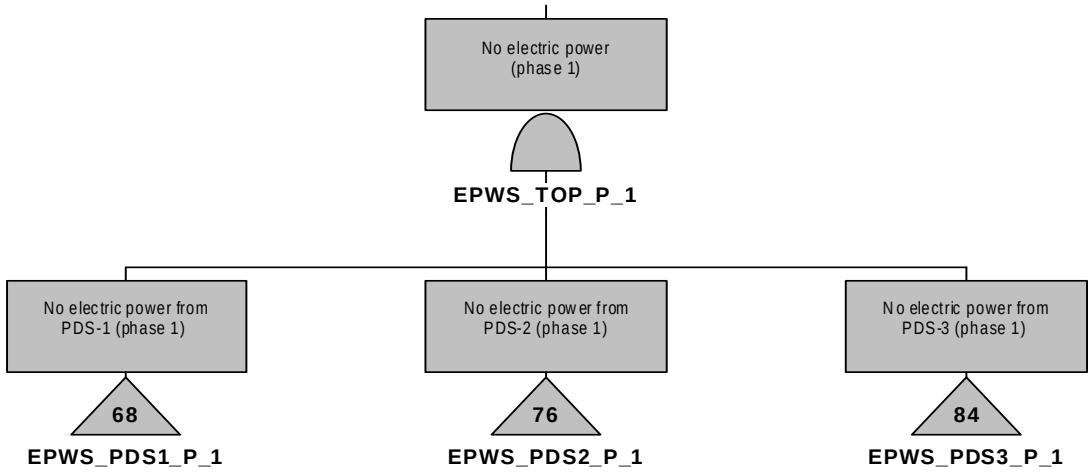
EPWS_PDS3_P_7 - No electric power from PDS-3 (phase 7)



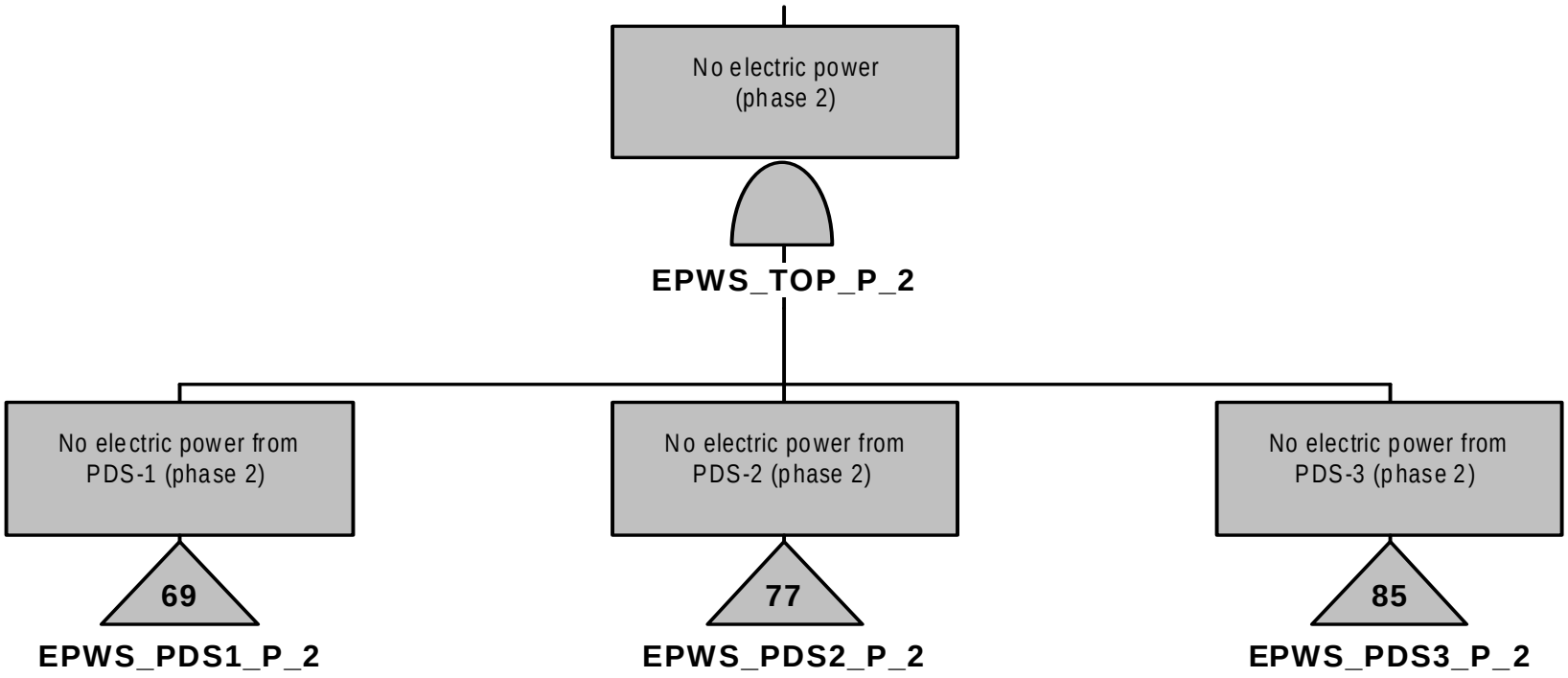
EPWS_PDS3_P_8 - No electric power from PDS-3 (phase 8)



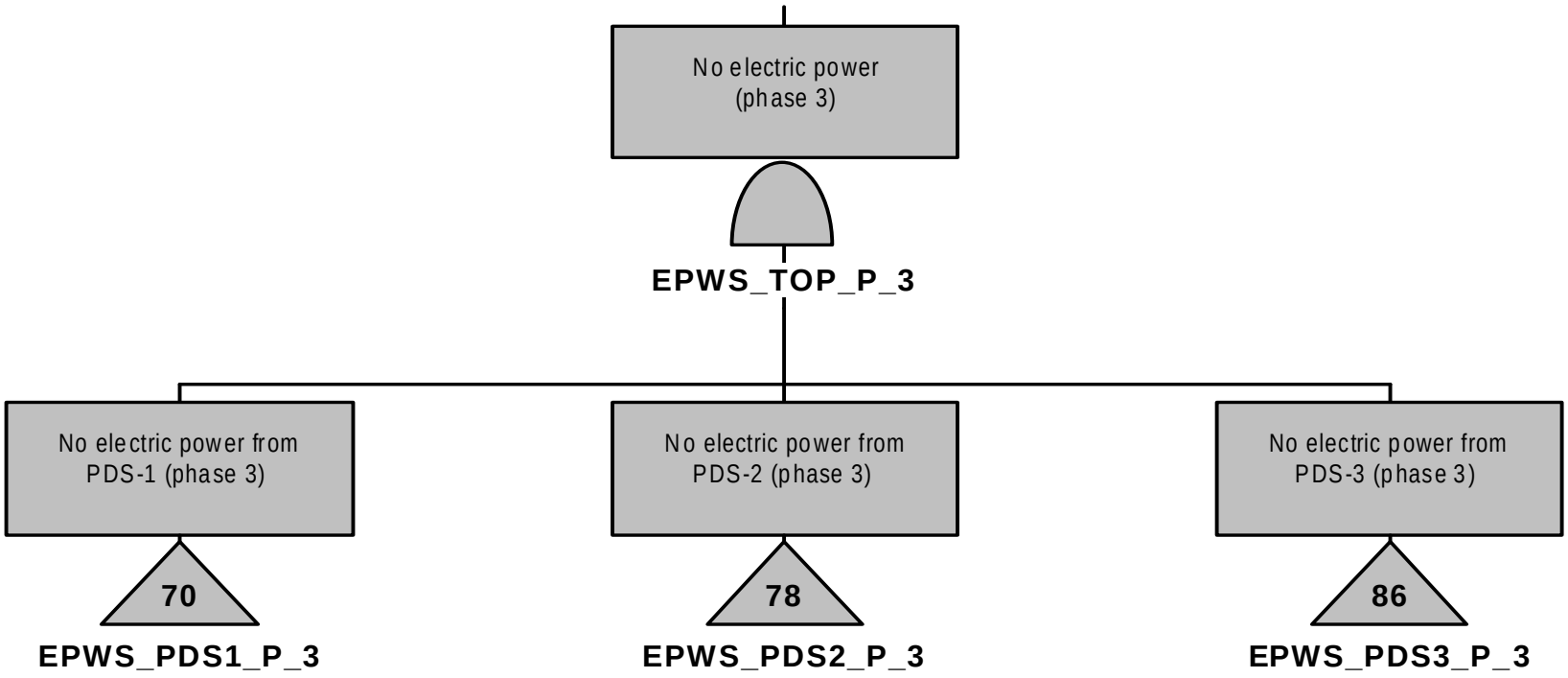
EPWS_TOP_P_1 - No electric power (phase 1)



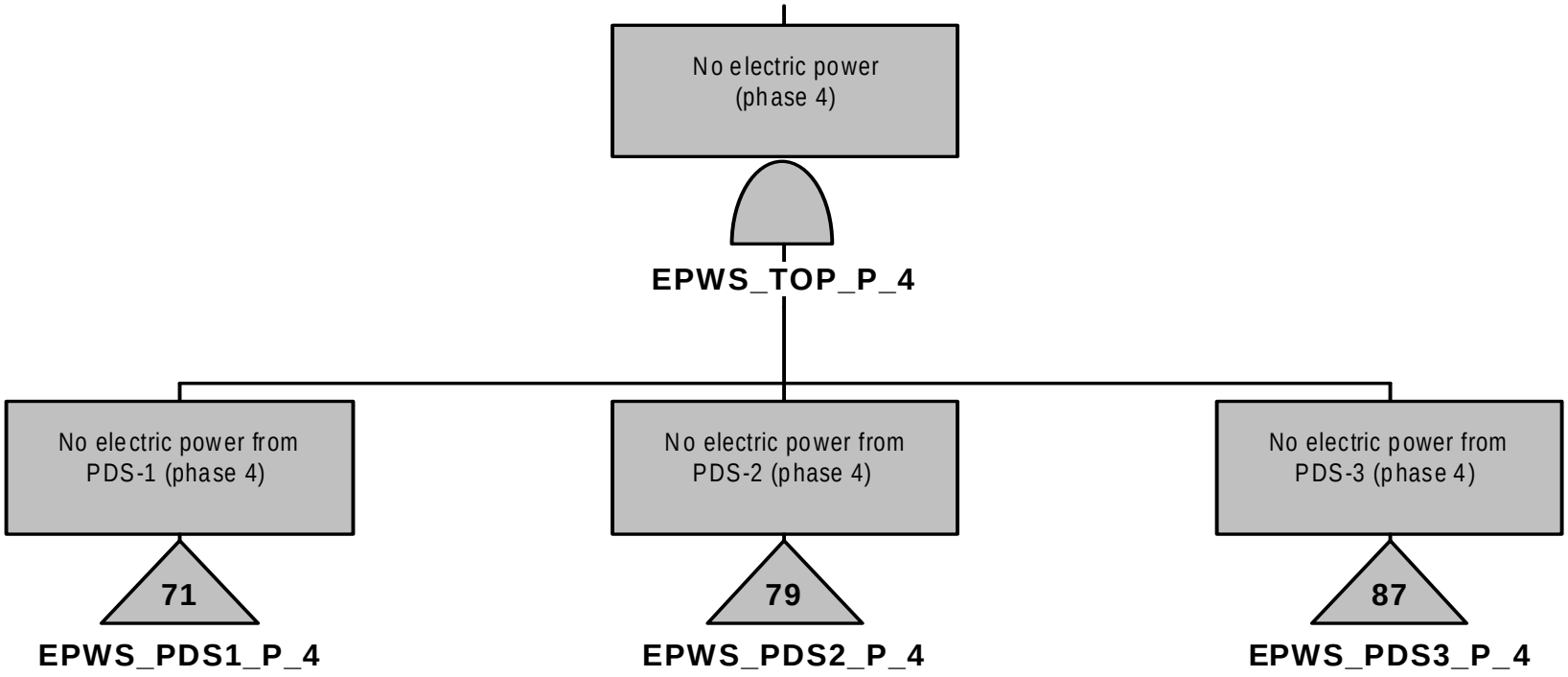
EPWS_TOP_P_2 - No electric power (phase 2)



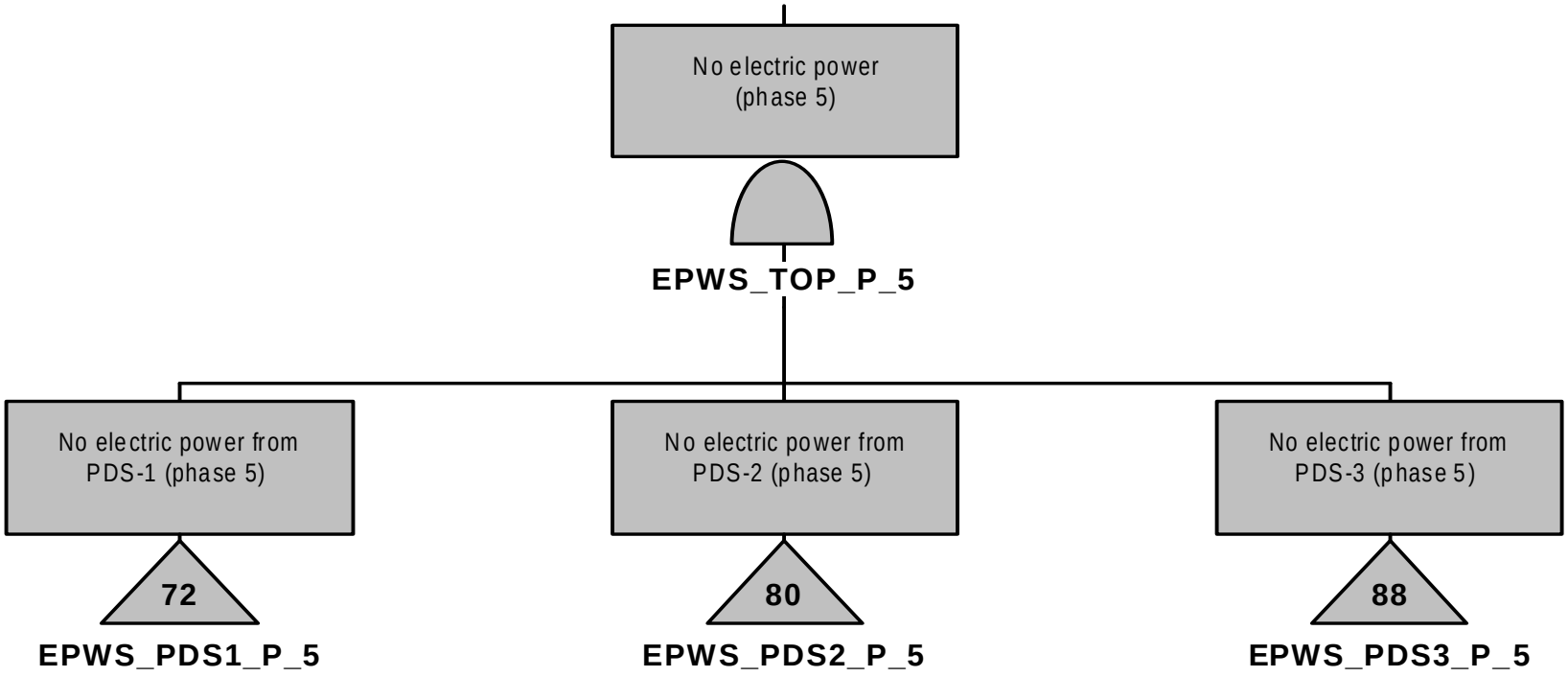
EPWS_TOP_P_3 - No electric power (phase 3)



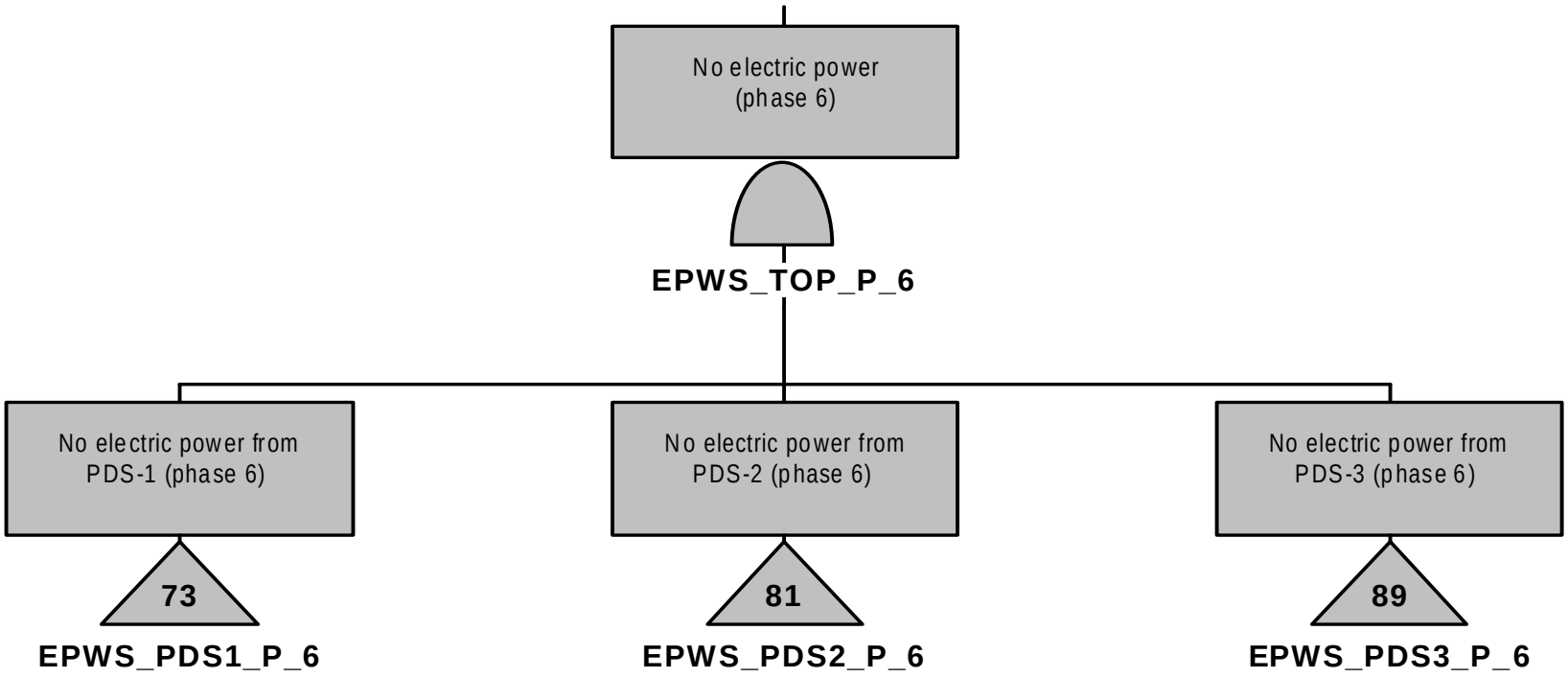
EPWS_TOP_P_4 - No electric power (phase 4)



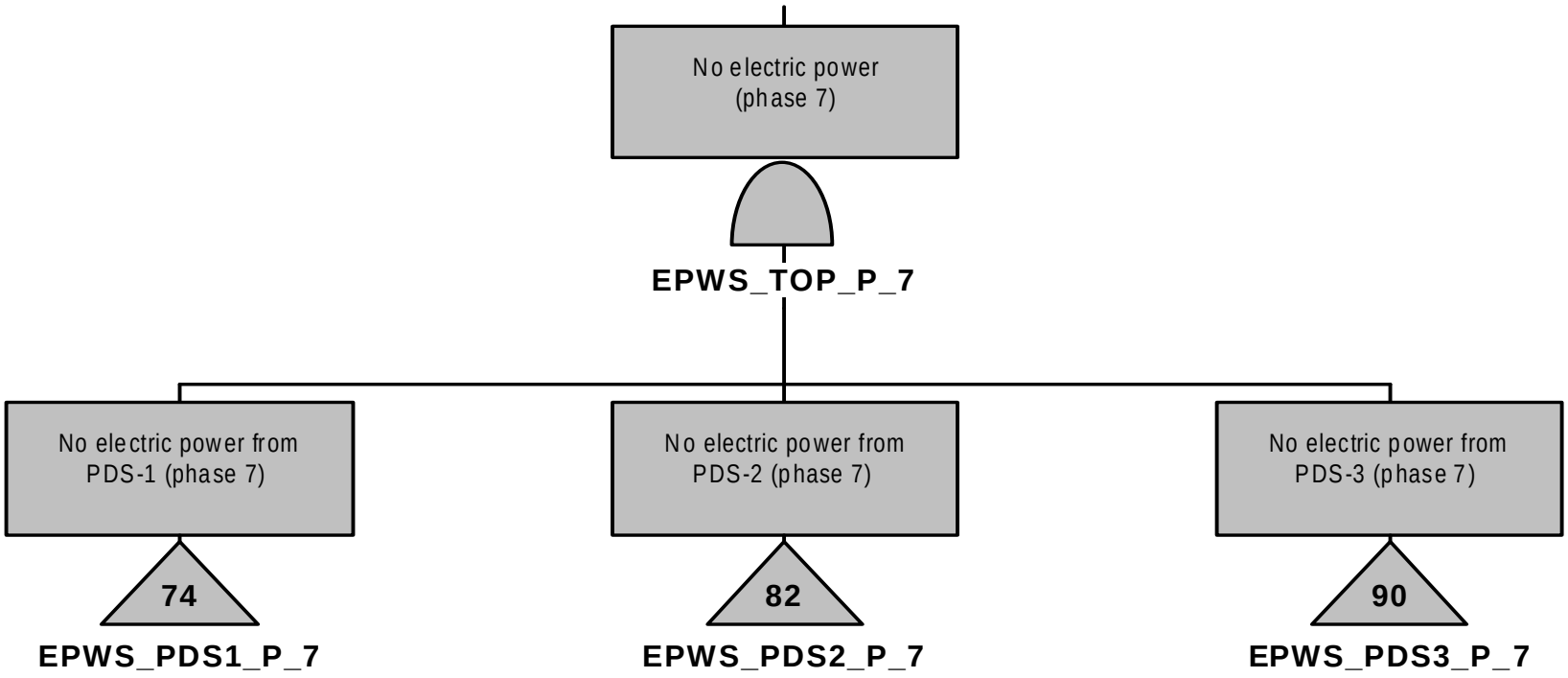
EPWS_TOP_P_5 - No electric power (phase 5)



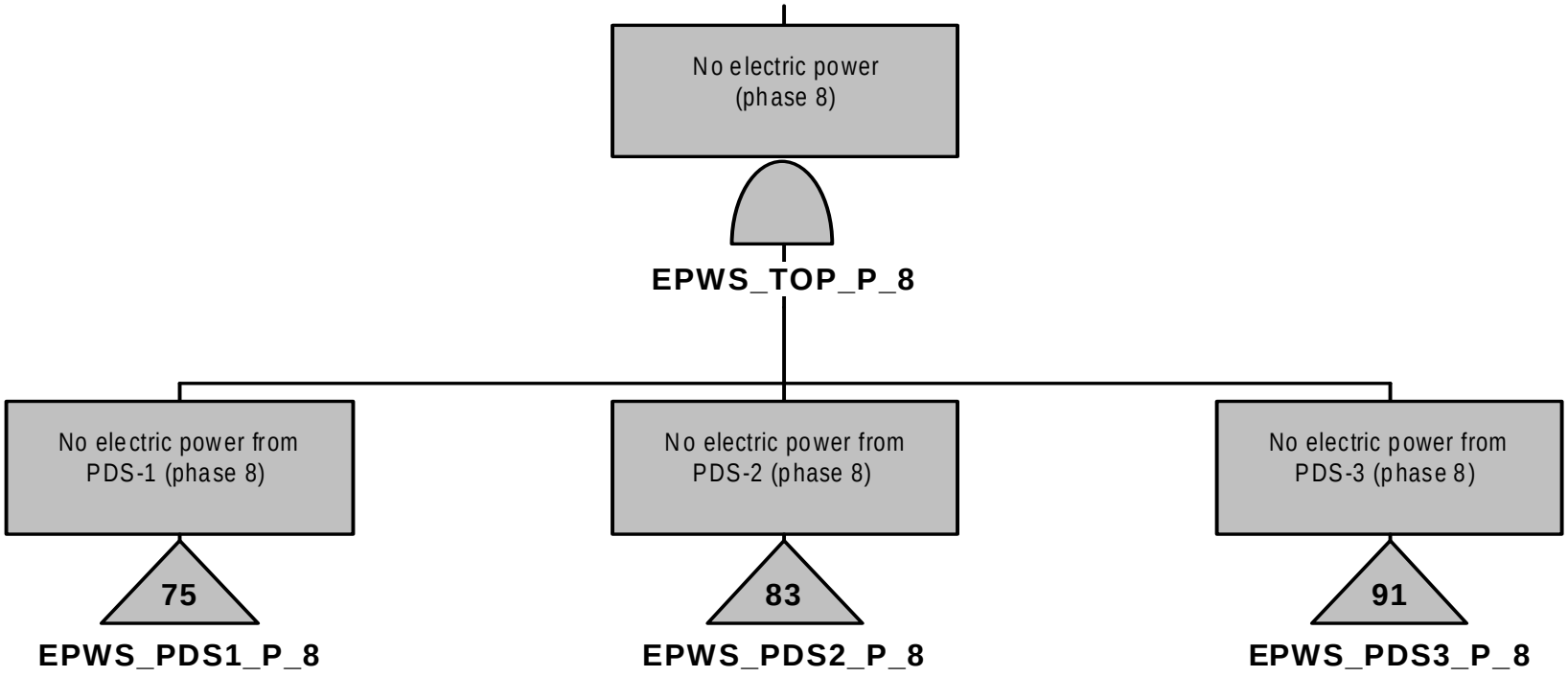
EPWS_TOP_P_6 - No electric power (phase 6)



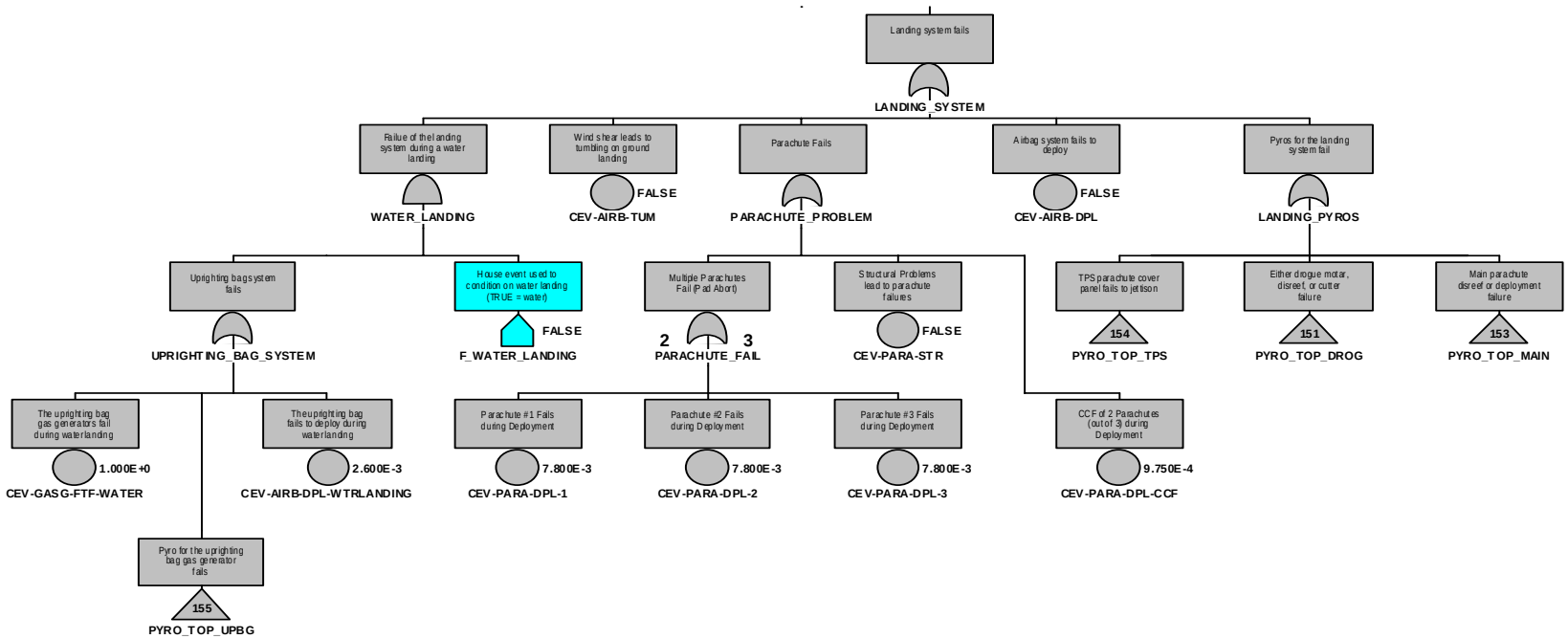
EPWS_TOP_P_7 - No electric power (phase 7)



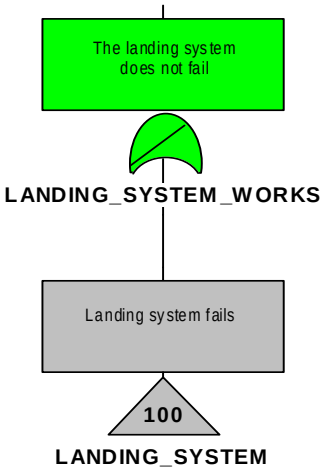
EPWS_TOP_P_8 - No electric power (phase 8)



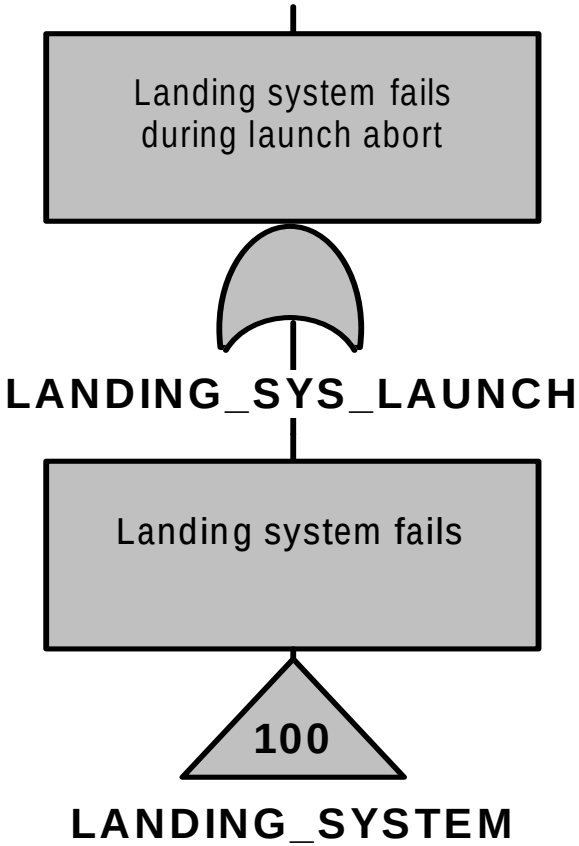
LANDING_SYSTEM - The landing system fails



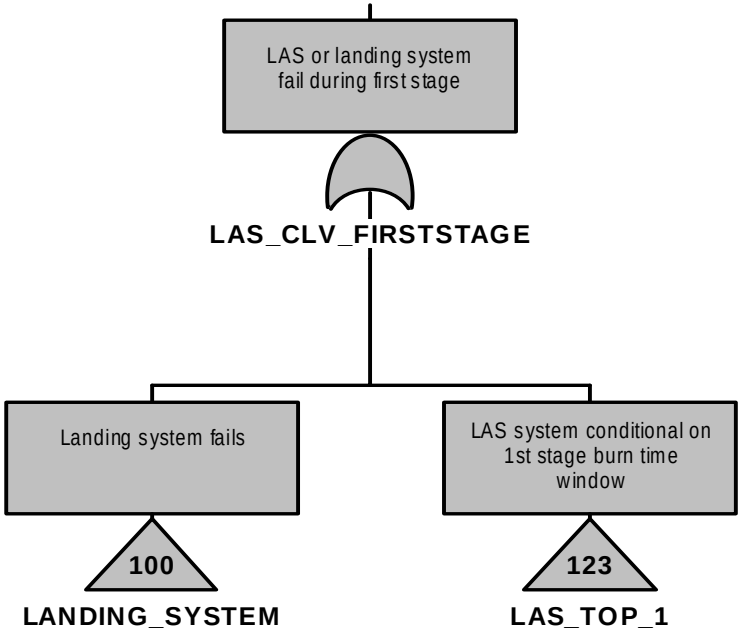
LANDING_SYSTEM_WORKS - The landing system does not fail



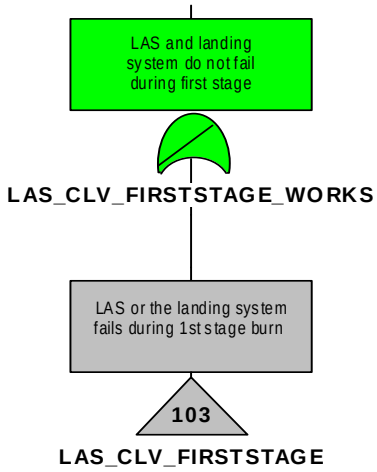
LANDING_SYS_LAUNCH - Landing system fails during launch abort



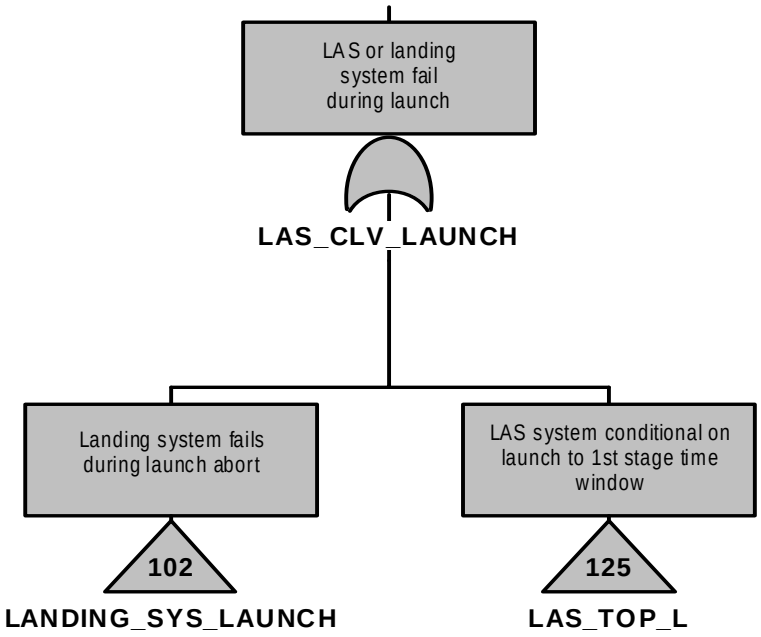
LAS_CLV_FIRSTSTAGE - LAS or landing system fail during first stage



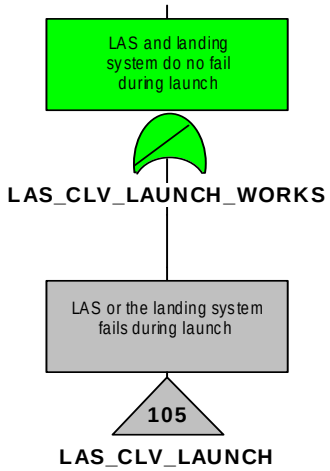
LAS_CLV_FIRSTSTAGE_WORKS - LAS and landing system do not fail during first stage



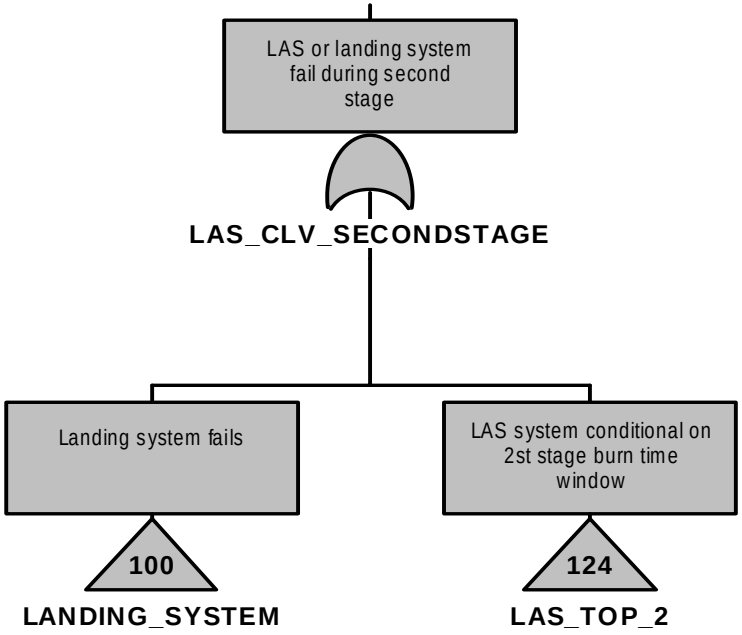
LAS_CLV_LAUNCH - LAS or landing system fail during launch



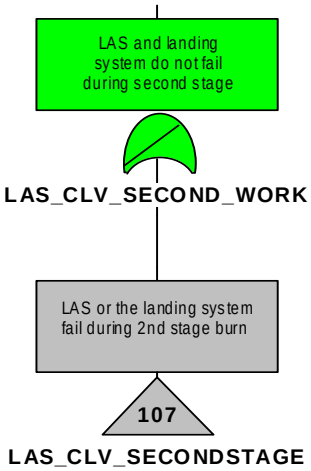
LAS_CLV_LAUNCH_WORKS - LAS and landing system do no fail during launch



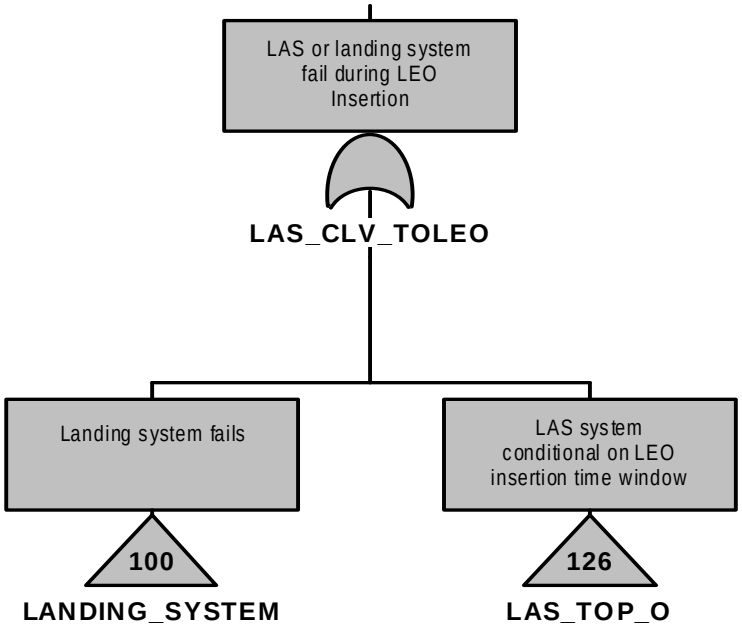
LAS_CLV_SECONDSTAGE - LAS or landing system fail during second stage



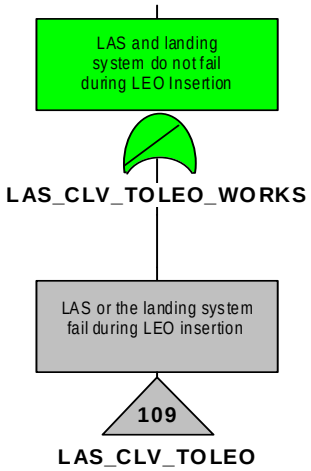
LAS_CLV_SECOND_WORK - LAS and landing system do not fail during second stage



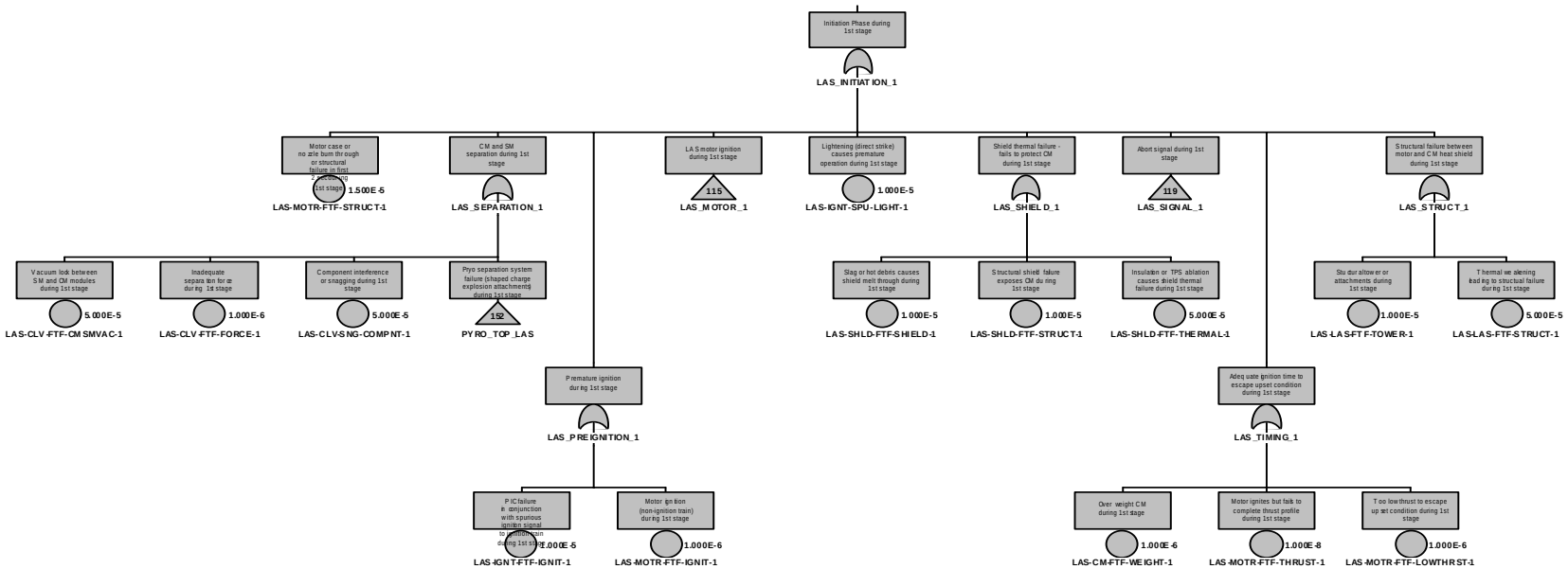
LAS_CLV_TOLEO - LAS or landing system fail during LEO Insertion



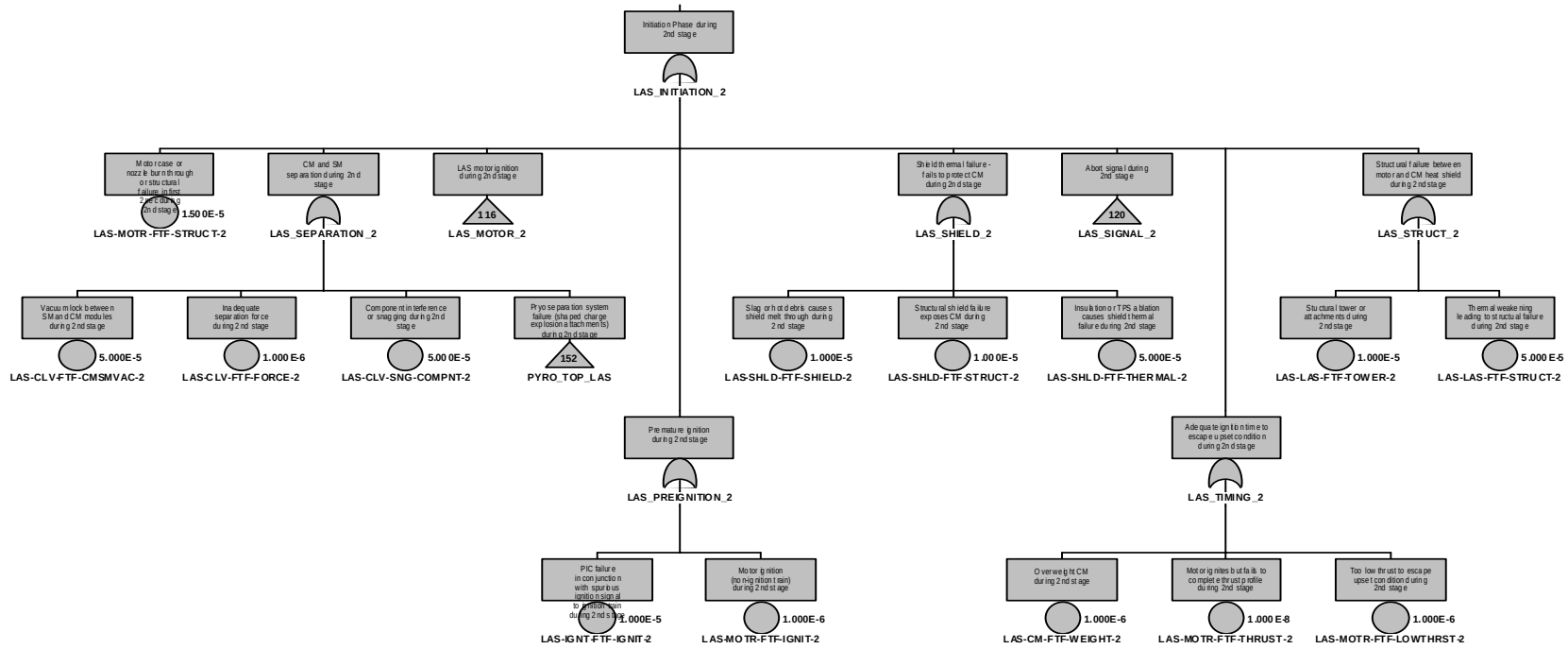
LAS_CLV_TOLEO_WORKS - LAS and landing system do not fail during LEO Insertion



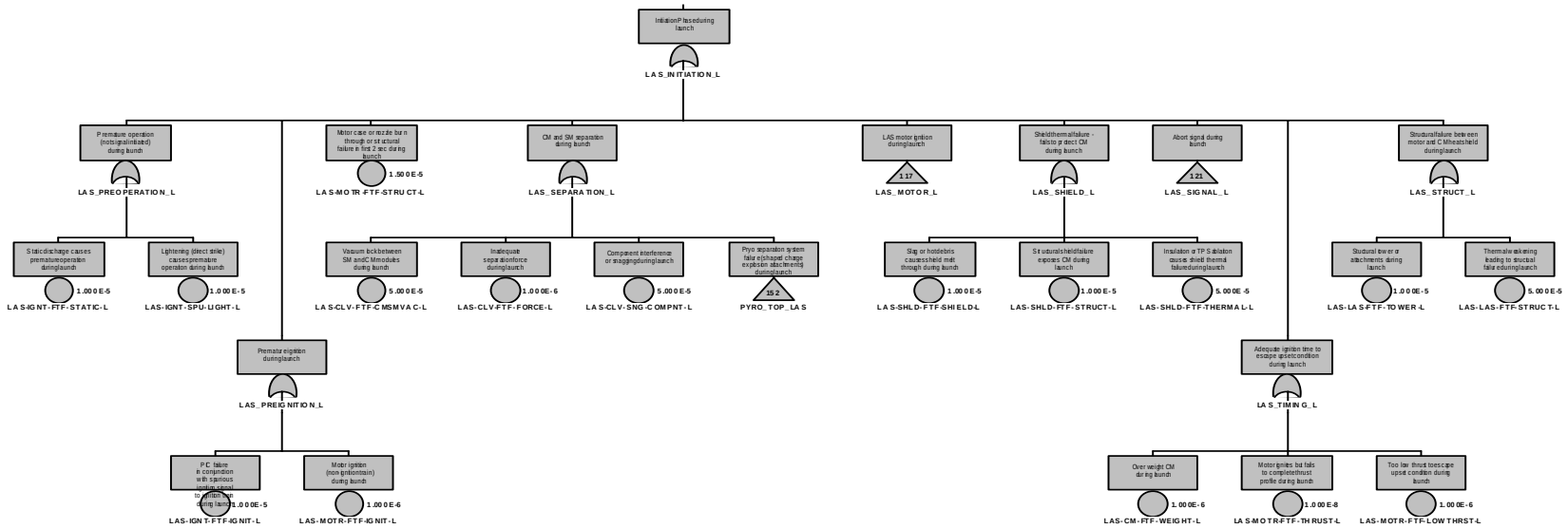
LAS_INITIATION_1 - Initiation Phase during 1st stage



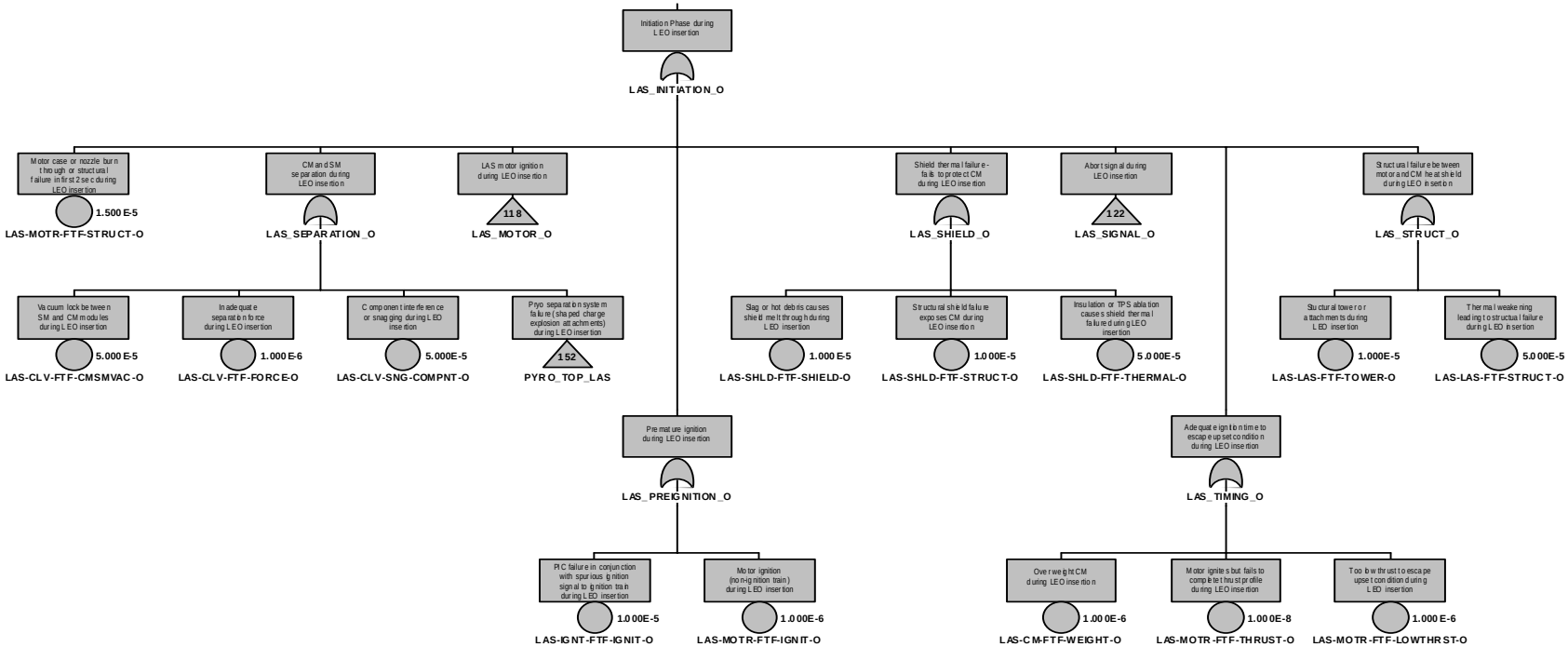
LAS_INITIATION_2 - Initiation Phase during 2nd stage



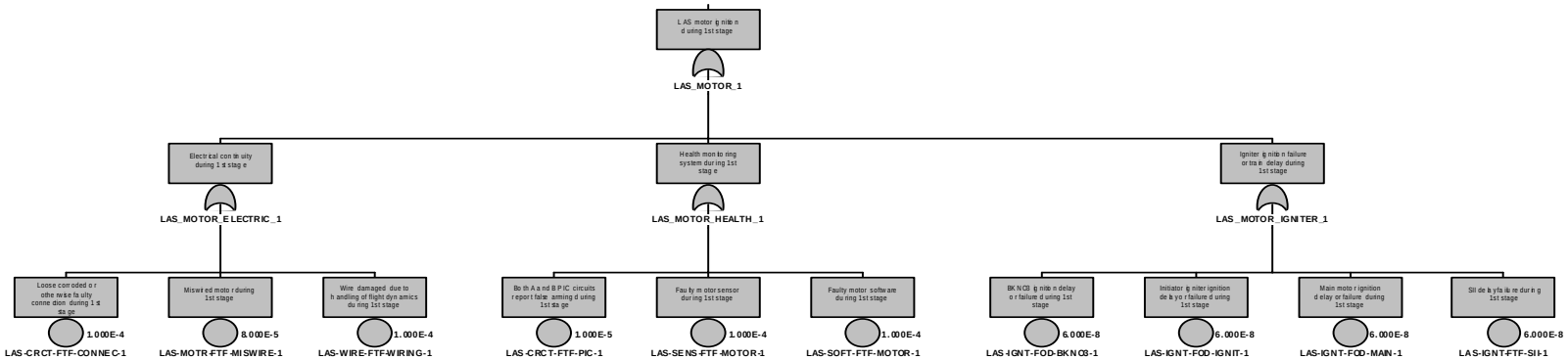
LAS_INITIATION_L - Initiation Phase during launch



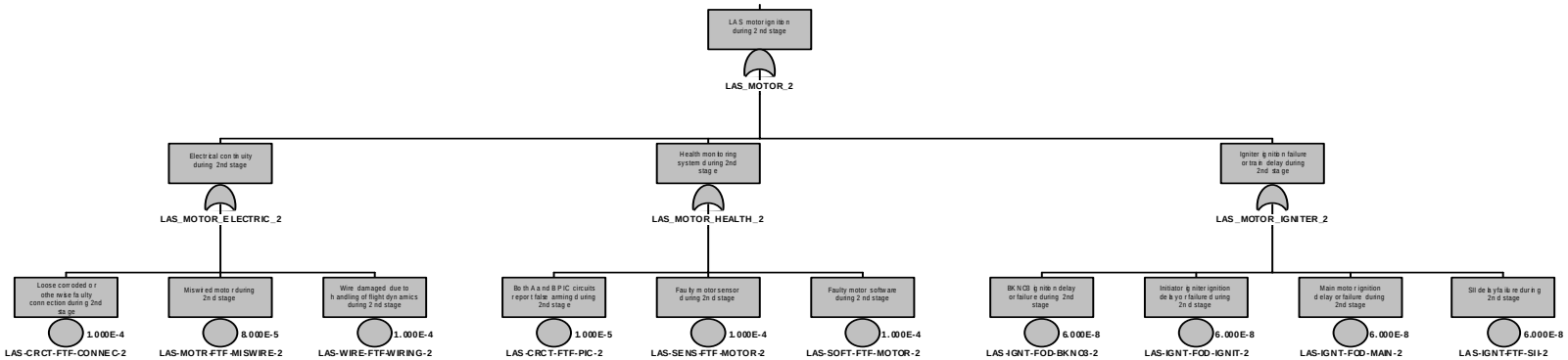
LAS_INITIATION_O - Initiation Phase during LEO insertion



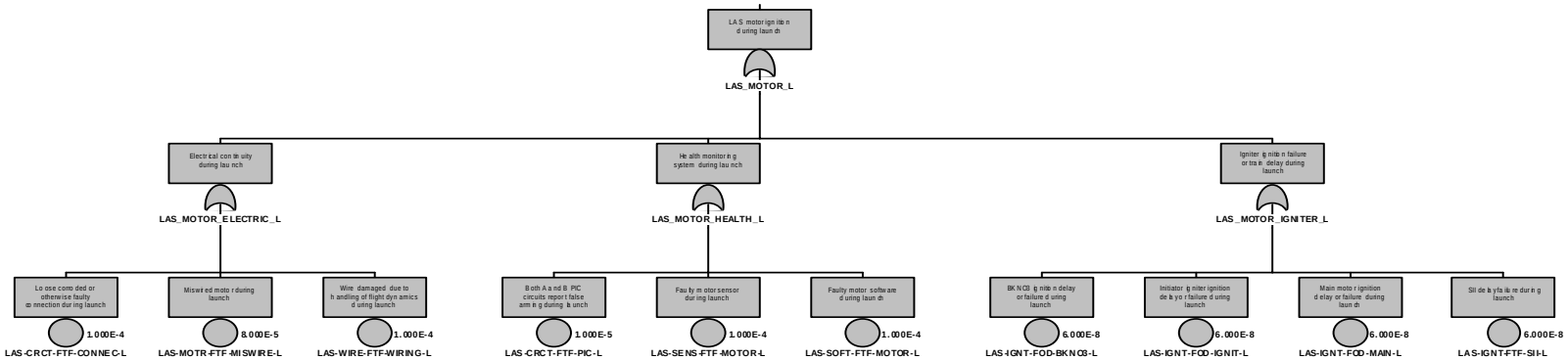
LAS_MOTOR_1 - LAS motor ignition during 1st stage



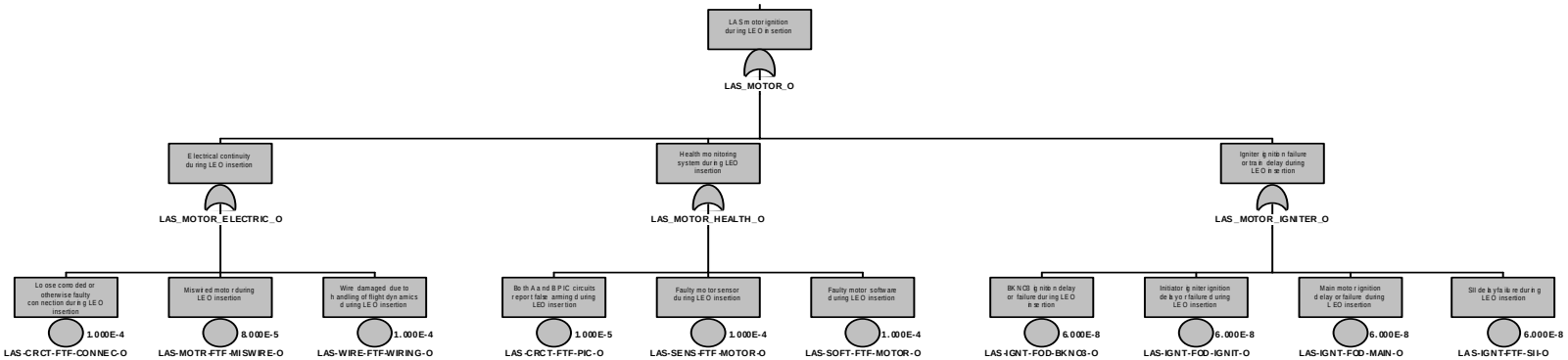
LAS_MOTOR_2 - LAS motor ignition during 2nd stage



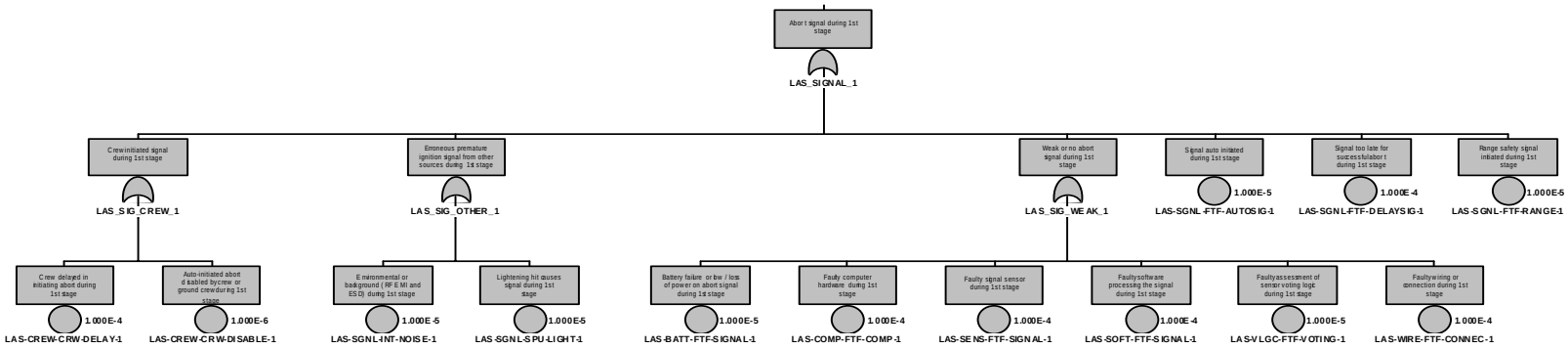
LAS_MOTOR_L - LAS motor ignition during launch



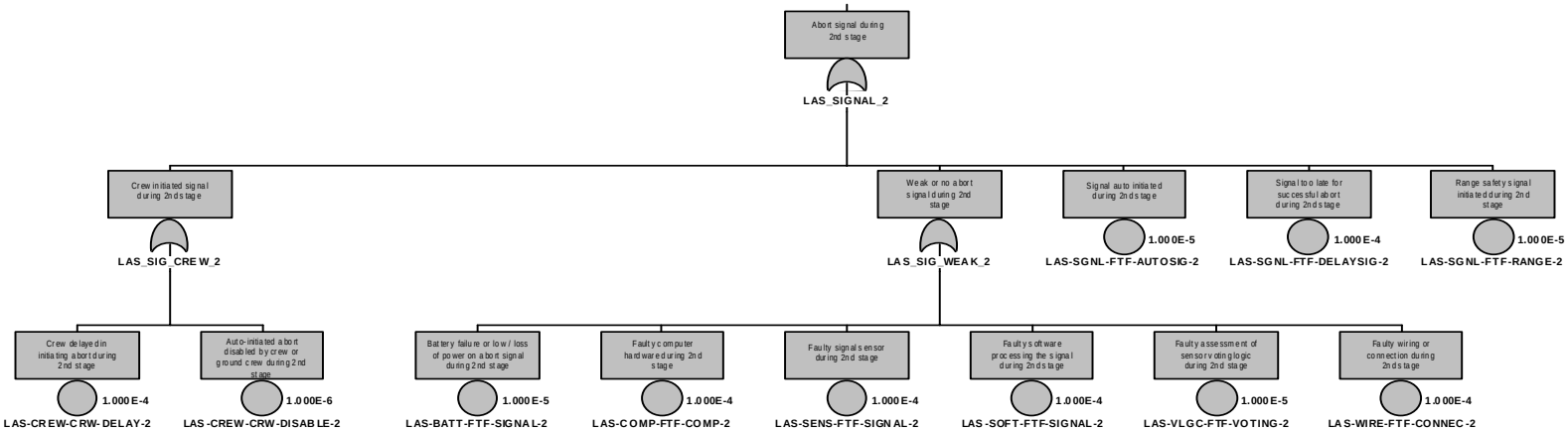
LAS_MOTOR_O - LAS motor ignition during LEO insertion



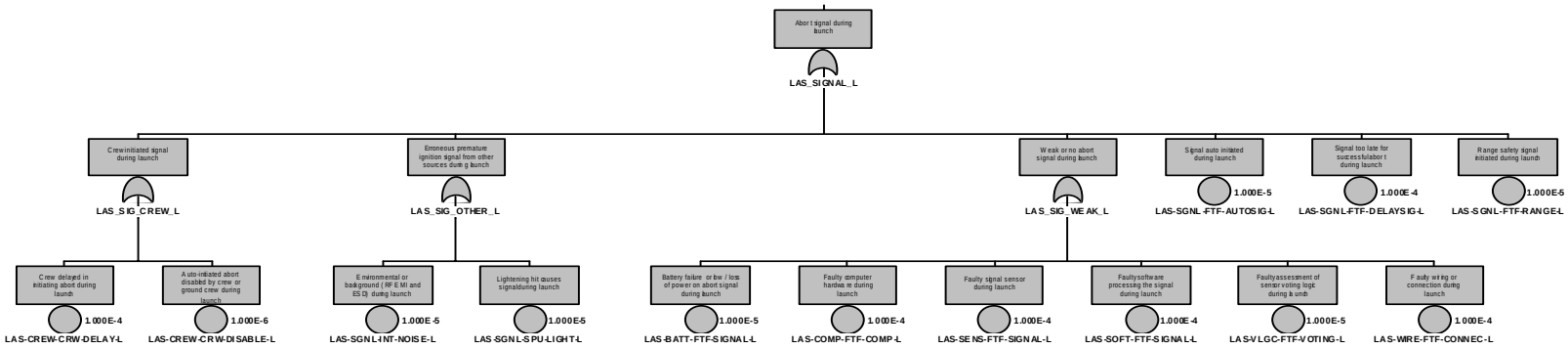
LAS_SIGNAL_1 - Abort signal during 1st stage



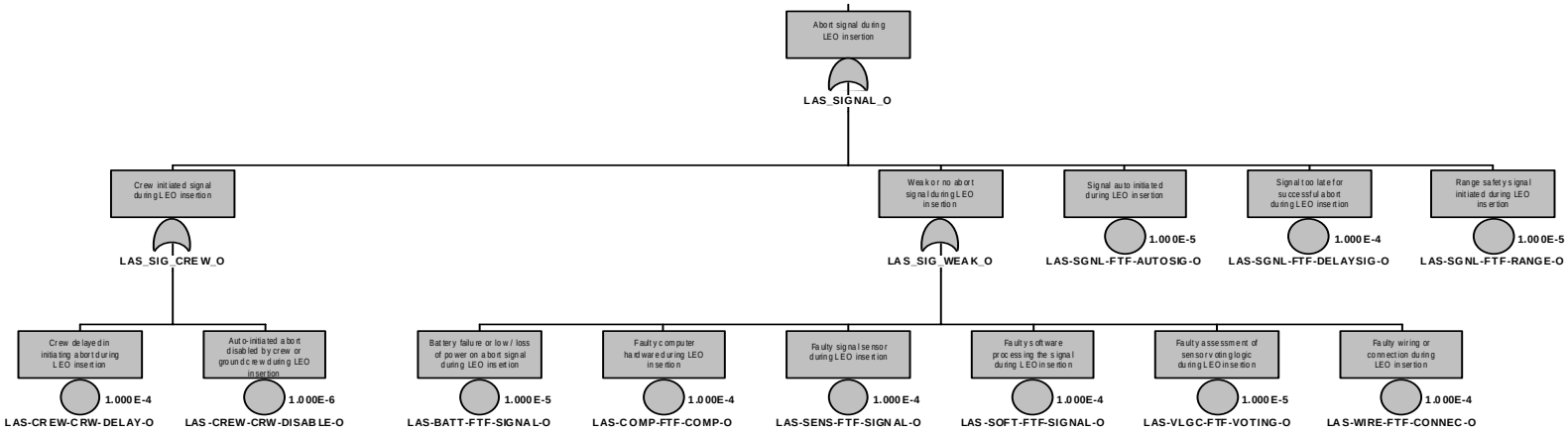
LAS_SIGNAL_2 - Abort signal during 2nd stage



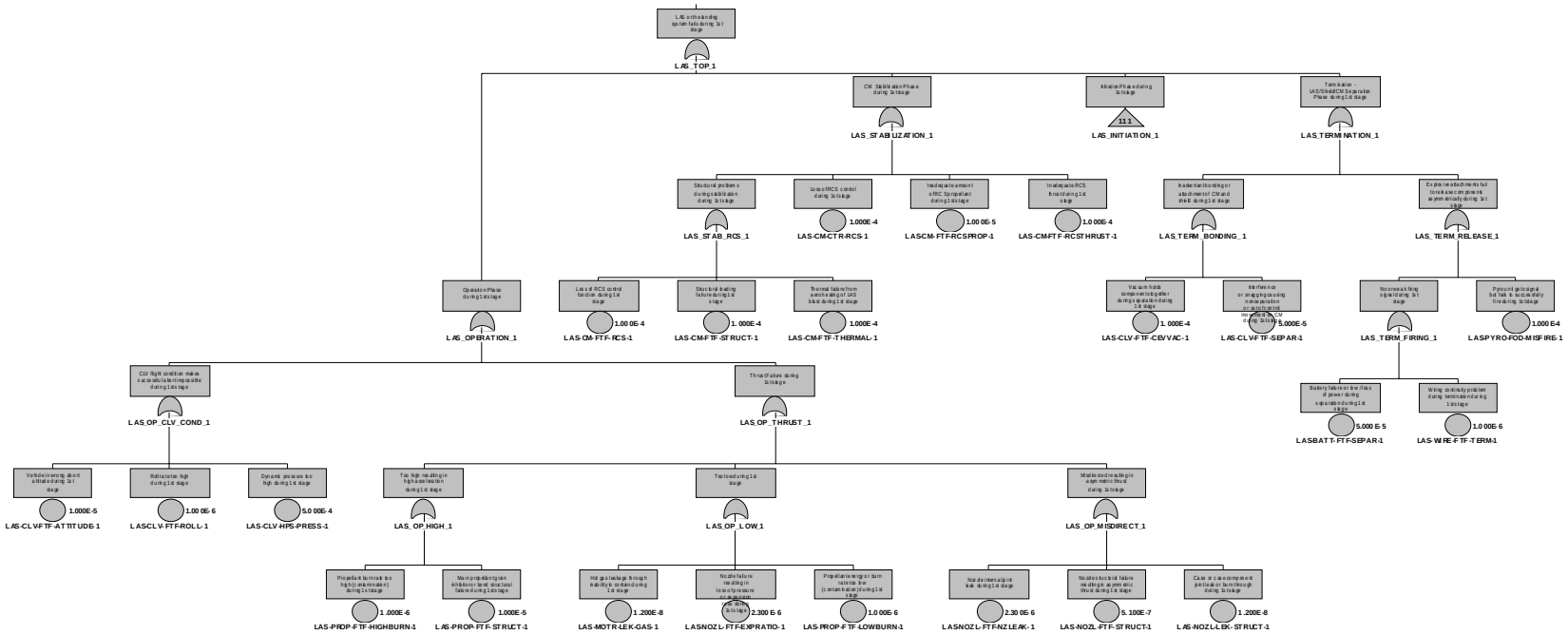
LAS_SIGNAL_L - Abort signal during launch



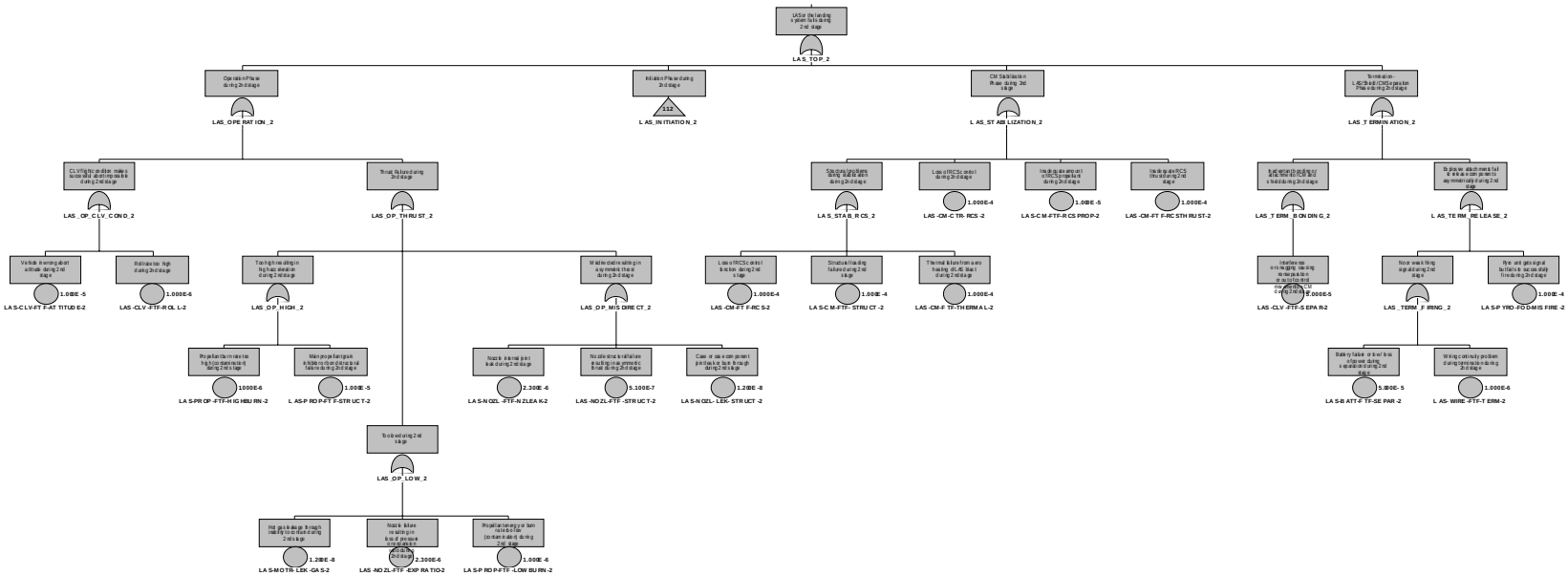
LAS_SIGNAL_O - Abort signal during LEO insertion



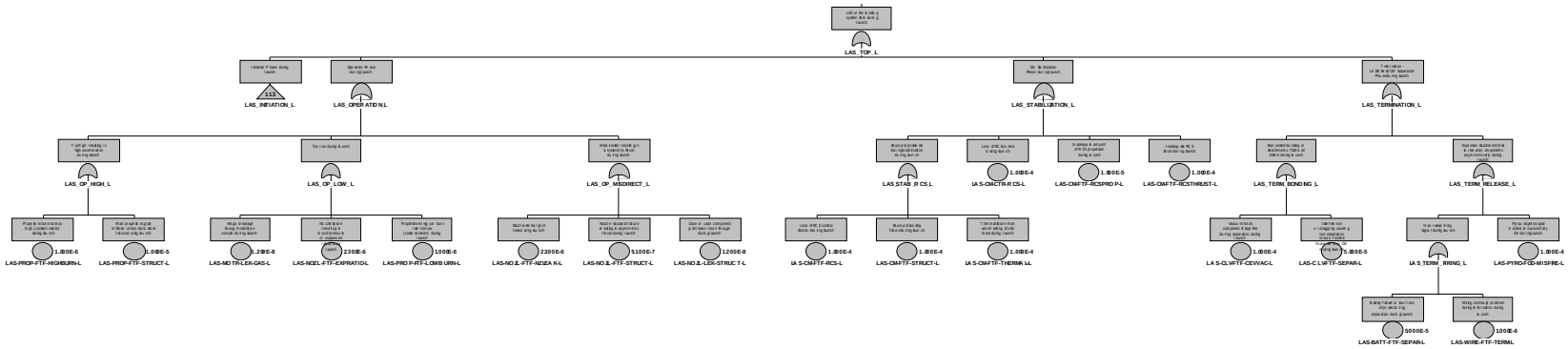
LAS_TOP_1 - LAS fails during first stage burn



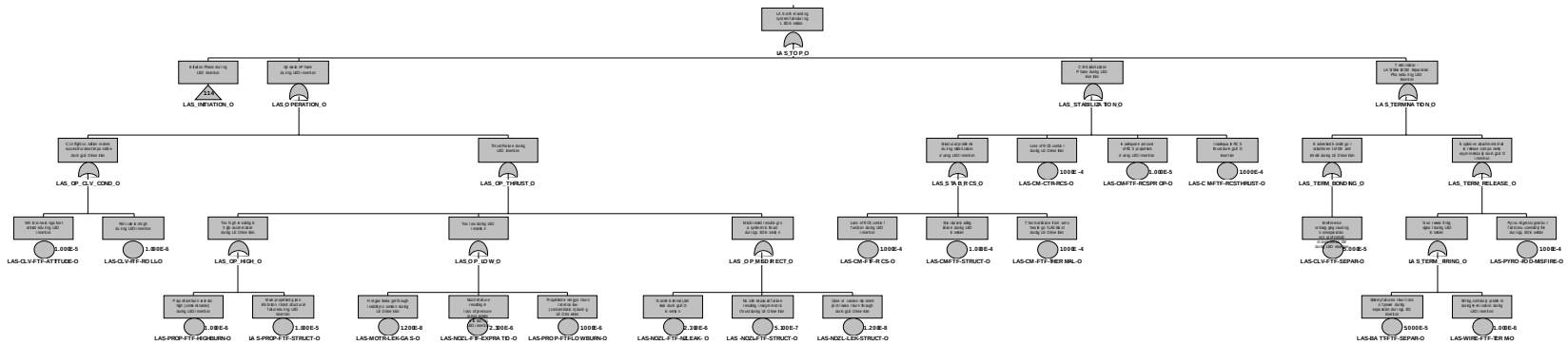
LAS_TOP_2 - LAS fails during second stage burn



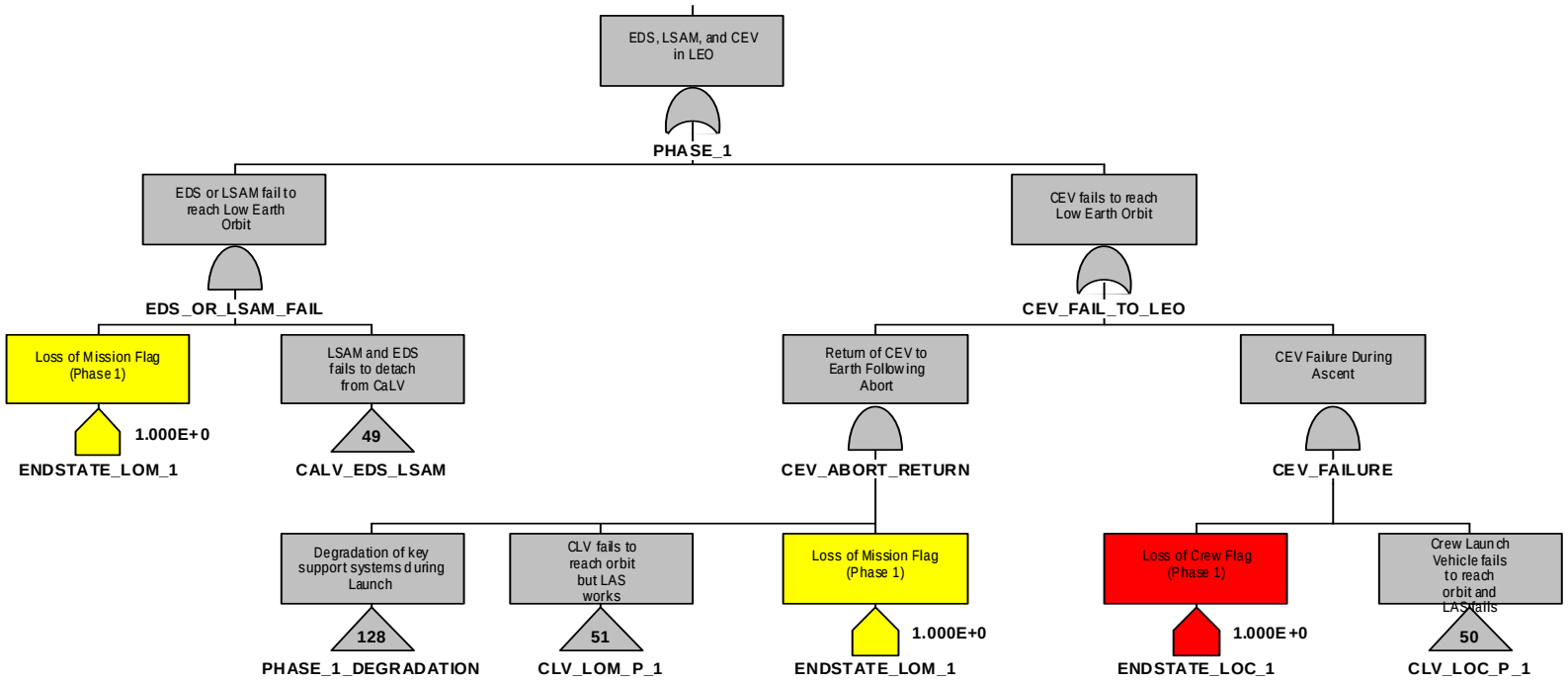
LAS_TOP_L - LAS fails during launch



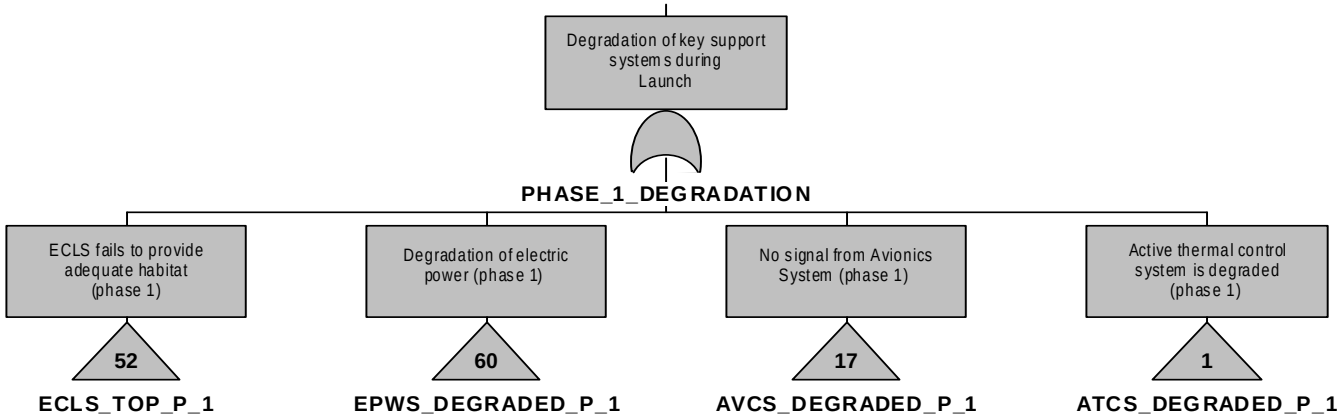
LAS_TOP_O - LAS fails during LEO insertion



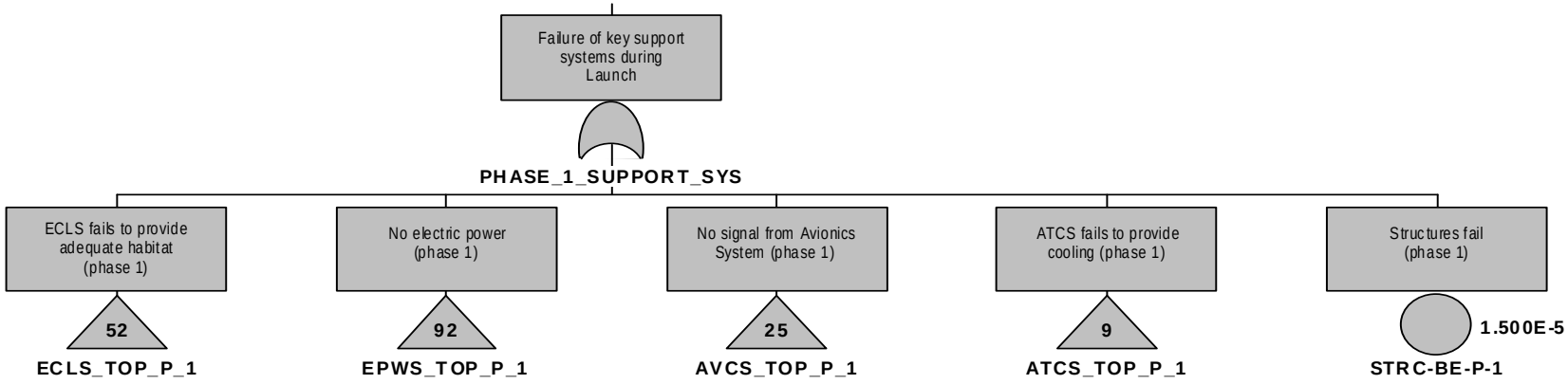
PHASE_1 - EDS LSAM and CEV in LEO



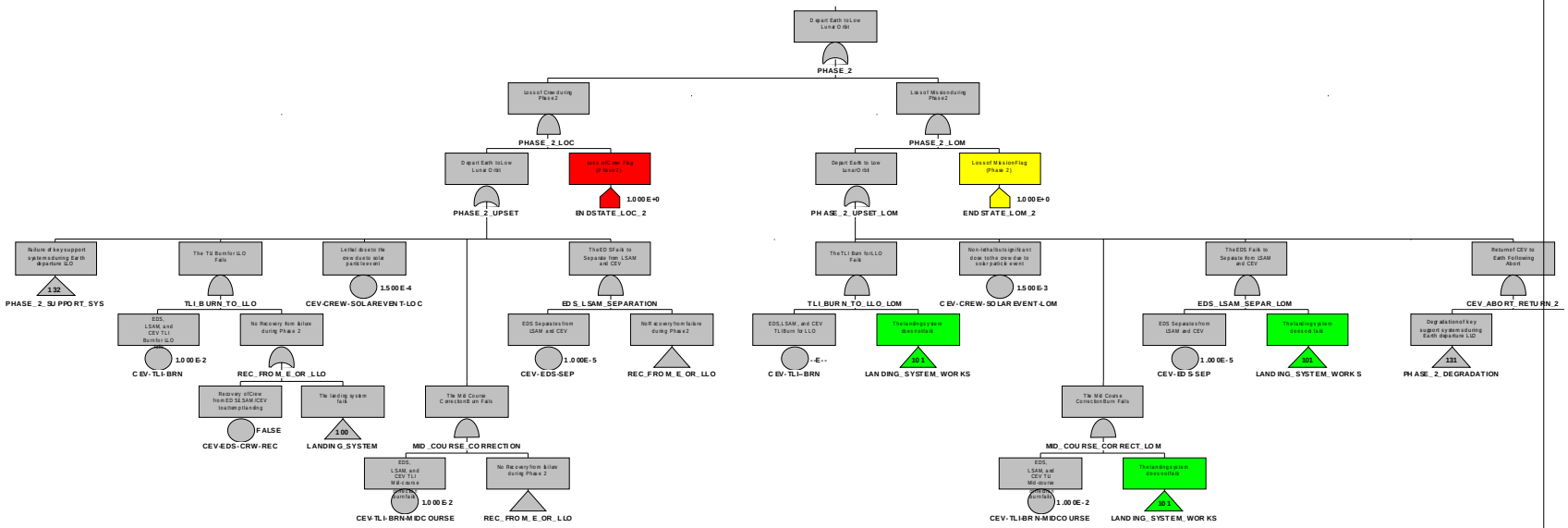
PHASE_1_DEGRADATION - Degradation of key support systems during Launch



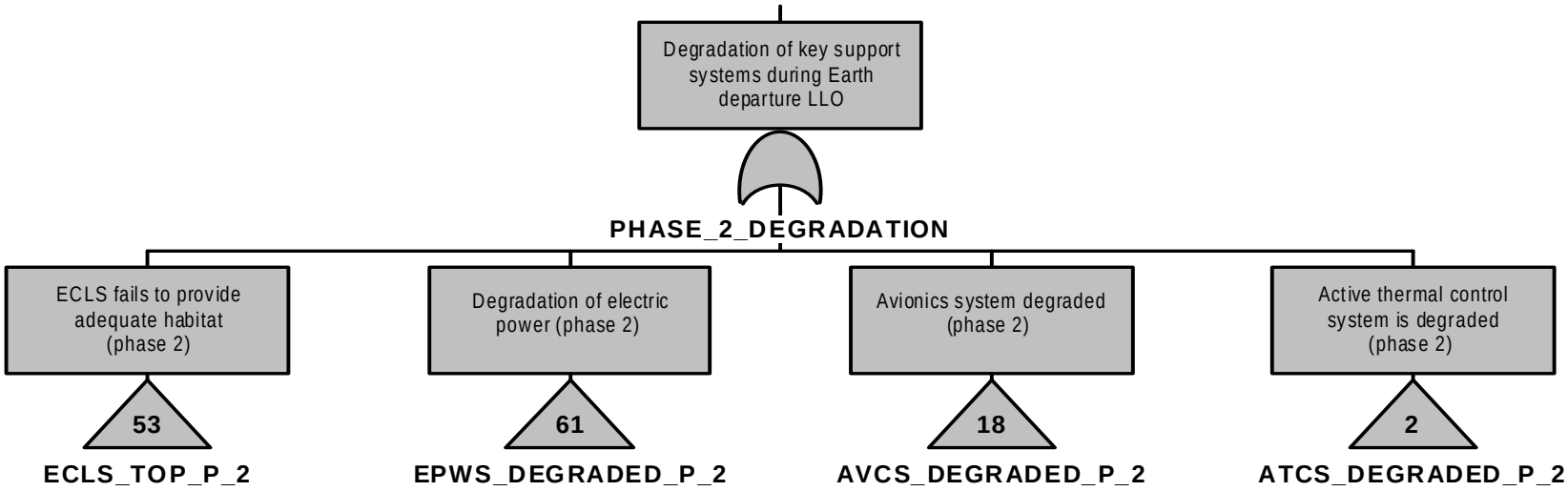
PHASE_1_SUPPORT_SYS - Failure of key support systems during Launch



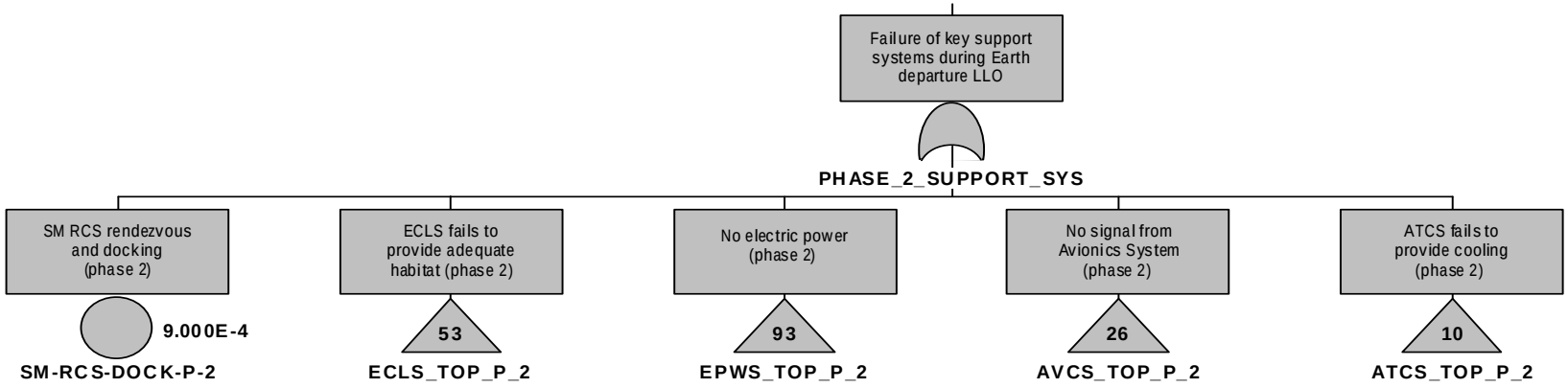
PHASE_2 - Depart Earth to Low Lunar Orbit



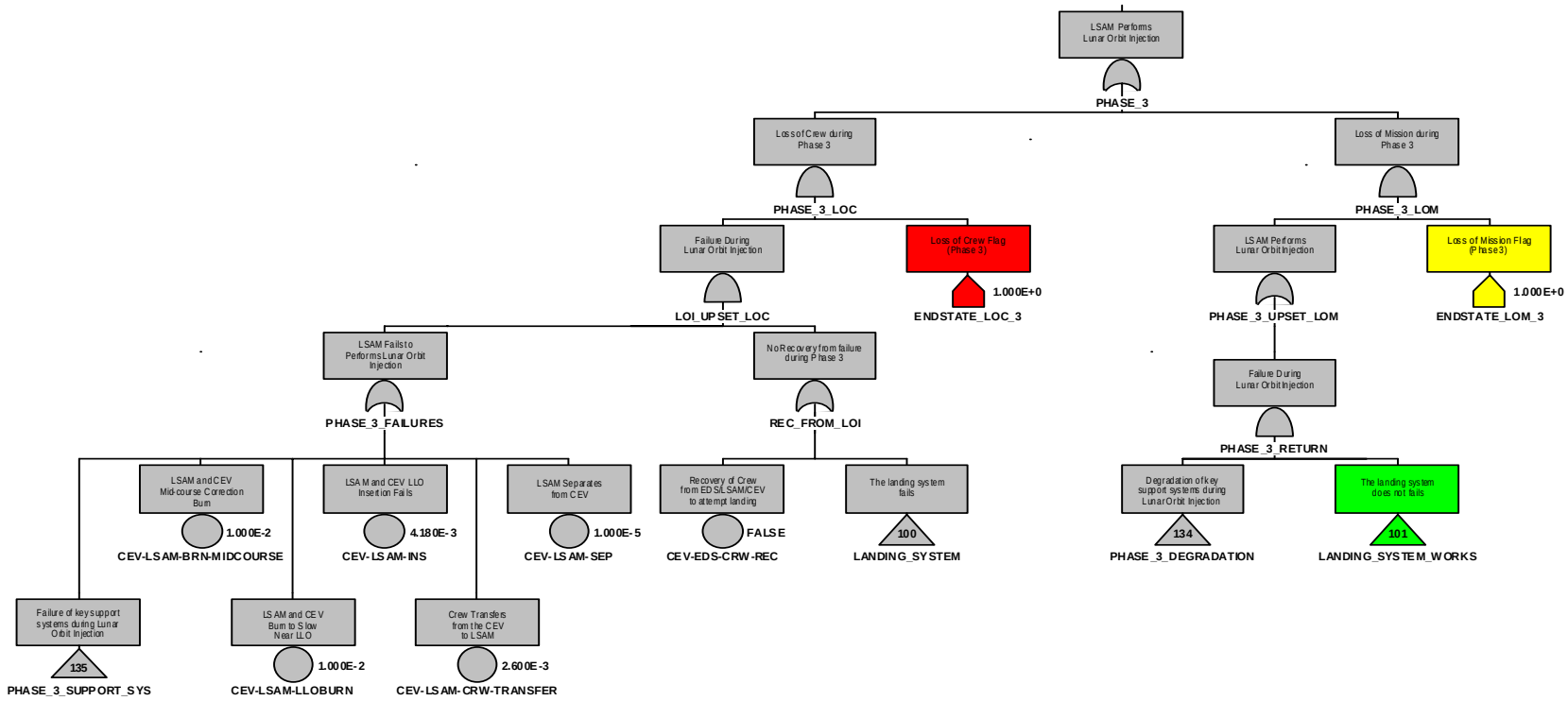
PHASE_2_DEGRADATION - Degradation of key support systems during Earth departure LLO



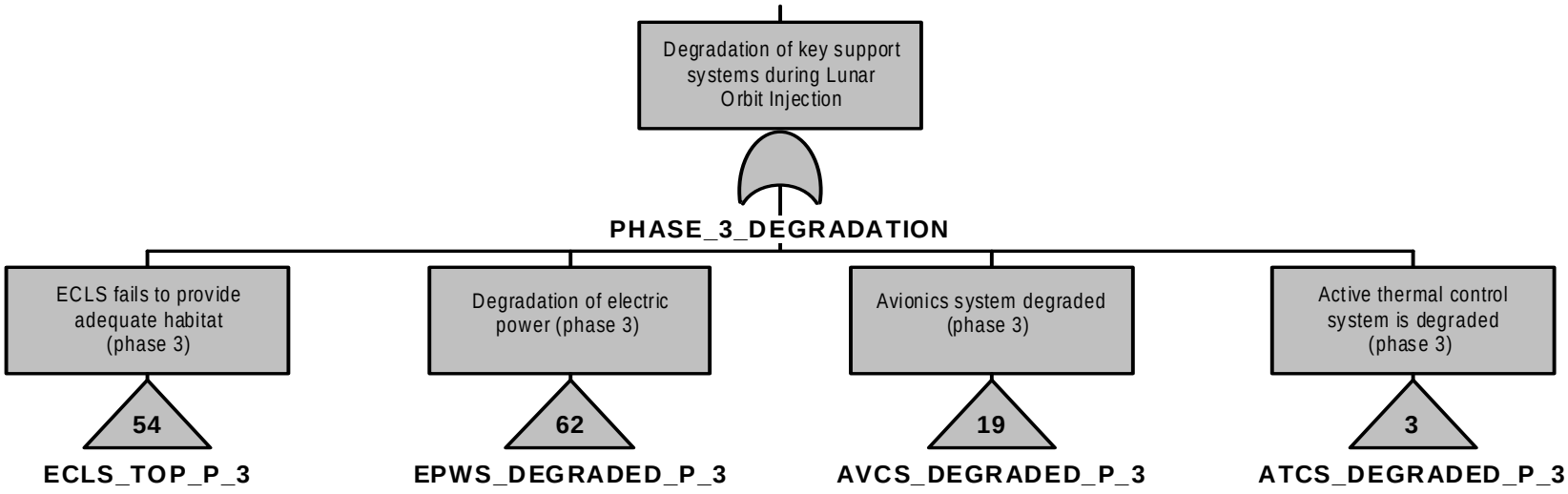
PHASE_2_SUPPORT_SYS - Failure of key support systems during Earth departure LLO



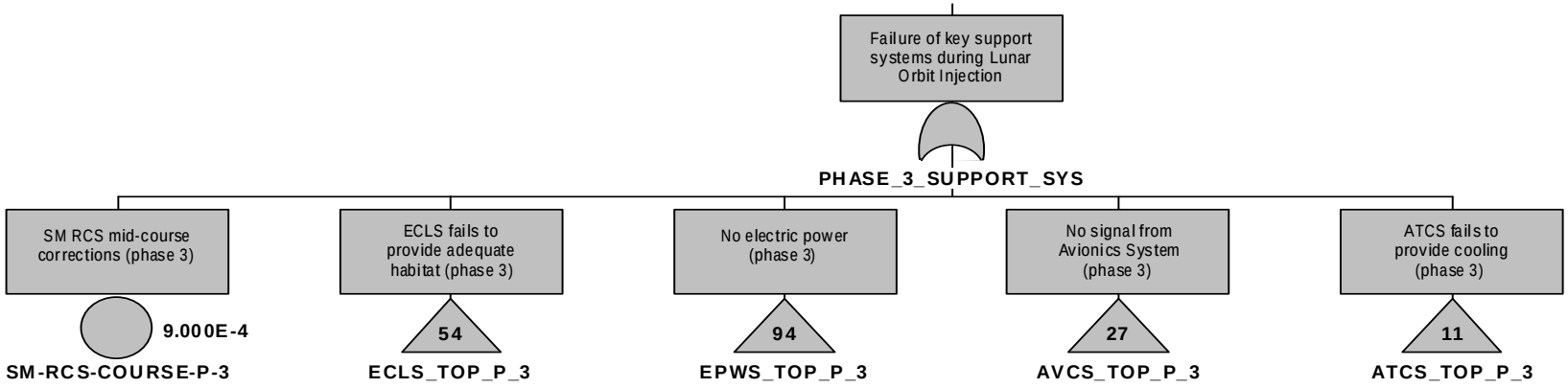
PHASE_3 - LSAM Performs Lunar Orbit Injection



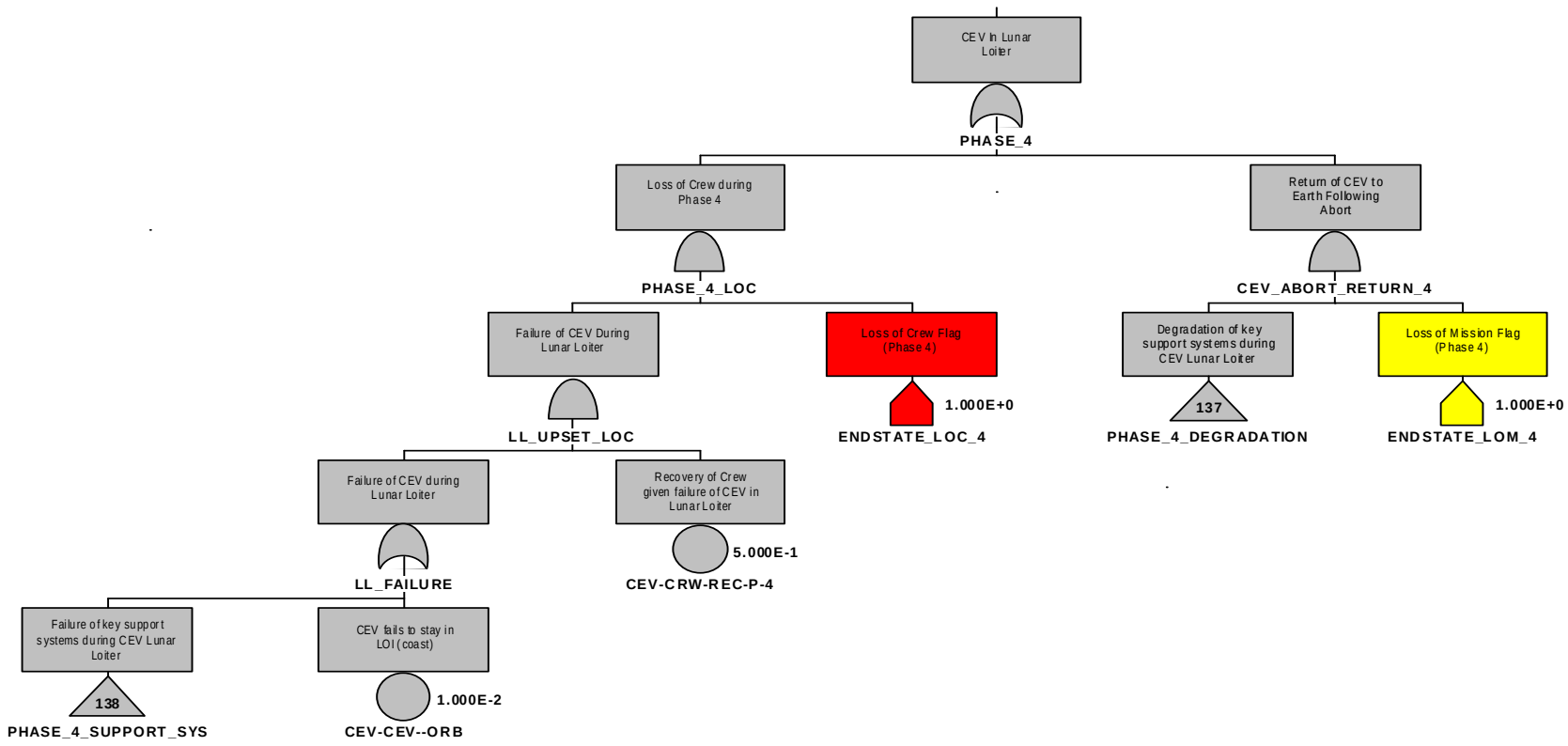
PHASE_3_DEGRADATION - Degradation of key support systems during Lunar Orbit Injection



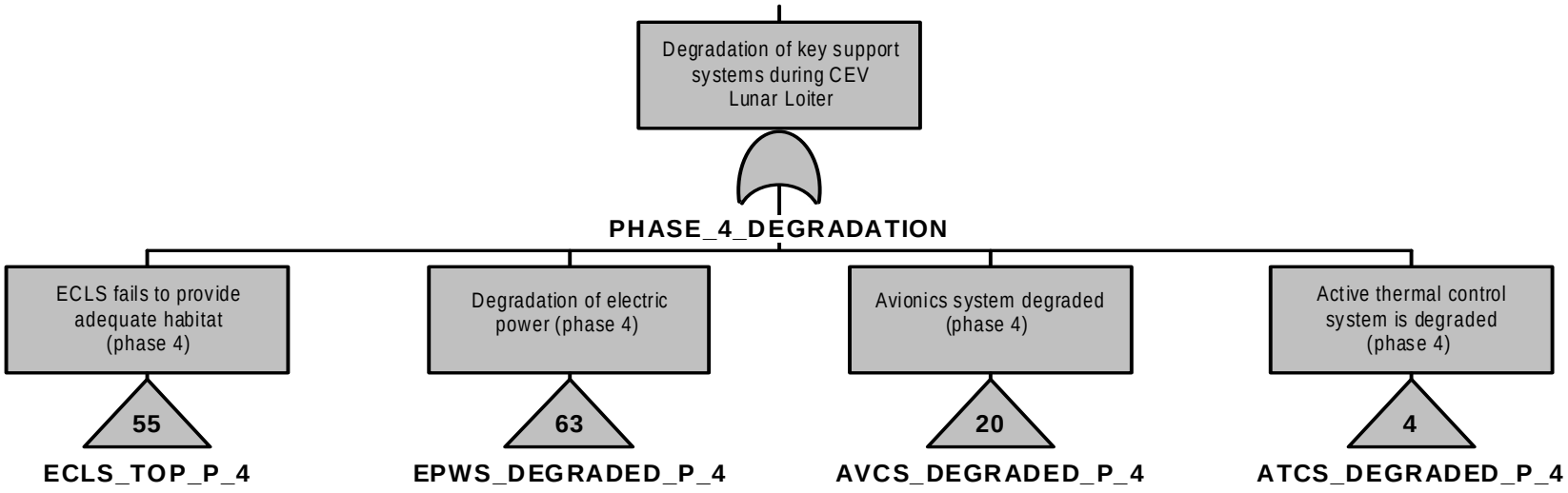
PHASE_3_SUPPORT_SYS - Failure of key support systems during Lunar Orbit Injection



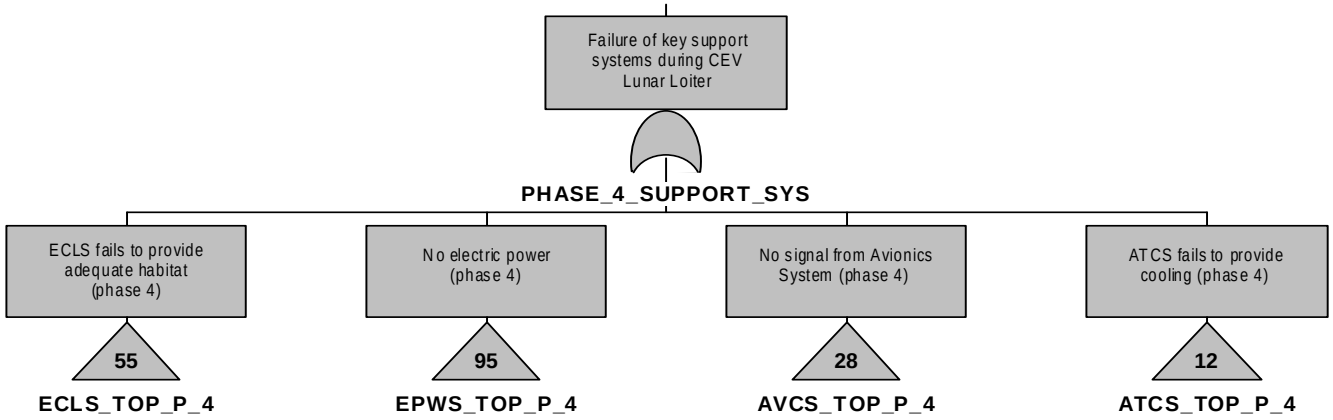
PHASE_4 - CEV In Lunar Loiter



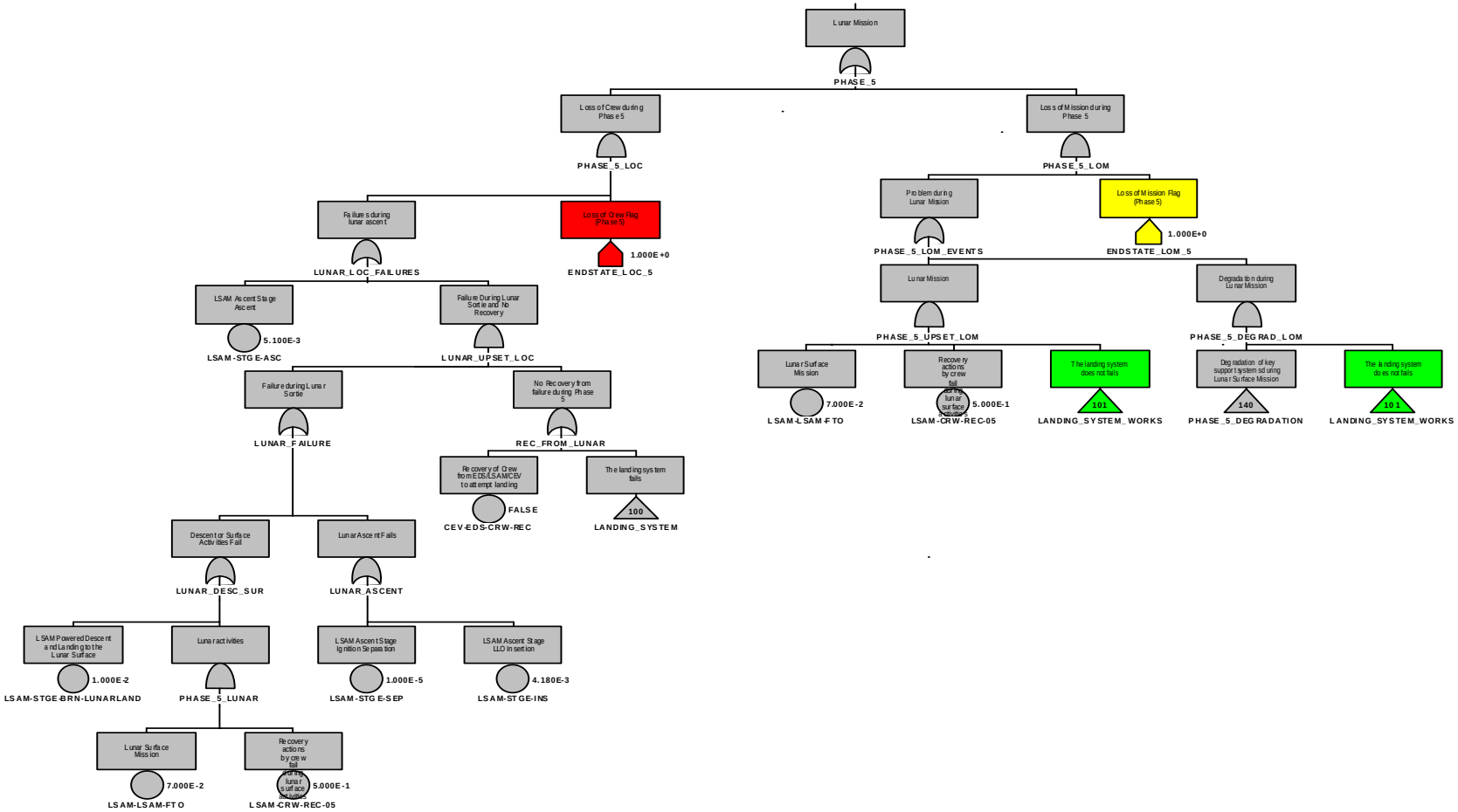
PHASE_4_DEGRADATION - Degradation of key support systems during CEV Lunar Loiter



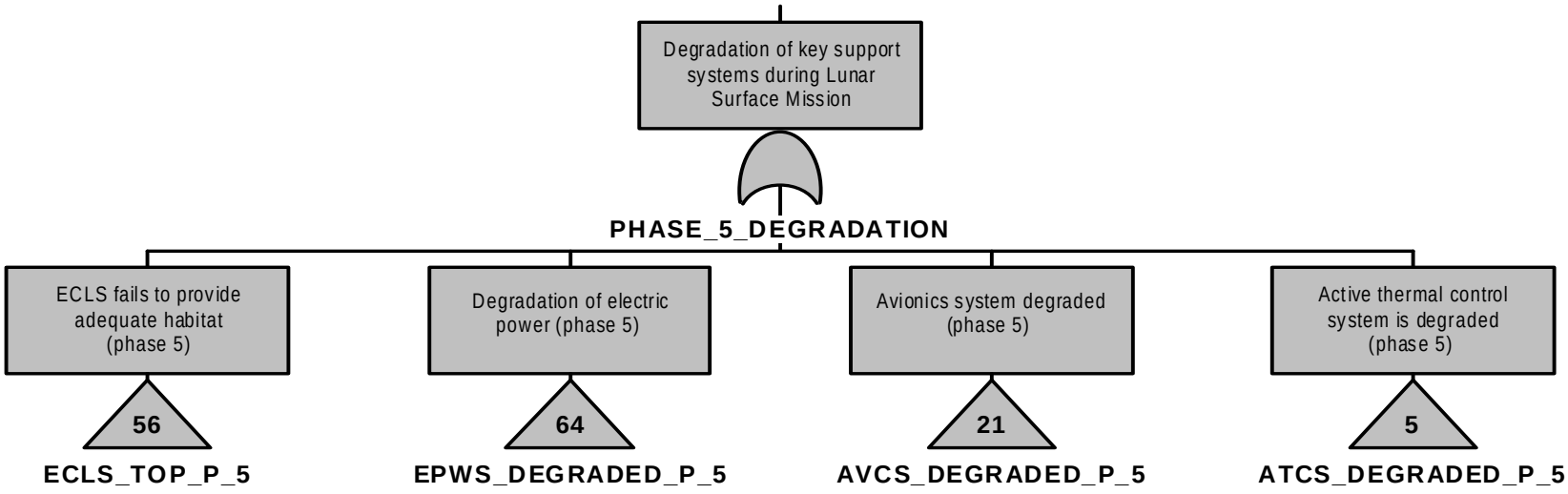
PHASE_4_SUPPORT_SYS - Failure of key support systems during CEV Lunar Loiter



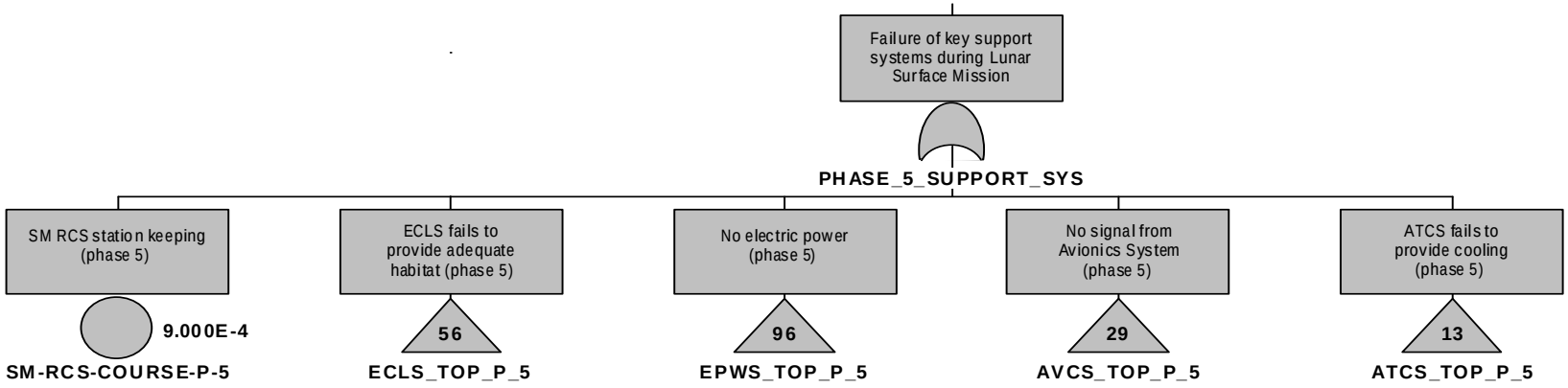
PHASE_5 - Lunar Mission



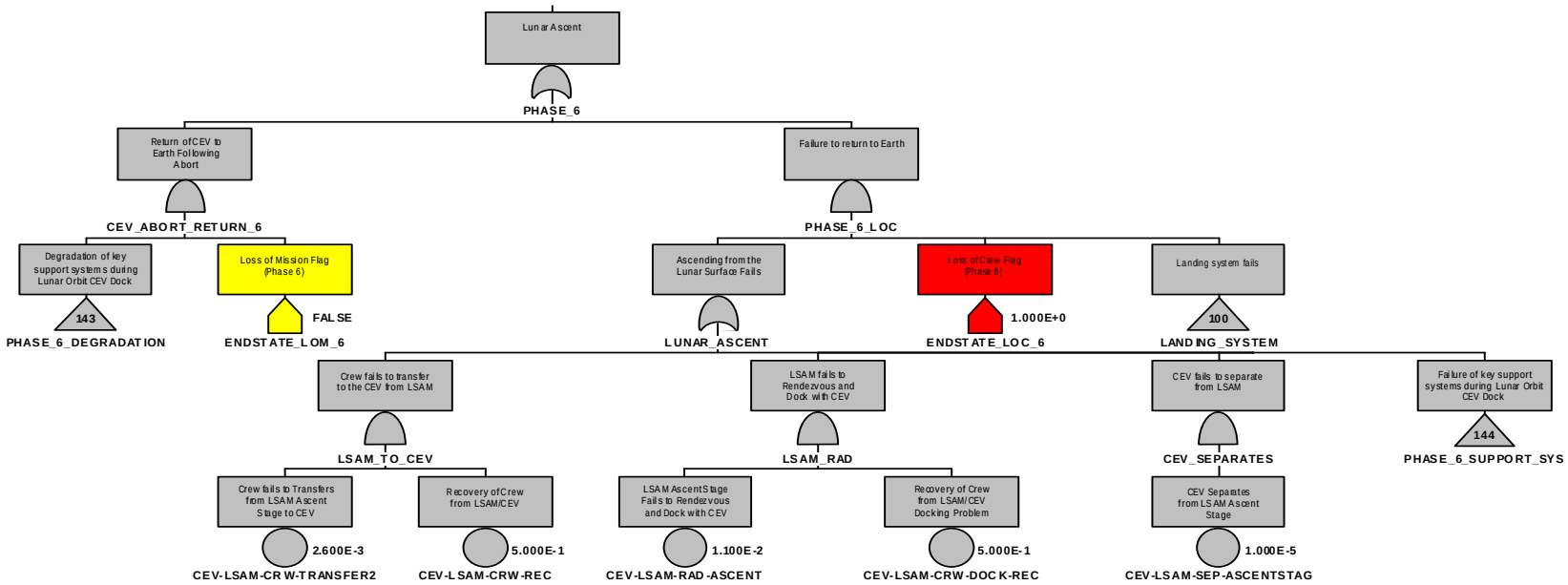
PHASE_5_DEGRADATION - Degradation of key support systems during Lunar Surface Mission



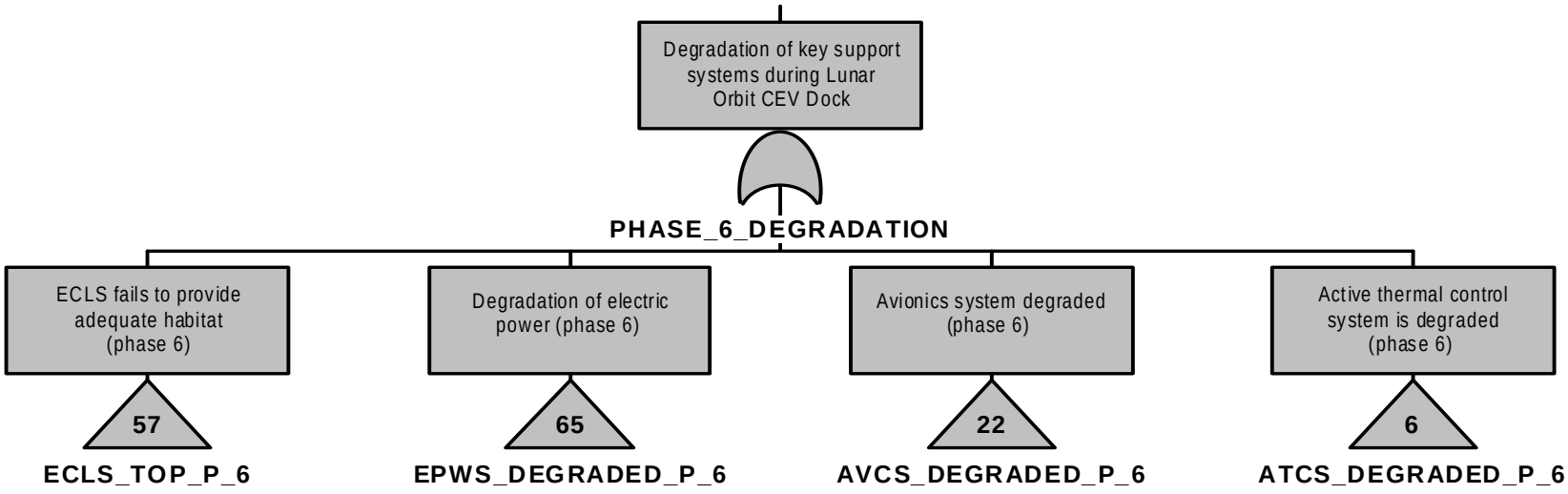
PHASE_5_SUPPORT_SYS - Failure of key support systems during Lunar Surface Mission



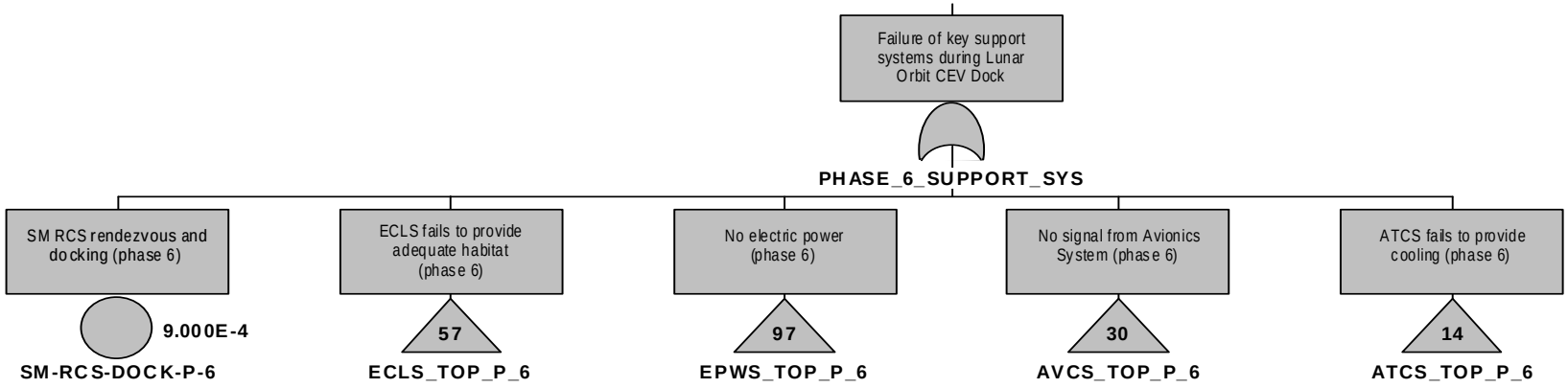
PHASE_6 - Dock with CEV in Lunar Orbit



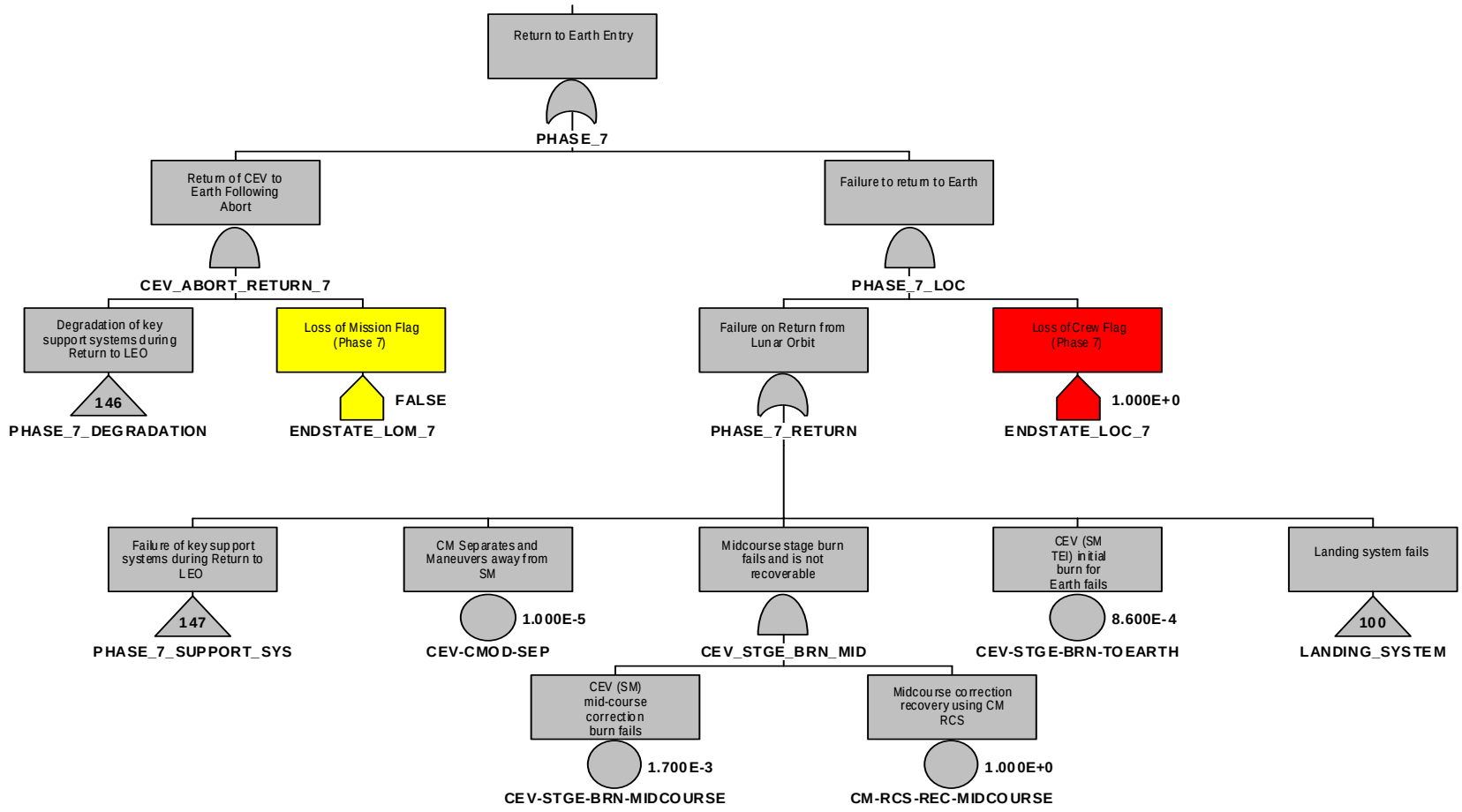
PHASE_6_DEGRADATION - Degradation of key support systems during Lunar Orbit CEV Dock



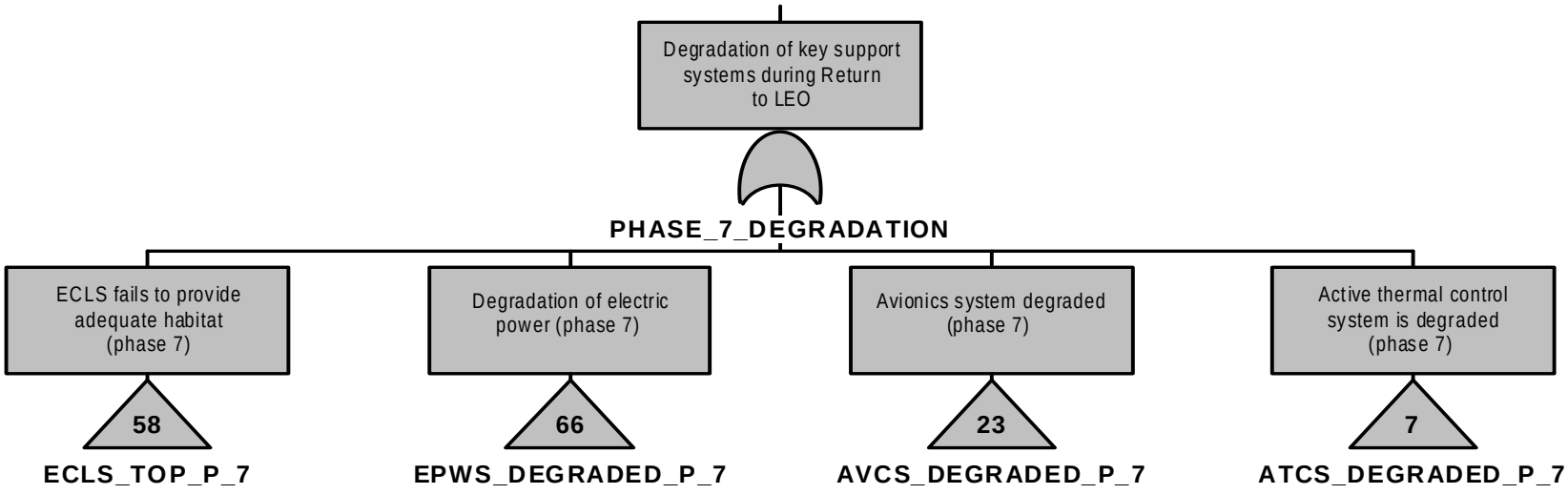
PHASE_6_SUPPORT_SYS - Failure of key support systems during Lunar Orbit CEV Dock



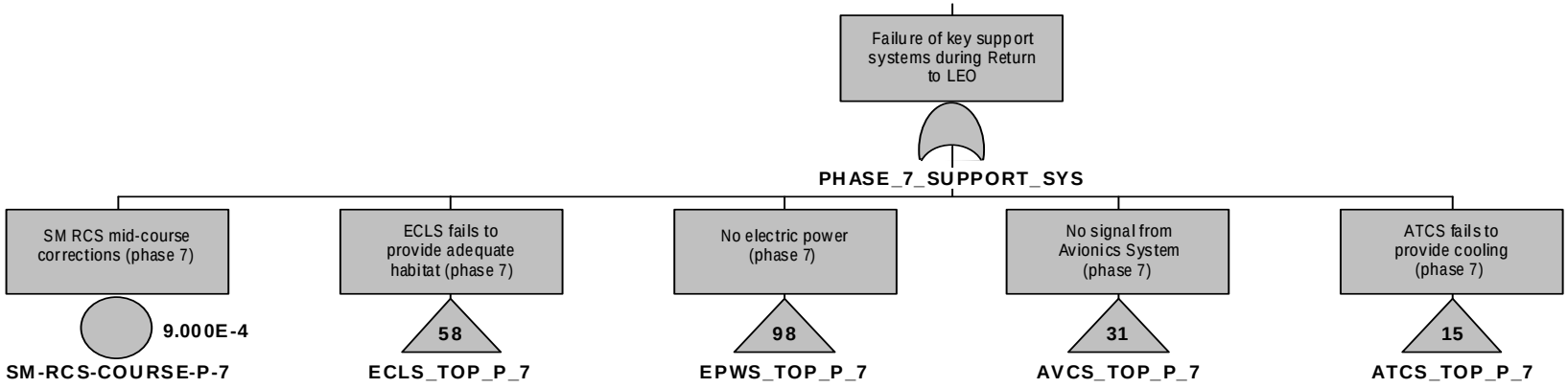
PHASE_7 - Return to Low Earth Orbit



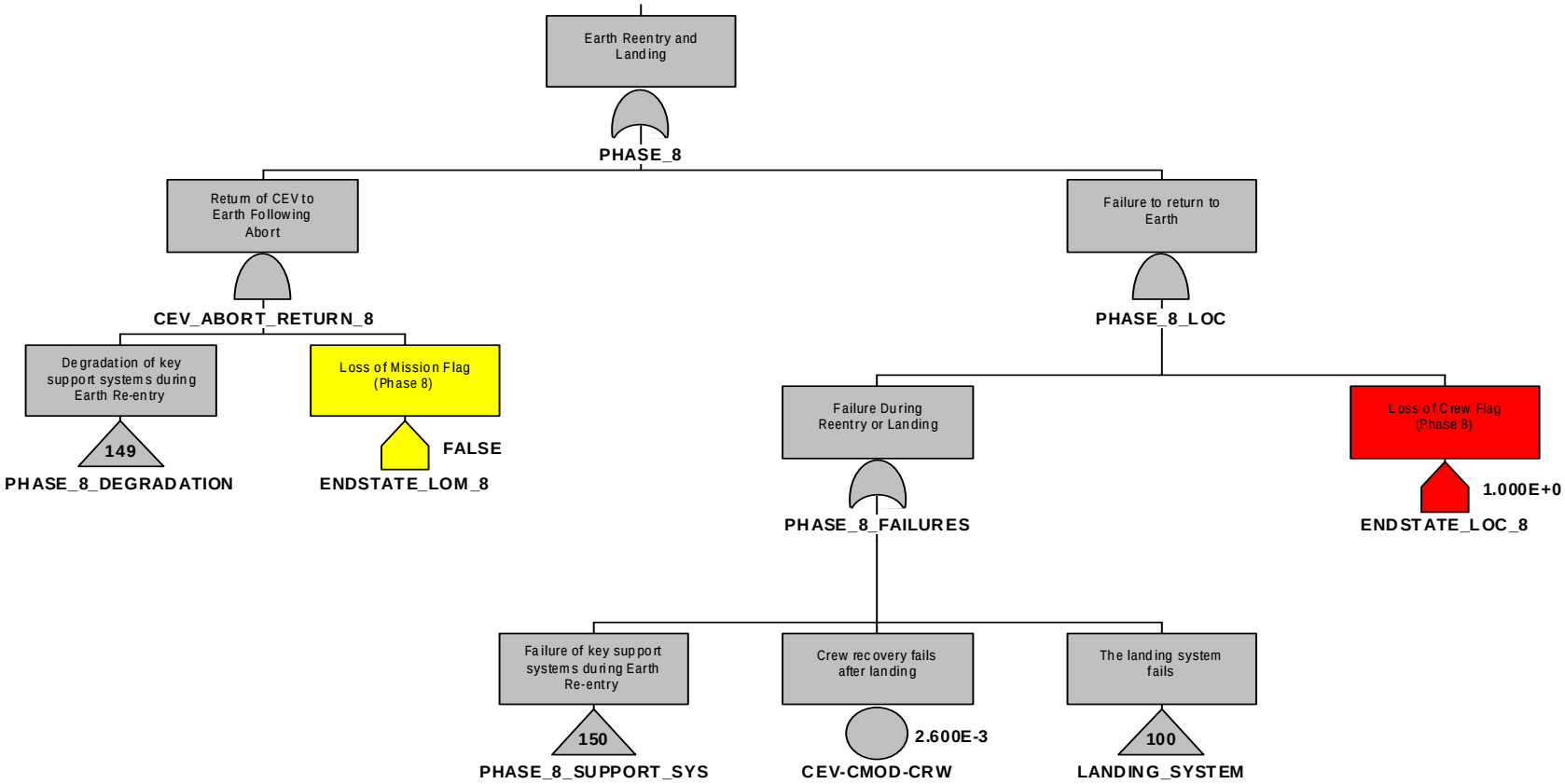
PHASE_7_DEGRADATION - Degradation of key support systems during Return to LEO



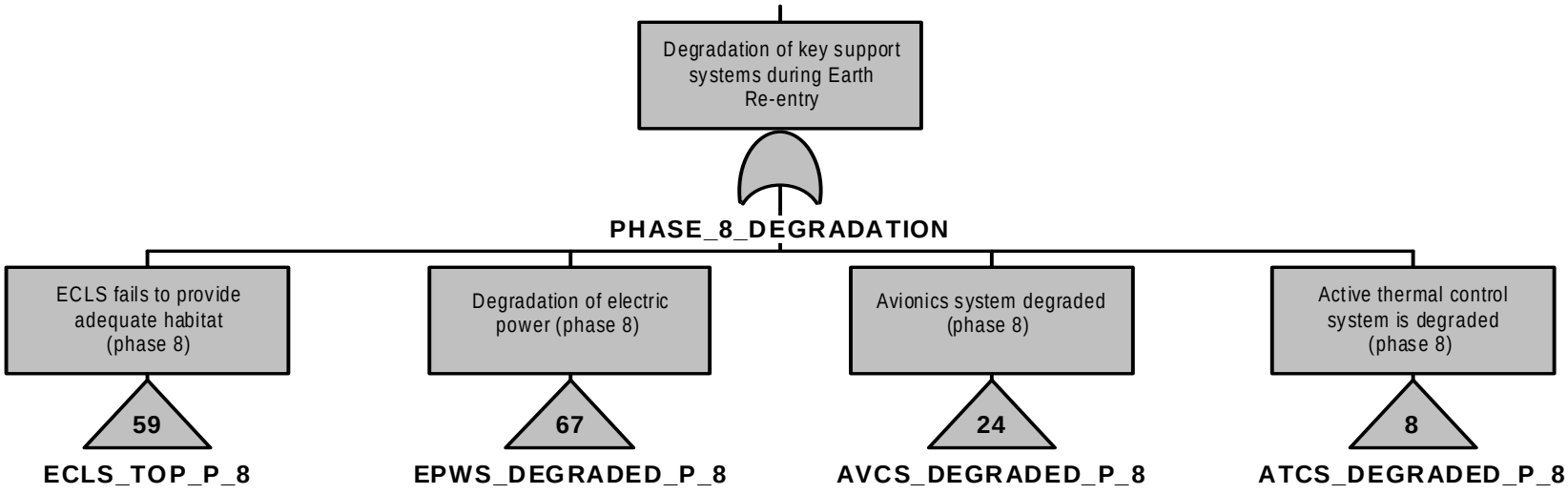
PHASE_7_SUPPORT_SYS - Failure of key support systems during Return to LEO



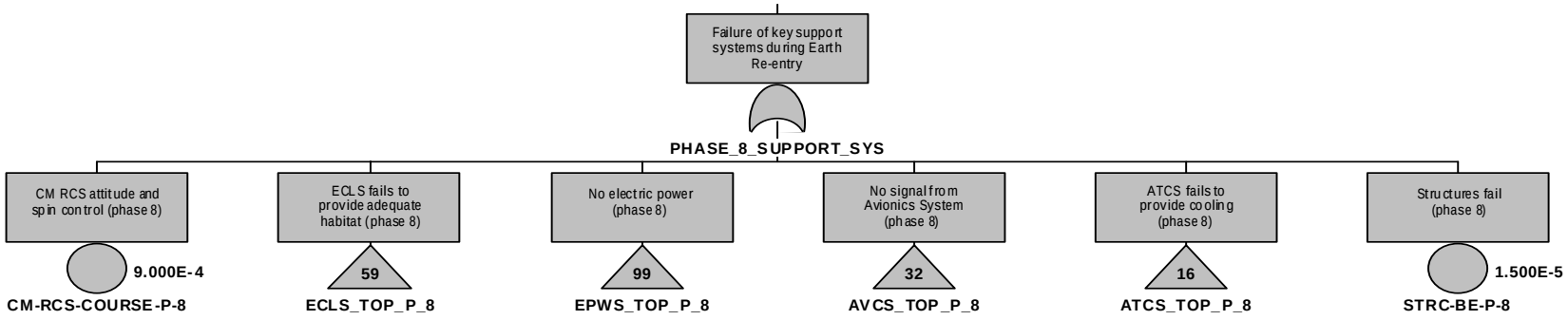
PHASE_8 - Earth Reentry and Landing



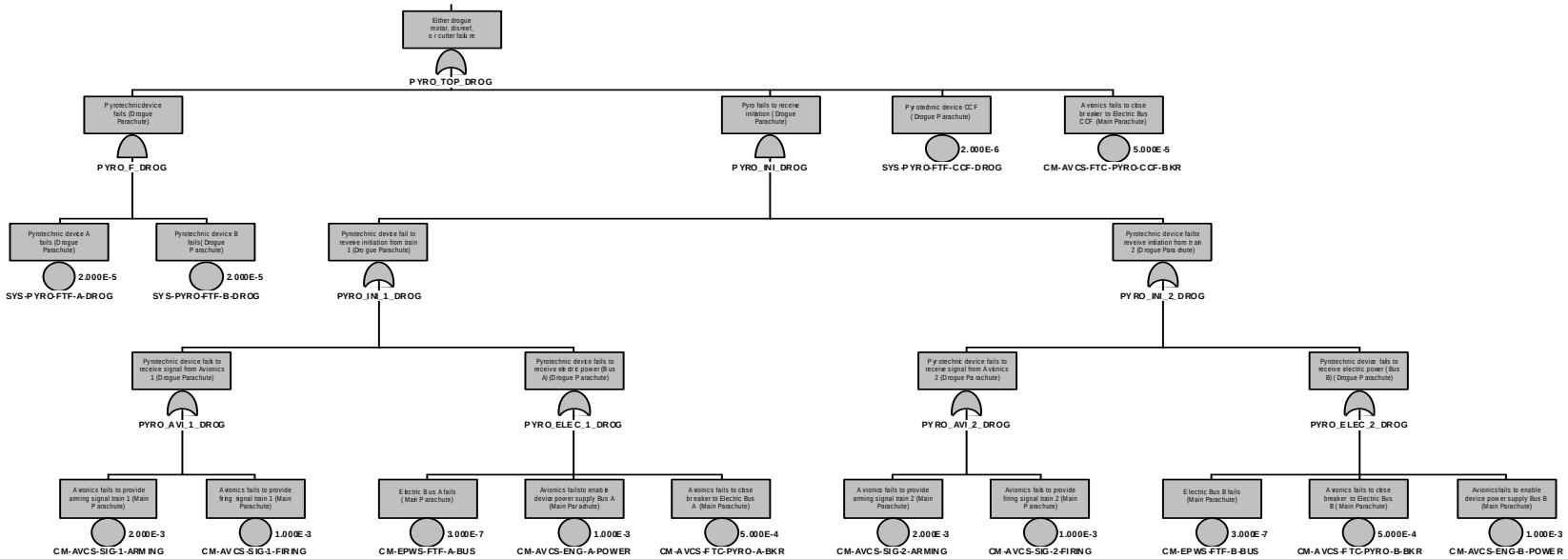
PHASE_8_DEGRADATION - Degradation of key support systems during Earth Re-entry



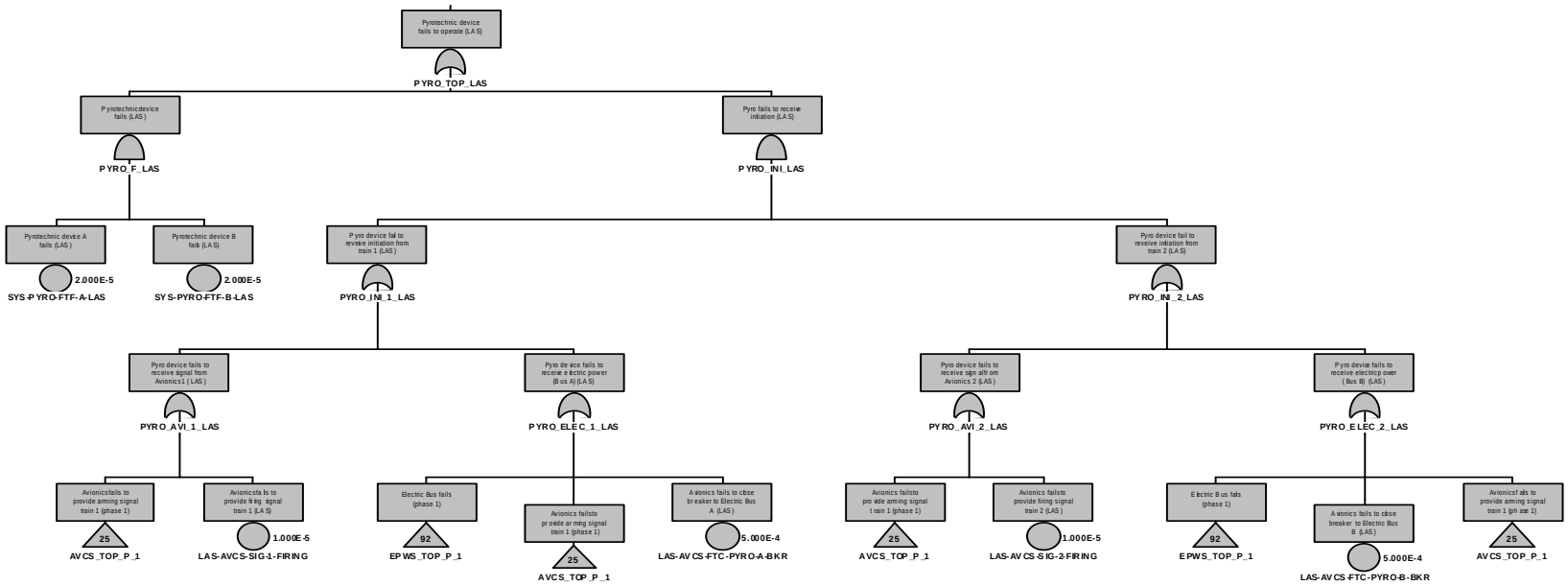
PHASE_8_SUPPORT_SYS - Failure of key support systems during Earth Re-entry



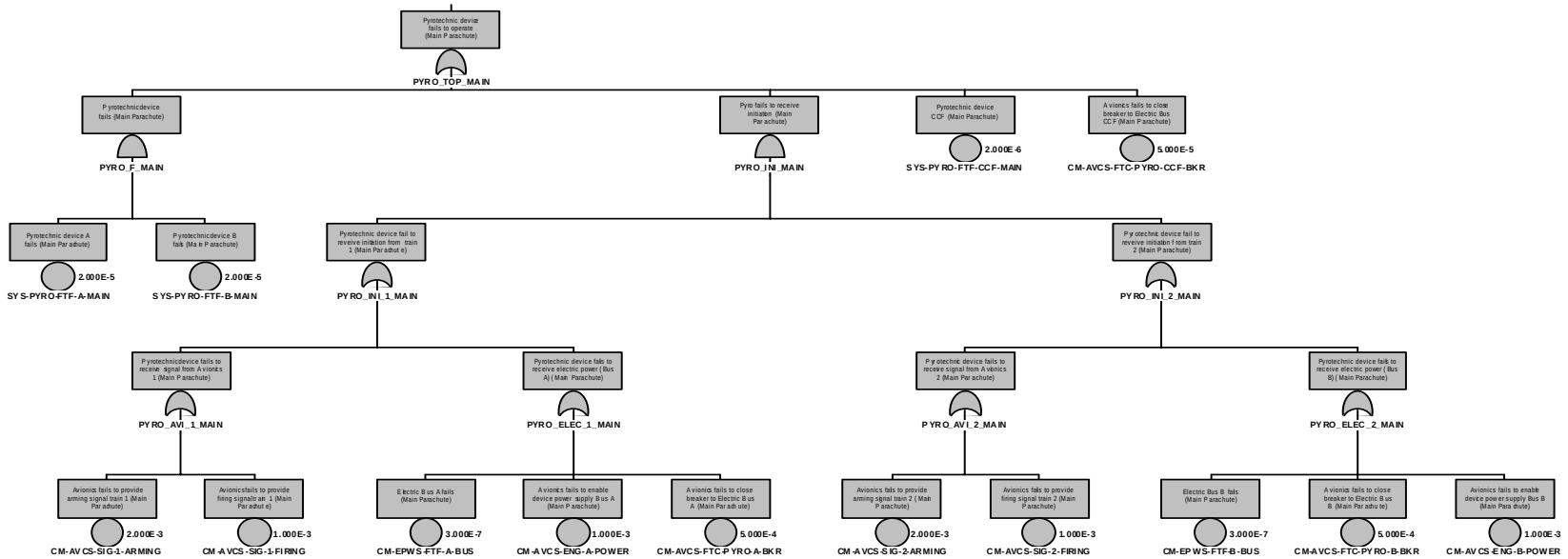
PYRO_TOP_DROG - Either drogue motar disreef or cutter failure



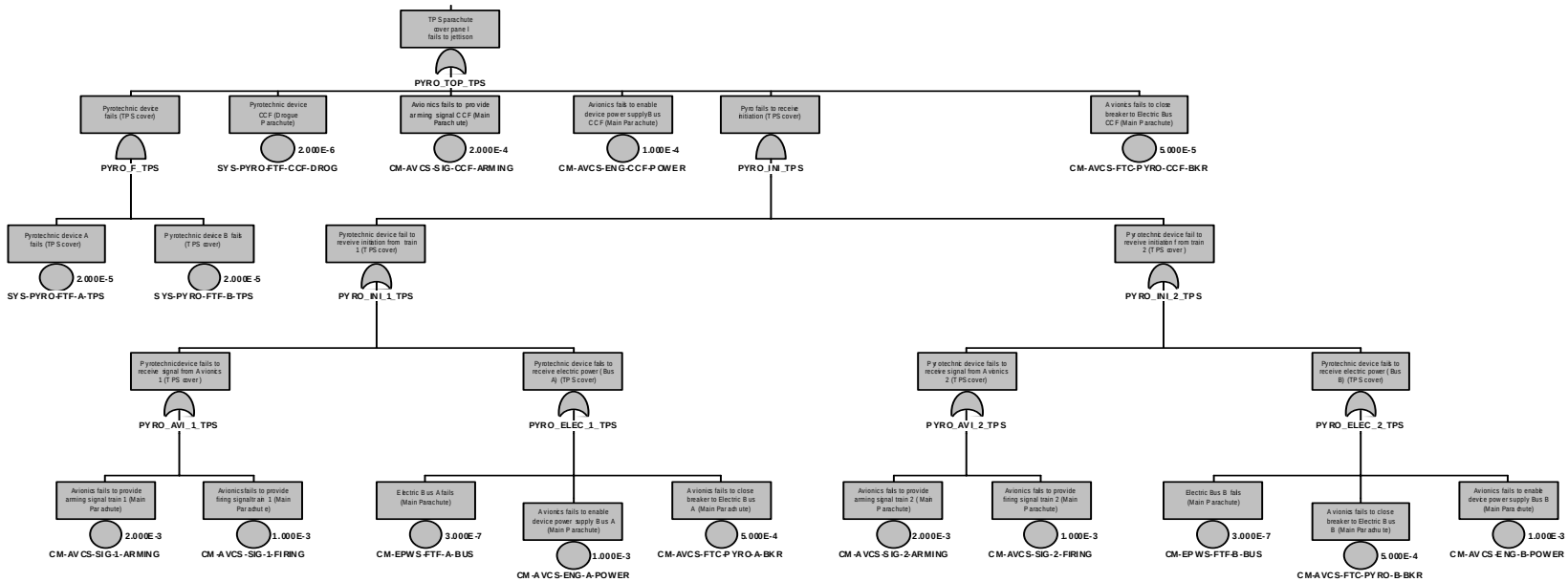
PYRO_TOP_LAS - Pyrotechnic device on LAS fails



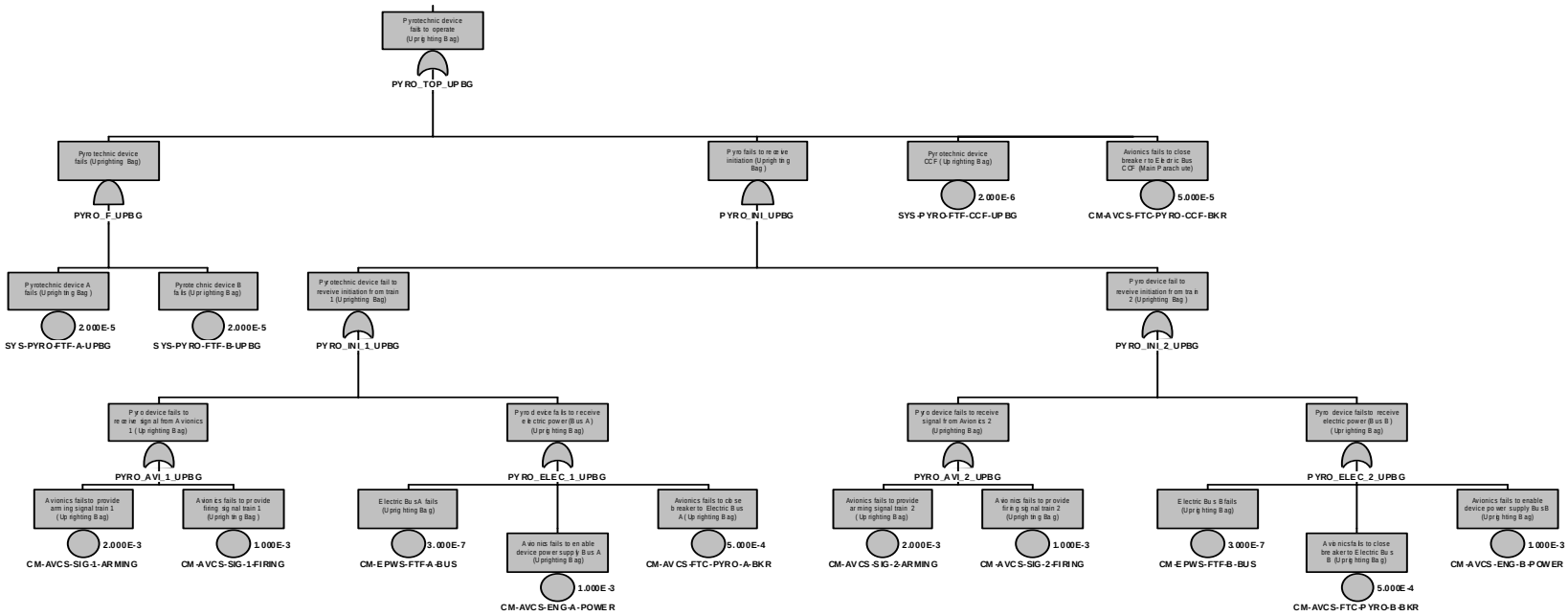
PYRO_TOP_MAIN - Pyrotechnic device fails to operate (Main Parachute)



PYRO_TOP_TPS - TPS parachute cover panel fails to jettison



PYRO_TOP_UPBG - Pyrotechnic device fails to operate (Uprighting Bag)



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Appendix B – Basic Event Data Table

This appendix contains the basic event data table. For each basic event, its name, probability, parameters (e.g., failure rate, mission time, or demand failure probability), uncertainty information, description, and source notes are provided.

ATCS-HCOL-FTF-1-P-1	**2.76E-04**	λ=2.30E-6/hr	Constrained non-informative
CEV ATCS CM Heat Collection Devices (Loop 1) (phase 1)		Time=120 hr	95th = 1.20E-3
Note: This event uses the Z-HCOL-FTF template event.			
ATCS-HCOL-FTF-1-P-2	**1.66E-04**	λ=2.30E-6/hr	Constrained non-informative
CEV ATCS CM Heat Collection Devices (Loop 1) (phase 2)		Time=72 hr	95th = 7.23E-4
Note: This event uses the Z-HCOL-FTF template event.			
ATCS-HCOL-FTF-1-P-3	**8.37E-05**	λ=2.30E-6/hr	Constrained non-informative
CEV ATCS CM Heat Collection Devices (Loop 1) (phase 3)		Time=36 hr	95th = 3.64E-4
Note: This event uses the Z-HCOL-FTF template event.			
ATCS-HCOL-FTF-1-P-4	**3.86E-04**	λ=2.30E-6/hr	Constrained non-informative
CEV ATCS CM Heat Collection Devices (Loop 1) (phase 4)		Time=168 hr	95th = 1.68E-3
Note: This event uses the Z-HCOL-FTF template event.			
ATCS-HCOL-FTF-1-P-5	**3.91E-04**	λ=2.30E-6/hr	Constrained non-informative
CEV ATCS CM Heat Collection Devices (Loop 1) (phase 5)		Time=170 hr	95th = 1.70E-3
Note: This event uses the Z-HCOL-FTF template event.			
ATCS-HCOL-FTF-1-P-6	**1.22E-05**	λ=2.30E-6/hr	Constrained non-informative
CEV ATCS CM Heat Collection Devices (Loop 1) (phase 6)		Time=5 hr	95th = 5.30E-5
Note: This event uses the Z-HCOL-FTF template event.			
ATCS-HCOL-FTF-1-P-7	**2.48E-04**	λ=2.30E-6/hr	Constrained non-informative
CEV ATCS CM Heat Collection Devices (Loop 1) (phase 7)		Time=108 hr	95th = 1.08E-3
Note: This event uses the Z-HCOL-FTF template event.			
ATCS-HCOL-FTF-1-P-8	**4.14E-06**	λ=2.30E-6/hr	Constrained non-informative
CEV ATCS CM Heat Collection Devices (Loop 1) (phase 8)		Time=2 hr	95th = 1.80E-5
Note: This event uses the Z-HCOL-FTF template event.			
ATCS-HCOL-FTF-2-P-1	**2.76E-04**	λ=2.30E-6/hr	Constrained non-informative
CEV ATCS CM Heat Collection Devices (Loop 2) (phase 1)		Time=120 hr	95th = 1.20E-3
Note: This event uses the Z-HCOL-FTF template event.			
ATCS-HCOL-FTF-2-P-2	**1.66E-04**	λ=2.30E-6/hr	Constrained non-informative
CEV ATCS CM Heat Collection Devices (Loop 2) (phase 2)		Time=72 hr	95th = 7.23E-4
Note: This event uses the Z-HCOL-FTF template event.			
ATCS-HCOL-FTF-2-P-3	**8.37E-05**	λ=2.30E-6/hr	Constrained non-informative
CEV ATCS CM Heat Collection Devices (Loop 2) (phase 3)		Time=36 hr	95th = 3.64E-4
Note: This event uses the Z-HCOL-FTF template event.			
ATCS-HCOL-FTF-2-P-4	**3.86E-04**	λ=2.30E-6/hr	Constrained non-informative
CEV ATCS CM Heat Collection Devices (Loop 2) (phase 4)		Time=168 hr	95th = 1.68E-3
Note: This event uses the Z-HCOL-FTF template event.			
ATCS-HCOL-FTF-2-P-5	**3.91E-04**	λ=2.30E-6/hr	Constrained non-informative
CEV ATCS CM Heat Collection Devices (Loop 2) (phase 5)		Time=170 hr	95th = 1.70E-3
Note: This event uses the Z-HCOL-FTF template event.			
ATCS-HCOL-FTF-2-P-6	**1.22E-05**	λ=2.30E-6/hr	Constrained non-informative

CEV ATCS CM Heat Collection Devices (Loop 2) (phase 6) *Note:* This event uses the Z-HCOL-FTF template event.		Time=5 hr	95th = 5.30E-5
ATCS-HCOL-FTF-2-P-7 CEV ATCS CM Heat Collection Devices (Loop 2) (phase 7) *Note:* This event uses the Z-HCOL-FTF template event.	**2.48E-04**	λ=2.30E-6/hr Time=108 hr	Constrained non-informative 95th = 1.08E-3
ATCS-HCOL-FTF-2-P-8 CEV ATCS CM Heat Collection Devices (Loop 2) (phase 8) *Note:* This event uses the Z-HCOL-FTF template event.	**4.14E-06**	λ=2.30E-6/hr Time=2 hr	Constrained non-informative 95th = 1.80E-5
ATCS-HCOL-FTF-CCF-P-1 CEV ATCS CM heat collection devices CCF (phase 1) *Note:*	**2.76E-05**		No distribution assigned to this event.
ATCS-HCOL-FTF-CCF-P-2 CEV ATCS CM heat collection devices CCF (phase 2) *Note:*	**1.66E-05**		No distribution assigned to this event.
ATCS-HCOL-FTF-CCF-P-3 CEV ATCS CM heat collection devices CCF (phase 3) *Note:*	**8.37E-06**		No distribution assigned to this event.
ATCS-HCOL-FTF-CCF-P-4 CEV ATCS CM heat collection devices CCF (phase 4) *Note:*	**3.86E-05**		No distribution assigned to this event.
ATCS-HCOL-FTF-CCF-P-5 CEV ATCS CM heat collection devices CCF (phase 5) *Note:*	**3.91E-05**		No distribution assigned to this event.
ATCS-HCOL-FTF-CCF-P-6 CEV ATCS CM heat collection devices CCF (phase 6) *Note:*	**1.22E-06**		No distribution assigned to this event.
ATCS-HCOL-FTF-CCF-P-7 CEV ATCS CM heat collection devices CCF (phase 7) *Note:*	**2.48E-05**		No distribution assigned to this event.
ATCS-HCOL-FTF-CCF-P-8 CEV ATCS CM heat collection devices CCF (phase 8) *Note:*	**4.14E-07**		No distribution assigned to this event.
ATCS-HSNK-FTF-EVAP-P-1 CEV ATCS CM Evaporative Heat Sink (phase 1) *Note:* This event uses the Z-HSNK-FTF-EVAP template event.	**3.60E-05**	λ=3.00E-7/hr Time=120 hr	Constrained non-informative 95th = 1.57E-4
ATCS-HSNK-FTF-EVAP-P-2 CEV ATCS CM Evaporative Heat Sink (phase 2) *Note:* This event uses the Z-HSNK-FTF-EVAP template event.	**2.17E-05**	λ=3.00E-7/hr Time=72 hr	Constrained non-informative 95th = 9.43E-5
ATCS-HSNK-FTF-EVAP-P-3 CEV ATCS CM Evaporative Heat Sink (phase 3) *Note:* This event uses the Z-HSNK-FTF-EVAP template event.	**1.09E-05**	λ=3.00E-7/hr Time=36 hr	Constrained non-informative 95th = 4.75E-5
ATCS-HSNK-FTF-EVAP-P-4 CEV ATCS CM Evaporative Heat Sink (phase 4) *Note:* This event uses the Z-HSNK-FTF-EVAP template event.	**5.04E-05**	λ=3.00E-7/hr Time=168 hr	Constrained non-informative 95th = 2.19E-4
ATCS-HSNK-FTF-EVAP-P-5 CEV ATCS CM Evaporative Heat Sink (phase 5) *Note:* This event uses the Z-HSNK-FTF-EVAP template event.	**5.11E-05**	λ=3.00E-7/hr Time=170 hr	Constrained non-informative 95th = 2.22E-4
ATCS-HSNK-FTF-EVAP-P-6 CEV ATCS CM Evaporative Heat Sink (phase 6) *Note:* This event uses the Z-HSNK-FTF-EVAP template event.	**1.59E-06**	λ=3.00E-7/hr Time=5 hr	Constrained non-informative 95th = 6.91E-6

ATCS-HSNK-FTF-EVAP-P-7	**3.24E-05**	λ=3.00E-7/hr	Constrained non-informative
CEV ATCS CM Evaporative Heat Sink (phase 7)		Time=108 hr	95th = 1.41E-4
Note: This event uses the Z-HSNK-FTF-EVAP template event.			
ATCS-HSNK-FTF-EVAP-P-8	**5.40E-07**	λ=3.00E-7/hr	Constrained non-informative
CEV ATCS CM Evaporative Heat Sink (phase 8)		Time=2 hr	95th = 2.35E-6
Note: This event uses the Z-HSNK-FTF-EVAP template event.			
ATCS-HTRN-FTF-1-P-1	**1.20E-07**	λ=1.00E-9/hr	Constrained non-informative
CEV ATCS CM Heat Transport Devices (Loop 1) (phase 1)		Time=120 hr	95th = 5.22E-7
Note: This event uses the Z-HTRN-FTF template event.			
ATCS-HTRN-FTF-1-P-2	**7.23E-08**	λ=1.00E-9/hr	Constrained non-informative
CEV ATCS CM Heat Transport Devices (Loop 1) (phase 2)		Time=72 hr	95th = 3.14E-7
Note: This event uses the Z-HTRN-FTF template event.			
ATCS-HTRN-FTF-1-P-3	**3.64E-08**	λ=1.00E-9/hr	Constrained non-informative
CEV ATCS CM Heat Transport Devices (Loop 1) (phase 3)		Time=36 hr	95th = 1.58E-7
Note: This event uses the Z-HTRN-FTF template event.			
ATCS-HTRN-FTF-1-P-4	**1.68E-07**	λ=1.00E-9/hr	Constrained non-informative
CEV ATCS CM Heat Transport Devices (Loop 1) (phase 4)		Time=168 hr	95th = 7.31E-7
Note: This event uses the Z-HTRN-FTF template event.			
ATCS-HTRN-FTF-1-P-5	**1.70E-07**	λ=1.00E-9/hr	Constrained non-informative
CEV ATCS CM Heat Transport Devices (Loop 1) (phase 5)		Time=170 hr	95th = 7.40E-7
Note: This event uses the Z-HTRN-FTF template event.			
ATCS-HTRN-FTF-1-P-6	**5.30E-09**	λ=1.00E-9/hr	Constrained non-informative
CEV ATCS CM Heat Transport Devices (Loop 1) (phase 6)		Time=5 hr	95th = 2.30E-8
Note: This event uses the Z-HTRN-FTF template event.			
ATCS-HTRN-FTF-1-P-7	**1.08E-07**	λ=1.00E-9/hr	Constrained non-informative
CEV ATCS CM Heat Transport Devices (Loop 1) (phase 7)		Time=108 hr	95th = 4.70E-7
Note: This event uses the Z-HTRN-FTF template event.			
ATCS-HTRN-FTF-1-P-8	**1.80E-09**	λ=1.00E-9/hr	Constrained non-informative
CEV ATCS CM Heat Transport Devices (Loop 1) (phase 8)		Time=2 hr	95th = 7.83E-9
Note: This event uses the Z-HTRN-FTF template event.			
ATCS-HTRN-FTF-2-P-1	**1.20E-07**	λ=1.00E-9/hr	Constrained non-informative
CEV ATCS CM Heat Transport Devices (Loop 2) (phase 1)		Time=120 hr	95th = 5.22E-7
Note: This event uses the Z-HTRN-FTF template event.			
ATCS-HTRN-FTF-2-P-2	**7.23E-08**	λ=1.00E-9/hr	Constrained non-informative
CEV ATCS CM Heat Transport Devices (Loop 2) (phase 2)		Time=72 hr	95th = 3.14E-7
Note: This event uses the Z-HTRN-FTF template event.			
ATCS-HTRN-FTF-2-P-3	**3.64E-08**	λ=1.00E-9/hr	Constrained non-informative
CEV ATCS CM Heat Transport Devices (Loop 2) (phase 3)		Time=36 hr	95th = 1.58E-7
Note: This event uses the Z-HTRN-FTF template event.			
ATCS-HTRN-FTF-2-P-4	**1.68E-07**	λ=1.00E-9/hr	Constrained non-informative
CEV ATCS CM Heat Transport Devices (Loop 2) (phase 4)		Time=168 hr	95th = 7.31E-7
Note: This event uses the Z-HTRN-FTF template event.			
ATCS-HTRN-FTF-2-P-5	**1.70E-07**	λ=1.00E-9/hr	Constrained non-informative
CEV ATCS CM Heat Transport Devices (Loop 2) (phase 5)		Time=170 hr	95th = 7.40E-7
Note: This event uses the Z-HTRN-FTF template event.			
ATCS-HTRN-FTF-2-P-6	**5.30E-09**	λ=1.00E-9/hr	Constrained non-informative
CEV ATCS CM Heat Transport Devices (Loop 2) (phase 6)		Time=5 hr	95th = 2.30E-8
Note: This event uses the Z-HTRN-FTF template event.			
ATCS-HTRN-FTF-2-P-7	**1.08E-07**	λ=1.00E-9/hr	Constrained non-informative
CEV ATCS CM Heat Transport Devices (Loop 2) (phase 7)		Time=108 hr	95th = 4.70E-7

Note: This event uses the Z-HTRN-FTF template event.			
ATCS-HTRN-FTF-2-P-8	**1.80E-09**	λ=1.00E-9/hr	Constrained non-informative
CEV ATCS CM Heat Transport Devices (Loop 2) (phase 8)		Time=2 hr	95th = 7.83E-9
Note: This event uses the Z-HTRN-FTF template event.			
ATCS-HTRN-FTF-CCF-P-1	**1.20E-08**		No distribution
CEV ATCS CM heat transport devices CCF (phase 1)			assigned to this event.
Note:			
ATCS-HTRN-FTF-CCF-P-2	**7.23E-09**		No distribution
CEV ATCS CM heat transport devices CCF (phase 2)			assigned to this event.
Note:			
ATCS-HTRN-FTF-CCF-P-3	**3.64E-09**		No distribution
CEV ATCS CM heat transport devices CCF (phase 3)			assigned to this event.
Note:			
ATCS-HTRN-FTF-CCF-P-4	**1.68E-08**		No distribution
CEV ATCS CM heat transport devices CCF (phase 4)			assigned to this event.
Note:			
ATCS-HTRN-FTF-CCF-P-5	**1.70E-08**		No distribution
CEV ATCS CM heat transport devices CCF (phase 5)			assigned to this event.
Note:			
ATCS-HTRN-FTF-CCF-P-6	**5.30E-10**		No distribution
CEV ATCS CM heat transport devices CCF (phase 6)			assigned to this event.
Note:			
ATCS-HTRN-FTF-CCF-P-7	**1.08E-08**		No distribution
CEV ATCS CM heat transport devices CCF (phase 7)			assigned to this event.
Note:			
ATCS-HTRN-FTF-CCF-P-8	**1.80E-10**		No distribution
CEV ATCS CM heat transport devices CCF (phase 8)			assigned to this event.
Note:			
ATCS-TANK-FTF-CM-P-1	**3.60E-05**	λ=3.00E-7/hr	Constrained non-informative
CEV ATCS CM Coolant Storage (phase 1)		Time=120 hr	95th = 1.57E-4
Note: This event uses the Z-TANK-FTF-COOLANT template event.			
ATCS-TANK-FTF-CM-P-2	**2.17E-05**	λ=3.00E-7/hr	Constrained non-informative
CEV ATCS CM Coolant Storage (phase 2)		Time=72 hr	95th = 9.43E-5
Note: This event uses the Z-TANK-FTF-COOLANT template event.			
ATCS-TANK-FTF-CM-P-3	**1.09E-05**	λ=3.00E-7/hr	Constrained non-informative
CEV ATCS CM Coolant Storage (phase 3)		Time=36 hr	95th = 4.75E-5
Note: This event uses the Z-TANK-FTF-COOLANT template event.			
ATCS-TANK-FTF-CM-P-4	**5.04E-05**	λ=3.00E-7/hr	Constrained non-informative
CEV ATCS CM Coolant Storage (phase 4)		Time=168 hr	95th = 2.19E-4
Note: This event uses the Z-TANK-FTF-COOLANT template event.			
ATCS-TANK-FTF-CM-P-5	**5.11E-05**	λ=3.00E-7/hr	Constrained non-informative
CEV ATCS CM Coolant Storage (phase 5)		Time=170 hr	95th = 2.22E-4
Note: This event uses the Z-TANK-FTF-COOLANT template event.			
ATCS-TANK-FTF-CM-P-6	**1.59E-06**	λ=3.00E-7/hr	Constrained non-informative
CEV ATCS CM Coolant Storage (phase 6)		Time=5 hr	95th = 6.91E-6
Note: This event uses the Z-TANK-FTF-COOLANT template event.			
ATCS-TANK-FTF-CM-P-7	**3.24E-05**	λ=3.00E-7/hr	Constrained non-informative
CEV ATCS CM Coolant Storage (phase 7)		Time=108 hr	95th = 1.41E-4
Note: This event uses the Z-TANK-FTF-COOLANT template event.			
ATCS-TANK-FTF-CM-P-8	**5.40E-07**	λ=3.00E-7/hr	Constrained non-informative

CEV ATCS CM Coolant Storage (phase 8) *Note:* This event uses the Z-TANK-FTF-COOLANT template event.		Time=2 hr	95th = 2.35E-6
ATCS_AVCS_BE_P_1 No signal from Avionics System fails ATCS (phase 1) *Note:*	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
ATCS_AVCS_BE_P_2 No signal from Avionics System fails ATCS (phase 2) *Note:*	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
ATCS_AVCS_BE_P_3 No signal from Avionics System fails ATCS (phase 3) *Note:*	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
ATCS_AVCS_BE_P_4 No signal from Avionics System fails ATCS (phase 4) *Note:*	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
ATCS_AVCS_BE_P_5 No signal from Avionics System fails ATCS (phase 5) *Note:*	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
ATCS_AVCS_BE_P_6 No signal from Avionics System fails ATCS (phase 6) *Note:*	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
ATCS_AVCS_BE_P_7 No signal from Avionics System fails ATCS (phase 7) *Note:*	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
ATCS_AVCS_BE_P_8 No signal from Avionics System fails ATCS (phase 8) *Note:*	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
ATCS_EPWS_BE_P_1 No power from electric power system fails ATCS (phase 1) *Note:*	**5.00E-06**	per demand	Constrained non-informative 95th = 2.17E-5
ATCS_EPWS_BE_P_2 No power from electric power system fails ATCS (phase 2) *Note:*	**5.00E-06**	per demand	Constrained non-informative 95th = 2.17E-5
ATCS_EPWS_BE_P_3 No power from electric power system fails ATCS (phase 3) *Note:*	**5.00E-06**	per demand	Constrained non-informative 95th = 2.17E-5
ATCS_EPWS_BE_P_4 No power from electric power system fails ATCS (phase 4) *Note:*	**5.00E-06**	per demand	Constrained non-informative 95th = 2.17E-5
ATCS_EPWS_BE_P_5 No power from electric power system fails ATCS (phase 5) *Note:*	**5.00E-06**	per demand	Constrained non-informative 95th = 2.17E-5
ATCS_EPWS_BE_P_6 No power from electric power system fails ATCS (phase 6) *Note:*	**5.00E-06**	per demand	Constrained non-informative 95th = 2.17E-5
ATCS_EPWS_BE_P_7 No power from electric power system fails ATCS (phase 7) *Note:*	**5.00E-06**	per demand	Constrained non-informative 95th = 2.17E-5
ATCS_EPWS_BE_P_8 No power from electric power system fails ATCS (phase 8) *Note:*	**5.00E-06**	per demand	Constrained non-informative 95th = 2.17E-5

CALV-EDS-FTO	**4.18E-03**	per demand	Constrained non-informative
CaLV Third Stage (EDS) Ascent Fails			95th = 1.82E-2
Note: Probability value from ESAS study			
CALV-EDS-IGN	**1.00E-04**	per demand	Constrained non-informative
CaLV EDS (3rd stage) Fails to Ignite			95th = 4.35E-4
Note: This event uses the Z-IGN template event. Probability value from: ROCKET MOTOR FAILS TO IGNITE (PYROTECHNIC) STS PRA Basic Events Database 1.00E-4 /d			
CALV-EDS-INS	**4.18E-03**	per demand	Constrained non-informative
CaLV Third Stage Shutdown/Orbital Insertion (EOI) Fails			95th = 1.82E-2
Note: This event uses the Z-INS template event. Probability value from: ESAS (upper stage burn)			
CALV-ESD-ORB-INLEO	**1.00E-02**	per demand	Constrained non-informative
EDS Fails to Loiter in LEO			95th = 4.34E-2
Note: This event uses the Z-ORB template event. Probability value from: ESAS (Coast)			
CALV-LSAM-ORB-INLEO	**1.00E-02**	per demand	Constrained non-informative
LSAM Fails to Loiter in LEO			95th = 4.34E-2
Note: This event uses the Z-ORB template event. Probability value from: ESAS (Coast)			
CALV-SRBS-FTO-5SSME	**4.18E-03**	per demand	Constrained non-informative
CaLV First Stage Ascent Fails			95th = 1.82E-2
Note: Probability value from ESAS study			
CALV-SRBS-LCH-5SSME	**4.18E-03**	per demand	Constrained non-informative
CaLV First Stage (5 SSMEs) Fail to Launch			95th = 1.82E-2
Note: This event uses the Z-LCH template event. Probability value from: ESAS (main stage burn)			
CALV-SRBS-SEP-5SSME	**1.00E-05**	per demand	Constrained non-informative
CaLV SRB Fail to Separate (5 SSMEs)			95th = 4.35E-5
Note: This event uses the Z-SEP template event. Probability value from ESAS study.			
CALV-STG2-FTO	**4.18E-03**	per demand	Constrained non-informative
CaLV Second Stage Ascent Fails			95th = 1.82E-2
Note: Probability value from ESAS study			
CALV-STG2-SEP	**1.00E-05**	per demand	Constrained non-informative
CaLV Second Stage Fails to Separate from EDS/LSAM			95th = 4.35E-5
Note: This event uses the Z-SEP template event. Probability value from ESAS study.			
CEV-AIRB-DPL	**0.00E+00**	FALSE house	House events
Airbag system fails to deploy			have no uncertainty.
Note:			
CEV-AIRB-DPL-WTRLANDING	**2.60E-03**	per demand	Constrained non-informative
The uprighting bag fails to deploy during water landing			95th = 1.13E-2
Note: CEV fails to touchdown intact (ESAS Study)			
CEV-AIRB-TUM	**0.00E+00**	FALSE house	House events
Wind shear leads to tumbling on ground landing			have no uncertainty.
Note:			
CEV-CEV--ORB	**1.00E-02**	per demand	Constrained non-informative
CEV fails to stay in LOI (coast)			95th = 4.34E-2
Note: This event uses the Z-ORB template event. Probability value from: ESAS (Coast)			
CEV-CEV--SEP-ISS	**1.00E-05**	per demand	Constrained non-informative
CEV Separates from ISS			95th = 4.35E-5
Note: This event uses the Z-SEP template event. Probability value from ESAS study.			
CEV-CMOD-CRW	**2.60E-03**	per demand	Constrained non-informative
Crew recovery fails after landing			95th = 1.13E-2
Note: Probability from ESAS			
CEV-CMOD-ENT	**2.60E-03**	per demand	Constrained non-informative

Crew module entry failure after landing			95th = 1.13E-2
Note: This event uses the Z-ENT template event. Probability value from ESAS study.			
CEV-CMOD-LND	**2.60E-03**	per demand	Constrained non-informative
Crew Module Landing			95th = 1.13E-2
Note: This event uses the Z-LND template event. Probability value from ESAS study.			
CEV-CMOD-PAR	**7.80E-03**	per demand	Beta(2.5, 317.5)
Crew Module Parachute Landing System Deployment Fails			95th = 1.72E-2
Note: This event uses the Z-DPL-PARA template event. From Bayesian update of Soyuz and Shuttle (SRD) parachute data. Soyuz had 1 failure (Soyuz 1) in 93 trials (through Soyuz TMA-6, Oct. 11, 2005) Shuttle had 1 failure (STS4 lost one SRB) in 2*113 trials. Total failure = 2, total trial = 319. Using Jeffreys noninformative prior yields: beta(2.5, 317.5)			
CEV-CMOD-SEP	**1.00E-05**	per demand	Constrained non-informative
CM Separates and Maneuvers away from SM			95th = 4.35E-5
Note: This event uses the Z-SEP template event. Probability value from ESAS study.			
CEV-CREW-SOLAREVENT-LOC	**1.50E-04**	per demand	Constrained non-informative
Lethal dose to the crew due to solar particle event			95th = 6.52E-4
Note: BIOLOGICAL RESPONSE TO SPE EXPOSURES J. W. Wilson, F. A. Cucinotta, M. Kim1, J. L. Shinn, T. D. Jones, and C. K. Chang P(significant solar particle event | 1 year) = 0.03 P(death | medical treatment and inside vessel) = 0.09 P(death | no medical treatment and inside vessel) = 0.88 Mission exposure fraction = 470 hr / 8760 hrs/year = 0.054 P(death | solar particle event) = 0.03 * 0.09 * 0.054 = 1.5E-4 per mission			
CEV-CREW-SOLAREVENT-LOM	**1.50E-03**	per demand	Constrained non-informative
Non-lethal but significant dose to the crew due to solar particle event			95th = 6.52E-3
Note: BIOLOGICAL RESPONSE TO SPE EXPOSURES J. W. Wilson, F. A. Cucinotta, M. Kim1, J. L. Shinn, T. D. Jones, and C. K. Chang P(significant solar particle event | 1 year) = 0.03 P(death | medical treatment and inside vessel) = 0.09 P(death | no medical treatment and inside vessel) = 0.88 Mission exposure fraction = 470 hr / 8760 hrs/year = 0.054			
CEV-CRW-REC-P-4	**5.00E-01**	per demand	Constrained non-informative
Recovery of Crew given failure of CEV in Lunar Loiter			95th = 9.99E-1
Note: Screening HRA value.			
CEV-EDS-CRW-REC	**0.00E+00**	FALSE house	House events
Recovery of Crew from EDS/LSAM/CEV to attempt landing			have no uncertainty.
Note:			
CEV-EDS-SEP	**1.00E-05**	per demand	Constrained non-informative
EDS Separates from LSAM and CEV			95th = 4.35E-5
Note: This event uses the Z-SEP template event. Probability value from ESAS study.			
CEV-GASG-FTF-WATER	**1.00E+00**	per demand	
The uprighting bag gas generators fail during water landing			
Note:			
CEV-LSAM-BRN-MIDCOURSE	**1.00E-02**	per demand	Constrained non-informative
LSAM and CEV Mid-course Correction Burn			95th = 4.34E-2
Note: This event uses the Z-BRN template event. Probability value from ESAS study.			
CEV-LSAM-CRW-DOCK-REC	**5.00E-01**	per demand	Constrained non-informative
Recovery of Crew from LSAM/CEV Docking Problem			95th = 9.99E-1
Note: Screening value.			
CEV-LSAM-CRW-REC	**5.00E-01**	per demand	Constrained non-informative
Recovery of Crew from LSAM/CEV			95th = 9.99E-1
Note: Screening value.			
CEV-LSAM-CRW-TRANSFER	**2.60E-03**	per demand	Constrained non-informative
Crew Transfers from the CEV to LSAM			95th = 1.13E-2
Note: This event uses the Z-CRW template event. Probability value from ESAS study.			
CEV-LSAM-CRW-TRANSFER2	**2.60E-03**	per demand	Constrained non-informative
Crew fails to Transfers from LSAM Ascent Stage to CEV			95th = 1.13E-2
Note: This event uses the Z-CRW template event. Probability value from ESAS study.			

CEV-LSAM-INS	**4.18E-03**	per demand	Constrained non-informative
LSAM and CEV LLO Insertion Fails			95th = 1.82E-2
Note: This event uses the Z-INS template event. Probability value from: ESAS (upper stage burn)			
CEV-LSAM-LLOBURN	**1.00E-02**	per demand	Constrained non-informative
LSAM and CEV Burn to Slow Near LLO			95th = 4.34E-2
Note: Probability from ESAS.			
CEV-LSAM-RAD-ASCENT	**1.10E-02**	per demand	Constrained non-informative
LSAM Ascent Stage Fails to Rendezvous and Dock with CEV			95th = 4.77E-2
Note: This event uses the Z-RAD template event. Probability value from ESAS study.			
CEV-LSAM-SEP	**1.00E-05**	per demand	Constrained non-informative
LSAM Separates from CEV			95th = 4.35E-5
Note: This event uses the Z-SEP template event. Probability value from ESAS study.			
CEV-LSAM-SEP-ASCENTSTAG	**1.00E-05**	per demand	Constrained non-informative
CEV Separates from LSAM Ascent Stage			95th = 4.35E-5
Note: This event uses the Z-SEP template event. Probability value from ESAS study.			
CEV-LUNAR-COM-P-1	**2.05E-03**	λ=1.70E-5/hr	Constrained non-informative
No input from external communications (phase 1)		Time=121 hr	95th = 8.92E-3
Note: This event uses the Z-COMM-FTF template event. S/L-band Low Gain Antenna + mount; S-band Antenna Amplifier; S-band Prox Ops Transceiver; S-band Prox Ops antenna + mount; S-band Antenna Amplifier; S-band Prox Ops Transceiver; S-Band Low Gain Antenna; S/Ka-band Antenna dual feed; Updated MADS Support Assy, S-Band Antenna (SASA) probability = 1.7E-05			
CEV-LUNAR-COM-P-2	**1.23E-03**	λ=1.70E-5/hr	Constrained non-informative
No input from external communications (phase 2)		Time=72 hr	95th = 5.34E-3
Note: This event uses the Z-COMM-FTF template event. S/L-band Low Gain Antenna + mount; S-band Antenna Amplifier; S-band Prox Ops Transceiver; S-band Prox Ops antenna + mount; S-band Antenna Amplifier; S-band Prox Ops Transceiver; S-Band Low Gain Antenna; S/Ka-band Antenna dual feed; Updated MADS Support Assy, S-Band Antenna (SASA) probability = 1.7E-05			
CEV-LUNAR-COM-P-3	**6.19E-04**	λ=1.70E-5/hr	Constrained non-informative
No input from external communications (phase 3)		Time=36 hr	95th = 2.69E-3
Note: This event uses the Z-COMM-FTF template event. S/L-band Low Gain Antenna + mount; S-band Antenna Amplifier; S-band Prox Ops Transceiver; S-band Prox Ops antenna + mount; S-band Antenna Amplifier; S-band Prox Ops Transceiver; S-Band Low Gain Antenna; S/Ka-band Antenna dual feed; Updated MADS Support Assy, S-Band Antenna (SASA) probability = 1.7E-05			
CEV-LUNAR-COM-P-4	**2.85E-03**	λ=1.70E-5/hr	Constrained non-informative
No input from external communications (phase 4)		Time=168 hr	95th = 1.24E-2
Note: This event uses the Z-COMM-FTF template event. S/L-band Low Gain Antenna + mount; S-band Antenna Amplifier; S-band Prox Ops Transceiver; S-band Prox Ops antenna + mount; S-band Antenna Amplifier; S-band Prox Ops Transceiver; S-Band Low Gain Antenna; S/Ka-band Antenna dual feed; Updated MADS Support Assy, S-Band Antenna (SASA) probability = 1.7E-05			
CEV-LUNAR-COM-P-5	**2.89E-03**	λ=1.70E-5/hr	Constrained non-informative
No input from external communications (phase 5)		Time=170 hr	95th = 1.26E-2
Note: This event uses the Z-COMM-FTF template event. S/L-band Low Gain Antenna + mount; S-band Antenna Amplifier; S-band Prox Ops Transceiver; S-band Prox Ops antenna + mount; S-band Antenna Amplifier; S-band Prox Ops Transceiver; S-Band Low Gain Antenna; S/Ka-band Antenna dual feed; Updated MADS Support Assy, S-Band Antenna (SASA) probability = 1.7E-05			
CEV-LUNAR-COM-P-6	**9.01E-05**	λ=1.70E-5/hr	Constrained non-informative
No input from external communications (phase 6)		Time=5 hr	95th = 3.92E-4
Note: This event uses the Z-COMM-FTF template event. S/L-band Low Gain Antenna + mount; S-band Antenna Amplifier; S-band Prox Ops Transceiver; S-band Prox Ops antenna + mount; S-band Antenna Amplifier; S-band Prox Ops Transceiver; S-Band Low Gain Antenna; S/Ka-band Antenna dual feed; Updated MADS Support Assy, S-Band Antenna (SASA) probability = 1.7E-05			
CEV-LUNAR-COM-P-7	**1.83E-03**	λ=1.70E-5/hr	Constrained non-informative
No input from external communications (phase 7)		Time=108 hr	95th = 7.97E-3
Note: This event uses the Z-COMM-FTF template event. S/L-band Low Gain Antenna + mount; S-band Antenna Amplifier; S-band			

Prox Ops Transceiver; S-band Prox Ops antenna + mount; S-band Antenna Amplifier; S-band Prox Ops Transceiver; S-Band Low Gain Antenna; S/Ka-band Antenna dual feed; Updated MADS Support Assy, S-Band Antenna (SASA) probability = 1.7E-05

CEV-LUNAR-COM-P-8	**3.06E-05**	λ=1.70E-5/hr	Constrained non-informative
No input from external communications (phase 8)		Time=2 hr	95th = 1.33E-4
Note: This event uses the Z-COMM-FTF template event. S/L-band Low Gain Antenna + mount; S-band Antenna Amplifier; S-band Prox Ops Transceiver; S-band Prox Ops antenna + mount; S-band Antenna Amplifier; S-band Prox Ops Transceiver; S-Band Low Gain Antenna; S/Ka-band Antenna dual feed; Updated MADS Support Assy, S-Band Antenna (SASA) probability = 1.7E-05			
CEV-PARA-DPL-1	**7.80E-03**	per demand	Beta(2.5, 317.5)
Parachute #1 Fails during Deployment			95th = 1.72E-2
Note: This event uses the Z-DPL-PARA template event. From Bayesian update of Soyuz and Shuttle (SRD) parachute data. Soyuz had 1 failure (Soyuz 1) in 93 trials (through Soyuz TMA-6, Oct. 11, 2005) Shuttle had 1 failure (STS4 lost one SRB) in 2*113 trials. Total failure = 2, total trial = 319. Using Jeffreys noninformative prior yields: beta(2.5, 317.5)			
CEV-PARA-DPL-2	**7.80E-03**	per demand	Beta(2.5, 317.5)
Parachute #2 Fails during Deployment			95th = 1.72E-2
Note: This event uses the Z-DPL-PARA template event. From Bayesian update of Soyuz and Shuttle (SRD) parachute data. Soyuz had 1 failure (Soyuz 1) in 93 trials (through Soyuz TMA-6, Oct. 11, 2005) Shuttle had 1 failure (STS4 lost one SRB) in 2*113 trials. Total failure = 2, total trial = 319. Using Jeffreys noninformative prior yields: beta(2.5, 317.5)			
CEV-PARA-DPL-3	**7.80E-03**	per demand	Beta(2.5, 317.5)
Parachute #3 Fails during Deployment			95th = 1.72E-2
Note: This event uses the Z-DPL-PARA template event. From Bayesian update of Soyuz and Shuttle (SRD) parachute data. Soyuz had 1 failure (Soyuz 1) in 93 trials (through Soyuz TMA-6, Oct. 11, 2005) Shuttle had 1 failure (STS4 lost one SRB) in 2*113 trials. Total failure = 2, total trial = 319. Using Jeffreys noninformative prior yields: beta(2.5, 317.5)			
CEV-PARA-DPL-CCF	**9.75E-04**		No distribution
CCF of 2 Parachutes (out of 3) during Deployment			assigned to this event.
Note:			
CEV-PARA-STR	**0.00E+00**	FALSE house	House events
Structural Problems lead to parachute failures			have no uncertainty.
Note: This event uses the Z-STR-PARA template event.			
CEV-STGE-BRN-MIDCOURSE	**1.70E-03**	per demand	Constrained non-informative
CEV (SM) mid-course correction burn fails			95th = 7.39E-3
Note: Probability value from ESAS study, assuming H2 burns: TEI burn 2 = 8.3E-4 TEI burn 3 = 8.7E-4 Total = 1.7E-3			
CEV-STGE-BRN-TOEARTH	**8.60E-04**	per demand	Constrained non-informative
CEV (SM TEI) initial burn for Earth fails			95th = 3.74E-3
Note: Probability value from ESAS study, assuming H2 burn: TEI burn 1 = 8.7E-4			
CEV-TLI-BRN	**1.00E-02**	per demand	Constrained non-informative
EDS LSAM and CEV TLI Burn for LLO fails			95th = 4.34E-2
Note: This event uses the Z-BRN template event. Probability value from ESAS study.			
CEV-TLI-BRN-MIDCOURSE	**1.00E-02**	per demand	Constrained non-informative
EDS LSAM and CEV TLI Mid-course correction burn fails			95th = 4.34E-2
Note: This event uses the Z-BRN template event. Probability value from ESAS study.			
CLV-CEV-INS	**4.18E-03**	per demand	Constrained non-informative
CEV Earth Orbit Insertion Fails			95th = 1.82E-2
Note: This event uses the Z-INS template event. Probability value from: ESAS (upper stage burn)			
CLV-CEV-RAD	**1.10E-02**	per demand	Constrained non-informative
CEV Rendezvous and Docking with EDS and LSAM fails			95th = 4.77E-2
Note: This event uses the Z-RAD template event. Probability value from ESAS study.			
CLV-LAS--SEP	**1.00E-05**	per demand	Constrained non-informative
LAS Jettison from CEV			95th = 4.35E-5
Note: This event uses the Z-SEP template event. Probability value from ESAS study.			
CLV-SRBS-LCH	**4.18E-03**	per demand	Constrained non-informative

CLV (5-Segment SRB) Fails to Launch with CEV			95th = 1.82E-2
Note: This event uses the Z-LCH template event. Probability value from: ESAS (main stage burn)			
CLV-STG1-FTO	**4.18E-03**	per demand	Constrained non-informative
CLV First Stage Ascent Fails			95th = 1.82E-2
Note:			
CLV-STG1-SEP	**1.00E-05**	per demand	Constrained non-informative
CLV First Stage & Second Stage Separation			95th = 4.35E-5
Note: This event uses the Z-SEP template event. Probability value from ESAS study.			
CLV-STG2-FTO	**4.18E-03**	per demand	Constrained non-informative
CLV Second Stage Ascent Fails			95th = 1.82E-2
Note:			
CLV-STG2-IGN	**1.00E-04**	per demand	Constrained non-informative
CLV Second Stage (J2-S) Ignition			95th = 4.35E-4
Note: This event uses the Z-IGN template event. Probability value from: ROCKET MOTOR FAILS TO IGNITE (PYROTECHNIC) STS PRA Basic Events Database 1.00E-4 /d			
CLV-STG2-SEP	**1.00E-05**	per demand	Constrained non-informative
CEV (CM+SM) separation from CLV second stage fails			95th = 4.35E-5
Note: This event uses the Z-SEP template event. Probability value from ESAS study.			
CM-AVCS-ENG-A-POWER	**1.00E-03**	per demand	Constrained non-informative
Avionics fails to enable device power supply Bus A (Main Parachute)			95th = 4.35E-3
Note: Based upon AVCS train calculation.			
CM-AVCS-ENG-B-POWER	**1.00E-03**	per demand	Constrained non-informative
Avionics fails to enable device power supply Bus B (Main Parachute)			95th = 4.35E-3
Note: Based upon AVCS train calculation.			
CM-AVCS-ENG-CCF-POWER	**1.00E-04**		No distribution
Avionics fails to enable device power supply Bus CCF (Main Parachute)			assigned to this event.
Note:			
CM-AVCS-FTC-PYRO-A-BKR	**5.00E-04**	per demand	Constrained non-informative
Avionics fails to close breaker to Electric Bus A (Main Parachute)			95th = 2.17E-3
Note: This event uses the Z-BKR-FTC template event. EGG-SSRE-8875 Generic Component Failure Data Base...Eide et al 1990			
CM-AVCS-FTC-PYRO-B-BKR	**5.00E-04**	per demand	Constrained non-informative
Avionics fails to close breaker to Electric Bus B (Main Parachute)			95th = 2.17E-3
Note: This event uses the Z-BKR-FTC template event. EGG-SSRE-8875 Generic Component Failure Data Base...Eide et al 1990			
CM-AVCS-FTC-PYRO-CCF-BKR	**5.00E-05**		No distribution
Avionics fails to close breaker to Electric Bus CCF (Main Parachute)			assigned to this event.
Note:			
CM-AVCS-SIG-1-ARMING	**2.00E-03**	per demand	Constrained non-informative
Avionics fails to provide arming signal train 1 (Main Parachute)			95th = 8.69E-3
Note: Estimated from AVCS one train fault tree, the largest probability in any phase.			
CM-AVCS-SIG-1-FIRING	**1.00E-03**	per demand	Constrained non-informative
Avionics fails to provide firing signal train 1 (Main Parachute)			95th = 4.35E-3
Note: This event uses the Z-BIU-FOD template event. Screening value (should be less than AVCS train failure probability ~ 2e-3)			
CM-AVCS-SIG-2-ARMING	**2.00E-03**	per demand	Constrained non-informative
Avionics fails to provide arming signal train 2 (Main Parachute)			95th = 8.69E-3
Note: Estimated from AVCS one train fault tree, the largest probability in any phase.			

CM-AVCS-SIG-2-FIRING	**1.00E-03**	per demand	Constrained non-informative
Avionics fails to provide firing signal train 2 (Main Parachute)			95th = 4.35E-3
Note: This event uses the Z-BIU-FOD template event. Screening value (should be less than AVCS train failure probability ~ 2e-3)			
CM-AVCS-SIG-CCF-ARMING	**2.00E-04**		No distribution
Avionics fails to provide arming signal CCF (Main Parachute)			assigned to this event.
Note:			
CM-BIU-FTF-1-P1	**1.00E-03**	per demand	Constrained non-informative
Bus interface unit 1 fails to transmit signal (phase 1)			95th = 4.35E-3
Note: This event uses the Z-BIU-FOD template event. Screening value (should be less than AVCS train failure probability ~ 2e-3)			
CM-BIU-FTF-1-P2	**1.00E-03**	per demand	Constrained non-informative
Bus interface unit 1 fails to transmit signal (phase 2)			95th = 4.35E-3
Note: This event uses the Z-BIU-FOD template event. Screening value (should be less than AVCS train failure probability ~ 2e-3)			
CM-BIU-FTF-1-P3	**1.00E-03**	per demand	Constrained non-informative
Bus interface unit 1 fails to transmit signal (phase 3)			95th = 4.35E-3
Note: This event uses the Z-BIU-FOD template event. Screening value (should be less than AVCS train failure probability ~ 2e-3)			
CM-BIU-FTF-1-P4	**1.00E-03**	per demand	Constrained non-informative
Bus interface unit 1 fails to transmit signal (phase 4)			95th = 4.35E-3
Note: This event uses the Z-BIU-FOD template event. Screening value (should be less than AVCS train failure probability ~ 2e-3)			
CM-BIU-FTF-1-P5	**1.00E-03**	per demand	Constrained non-informative
Bus interface unit 1 fails to transmit signal (phase 5)			95th = 4.35E-3
Note: This event uses the Z-BIU-FOD template event. Screening value (should be less than AVCS train failure probability ~ 2e-3)			
CM-BIU-FTF-1-P6	**1.00E-03**	per demand	Constrained non-informative
Bus interface unit 1 fails to transmit signal (phase 6)			95th = 4.35E-3
Note: This event uses the Z-BIU-FOD template event. Screening value (should be less than AVCS train failure probability ~ 2e-3)			
CM-BIU-FTF-1-P7	**1.00E-03**	per demand	Constrained non-informative
Bus interface unit 1 fails to transmit signal (phase 7)			95th = 4.35E-3
Note: This event uses the Z-BIU-FOD template event. Screening value (should be less than AVCS train failure probability ~ 2e-3)			
CM-BIU-FTF-1-P8	**1.00E-03**	per demand	Constrained non-informative
Bus interface unit 1 fails to transmit signal (phase 8)			95th = 4.35E-3
Note: This event uses the Z-BIU-FOD template event. Screening value (should be less than AVCS train failure probability ~ 2e-3)			
CM-BIU-FTF-2-P1	**1.00E-03**	per demand	Constrained non-informative
Bus interface unit 2 fails to transmit signal (phase 1)			95th = 4.35E-3
Note: This event uses the Z-BIU-FOD template event. Screening value (should be less than AVCS train failure probability ~ 2e-3)			
CM-BIU-FTF-2-P2	**1.00E-03**	per demand	Constrained non-informative
Bus interface unit 2 fails to transmit signal (phase 2)			95th = 4.35E-3
Note: This event uses the Z-BIU-FOD template event. Screening value (should be less than AVCS train failure probability ~ 2e-3)			
CM-BIU-FTF-2-P3	**1.00E-03**	per demand	Constrained non-informative
Bus interface unit 2 fails to transmit signal (phase 3)			95th = 4.35E-3
Note: This event uses the Z-BIU-FOD template event. Screening value (should be less than AVCS train failure probability ~ 2e-3)			
CM-BIU-FTF-2-P4	**1.00E-03**	per demand	Constrained non-informative
Bus interface unit 2 fails to transmit signal (phase 4)			95th = 4.35E-3
Note: This event uses the Z-BIU-FOD template event. Screening value (should be less than AVCS train failure probability ~ 2e-3)			
CM-BIU-FTF-2-P5	**1.00E-03**	per demand	Constrained non-informative
Bus interface unit 2 fails to transmit signal (phase 5)			95th = 4.35E-3
Note: This event uses the Z-BIU-FOD template event. Screening value (should be less than AVCS train failure probability ~ 2e-3)			
CM-BIU-FTF-2-P6	**1.00E-03**	per demand	Constrained non-informative
Bus interface unit 2 fails to transmit signal (phase 6)			95th = 4.35E-3
Note: This event uses the Z-BIU-FOD template event. Screening value (should be less than AVCS train failure probability ~ 2e-3)			
CM-BIU-FTF-2-P7	**1.00E-03**	per demand	Constrained non-informative
Bus interface unit 2 fails to transmit signal (phase 7)			95th = 4.35E-3

Note: This event uses the Z-BIU-FOD template event. Screening value (should be less than AVCS train failure probability ~ 2e-3)

CM-BIU-FTF-2-P8	**1.00E-03**	per demand	Constrained non-informative
Bus interface unit 2 fails to transmit signal (phase 8)			95th = 4.35E-3

Note: This event uses the Z-BIU-FOD template event. Screening value (should be less than AVCS train failure probability ~ 2e-3)

CM-BIU-FTF-3-P1	**1.00E-03**	per demand	Constrained non-informative
Bus interface unit 3 fails to transmit signal (phase 1)			95th = 4.35E-3

Note: This event uses the Z-BIU-FOD template event. Screening value (should be less than AVCS train failure probability ~ 2e-3)

CM-BIU-FTF-3-P2	**1.00E-03**	per demand	Constrained non-informative
Bus interface unit 3 fails to transmit signal (phase 2)			95th = 4.35E-3

Note: This event uses the Z-BIU-FOD template event. Screening value (should be less than AVCS train failure probability ~ 2e-3)

CM-BIU-FTF-3-P3	**1.00E-03**	per demand	Constrained non-informative
Bus interface unit 3 fails to transmit signal (phase 3)			95th = 4.35E-3

Note: This event uses the Z-BIU-FOD template event. Screening value (should be less than AVCS train failure probability ~ 2e-3)

CM-BIU-FTF-3-P4	**1.00E-03**	per demand	Constrained non-informative
Bus interface unit 3 fails to transmit signal (phase 4)			95th = 4.35E-3

Note: This event uses the Z-BIU-FOD template event. Screening value (should be less than AVCS train failure probability ~ 2e-3)

CM-BIU-FTF-3-P5	**1.00E-03**	per demand	Constrained non-informative
Bus interface unit 3 fails to transmit signal (phase 5)			95th = 4.35E-3

Note: This event uses the Z-BIU-FOD template event. Screening value (should be less than AVCS train failure probability ~ 2e-3)

CM-BIU-FTF-3-P6	**1.00E-03**	per demand	Constrained non-informative
Bus interface unit 3 fails to transmit signal (phase 6)			95th = 4.35E-3

Note: This event uses the Z-BIU-FOD template event. Screening value (should be less than AVCS train failure probability ~ 2e-3)

CM-BIU-FTF-3-P7	**1.00E-03**	per demand	Constrained non-informative
Bus interface unit 3 fails to transmit signal (phase 7)			95th = 4.35E-3

Note: This event uses the Z-BIU-FOD template event. Screening value (should be less than AVCS train failure probability ~ 2e-3)

CM-BIU-FTF-3-P8	**1.00E-03**	per demand	Constrained non-informative
Bus interface unit 3 fails to transmit signal (phase 8)			95th = 4.35E-3

Note: This event uses the Z-BIU-FOD template event. Screening value (should be less than AVCS train failure probability ~ 2e-3)

CM-COMP-FTF-1-P1	**2.40E-05**	per demand	Constrained non-informative
Critical control computer 1 fails (phase 1)			95th = 1.04E-4

Note: This event uses the Z-COMP-FTF template event.

CM-COMP-FTF-1-P2	**2.40E-05**	per demand	Constrained non-informative
Critical control computer 1 fails (phase 2)			95th = 1.04E-4

Note: This event uses the Z-COMP-FTF template event.

CM-COMP-FTF-1-P3	**2.40E-05**	per demand	Constrained non-informative
Critical control computer 1 fails (phase 3)			95th = 1.04E-4

Note: This event uses the Z-COMP-FTF template event.

CM-COMP-FTF-1-P4	**2.40E-05**	per demand	Constrained non-informative
Critical control computer 1 fails (phase 4)			95th = 1.04E-4

Note: This event uses the Z-COMP-FTF template event.

CM-COMP-FTF-1-P5	**2.40E-05**	per demand	Constrained non-informative
Critical control computer 1 fails (phase 5)			95th = 1.04E-4

Note: This event uses the Z-COMP-FTF template event.

CM-COMP-FTF-1-P6	**2.40E-05**	per demand	Constrained non-informative
Critical control computer 1 fails (phase 6)			95th = 1.04E-4

Note: This event uses the Z-COMP-FTF template event.

CM-COMP-FTF-1-P7	**2.40E-05**	per demand	Constrained non-informative
Critical control computer 1 fails (phase 7)			95th = 1.04E-4

Note: This event uses the Z-COMP-FTF template event.

CM-COMP-FTF-1-P8	**2.40E-05**	per demand	Constrained non-informative

Critical control computer 1 fails (phase 8) *Note:* This event uses the Z-COMP-FTF template event.			95th = 1.04E-4
CM-COMP-FTF-2-P1 Critical control computer 2 fails (phase 1) *Note:* This event uses the Z-COMP-FTF template event.	**2.40E-05**	per demand	Constrained non-informative 95th = 1.04E-4
CM-COMP-FTF-2-P2 Critical control computer 2 fails (phase 2) *Note:* This event uses the Z-COMP-FTF template event.	**2.40E-05**	per demand	Constrained non-informative 95th = 1.04E-4
CM-COMP-FTF-2-P3 Critical control computer 2 fails (phase 3) *Note:* This event uses the Z-COMP-FTF template event.	**2.40E-05**	per demand	Constrained non-informative 95th = 1.04E-4
CM-COMP-FTF-2-P4 Critical control computer 2 fails (phase 4) *Note:* This event uses the Z-COMP-FTF template event.	**2.40E-05**	per demand	Constrained non-informative 95th = 1.04E-4
CM-COMP-FTF-2-P5 Critical control computer 2 fails (phase 5) *Note:* This event uses the Z-COMP-FTF template event.	**2.40E-05**	per demand	Constrained non-informative 95th = 1.04E-4
CM-COMP-FTF-2-P6 Critical control computer 2 fails (phase 6) *Note:* This event uses the Z-COMP-FTF template event.	**2.40E-05**	per demand	Constrained non-informative 95th = 1.04E-4
CM-COMP-FTF-2-P7 Critical control computer 2 fails (phase 7) *Note:* This event uses the Z-COMP-FTF template event.	**2.40E-05**	per demand	Constrained non-informative 95th = 1.04E-4
CM-COMP-FTF-2-P8 Critical control computer 2 fails (phase 8) *Note:* This event uses the Z-COMP-FTF template event.	**2.40E-05**	per demand	Constrained non-informative 95th = 1.04E-4
CM-COMP-FTF-3-P1 Critical control computer 3 fails (phase 1) *Note:* This event uses the Z-COMP-FTF template event.	**2.40E-05**	per demand	Constrained non-informative 95th = 1.04E-4
CM-COMP-FTF-3-P2 Critical control computer 3 fails (phase 2) *Note:* This event uses the Z-COMP-FTF template event.	**2.40E-05**	per demand	Constrained non-informative 95th = 1.04E-4
CM-COMP-FTF-3-P3 Critical control computer 3 fails (phase 3) *Note:* This event uses the Z-COMP-FTF template event.	**2.40E-05**	per demand	Constrained non-informative 95th = 1.04E-4
CM-COMP-FTF-3-P4 Critical control computer 3 fails (phase 4) *Note:* This event uses the Z-COMP-FTF template event.	**2.40E-05**	per demand	Constrained non-informative 95th = 1.04E-4
CM-COMP-FTF-3-P5 Critical control computer 3 fails (phase 5) *Note:* This event uses the Z-COMP-FTF template event.	**2.40E-05**	per demand	Constrained non-informative 95th = 1.04E-4
CM-COMP-FTF-3-P6 Critical control computer 3 fails (phase 6) *Note:* This event uses the Z-COMP-FTF template event.	**2.40E-05**	per demand	Constrained non-informative 95th = 1.04E-4
CM-COMP-FTF-3-P7 Critical control computer 3 fails (phase 7) *Note:* This event uses the Z-COMP-FTF template event.	**2.40E-05**	per demand	Constrained non-informative 95th = 1.04E-4
CM-COMP-FTF-3-P8 Critical control computer 3 fails (phase 8) *Note:* This event uses the Z-COMP-FTF template event.	**2.40E-05**	per demand	Constrained non-informative 95th = 1.04E-4

CM-COMP-FTF-CCF-P1 CCF of all critical control computer (phase 8) *Note:*	**1.20E-06**		No distribution assigned to this event.
CM-COMP-FTF-CCF-P2 CCF of all critical control computer (phase 2) *Note:*	**1.20E-06**		No distribution assigned to this event.
CM-COMP-FTF-CCF-P3 CCF of all critical control computer (phase 3) *Note:*	**1.20E-06**		No distribution assigned to this event.
CM-COMP-FTF-CCF-P4 CCF of all critical control computer (phase 4) *Note:*	**1.20E-06**		No distribution assigned to this event.
CM-COMP-FTF-CCF-P5 CCF of all critical control computer (phase 5) *Note:*	**1.20E-06**		No distribution assigned to this event.
CM-COMP-FTF-CCF-P6 CCF of all critical control computer (phase 6) *Note:*	**1.20E-06**		No distribution assigned to this event.
CM-COMP-FTF-CCF-P7 CCF of all critical control computer (phase 7) *Note:*	**1.20E-06**		No distribution assigned to this event.
CM-COMP-FTF-CCF-P8 CCF of all critical control computer (phase 8) *Note:*	**1.20E-06**		No distribution assigned to this event.
CM-CREW-CRW CEV crew cause a critical error *Note:*	**5.50E-03**		No distribution assigned to this event.
CM-ECLS-FTF-ATMQUAL-P-1 CEV ECLSS Atmosphere Temperature/Humdity Control (Phase 1) *Note:* This basic event is not currently used in the PRA model.	**1.00E+00**	per demand	No distribution assigned to this event.
CM-ECLS-FTF-ATMSUP-P-1 CEV ECLSS CM Atmosphere Supply and Control (Phase 1) *Note:* This basic event is not currently used in the PRA model.	**1.00E+00**	per demand	No distribution assigned to this event.
CM-ECLS-FTF-CONTAM-P-1 CEV ECLSS Atmosphere Contaminent Control System (Phase 1) *Note:* This basic event is not currently used in the PRA model.	**1.00E+00**	per demand	No distribution assigned to this event.
CM-ECLS-FTF-EVAUMB-P-1 CEV ECLSS CM EVA Umbilical Systems (Phase 1) *Note:* This basic event is not currently used in the PRA model.	**1.00E+00**	per demand	No distribution assigned to this event.
CM-ECLS-FTF-FIRESYS-P-1 CEV fire detection and suppression (Phase 1) *Note:* This basic event is not currently used in the PRA model.	**1.00E+00**	per demand	No distribution assigned to this event.
CM-ECLS-FTF-N2SYS-P-1 CEV ECLSS CM N2 Storage/Distribution (Phase 1) *Note:* This basic event is not currently used in the PRA model.	**1.00E+00**	per demand	No distribution assigned to this event.
CM-ECLS-FTF-O2SYS-P-1 CEV ECLSS CM O2 Storage/Distribution (Phase 1) *Note:* This basic event is not currently used in the PRA model.	**1.00E+00**	per demand	No distribution assigned to this event.

CM-ECLS-FTF-SYS-P-1 CEV ECLSS System (Phase 1) *Note:* From T. Hamlin calculation.	**6.20E-05**	per demand	Constrained non-informative 95th = 2.70E-4
CM-ECLS-FTF-SYS-P-2 CEV ECLSS System (Phase 2) *Note:* From T. Hamlin calculation.	**3.70E-05**	per demand	Constrained non-informative 95th = 1.61E-4
CM-ECLS-FTF-SYS-P-3 CEV ECLSS System (Phase 3) *Note:* From T. Hamlin calculation.	**1.90E-05**	per demand	Constrained non-informative 95th = 8.26E-5
CM-ECLS-FTF-SYS-P-4 CEV ECLSS System (Phase 4) *Note:* From T. Hamlin calculation (~ same as phase 5).	**8.70E-05**	per demand	Constrained non-informative 95th = 3.78E-4
CM-ECLS-FTF-SYS-P-5 CEV ECLSS System (Phase 5) *Note:* From T. Hamlin calculation.	**8.70E-05**	per demand	Constrained non-informative 95th = 3.78E-4
CM-ECLS-FTF-SYS-P-6 CEV ECLSS System (Phase 6) *Note:* From T. Hamlin calculation.	**2.70E-06**	per demand	Constrained non-informative 95th = 1.17E-5
CM-ECLS-FTF-SYS-P-7 CEV ECLSS System (Phase 7) *Note:* From T. Hamlin calculation.	**5.60E-05**	per demand	Constrained non-informative 95th = 2.44E-4
CM-ECLS-FTF-SYS-P-8 CEV ECLSS System (Phase 8) *Note:* From T. Hamlin calculation.	**1.20E-06**	per demand	Constrained non-informative 95th = 5.22E-6
CM-ECLS-FTF-WATER-P-1 CEV ECLSS Water Management/Storage System (Phase 1) *Note:* This basic event is not currently used in the PRA model.	**1.00E+00**	per demand	No distribution assigned to this event.
CM-EPWS-BATT-CCF-P-1 CEV CM EPS Battery CCF of 1 2 and 3 (phase 1) *Note:*	**4.67E-06**		No distribution assigned to this event.
CM-EPWS-BATT-CCF-P-2 CEV CM EPS Battery CCF of 1 2 and 3 (phase 2) *Note:*	**2.82E-06**		No distribution assigned to this event.
CM-EPWS-BATT-CCF-P-3 CEV CM EPS Battery CCF of 1 2 and 3 (phase 3) *Note:*	**1.42E-06**		No distribution assigned to this event.
CM-EPWS-BATT-CCF-P-4 CEV CM EPS Battery CCF of 1 2 and 3 (phase 4) *Note:*	**6.54E-06**		No distribution assigned to this event.
CM-EPWS-BATT-CCF-P-5 CEV CM EPS Battery CCF of 1 2 and 3 (phase 5) *Note:*	**6.63E-06**		No distribution assigned to this event.
CM-EPWS-BATT-CCF-P-6 CEV CM EPS Battery CCF of 1 2 and 3 (phase 6) *Note:*	**2.06E-07**		No distribution assigned to this event.
CM-EPWS-BATT-CCF-P-7 CEV CM EPS Battery CCF of 1 2 and 3 (phase 7) *Note:*	**4.21E-06**		No distribution assigned to this event.
CM-EPWS-BATT-CCF-P-8 CEV CM EPS Battery CCF of 1 2 and 3 (phase 8)	**7.01E-08**		No distribution assigned to this event.

Note:			
CM-EPWS-BATT-DCCF-P-1	**1.17E-05**		No distribution
CEV CM EPS Battery degraded CCF 2 of 3 (phase 1)			assigned to this event.
Note:			
CM-EPWS-BATT-DCCF-P-2	**7.04E-06**		No distribution
CEV CM EPS Battery degraded CCF 2 of 3 (phase 2)			assigned to this event.
Note:			
CM-EPWS-BATT-DCCF-P-3	**3.54E-06**		No distribution
CEV CM EPS Battery degraded CCF 2 of 3 (phase 3)			assigned to this event.
Note:			
CM-EPWS-BATT-DCCF-P-4	**1.64E-05**		No distribution
CEV CM EPS Battery degraded CCF 2 of 3 (phase 4)			assigned to this event.
Note:			
CM-EPWS-BATT-DCCF-P-5	**1.66E-05**		No distribution
CEV CM EPS Battery degraded CCF 2 of 3 (phase 5)			assigned to this event.
Note:			
CM-EPWS-BATT-DCCF-P-6	**5.16E-07**		No distribution
CEV CM EPS Battery degraded CCF 2 of 3 (phase 6)			assigned to this event.
Note:			
CM-EPWS-BATT-DCCF-P-7	**1.05E-05**		No distribution
CEV CM EPS Battery degraded CCF 2 of 3 (phase 7)			assigned to this event.
Note:			
CM-EPWS-BATT-DCCF-P-8	**1.75E-07**		No distribution
CEV CM EPS Battery degraded CCF 2 of 3 (phase 8)			assigned to this event.
Note:			
CM-EPWS-FTF-A-BUS	**3.00E-07**	λ=3.00E-7/hr	Constrained non-informative
Electric Bus A fails (Main Parachute)		Time=1 hr	95th = 1.30E-6
Note: This event uses the Z-EPWS-FTF-DIST template event. Shuttle PRA I2 EPS (bus short)			
CM-EPWS-FTF-B-BUS	**3.00E-07**	λ=3.00E-7/hr	Constrained non-informative
Electric Bus B fails (Main Parachute)		Time=1 hr	95th = 1.30E-6
Note: This event uses the Z-EPWS-FTF-DIST template event. Shuttle PRA I2 EPS (bus short)			
CM-EPWS-FTF-BATT1-P-1	**9.35E-05**	λ=7.79E-7/hr	Constrained non-informative
CEV CM EPS Battery 1 (Phase 1)		Time=120 hr	95th = 4.06E-4
Note: This event uses the Z-EPWS-FTF-BATT template event. ISS PRA			
CM-EPWS-FTF-BATT1-P-2	**5.63E-05**	λ=7.79E-7/hr	Constrained non-informative
CEV CM EPS Battery 1 (phase 2)		Time=72 hr	95th = 2.45E-4
Note: This event uses the Z-EPWS-FTF-BATT template event. ISS PRA			
CM-EPWS-FTF-BATT1-P-3	**2.84E-05**	λ=7.79E-7/hr	Constrained non-informative
CEV CM EPS Battery 1 (phase 3)		Time=36 hr	95th = 1.23E-4
Note: This event uses the Z-EPWS-FTF-BATT template event. ISS PRA			
CM-EPWS-FTF-BATT1-P-4	**1.31E-04**	λ=7.79E-7/hr	Constrained non-informative
CEV CM EPS Battery 1 (phase 4)		Time=168 hr	95th = 5.69E-4
Note: This event uses the Z-EPWS-FTF-BATT template event. ISS PRA			
CM-EPWS-FTF-BATT1-P-5	**1.33E-04**	λ=7.79E-7/hr	Constrained non-informative
CEV CM EPS Battery 1 (phase 5)		Time=170 hr	95th = 5.77E-4
Note: This event uses the Z-EPWS-FTF-BATT template event. ISS PRA			
CM-EPWS-FTF-BATT1-P-6	**4.13E-06**	λ=7.79E-7/hr	Constrained non-informative
CEV CM EPS Battery 1 (phase 6)		Time=5 hr	95th = 1.80E-5
Note: This event uses the Z-EPWS-FTF-BATT template event. ISS PRA			
CM-EPWS-FTF-BATT1-P-7	**8.41E-05**	λ=7.79E-7/hr	Constrained non-informative

CEV CM EPS Battery 1 (phase 7)		Time=108 hr	95th = 3.66E-4
Note: This event uses the Z-EPWS-FTF-BATT template event. ISS PRA			
CM-EPWS-FTF-BATT1-P-8	**1.40E-06**	λ=7.79E-7/hr	Constrained non-informative
CEV CM EPS Battery 1 (phase 8)		Time=2 hr	95th = 6.10E-6
Note: This event uses the Z-EPWS-FTF-BATT template event. ISS PRA			
CM-EPWS-FTF-BATT2-P-1	**9.35E-05**	λ=7.79E-7/hr	Constrained non-informative
CEV CM EPS Battery 2 (Phase 1)		Time=120 hr	95th = 4.06E-4
Note: This event uses the Z-EPWS-FTF-BATT template event. ISS PRA			
CM-EPWS-FTF-BATT2-P-2	**5.63E-05**	λ=7.79E-7/hr	Constrained non-informative
CEV CM EPS Battery 2 (phase 2)		Time=72 hr	95th = 2.45E-4
Note: This event uses the Z-EPWS-FTF-BATT template event. ISS PRA			
CM-EPWS-FTF-BATT2-P-3	**2.84E-05**	λ=7.79E-7/hr	Constrained non-informative
CEV CM EPS Battery 2 (phase 3)		Time=36 hr	95th = 1.23E-4
Note: This event uses the Z-EPWS-FTF-BATT template event. ISS PRA			
CM-EPWS-FTF-BATT2-P-4	**1.31E-04**	λ=7.79E-7/hr	Constrained non-informative
CEV CM EPS Battery 2 (phase 4)		Time=168 hr	95th = 5.69E-4
Note: This event uses the Z-EPWS-FTF-BATT template event. ISS PRA			
CM-EPWS-FTF-BATT2-P-5	**1.33E-04**	λ=7.79E-7/hr	Constrained non-informative
CEV CM EPS Battery 2 (phase 5)		Time=170 hr	95th = 5.77E-4
Note: This event uses the Z-EPWS-FTF-BATT template event. ISS PRA			
CM-EPWS-FTF-BATT2-P-6	**4.13E-06**	λ=7.79E-7/hr	Constrained non-informative
CEV CM EPS Battery 2 (phase 6)		Time=5 hr	95th = 1.80E-5
Note: This event uses the Z-EPWS-FTF-BATT template event. ISS PRA			
CM-EPWS-FTF-BATT2-P-7	**8.41E-05**	λ=7.79E-7/hr	Constrained non-informative
CEV CM EPS Battery 2 (phase 7)		Time=108 hr	95th = 3.66E-4
Note: This event uses the Z-EPWS-FTF-BATT template event. ISS PRA			
CM-EPWS-FTF-BATT2-P-8	**1.40E-06**	λ=7.79E-7/hr	Constrained non-informative
CEV CM EPS Battery 2 (phase 8)		Time=2 hr	95th = 6.10E-6
Note: This event uses the Z-EPWS-FTF-BATT template event. ISS PRA			
CM-EPWS-FTF-BATT3-P-1	**9.35E-05**	λ=7.79E-7/hr	Constrained non-informative
CEV CM EPS Battery 3 (phase 1)		Time=120 hr	95th = 4.06E-4
Note: This event uses the Z-EPWS-FTF-BATT template event. ISS PRA			
CM-EPWS-FTF-BATT3-P-2	**5.63E-05**	λ=7.79E-7/hr	Constrained non-informative
CEV CM EPS Battery 3 (phase 2)		Time=72 hr	95th = 2.45E-4
Note: This event uses the Z-EPWS-FTF-BATT template event. ISS PRA			
CM-EPWS-FTF-BATT3-P-3	**2.84E-05**	λ=7.79E-7/hr	Constrained non-informative
CEV CM EPS Battery 3 (phase 3)		Time=36 hr	95th = 1.23E-4
Note: This event uses the Z-EPWS-FTF-BATT template event. ISS PRA			
CM-EPWS-FTF-BATT3-P-4	**1.31E-04**	λ=7.79E-7/hr	Constrained non-informative
CEV CM EPS Battery 3 (phase 4)		Time=168 hr	95th = 5.69E-4
Note: This event uses the Z-EPWS-FTF-BATT template event. ISS PRA			
CM-EPWS-FTF-BATT3-P-5	**1.33E-04**	λ=7.79E-7/hr	Constrained non-informative
CEV CM EPS Battery 3 (phase 5)		Time=170 hr	95th = 5.77E-4
Note: This event uses the Z-EPWS-FTF-BATT template event. ISS PRA			
CM-EPWS-FTF-BATT3-P-6	**4.13E-06**	λ=7.79E-7/hr	Constrained non-informative
CEV CM EPS Battery 3 (phase 6)		Time=5 hr	95th = 1.80E-5
Note: This event uses the Z-EPWS-FTF-BATT template event. ISS PRA			
CM-EPWS-FTF-BATT3-P-7	**8.41E-05**	λ=7.79E-7/hr	Constrained non-informative
CEV CM EPS Battery 3 (phase 7)		Time=108 hr	95th = 3.66E-4
Note: This event uses the Z-EPWS-FTF-BATT template event. ISS PRA			

CM-EPWS-FTF-BATT3-P-8 CEV CM EPS Battery 3 (phase 8) *Note:* This event uses the Z-EPWS-FTF-BATT template event. ISS PRA	**1.40E-06**	λ=7.79E-7/hr Time=2 hr	Constrained non-informative 95th = 6.10E-6
CM-EPWS-FTF-CCF-P-1 CEV CM EPS Power Distribution CCF of 1 2 and 3 (phase 1) *Note:*	**1.80E-06**		No distribution assigned to this event.
CM-EPWS-FTF-CCF-P-2 CEV CM EPS Power Distribution CCF of 1 2 and 3 (phase 2) *Note:*	**1.09E-06**		No distribution assigned to this event.
CM-EPWS-FTF-CCF-P-3 CEV CM EPS Power Distribution CCF of 1 2 and 3 (phase 3) *Note:*	**5.46E-07**		No distribution assigned to this event.
CM-EPWS-FTF-CCF-P-4 CEV CM EPS Power Distribution CCF of 1 2 and 3 (phase 4) *Note:*	**2.52E-06**		No distribution assigned to this event.
CM-EPWS-FTF-CCF-P-5 CEV CM EPS Power Distribution CCF of 1 2 and 3 (phase 5) *Note:*	**2.55E-06**		No distribution assigned to this event.
CM-EPWS-FTF-CCF-P-6 CEV CM EPS Power Distribution CCF of 1 2 and 3 (phase 6) *Note:*	**7.95E-08**		No distribution assigned to this event.
CM-EPWS-FTF-CCF-P-7 CEV CM EPS Power Distribution CCF of 1 2 and 3 (phase 7) *Note:*	**1.62E-06**		No distribution assigned to this event.
CM-EPWS-FTF-CCF-P-8 CEV CM EPS Power Distribution CCF of 1 2 and 3 (phase 8) *Note:*	**2.70E-08**		No distribution assigned to this event.
CM-EPWS-FTF-DCCF-P-1 CEV CM EPS Power Distribution degraded CCF 2 of 3 (phase 1) *Note:*	**4.50E-06**		No distribution assigned to this event.
CM-EPWS-FTF-DCCF-P-2 CEV CM EPS Power Distribution degraded CCF 2 of 3 (phase 2) *Note:*	**2.71E-06**		No distribution assigned to this event.
CM-EPWS-FTF-DCCF-P-3 CEV CM EPS Power Distribution degraded CCF 2 of 3 (phase 3) *Note:*	**1.37E-06**		No distribution assigned to this event.
CM-EPWS-FTF-DCCF-P-4 CEV CM EPS Power Distribution degraded CCF 2 of 3 (phase 4) *Note:*	**6.30E-06**		No distribution assigned to this event.
CM-EPWS-FTF-DCCF-P-5 CEV CM EPS Power Distribution degraded CCF 2 of 3 (phase 5) *Note:*	**6.38E-06**		No distribution assigned to this event.
CM-EPWS-FTF-DCCF-P-6 CEV CM EPS Power Distribution degraded CCF 2 of 3 (phase 6)	**1.99E-07**		No distribution assigned to this event.

Note:			
CM-EPWS-FTF-DCCF-P-7	**4.05E-06**		No distribution assigned to this event.
CEV CM EPS Power Distribution degraded CCF 2 of 3 (phase 7)			
Note:			
CM-EPWS-FTF-DCCF-P-8	**6.75E-08**		No distribution assigned to this event.
CEV CM EPS Power Distribution degraded CCF 2 of 3 (phase 8)			
Note:			
CM-EPWS-FTF-DIST-1-P-1	**3.60E-05**	λ=3.00E-7/hr	Constrained non-informative
CEV CM EPS Power Distribution Subsystem 1 (Phase 1)		Time=120 hr	95th = 1.57E-4
Note:	This event uses the Z-EPWS-FTF-DIST template event. Shuttle PRA I2 EPS (bus short)		
CM-EPWS-FTF-DIST-1-P-2	**2.17E-05**	λ=3.00E-7/hr	Constrained non-informative
CEV CM EPS Power Distribution Subsystem 1 (phase 2)		Time=72 hr	95th = 9.43E-5
Note:	This event uses the Z-EPWS-FTF-DIST template event. Shuttle PRA I2 EPS (bus short)		
CM-EPWS-FTF-DIST-1-P-3	**1.09E-05**	λ=3.00E-7/hr	Constrained non-informative
CEV CM EPS Power Distribution Subsystem 1 (phase 3)		Time=36 hr	95th = 4.75E-5
Note:	This event uses the Z-EPWS-FTF-DIST template event. Shuttle PRA I2 EPS (bus short)		
CM-EPWS-FTF-DIST-1-P-4	**5.04E-05**	λ=3.00E-7/hr	Constrained non-informative
CEV CM EPS Power Distribution Subsystem 1 (phase 4)		Time=168 hr	95th = 2.19E-4
Note:	This event uses the Z-EPWS-FTF-DIST template event. Shuttle PRA I2 EPS (bus short)		
CM-EPWS-FTF-DIST-1-P-5	**5.11E-05**	λ=3.00E-7/hr	Constrained non-informative
CEV CM EPS Power Distribution Subsystem 1 (phase 5)		Time=170 hr	95th = 2.22E-4
Note:	This event uses the Z-EPWS-FTF-DIST template event. Shuttle PRA I2 EPS (bus short)		
CM-EPWS-FTF-DIST-1-P-6	**1.59E-06**	λ=3.00E-7/hr	Constrained non-informative
CEV CM EPS Power Distribution Subsystem 1 (phase 6)		Time=5 hr	95th = 6.91E-6
Note:	This event uses the Z-EPWS-FTF-DIST template event. Shuttle PRA I2 EPS (bus short)		
CM-EPWS-FTF-DIST-1-P-7	**3.24E-05**	λ=3.00E-7/hr	Constrained non-informative
CEV CM EPS Power Distribution Subsystem 1 (phase 7)		Time=108 hr	95th = 1.41E-4
Note:	This event uses the Z-EPWS-FTF-DIST template event. Shuttle PRA I2 EPS (bus short)		
CM-EPWS-FTF-DIST-1-P-8	**5.40E-07**	λ=3.00E-7/hr	Constrained non-informative
CEV CM EPS Power Distribution Subsystem 1 (phase 8)		Time=2 hr	95th = 2.35E-6
Note:	This event uses the Z-EPWS-FTF-DIST template event. Shuttle PRA I2 EPS (bus short)		
CM-EPWS-FTF-DIST-2-P-1	**3.60E-05**	λ=3.00E-7/hr	Constrained non-informative
CEV CM EPS Power Distribution Subsystem 2 (Phase 1)		Time=120 hr	95th = 1.57E-4
Note:	This event uses the Z-EPWS-FTF-DIST template event. Shuttle PRA I2 EPS (bus short)		
CM-EPWS-FTF-DIST-2-P-2	**2.17E-05**	λ=3.00E-7/hr	Constrained non-informative
CEV CM EPS Power Distribution Subsystem 2 (phase 2)		Time=72 hr	95th = 9.43E-5
Note:	This event uses the Z-EPWS-FTF-DIST template event. Shuttle PRA I2 EPS (bus short)		
CM-EPWS-FTF-DIST-2-P-3	**1.09E-05**	λ=3.00E-7/hr	Constrained non-informative
CEV CM EPS Power Distribution Subsystem 2 (phase 3)		Time=36 hr	95th = 4.75E-5
Note:	This event uses the Z-EPWS-FTF-DIST template event. Shuttle PRA I2 EPS (bus short)		
CM-EPWS-FTF-DIST-2-P-4	**5.04E-05**	λ=3.00E-7/hr	Constrained non-informative
CEV CM EPS Power Distribution Subsystem 2 (phase 4)		Time=168 hr	95th = 2.19E-4
Note:	This event uses the Z-EPWS-FTF-DIST template event. Shuttle PRA I2 EPS (bus short)		
CM-EPWS-FTF-DIST-2-P-5	**5.11E-05**	λ=3.00E-7/hr	Constrained non-informative
CEV CM EPS Power Distribution Subsystem 2 (phase 5)		Time=170 hr	95th = 2.22E-4
Note:	This event uses the Z-EPWS-FTF-DIST template event. Shuttle PRA I2 EPS (bus short)		
CM-EPWS-FTF-DIST-2-P-6	**1.59E-06**	λ=3.00E-7/hr	Constrained non-informative
CEV CM EPS Power Distribution Subsystem 2 (phase 6)		Time=5 hr	95th = 6.91E-6

Note: This event uses the Z-EPWS-FTF-DIST template event. Shuttle PRA I2 EPS (bus short)

CM-EPWS-FTF-DIST-2-P-7	**3.24E-05**	λ=3.00E-7/hr	Constrained non-informative
CEV CM EPS Power Distribution Subsystem 2 (phase 7)		Time=108 hr	95th = 1.41E-4
Note: This event uses the Z-EPWS-FTF-DIST template event. Shuttle PRA I2 EPS (bus short)			
CM-EPWS-FTF-DIST-2-P-8	**5.40E-07**	λ=3.00E-7/hr	Constrained non-informative
CEV CM EPS Power Distribution Subsystem 2 (phase 8)		Time=2 hr	95th = 2.35E-6
Note: This event uses the Z-EPWS-FTF-DIST template event. Shuttle PRA I2 EPS (bus short)			
CM-EPWS-FTF-DIST-3-P-1	**3.60E-05**	λ=3.00E-7/hr	Constrained non-informative
CEV CM EPS Power Distribution Subsystem 3 (phase 1)		Time=120 hr	95th = 1.57E-4
Note: This event uses the Z-EPWS-FTF-DIST template event. Shuttle PRA I2 EPS (bus short)			
CM-EPWS-FTF-DIST-3-P-2	**2.17E-05**	λ=3.00E-7/hr	Constrained non-informative
CEV CM EPS Power Distribution Subsystem 3 (phase 2)		Time=72 hr	95th = 9.43E-5
Note: This event uses the Z-EPWS-FTF-DIST template event. Shuttle PRA I2 EPS (bus short)			
CM-EPWS-FTF-DIST-3-P-3	**1.09E-05**	λ=3.00E-7/hr	Constrained non-informative
CEV CM EPS Power Distribution Subsystem 3 (phase 3)		Time=36 hr	95th = 4.75E-5
Note: This event uses the Z-EPWS-FTF-DIST template event. Shuttle PRA I2 EPS (bus short)			
CM-EPWS-FTF-DIST-3-P-4	**5.04E-05**	λ=3.00E-7/hr	Constrained non-informative
CEV CM EPS Power Distribution Subsystem 3 (phase 4)		Time=168 hr	95th = 2.19E-4
Note: This event uses the Z-EPWS-FTF-DIST template event. Shuttle PRA I2 EPS (bus short)			
CM-EPWS-FTF-DIST-3-P-5	**5.11E-05**	λ=3.00E-7/hr	Constrained non-informative
CEV CM EPS Power Distribution Subsystem 3 (phase 5)		Time=170 hr	95th = 2.22E-4
Note: This event uses the Z-EPWS-FTF-DIST template event. Shuttle PRA I2 EPS (bus short)			
CM-EPWS-FTF-DIST-3-P-6	**1.59E-06**	λ=3.00E-7/hr	Constrained non-informative
CEV CM EPS Power Distribution Subsystem 3 (phase 6)		Time=5 hr	95th = 6.91E-6
Note: This event uses the Z-EPWS-FTF-DIST template event. Shuttle PRA I2 EPS (bus short)			
CM-EPWS-FTF-DIST-3-P-7	**3.24E-05**	λ=3.00E-7/hr	Constrained non-informative
CEV CM EPS Power Distribution Subsystem 3 (phase 7)		Time=108 hr	95th = 1.41E-4
Note: This event uses the Z-EPWS-FTF-DIST template event. Shuttle PRA I2 EPS (bus short)			
CM-EPWS-FTF-DIST-3-P-8	**5.40E-07**	λ=3.00E-7/hr	Constrained non-informative
CEV CM EPS Power Distribution Subsystem 3 (phase 8)		Time=2 hr	95th = 2.35E-6
Note: This event uses the Z-EPWS-FTF-DIST template event. Shuttle PRA I2 EPS (bus short)			
CM-RCS-COURSE-P-8	**9.00E-04**	per demand	Constrained non-informative
CM RCS attitude and spin control (phase 8)			95th = 3.91E-3
Note: P(3 thrusters | one degree of freedom in one pod) => 3-of-4 = [4! / 3!(4-3)!] * P(3 fail | CCF) = 4 * 0.28 * P(one thruster fails) Shuttle data, Thruster, RCS fails, 8E-05/demand Assume at most 10 demands per phase. 10*8E-5 = 8E-4 /phase P(one thruster fails) = 8E-4 P(LOC | RCS) = 4 * 0.28 * 8E-4 = 9E-4			
CM-RCS-REC-MIDCOURSE	**1.00E+00**	per demand	
Midcourse correction recovery using CM RCS			
Note:			
CM-SENS-FTF-AVCS-1-P1	**1.92E-05**	λ=1.60E-7/hr	Constrained non-informative
Avionics train 1 sensor fails (phase 1)		Time=120 hr	95th = 8.35E-5
Note: This event uses the Z-SENS-FTF-AVCS template event.			
CM-SENS-FTF-AVCS-1-P2	**1.16E-05**	λ=1.60E-7/hr	Constrained non-informative
Avionics train 1 sensor fails (phase 2)		Time=72 hr	95th = 5.03E-5
Note: This event uses the Z-SENS-FTF-AVCS template event.			
CM-SENS-FTF-AVCS-1-P3	**5.82E-06**	λ=1.60E-7/hr	Constrained non-informative
Avionics train 1 sensor fails (phase 3)		Time=36 hr	95th = 2.53E-5
Note: This event uses the Z-SENS-FTF-AVCS template event.			
CM-SENS-FTF-AVCS-1-P4	**2.69E-05**	λ=1.60E-7/hr	Constrained non-informative
Avionics train 1 sensor fails (phase 4)		Time=168 hr	95th = 1.17E-4
Note: This event uses the Z-SENS-FTF-AVCS template event.			

CM-SENS-FTF-AVCS-1-P5	**2.72E-05**	λ=1.60E-7/hr	Constrained non-informative
Avionics train 1 sensor fails (phase 5)		Time=170 hr	95th = 1.18E-4
Note: This event uses the Z-SENS-FTF-AVCS template event.			
CM-SENS-FTF-AVCS-1-P6	**8.48E-07**	λ=1.60E-7/hr	Constrained non-informative
Avionics train 1 sensor fails (phase 6)		Time=5 hr	95th = 3.69E-6
Note: This event uses the Z-SENS-FTF-AVCS template event.			
CM-SENS-FTF-AVCS-1-P7	**1.73E-05**	λ=1.60E-7/hr	Constrained non-informative
Avionics train 1 sensor fails (phase 7)		Time=108 hr	95th = 7.51E-5
Note: This event uses the Z-SENS-FTF-AVCS template event.			
CM-SENS-FTF-AVCS-1-P8	**2.88E-07**	λ=1.60E-7/hr	Constrained non-informative
Avionics train 1 sensor fails (phase 8)		Time=2 hr	95th = 1.25E-6
Note: This event uses the Z-SENS-FTF-AVCS template event.			
CM-SENS-FTF-AVCS-2-P1	**1.92E-05**	λ=1.60E-7/hr	Constrained non-informative
Avionics train 2 sensor fails (phase 1)		Time=120 hr	95th = 8.35E-5
Note: This event uses the Z-SENS-FTF-AVCS template event.			
CM-SENS-FTF-AVCS-2-P2	**1.16E-05**	λ=1.60E-7/hr	Constrained non-informative
Avionics train 2 sensor fails (phase 2)		Time=72 hr	95th = 5.03E-5
Note: This event uses the Z-SENS-FTF-AVCS template event.			
CM-SENS-FTF-AVCS-2-P3	**5.82E-06**	λ=1.60E-7/hr	Constrained non-informative
Avionics train 2 sensor fails (phase 3)		Time=36 hr	95th = 2.53E-5
Note: This event uses the Z-SENS-FTF-AVCS template event.			
CM-SENS-FTF-AVCS-2-P4	**2.69E-05**	λ=1.60E-7/hr	Constrained non-informative
Avionics train 2 sensor fails (phase 4)		Time=168 hr	95th = 1.17E-4
Note: This event uses the Z-SENS-FTF-AVCS template event.			
CM-SENS-FTF-AVCS-2-P5	**2.72E-05**	λ=1.60E-7/hr	Constrained non-informative
Avionics train 2 sensor fails (phase 5)		Time=170 hr	95th = 1.18E-4
Note: This event uses the Z-SENS-FTF-AVCS template event.			
CM-SENS-FTF-AVCS-2-P6	**8.48E-07**	λ=1.60E-7/hr	Constrained non-informative
Avionics train 2 sensor fails (phase 6)		Time=5 hr	95th = 3.69E-6
Note: This event uses the Z-SENS-FTF-AVCS template event.			
CM-SENS-FTF-AVCS-2-P7	**1.73E-05**	λ=1.60E-7/hr	Constrained non-informative
Avionics train 2 sensor fails (phase 7)		Time=108 hr	95th = 7.51E-5
Note: This event uses the Z-SENS-FTF-AVCS template event.			
CM-SENS-FTF-AVCS-2-P8	**2.88E-07**	λ=1.60E-7/hr	Constrained non-informative
Avionics train 2 sensor fails (phase 8)		Time=2 hr	95th = 1.25E-6
Note: This event uses the Z-SENS-FTF-AVCS template event.			
CM-SENS-FTF-AVCS-3-P1	**1.92E-05**	λ=1.60E-7/hr	Constrained non-informative
Avionics train 3 sensor fails (phase 1)		Time=120 hr	95th = 8.35E-5
Note: This event uses the Z-SENS-FTF-AVCS template event.			
CM-SENS-FTF-AVCS-3-P2	**1.16E-05**	λ=1.60E-7/hr	Constrained non-informative
Avionics train 3 sensor fails (phase 2)		Time=72 hr	95th = 5.03E-5
Note: This event uses the Z-SENS-FTF-AVCS template event.			
CM-SENS-FTF-AVCS-3-P3	**5.82E-06**	λ=1.60E-7/hr	Constrained non-informative
Avionics train 3 sensor fails (phase 3)		Time=36 hr	95th = 2.53E-5
Note: This event uses the Z-SENS-FTF-AVCS template event.			
CM-SENS-FTF-AVCS-3-P4	**2.69E-05**	λ=1.60E-7/hr	Constrained non-informative
Avionics train 3 sensor fails (phase 4)		Time=168 hr	95th = 1.17E-4
Note: This event uses the Z-SENS-FTF-AVCS template event.			
CM-SENS-FTF-AVCS-3-P5	**2.72E-05**	λ=1.60E-7/hr	Constrained non-informative
Avionics train 3 sensor fails (phase 5)		Time=170 hr	95th = 1.18E-4

Note: This event uses the Z-SENS-FTF-AVCS template event.

CM-SENS-FTF-AVCS-3-P6	**8.48E-07**	λ=1.60E-7/hr	Constrained non-informative
Avionics train 3 sensor fails (phase 6)		Time=5 hr	95th = 3.69E-6

Note: This event uses the Z-SENS-FTF-AVCS template event.

CM-SENS-FTF-AVCS-3-P7	**1.73E-05**	λ=1.60E-7/hr	Constrained non-informative
Avionics train 3 sensor fails (phase 7)		Time=108 hr	95th = 7.51E-5

Note: This event uses the Z-SENS-FTF-AVCS template event.

CM-SENS-FTF-AVCS-3-P8	**2.88E-07**	λ=1.60E-7/hr	Constrained non-informative
Avionics train 3 sensor fails (phase 8)		Time=2 hr	95th = 1.25E-6

Note: This event uses the Z-SENS-FTF-AVCS template event.

CM-SENS-FTF-BIU-1-P1	**1.80E-04**	λ=1.50E-6/hr	Constrained non-informative
Sensor BIU 1 fails (phase 1)		Time=120 hr	95th = 7.83E-4

Note: This event uses the Z-BIU-FTF template event. RCS thruster valve BIU, computer electronic unit assy.

CM-SENS-FTF-BIU-1-P2	**1.08E-04**	λ=1.50E-6/hr	Constrained non-informative
Sensor BIU 1 fails (phase 2)		Time=72 hr	95th = 4.71E-4

Note: This event uses the Z-BIU-FTF template event. RCS thruster valve BIU, computer electronic unit assy.

CM-SENS-FTF-BIU-1-P3	**5.46E-05**	λ=1.50E-6/hr	Constrained non-informative
Sensor BIU 1 fails (phase 3)		Time=36 hr	95th = 2.37E-4

Note: This event uses the Z-BIU-FTF template event. RCS thruster valve BIU, computer electronic unit assy.

CM-SENS-FTF-BIU-1-P4	**2.52E-04**	λ=1.50E-6/hr	Constrained non-informative
Sensor BIU 1 fails (phase 4)		Time=168 hr	95th = 1.10E-3

Note: This event uses the Z-BIU-FTF template event. RCS thruster valve BIU, computer electronic unit assy.

CM-SENS-FTF-BIU-1-P5	**2.55E-04**	λ=1.50E-6/hr	Constrained non-informative
Sensor BIU 1 fails (phase 5)		Time=170 hr	95th = 1.11E-3

Note: This event uses the Z-BIU-FTF template event. RCS thruster valve BIU, computer electronic unit assy.

CM-SENS-FTF-BIU-1-P6	**7.95E-06**	λ=1.50E-6/hr	Constrained non-informative
Sensor BIU 1 fails (phase 6)		Time=5 hr	95th = 3.46E-5

Note: This event uses the Z-BIU-FTF template event. RCS thruster valve BIU, computer electronic unit assy.

CM-SENS-FTF-BIU-1-P7	**1.62E-04**	λ=1.50E-6/hr	Constrained non-informative
Sensor BIU 1 fails (phase 7)		Time=108 hr	95th = 7.04E-4

Note: This event uses the Z-BIU-FTF template event. RCS thruster valve BIU, computer electronic unit assy.

CM-SENS-FTF-BIU-1-P8	**2.70E-06**	λ=1.50E-6/hr	Constrained non-informative
Sensor BIU 1 fails (phase 8)		Time=2 hr	95th = 1.17E-5

Note: This event uses the Z-BIU-FTF template event. RCS thruster valve BIU, computer electronic unit assy.

CM-SENS-FTF-BIU-2-P1	**1.80E-04**	λ=1.50E-6/hr	Constrained non-informative
Sensor BIU 2 fails (phase 1)		Time=120 hr	95th = 7.83E-4

Note: This event uses the Z-BIU-FTF template event. RCS thruster valve BIU, computer electronic unit assy.

CM-SENS-FTF-BIU-2-P2	**1.08E-04**	λ=1.50E-6/hr	Constrained non-informative
Sensor BIU 2 fails (phase 2)		Time=72 hr	95th = 4.71E-4

Note: This event uses the Z-BIU-FTF template event. RCS thruster valve BIU, computer electronic unit assy.

CM-SENS-FTF-BIU-2-P3	**5.46E-05**	λ=1.50E-6/hr	Constrained non-informative
Sensor BIU 2 fails (phase 3)		Time=36 hr	95th = 2.37E-4

Note: This event uses the Z-BIU-FTF template event. RCS thruster valve BIU, computer electronic unit assy.

CM-SENS-FTF-BIU-2-P4	**2.52E-04**	λ=1.50E-6/hr	Constrained non-informative
Sensor BIU 2 fails (phase 4)		Time=168 hr	95th = 1.10E-3

Note: This event uses the Z-BIU-FTF template event. RCS thruster valve BIU, computer electronic unit assy.

CM-SENS-FTF-BIU-2-P5	**2.55E-04**	λ=1.50E-6/hr	Constrained non-informative
Sensor BIU 2 fails (phase 5)		Time=170 hr	95th = 1.11E-3

Note: This event uses the Z-BIU-FTF template event. RCS thruster valve BIU, computer electronic unit assy.

CM-SENS-FTF-BIU-2-P6	**7.95E-06**	λ=1.50E-6/hr	Constrained non-informative

Sensor BIU 2 fails (phase 6)		Time=5 hr	95th = 3.46E-5
Note: This event uses the Z-BIU-FTF template event. RCS thruster valve BIU, computer electronic unit assy.			
CM-SENS-FTF-BIU-2-P7	**1.62E-04**	λ=1.50E-6/hr	Constrained non-informative
Sensor BIU 2 fails (phase 7)		Time=108 hr	95th = 7.04E-4
Note: This event uses the Z-BIU-FTF template event. RCS thruster valve BIU, computer electronic unit assy.			
CM-SENS-FTF-BIU-2-P8	**2.70E-06**	λ=1.50E-6/hr	Constrained non-informative
Sensor BIU 2 fails (phase 8)		Time=2 hr	95th = 1.17E-5
Note: This event uses the Z-BIU-FTF template event. RCS thruster valve BIU, computer electronic unit assy.			
CM-SENS-FTF-BIU-3-P1	**1.80E-04**	λ=1.50E-6/hr	Constrained non-informative
Sensor BIU 3 fails (phase 1)		Time=120 hr	95th = 7.83E-4
Note: This event uses the Z-BIU-FTF template event. RCS thruster valve BIU, computer electronic unit assy.			
CM-SENS-FTF-BIU-3-P2	**1.08E-04**	λ=1.50E-6/hr	Constrained non-informative
Sensor BIU 3 fails (phase 2)		Time=72 hr	95th = 4.71E-4
Note: This event uses the Z-BIU-FTF template event. RCS thruster valve BIU, computer electronic unit assy.			
CM-SENS-FTF-BIU-3-P3	**5.46E-05**	λ=1.50E-6/hr	Constrained non-informative
Sensor BIU 3 fails (phase 3)		Time=36 hr	95th = 2.37E-4
Note: This event uses the Z-BIU-FTF template event. RCS thruster valve BIU, computer electronic unit assy.			
CM-SENS-FTF-BIU-3-P4	**2.52E-04**	λ=1.50E-6/hr	Constrained non-informative
Sensor BIU 3 fails (phase 4)		Time=168 hr	95th = 1.10E-3
Note: This event uses the Z-BIU-FTF template event. RCS thruster valve BIU, computer electronic unit assy.			
CM-SENS-FTF-BIU-3-P5	**2.55E-04**	λ=1.50E-6/hr	Constrained non-informative
Sensor BIU 3 fails (phase 5)		Time=170 hr	95th = 1.11E-3
Note: This event uses the Z-BIU-FTF template event. RCS thruster valve BIU, computer electronic unit assy.			
CM-SENS-FTF-BIU-3-P6	**7.95E-06**	λ=1.50E-6/hr	Constrained non-informative
Sensor BIU 3 fails (phase 6)		Time=5 hr	95th = 3.46E-5
Note: This event uses the Z-BIU-FTF template event. RCS thruster valve BIU, computer electronic unit assy.			
CM-SENS-FTF-BIU-3-P7	**1.62E-04**	λ=1.50E-6/hr	Constrained non-informative
Sensor BIU 3 fails (phase 7)		Time=108 hr	95th = 7.04E-4
Note: This event uses the Z-BIU-FTF template event. RCS thruster valve BIU, computer electronic unit assy.			
CM-SENS-FTF-BIU-3-P8	**2.70E-06**	λ=1.50E-6/hr	Constrained non-informative
Sensor BIU 3 fails (phase 8)		Time=2 hr	95th = 1.17E-5
Note: This event uses the Z-BIU-FTF template event. RCS thruster valve BIU, computer electronic unit assy.			
ENDSTATE_LOC_1	**1.00E+00**	per demand	
Loss of Crew Flag (Phase 1)			
Note:			
ENDSTATE_LOC_2	**1.00E+00**	per demand	
Loss of Crew Flag (Phase 2)			
Note:			
ENDSTATE_LOC_3	**1.00E+00**	per demand	
Loss of Crew Flag (Phase 3)			
Note:			
ENDSTATE_LOC_4	**1.00E+00**	per demand	
Loss of Crew Flag (Phase 4)			
Note:			
ENDSTATE_LOC_5	**1.00E+00**	per demand	
Loss of Crew Flag (Phase 5)			
Note:			
ENDSTATE_LOC_6	**1.00E+00**	per demand	
Loss of Crew Flag (Phase 6)			
Note:			

ENDSTATE_LOC_7 Loss of Crew Flag (Phase 7) *Note:*	**1.00E+00**	per demand	
ENDSTATE_LOC_8 Loss of Crew Flag (Phase 8) *Note:*	**1.00E+00**	per demand	
ENDSTATE_LOM_1 Loss of Mission Flag (Phase 1) *Note:*	**1.00E+00**	per demand	
ENDSTATE_LOM_2 Loss of Mission Flag (Phase 2) *Note:*	**1.00E+00**	per demand	
ENDSTATE_LOM_3 Loss of Mission Flag (Phase 3) *Note:*	**1.00E+00**	per demand	
ENDSTATE_LOM_4 Loss of Mission Flag (Phase 4) *Note:*	**1.00E+00**	per demand	
ENDSTATE_LOM_5 Loss of Mission Flag (Phase 5) *Note:*	**1.00E+00**	per demand	
ENDSTATE_LOM_6 Loss of Mission Flag (Phase 6) *Note:*	**0.00E+00**	FALSE house	House events have no uncertainty.
ENDSTATE_LOM_7 Loss of Mission Flag (Phase 7) *Note:*	**0.00E+00**	FALSE house	House events have no uncertainty.
ENDSTATE_LOM_8 Loss of Mission Flag (Phase 8) *Note:*	**0.00E+00**	FALSE house	House events have no uncertainty.
EPWS_AVCS_BE_P_1 No signal from Avionics System fails EPS (phase 1) *Note:*	**5.00E-06**	per demand	Constrained non-informative 95th = 2.17E-5
EPWS_AVCS_BE_P_2 No signal from Avionics System fails EPS (phase 2) *Note:*	**5.00E-06**	per demand	Constrained non-informative 95th = 2.17E-5
EPWS_AVCS_BE_P_3 No signal from Avionics System fails EPS (phase 3) *Note:*	**5.00E-06**	per demand	Constrained non-informative 95th = 2.17E-5
EPWS_AVCS_BE_P_4 No signal from Avionics System fails EPS (phase 4) *Note:*	**5.00E-06**	per demand	Constrained non-informative 95th = 2.17E-5
EPWS_AVCS_BE_P_5 No signal from Avionics System fails EPS (phase 5) *Note:*	**5.00E-06**	per demand	Constrained non-informative 95th = 2.17E-5
EPWS_AVCS_BE_P_6 No signal from Avionics System fails EPS (phase 6) *Note:*	**5.00E-06**	per demand	Constrained non-informative 95th = 2.17E-5
EPWS_AVCS_BE_P_7 No signal from Avionics System fails EPS (phase 7)	**5.00E-06**	per demand	Constrained non-informative 95th = 2.17E-5

Note:

EPWS_AVCS_BE_P_8	**5.00E-06**	per demand	Constrained non-informative
No signal from Avionics System fails EPS (phase 8)			95th = 2.17E-5
Note:			
F_WATER_LANDING	**0.00E+00**	FALSE house	House events
House event used to condition on water landing (TRUE = water)			have no uncertainty.
Note:			
LAS-AVCS-FTC-PYRO-A-BKR	**5.00E-04**	per demand	Constrained non-informative
Avionics fails to close breaker to Electric Bus A (LAS)			95th = 2.17E-3
Note: This event uses the Z-BKR-FTC template event. EGG-SSRE-8875 Generic Component Failure Data Base...Eide et al 1990			
LAS-AVCS-FTC-PYRO-B-BKR	**5.00E-04**	per demand	Constrained non-informative
Avionics fails to close breaker to Electric Bus B (LAS)			95th = 2.17E-3
Note: This event uses the Z-BKR-FTC template event. EGG-SSRE-8875 Generic Component Failure Data Base...Eide et al 1990			
LAS-AVCS-SIG-1-FIRING	**1.00E-05**	per demand	Constrained non-informative
Avionics fails to provide firing signal train 1 (LAS)			95th = 4.35E-5
Note: P(firing signal fails | arming system works)			
LAS-AVCS-SIG-2-FIRING	**1.00E-05**	per demand	Constrained non-informative
Avionics fails to provide firing signal train 2 (LAS)			95th = 4.35E-5
Note: P(firing signal fails | arming system works)			
LAS-BATT-FTF-SEPAR-1	**5.00E-05**	per demand	Constrained non-informative
Battery failure or low / loss of power during separation during 1st stage			95th = 2.17E-4
Note: Prince Kalia LAS calculation.			
LAS-BATT-FTF-SEPAR-2	**5.00E-05**	per demand	Constrained non-informative
Battery failure or low / loss of power during separation during 2nd stage			95th = 2.17E-4
Note: Prince Kalia LAS calculation.			
LAS-BATT-FTF-SEPAR-L	**5.00E-05**	per demand	Constrained non-informative
Battery failure or low / loss of power during separation during launch			95th = 2.17E-4
Note: Prince Kalia LAS calculation.			
LAS-BATT-FTF-SEPAR-O	**5.00E-05**	per demand	Constrained non-informative
Battery failure or low / loss of power during separation during LEO insertion			95th = 2.17E-4
Note: Prince Kalia LAS calculation.			
LAS-BATT-FTF-SIGNAL-1	**1.00E-05**	per demand	Constrained non-informative
Battery failure or low / loss of power on abort signal during 1st stage			95th = 4.35E-5
Note: Prince Kalia LAS calculation.			
LAS-BATT-FTF-SIGNAL-2	**1.00E-05**	per demand	Constrained non-informative
Battery failure or low / loss of power on abort signal during 2nd stage			95th = 4.35E-5
Note: Prince Kalia LAS calculation.			
LAS-BATT-FTF-SIGNAL-L	**1.00E-05**	per demand	Constrained non-informative
Battery failure or low / loss of power on abort signal during launch			95th = 4.35E-5
Note: Prince Kalia LAS calculation.			
LAS-BATT-FTF-SIGNAL-O	**1.00E-05**	per demand	Constrained non-informative
Battery failure or low / loss of power on abort signal during			95th = 4.35E-5

LEO insertion *Note:* Prince Kalia LAS calculation.			
LAS-CLV-FTF-ATTITUDE-1 Vehicle in wrong abort attitude during 1st stage *Note:* Prince Kalia LAS calculation.	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
LAS-CLV-FTF-ATTITUDE-2 Vehicle in wrong abort attitude during 2nd stage *Note:* Prince Kalia LAS calculation.	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
LAS-CLV-FTF-ATTITUDE-O Vehicle in wrong abort attitude during LEO insertion *Note:* Prince Kalia LAS calculation.	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
LAS-CLV-FTF-CEVVAC-1 Vacuum holds components together during separation during 1st stage *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-CLV-FTF-CEVVAC-L Vacuum holds components together during separation during launch *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-CLV-FTF-CMSMVAC-1 Vacuum lock between SM and CM modules during 1st stage *Note:* Prince Kalia LAS calculation.	**5.00E-05**	per demand	Constrained non-informative 95th = 2.17E-4
LAS-CLV-FTF-CMSMVAC-2 Vacuum lock between SM and CM modules during 2nd stage *Note:* Prince Kalia LAS calculation.	**5.00E-05**	per demand	Constrained non-informative 95th = 2.17E-4
LAS-CLV-FTF-CMSMVAC-L Vacuum lock between SM and CM modules during launch *Note:* Prince Kalia LAS calculation.	**5.00E-05**	per demand	Constrained non-informative 95th = 2.17E-4
LAS-CLV-FTF-CMSMVAC-O Vacuum lock between SM and CM modules during LEO insertion *Note:* Prince Kalia LAS calculation.	**5.00E-05**	per demand	Constrained non-informative 95th = 2.17E-4
LAS-CLV-FTF-FORCE-1 Inadequate separation force during 1st stage *Note:* Prince Kalia LAS calculation.	**1.00E-06**	per demand	Constrained non-informative 95th = 4.35E-6
LAS-CLV-FTF-FORCE-2 Inadequate separation force during 2nd stage *Note:* Prince Kalia LAS calculation.	**1.00E-06**	per demand	Constrained non-informative 95th = 4.35E-6
LAS-CLV-FTF-FORCE-L Inadequate separation force during launch *Note:* Prince Kalia LAS calculation.	**1.00E-06**	per demand	Constrained non-informative 95th = 4.35E-6
LAS-CLV-FTF-FORCE-O Inadequate separation force during LEO insertion *Note:* Prince Kalia LAS calculation.	**1.00E-06**	per demand	Constrained non-informative 95th = 4.35E-6
LAS-CLV-FTF-ROLL-1 Roll rate too high during 1st stage *Note:* Prince Kalia LAS calculation.	**1.00E-06**	per demand	Constrained non-informative 95th = 4.35E-6
LAS-CLV-FTF-ROLL-2 Roll rate too high during 2nd stage *Note:* Prince Kalia LAS calculation.	**1.00E-06**	per demand	Constrained non-informative 95th = 4.35E-6

LAS-CLV-FTF-ROLL-O Roll rate too high during LEO insertion *Note:* Prince Kalia LAS calculation.	**1.00E-06**	per demand	Constrained non-informative 95th = 4.35E-6
LAS-CLV-FTF-SEPAR-1 Interference or snagging causing nonseparation or out of control movement on CM during 1st stage *Note:* Prince Kalia LAS calculation.	**5.00E-05**	per demand	Constrained non-informative 95th = 2.17E-4
LAS-CLV-FTF-SEPAR-2 Interference or snagging causing nonseparation or out of control movement on CM during 2nd stage *Note:* Prince Kalia LAS calculation.	**5.00E-05**	per demand	Constrained non-informative 95th = 2.17E-4
LAS-CLV-FTF-SEPAR-L Interference or snagging causing nonseparation or out of control movement on CM during launch *Note:* Prince Kalia LAS calculation.	**5.00E-05**	per demand	Constrained non-informative 95th = 2.17E-4
LAS-CLV-FTF-SEPAR-O Interference or snagging causing nonseparation or out of control movement on CM during LEO insertion *Note:* Prince Kalia LAS calculation.	**5.00E-05**	per demand	Constrained non-informative 95th = 2.17E-4
LAS-CLV-HPS-PRESS-1 Dynamic pressure too high during 1st stage *Note:* Prince Kalia LAS calculation.	**5.00E-04**	per demand	Constrained non-informative 95th = 2.17E-3
LAS-CLV-SNG-COMPNT-1 Component interference or snagging during 1st stage *Note:* Prince Kalia LAS calculation.	**5.00E-05**	per demand	Constrained non-informative 95th = 2.17E-4
LAS-CLV-SNG-COMPNT-2 Component interference or snagging during 2nd stage *Note:* Prince Kalia LAS calculation.	**5.00E-05**	per demand	Constrained non-informative 95th = 2.17E-4
LAS-CLV-SNG-COMPNT-L Component interference or snagging during launch *Note:* Prince Kalia LAS calculation.	**5.00E-05**	per demand	Constrained non-informative 95th = 2.17E-4
LAS-CLV-SNG-COMPNT-O Component interference or snagging during LEO insertion *Note:* Prince Kalia LAS calculation.	**5.00E-05**	per demand	Constrained non-informative 95th = 2.17E-4
LAS-CM-CTR-RCS-1 Loss of RCS control during 1st stage *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-CM-CTR-RCS-2 Loss of RCS control during 2nd stage *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-CM-CTR-RCS-L Loss of RCS control during launch *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-CM-CTR-RCS-O Loss of RCS control during LEO insertion *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-CM-FTF-RCS-1 Loss of RCS control function during 1st stage *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-CM-FTF-RCS-2	**1.00E-04**	per demand	Constrained non-informative

Loss of RCS control function during 2nd stage *Note:* Prince Kalia LAS calculation.			95th = 4.35E-4
LAS-CM-FTF-RCS-L Loss of RCS control function during launch *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-CM-FTF-RCS-O Loss of RCS control function during LEO insertion *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-CM-FTF-RCSPROP-1 Inadequate amount of RCS propellant during 1st stage *Note:* Prince Kalia LAS calculation.	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
LAS-CM-FTF-RCSPROP-2 Inadequate amount of RCS propellant during 2nd stage *Note:* Prince Kalia LAS calculation.	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
LAS-CM-FTF-RCSPROP-L Inadequate amount of RCS propellant during launch *Note:* Prince Kalia LAS calculation.	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
LAS-CM-FTF-RCSPROP-O Inadequate amount of RCS propellant during LEO insertion *Note:* Prince Kalia LAS calculation.	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
LAS-CM-FTF-RCSTHRUST-1 Inadequate RCS thrust during 1st stage *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-CM-FTF-RCSTHRUST-2 Inadequate RCS thrust during 2nd stage *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-CM-FTF-RCSTHRUST-L Inadequate RCS thrust during launch *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-CM-FTF-RCSTHRUST-O Inadequate RCS thrust during LEO insertion *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-CM-FTF-STRUCT-1 Structural loading failure during 1st stage *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-CM-FTF-STRUCT-2 Structural loading failure during 2nd stage *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-CM-FTF-STRUCT-L Structural loading failure during launch *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-CM-FTF-STRUCT-O Structural loading failure during LEO insertion *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-CM-FTF-THERMAL-1 Thermal failure from aero heating of LAS blast during 1st stage *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-CM-FTF-THERMAL-2 Thermal failure from aero heating of LAS blast during 2nd stage	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4

Note: Prince Kalia LAS calculation.

LAS-CM-FTF-THERMAL-L Thermal failure from aero heating of LAS blast during launch *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-CM-FTF-THERMAL-O Thermal failure from aero heating of LAS blast during LEO insertion *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-CM-FTF-WEIGHT-1 Over weight CM during 1st stage *Note:* Prince Kalia LAS calculation.	**1.00E-06**	per demand	Constrained non-informative 95th = 4.35E-6
LAS-CM-FTF-WEIGHT-2 Over weight CM during 2nd stage *Note:* Prince Kalia LAS calculation.	**1.00E-06**	per demand	Constrained non-informative 95th = 4.35E-6
LAS-CM-FTF-WEIGHT-L Over weight CM during launch *Note:* Prince Kalia LAS calculation.	**1.00E-06**	per demand	Constrained non-informative 95th = 4.35E-6
LAS-CM-FTF-WEIGHT-O Over weight CM during LEO insertion *Note:* Prince Kalia LAS calculation.	**1.00E-06**	per demand	Constrained non-informative 95th = 4.35E-6
LAS-COMP-FTF-COMP-1 Faulty computer hardware during 1st stage *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-COMP-FTF-COMP-2 Faulty computer hardware during 2nd stage *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-COMP-FTF-COMP-L Faulty computer hardware during launch *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-COMP-FTF-COMP-O Faulty computer hardware during LEO insertion *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-CRCT-FTF-CONNEC-1 Loose corroded or otherwise faulty connection during 1st stage *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-CRCT-FTF-CONNEC-2 Loose corroded or otherwise faulty connection during 2nd stage *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-CRCT-FTF-CONNEC-L Loose corroded or otherwise faulty connection during launch *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-CRCT-FTF-CONNEC-O Loose corroded or otherwise faulty connection during LEO insertion *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-CRCT-FTF-PIC-1 Both A and B PIC circuits report false arming during 1st stage *Note:* Prince Kalia LAS calculation.	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
LAS-CRCT-FTF-PIC-2 Both A and B PIC circuits report false arming during 2nd stage	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5

Note: Prince Kalia LAS calculation.

LAS-CRCT-FTF-PIC-L	**1.00E-05**	per demand	Constrained non-informative
Both A and B PIC circuits report false arming during launch			95th = 4.35E-5
Note: Prince Kalia LAS calculation.			
LAS-CRCT-FTF-PIC-O	**1.00E-05**	per demand	Constrained non-informative
Both A and B PIC circuits report false arming during LEO insertion			95th = 4.35E-5
Note: Prince Kalia LAS calculation.			
LAS-CREW-CRW-DELAY-1	**1.00E-04**	per demand	Constrained non-informative
Crew delayed in initiating abort during 1st stage			95th = 4.35E-4
Note: Prince Kalia LAS calculation.			
LAS-CREW-CRW-DELAY-2	**1.00E-04**	per demand	Constrained non-informative
Crew delayed in initiating abort during 2nd stage			95th = 4.35E-4
Note: Prince Kalia LAS calculation.			
LAS-CREW-CRW-DELAY-L	**1.00E-04**	per demand	Constrained non-informative
Crew delayed in initiating abort during launch			95th = 4.35E-4
Note: Prince Kalia LAS calculation.			
LAS-CREW-CRW-DELAY-O	**1.00E-04**	per demand	Constrained non-informative
Crew delayed in initiating abort during LEO insertion			95th = 4.35E-4
Note: Prince Kalia LAS calculation.			
LAS-CREW-CRW-DISABLE-1	**1.00E-06**	per demand	Constrained non-informative
Auto-initiated abort disabled by crew or ground crew during 1st stage			95th = 4.35E-6
Note: Prince Kalia LAS calculation.			
LAS-CREW-CRW-DISABLE-2	**1.00E-06**	per demand	Constrained non-informative
Auto-initiated abort disabled by crew or ground crew during 2nd stage			95th = 4.35E-6
Note: Prince Kalia LAS calculation.			
LAS-CREW-CRW-DISABLE-L	**1.00E-06**	per demand	Constrained non-informative
Auto-initiated abort disabled by crew or ground crew during launch			95th = 4.35E-6
Note: Prince Kalia LAS calculation.			
LAS-CREW-CRW-DISABLE-O	**1.00E-06**	per demand	Constrained non-informative
Auto-initiated abort disabled by crew or ground crew during LEO insertion			95th = 4.35E-6
Note: Prince Kalia LAS calculation.			
LAS-IGNT-FOD-BKNO3-1	**6.00E-08**	per demand	Constrained non-informative
BKNO3 ignition delay or failure during 1st stage			95th = 2.61E-7
Note: Prince Kalia LAS calculation.			
LAS-IGNT-FOD-BKNO3-2	**6.00E-08**	per demand	Constrained non-informative
BKNO3 ignition delay or failure during 2nd stage			95th = 2.61E-7
Note: Prince Kalia LAS calculation.			
LAS-IGNT-FOD-BKNO3-L	**6.00E-08**	per demand	Constrained non-informative
BKNO3 ignition delay or failure during launch			95th = 2.61E-7
Note: Prince Kalia LAS calculation.			
LAS-IGNT-FOD-BKNO3-O	**6.00E-08**	per demand	Constrained non-informative
BKNO3 ignition delay or failure during LEO insertion			95th = 2.61E-7
Note: Prince Kalia LAS calculation.			
LAS-IGNT-FOD-IGNIT-1	**6.00E-08**	per demand	Constrained non-informative
Initiator igniter ignition delay or failure during 1st stage			95th = 2.61E-7

Note: Prince Kalia LAS calculation.			
LAS-IGNT-FOD-IGNIT-2 Initiator igniter ignition delay or failure during 2nd stage *Note:* Prince Kalia LAS calculation.	**6.00E-08**	per demand	Constrained non-informative 95th = 2.61E-7
LAS-IGNT-FOD-IGNIT-L Initiator igniter ignition delay or failure during launch *Note:* Prince Kalia LAS calculation.	**6.00E-08**	per demand	Constrained non-informative 95th = 2.61E-7
LAS-IGNT-FOD-IGNIT-O Initiator igniter ignition delay or failure during LEO insertion *Note:* Prince Kalia LAS calculation.	**6.00E-08**	per demand	Constrained non-informative 95th = 2.61E-7
LAS-IGNT-FOD-MAIN-1 Main motor ignition delay or failure during 1st stage *Note:* Prince Kalia LAS calculation.	**6.00E-08**	per demand	Constrained non-informative 95th = 2.61E-7
LAS-IGNT-FOD-MAIN-2 Main motor ignition delay or failure during 2nd stage *Note:* Prince Kalia LAS calculation.	**6.00E-08**	per demand	Constrained non-informative 95th = 2.61E-7
LAS-IGNT-FOD-MAIN-L Main motor ignition delay or failure during launch *Note:* Prince Kalia LAS calculation.	**6.00E-08**	per demand	Constrained non-informative 95th = 2.61E-7
LAS-IGNT-FOD-MAIN-O Main motor ignition delay or failure during LEO insertion *Note:* Prince Kalia LAS calculation.	**6.00E-08**	per demand	Constrained non-informative 95th = 2.61E-7
LAS-IGNT-FTF-IGNIT-1 PIC failure in conjunction with spurious ignition signal to ignition train during 1st stage *Note:* Prince Kalia LAS calculation.	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
LAS-IGNT-FTF-IGNIT-2 PIC failure in conjunction with spurious ignition signal to ignition train during 2nd stage *Note:* Prince Kalia LAS calculation.	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
LAS-IGNT-FTF-IGNIT-L PIC failure in conjunction with spurious ignition signal to ignition train during launch *Note:* Prince Kalia LAS calculation.	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
LAS-IGNT-FTF-IGNIT-O PIC failure in conjunction with spurious ignition signal to ignition train during LEO insertion *Note:* Prince Kalia LAS calculation.	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
LAS-IGNT-FTF-SII-1 SII delay failure during 1st stage *Note:* Prince Kalia LAS calculation.	**6.00E-08**	per demand	Constrained non-informative 95th = 2.61E-7
LAS-IGNT-FTF-SII-2 SII delay failure during 2nd stage *Note:* Prince Kalia LAS calculation.	**6.00E-08**	per demand	Constrained non-informative 95th = 2.61E-7
LAS-IGNT-FTF-SII-L SII delay failure during launch *Note:* Prince Kalia LAS calculation.	**6.00E-08**	per demand	Constrained non-informative 95th = 2.61E-7
LAS-IGNT-FTF-SII-O SII delay failure during LEO insertion *Note:* Prince Kalia LAS calculation.	**6.00E-08**	per demand	Constrained non-informative 95th = 2.61E-7

LAS-IGNT-FTF-STATIC-L	**1.00E-05**	per demand	Constrained non-informative
Static discharge causes premature operation during launch			95th = 4.35E-5
Note: Prince Kalia LAS calculation.			
LAS-IGNT-SPU-LIGHT-1	**1.00E-05**	per demand	Constrained non-informative
Lightening (direct strike) causes premature operation during 1st stage			95th = 4.35E-5
Note: Prince Kalia LAS calculation.			
LAS-IGNT-SPU-LIGHT-L	**1.00E-05**	per demand	Constrained non-informative
Lightening (direct strike) causes premature operation during launch			95th = 4.35E-5
Note: Prince Kalia LAS calculation.			
LAS-LAS-FTF-STRUCT-1	**5.00E-05**	per demand	Constrained non-informative
Thermal weakening leading to structual failure during 1st stage			95th = 2.17E-4
Note: Prince Kalia LAS calculation.			
LAS-LAS-FTF-STRUCT-2	**5.00E-05**	per demand	Constrained non-informative
Thermal weakening leading to structual failure during 2nd stage			95th = 2.17E-4
Note: Prince Kalia LAS calculation.			
LAS-LAS-FTF-STRUCT-L	**5.00E-05**	per demand	Constrained non-informative
Thermal weakening leading to structual failure during launch			95th = 2.17E-4
Note: Prince Kalia LAS calculation.			
LAS-LAS-FTF-STRUCT-O	**5.00E-05**	per demand	Constrained non-informative
Thermal weakening leading to structual failure during LEO insertion			95th = 2.17E-4
Note: Prince Kalia LAS calculation.			
LAS-LAS-FTF-TOWER-1	**1.00E-05**	per demand	Constrained non-informative
Stuctural tower or attachments during 1st stage			95th = 4.35E-5
Note: Prince Kalia LAS calculation.			
LAS-LAS-FTF-TOWER-2	**1.00E-05**	per demand	Constrained non-informative
Stuctural tower or attachments during 2nd stage			95th = 4.35E-5
Note: Prince Kalia LAS calculation.			
LAS-LAS-FTF-TOWER-L	**1.00E-05**	per demand	Constrained non-informative
Stuctural tower or attachments during launch			95th = 4.35E-5
Note: Prince Kalia LAS calculation.			
LAS-LAS-FTF-TOWER-O	**1.00E-05**	per demand	Constrained non-informative
Stuctural tower or attachments during LEO insertion			95th = 4.35E-5
Note: Prince Kalia LAS calculation.			
LAS-MOTR-FTF-IGNIT-1	**1.00E-06**	per demand	Constrained non-informative
Motor ignition (non-ignition train) during 1st stage			95th = 4.35E-6
Note: Prince Kalia LAS calculation.			
LAS-MOTR-FTF-IGNIT-2	**1.00E-06**	per demand	Constrained non-informative
Motor ignition (non-ignition train) during 2nd stage			95th = 4.35E-6
Note: Prince Kalia LAS calculation.			
LAS-MOTR-FTF-IGNIT-L	**1.00E-06**	per demand	Constrained non-informative
Motor ignition (non-ignition train) during launch			95th = 4.35E-6
Note: Prince Kalia LAS calculation.			
LAS-MOTR-FTF-IGNIT-O	**1.00E-06**	per demand	Constrained non-informative
Motor ignition (non-ignition train) during LEO insertion			95th = 4.35E-6
Note: Prince Kalia LAS calculation.			
LAS-MOTR-FTF-LOWTHRST-1	**1.00E-06**	per demand	Constrained non-informative
Too low thrust to escape upset condition during 1st stage			95th = 4.35E-6

Note: Prince Kalia LAS calculation.			
LAS-MOTR-FTF-LOWTHRST-2 Too low thrust to escape upset condition during 2nd stage *Note:* Prince Kalia LAS calculation.	**1.00E-06**	per demand	Constrained non-informative 95th = 4.35E-6
LAS-MOTR-FTF-LOWTHRST-L Too low thrust to escape upset condition during launch *Note:* Prince Kalia LAS calculation.	**1.00E-06**	per demand	Constrained non-informative 95th = 4.35E-6
LAS-MOTR-FTF-LOWTHRST-O Too low thrust to escape upset condition during LEO insertion *Note:* Prince Kalia LAS calculation.	**1.00E-06**	per demand	Constrained non-informative 95th = 4.35E-6
LAS-MOTR-FTF-MISWIRE-1 Miswired motor during 1st stage *Note:* Prince Kalia LAS calculation.	**8.00E-05**	per demand	Constrained non-informative 95th = 3.48E-4
LAS-MOTR-FTF-MISWIRE-2 Miswired motor during 2nd stage *Note:* Prince Kalia LAS calculation.	**8.00E-05**	per demand	Constrained non-informative 95th = 3.48E-4
LAS-MOTR-FTF-MISWIRE-L Miswired motor during launch *Note:* Prince Kalia LAS calculation.	**8.00E-05**	per demand	Constrained non-informative 95th = 3.48E-4
LAS-MOTR-FTF-MISWIRE-O Miswired motor during LEO insertion *Note:* Prince Kalia LAS calculation.	**8.00E-05**	per demand	Constrained non-informative 95th = 3.48E-4
LAS-MOTR-FTF-STRUCT-1 Motor case or nozzle burn through or structural failure in first 2 sec during 1st stage *Note:* Prince Kalia LAS calculation.	**1.50E-05**	per demand	Constrained non-informative 95th = 6.52E-5
LAS-MOTR-FTF-STRUCT-2 Motor case or nozzle burn through or structural failure in first 2 sec during 2nd stage *Note:* Prince Kalia LAS calculation.	**1.50E-05**	per demand	Constrained non-informative 95th = 6.52E-5
LAS-MOTR-FTF-STRUCT-L Motor case or nozzle burn through or structural failure in first 2 sec during launch *Note:* Prince Kalia LAS calculation.	**1.50E-05**	per demand	Constrained non-informative 95th = 6.52E-5
LAS-MOTR-FTF-STRUCT-O Motor case or nozzle burn through or structural failure in first 2 sec during LEO insertion *Note:* Prince Kalia LAS calculation.	**1.50E-05**	per demand	Constrained non-informative 95th = 6.52E-5
LAS-MOTR-FTF-THRUST-1 Motor ignites but fails to complete thrust profile during 1st stage *Note:* Prince Kalia LAS calculation.	**1.00E-08**	per demand	Constrained non-informative 95th = 4.35E-8
LAS-MOTR-FTF-THRUST-2 Motor ignites but fails to complete thrust profile during 2nd stage *Note:* Prince Kalia LAS calculation.	**1.00E-08**	per demand	Constrained non-informative 95th = 4.35E-8
LAS-MOTR-FTF-THRUST-L Motor ignites but fails to complete thrust profile during launch *Note:* Prince Kalia LAS calculation.	**1.00E-08**	per demand	Constrained non-informative 95th = 4.35E-8
LAS-MOTR-FTF-THRUST-O	**1.00E-08**	per demand	Constrained non-informative

Motor ignites but fails to complete thrust profile during LEO insertion *Note:* Prince Kalia LAS calculation.			95th = 4.35E-8
LAS-MOTR-LEK-GAS-1 Hot gas leakage through inability to contain during 1st stage *Note:* Prince Kalia LAS calculation.	**1.20E-08**	per demand	Constrained non-informative 95th = 5.22E-8
LAS-MOTR-LEK-GAS-2 Hot gas leakage through inability to contain during 2nd stage *Note:* Prince Kalia LAS calculation.	**1.20E-08**	per demand	Constrained non-informative 95th = 5.22E-8
LAS-MOTR-LEK-GAS-L Hot gas leakage through inability to contain during launch *Note:* Prince Kalia LAS calculation.	**1.20E-08**	per demand	Constrained non-informative 95th = 5.22E-8
LAS-MOTR-LEK-GAS-O Hot gas leakage through inability to contain during LEO insertion *Note:* Prince Kalia LAS calculation.	**1.20E-08**	per demand	Constrained non-informative 95th = 5.22E-8
LAS-NOZL-FTF-EXPRATIO-1 Nozzle failure resulting in loss of pressure or expansion ratio during 1st stage *Note:* Prince Kalia LAS calculation.	**2.30E-06**	per demand	Constrained non-informative 95th = 1.00E-5
LAS-NOZL-FTF-EXPRATIO-2 Nozzle failure resulting in loss of pressure or expansion ratio during 2nd stage *Note:* Prince Kalia LAS calculation.	**2.30E-06**	per demand	Constrained non-informative 95th = 1.00E-5
LAS-NOZL-FTF-EXPRATIO-L Nozzle failure resulting in loss of pressure or expansion ratio during launch *Note:* Prince Kalia LAS calculation.	**2.30E-06**	per demand	Constrained non-informative 95th = 1.00E-5
LAS-NOZL-FTF-EXPRATIO-O Nozzle failure resulting in loss of pressure or expansion ratio during LEO insertion *Note:* Prince Kalia LAS calculation.	**2.30E-06**	per demand	Constrained non-informative 95th = 1.00E-5
LAS-NOZL-FTF-NZLEAK-1 Nozzle internal joint leak during 1st stage *Note:* Prince Kalia LAS calculation.	**2.30E-06**	per demand	Constrained non-informative 95th = 1.00E-5
LAS-NOZL-FTF-NZLEAK-2 Nozzle internal joint leak during 2nd stage *Note:* Prince Kalia LAS calculation.	**2.30E-06**	per demand	Constrained non-informative 95th = 1.00E-5
LAS-NOZL-FTF-NZLEAK-L Nozzle internal joint leak during launch *Note:* Prince Kalia LAS calculation.	**2.30E-06**	per demand	Constrained non-informative 95th = 1.00E-5
LAS-NOZL-FTF-NZLEAK-O Nozzle internal joint leak during LEO insertion *Note:* Prince Kalia LAS calculation.	**2.30E-06**	per demand	Constrained non-informative 95th = 1.00E-5
LAS-NOZL-FTF-STRUCT-1 Nozzle structural failure resulting in asymmetric thrust during 1st stage *Note:* Prince Kalia LAS calculation.	**5.10E-07**	per demand	Constrained non-informative 95th = 2.22E-6
LAS-NOZL-FTF-STRUCT-2 Nozzle structural failure resulting in asymmetric thrust during	**5.10E-07**	per demand	Constrained non-informative 95th = 2.22E-6

2nd stage
Note: Prince Kalia LAS calculation.

LAS-NOZL-FTF-STRUCT-L	**5.10E-07**	per demand	Constrained non-informative 95th = 2.22E-6
Nozzle structural failure resulting in asymmetric thrust during launch *Note:* Prince Kalia LAS calculation.			
LAS-NOZL-FTF-STRUCT-O	**5.10E-07**	per demand	Constrained non-informative 95th = 2.22E-6
Nozzle structural failure resulting in asymmetric thrust during LEO insertion *Note:* Prince Kalia LAS calculation.			
LAS-NOZL-LEK-STRUCT-1	**1.20E-08**	per demand	Constrained non-informative 95th = 5.22E-8
Case or case component joint leak or burn through during 1st stage *Note:* Prince Kalia LAS calculation.			
LAS-NOZL-LEK-STRUCT-2	**1.20E-08**	per demand	Constrained non-informative 95th = 5.22E-8
Case or case component joint leak or burn through during 2nd stage *Note:* Prince Kalia LAS calculation.			
LAS-NOZL-LEK-STRUCT-L	**1.20E-08**	per demand	Constrained non-informative 95th = 5.22E-8
Case or case component joint leak or burn through during launch *Note:* Prince Kalia LAS calculation.			
LAS-NOZL-LEK-STRUCT-O	**1.20E-08**	per demand	Constrained non-informative 95th = 5.22E-8
Case or case component joint leak or burn through during LEO insertion *Note:* Prince Kalia LAS calculation.			
LAS-PROP-FTF-HIGHBURN-1	**1.00E-06**	per demand	Constrained non-informative 95th = 4.35E-6
Propellant burn rate too high (contamination) during 1st stage *Note:* Prince Kalia LAS calculation.			
LAS-PROP-FTF-HIGHBURN-2	**1.00E-06**	per demand	Constrained non-informative 95th = 4.35E-6
Propellant burn rate too high (contamination) during 2nd stage *Note:* Prince Kalia LAS calculation.			
LAS-PROP-FTF-HIGHBURN-L	**1.00E-06**	per demand	Constrained non-informative 95th = 4.35E-6
Propellant burn rate too high (contamination) during launch *Note:* Prince Kalia LAS calculation.			
LAS-PROP-FTF-HIGHBURN-O	**1.00E-06**	per demand	Constrained non-informative 95th = 4.35E-6
Propellant burn rate too high (contamination) during LEO insertion *Note:* Prince Kalia LAS calculation.			
LAS-PROP-FTF-LOWBURN-1	**1.00E-06**	per demand	Constrained non-informative 95th = 4.35E-6
Propellant energy or burn rate too low (contamination) during 1st stage *Note:* Prince Kalia LAS calculation.			
LAS-PROP-FTF-LOWBURN-2	**1.00E-06**	per demand	Constrained non-informative 95th = 4.35E-6
Propellant energy or burn rate too low (contamination) during 2nd stage *Note:* Prince Kalia LAS calculation.			
LAS-PROP-FTF-LOWBURN-L	**1.00E-06**	per demand	Constrained non-informative 95th = 4.35E-6
Propellant energy or burn rate too low (contamination) during launch			

Note: Prince Kalia LAS calculation.

LAS-PROP-FTF-LOWBURN-O	**1.00E-06**	per demand	Constrained non-informative 95th = 4.35E-6
Propellant energy or burn rate too low (contamination) during LEO insertion *Note:* Prince Kalia LAS calculation.			
LAS-PROP-FTF-STRUCT-1	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
Main propellant grain inhibitor or bond structural failure during 1st stage *Note:* Prince Kalia LAS calculation.			
LAS-PROP-FTF-STRUCT-2	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
Main propellant grain inhibitor or bond structural failure during 2nd stage *Note:* Prince Kalia LAS calculation.			
LAS-PROP-FTF-STRUCT-L	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
Main propellant grain inhibitor or bond structural failure during launch *Note:* Prince Kalia LAS calculation.			
LAS-PROP-FTF-STRUCT-O	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
Main propellant grain inhibitor or bond structural failure during LEO insertion *Note:* Prince Kalia LAS calculation.			
LAS-PYRO-FOD-MISFIRE-1	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
Pyro unit gets signal but fails to successfully fire during 1st stage *Note:* Prince Kalia LAS calculation.			
LAS-PYRO-FOD-MISFIRE-2	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
Pyro unit gets signal but fails to successfully fire during 2nd stage *Note:* Prince Kalia LAS calculation.			
LAS-PYRO-FOD-MISFIRE-L	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
Pyro unit gets signal but fails to successfully fire during launch *Note:* Prince Kalia LAS calculation.			
LAS-PYRO-FOD-MISFIRE-O	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
Pyro unit gets signal but fails to successfully fire during LEO insertion *Note:* Prince Kalia LAS calculation.			
LAS-SENS-FTF-MOTOR-1	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
Faulty motor sensor during 1st stage *Note:* Prince Kalia LAS calculation.			
LAS-SENS-FTF-MOTOR-2	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
Faulty motor sensor during 2nd stage *Note:* Prince Kalia LAS calculation.			
LAS-SENS-FTF-MOTOR-L	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
Faulty motor sensor during launch *Note:* Prince Kalia LAS calculation.			
LAS-SENS-FTF-MOTOR-O	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
Faulty motor sensor during LEO insertion *Note:* Prince Kalia LAS calculation.			
LAS-SENS-FTF-SIGNAL-1	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
Faulty signal sensor during 1st stage			

Note: Prince Kalia LAS calculation.			
LAS-SENS-FTF-SIGNAL-2 Faulty signal sensor during 2nd stage *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-SENS-FTF-SIGNAL-L Faulty signal sensor during launch *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-SENS-FTF-SIGNAL-O Faulty signal sensor during LEO insertion *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-SGNL-FTF-AUTOSIG-1 Signal auto initiated during 1st stage *Note:* Prince Kalia LAS calculation.	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
LAS-SGNL-FTF-AUTOSIG-2 Signal auto initiated during 2nd stage *Note:* Prince Kalia LAS calculation.	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
LAS-SGNL-FTF-AUTOSIG-L Signal auto initiated during launch *Note:* Prince Kalia LAS calculation.	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
LAS-SGNL-FTF-AUTOSIG-O Signal auto initiated during LEO insertion *Note:* Prince Kalia LAS calculation.	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
LAS-SGNL-FTF-DELAYSIG-1 Signal too late for successful abort during 1st stage *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-SGNL-FTF-DELAYSIG-2 Signal too late for successful abort during 2nd stage *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-SGNL-FTF-DELAYSIG-L Signal too late for successful abort during launch *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-SGNL-FTF-DELAYSIG-O Signal too late for successful abort during LEO insertion *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-SGNL-FTF-RANGE-1 Range safety signal initiated during 1st stage *Note:* Prince Kalia LAS calculation.	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
LAS-SGNL-FTF-RANGE-2 Range safety signal initiated during 2nd stage *Note:* Prince Kalia LAS calculation.	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
LAS-SGNL-FTF-RANGE-L Range safety signal initiated during launch *Note:* Prince Kalia LAS calculation.	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
LAS-SGNL-FTF-RANGE-O Range safety signal initiated during LEO insertion *Note:* Prince Kalia LAS calculation.	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
LAS-SGNL-INT-NOISE-1 Environmental or background (RF EMI and ESD) during 1st stage *Note:* Prince Kalia LAS calculation.	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5

LAS-SGNL-INT-NOISE-L	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
Environmental or background (RF EMI and ESD) during launch *Note:* Prince Kalia LAS calculation.			
LAS-SGNL-SPU-LIGHT-1	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
Lightening hit causes signal during 1st stage *Note:* Prince Kalia LAS calculation.			
LAS-SGNL-SPU-LIGHT-L	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
Lightening hit causes signal during launch *Note:* Prince Kalia LAS calculation.			
LAS-SHLD-FTF-SHIELD-1	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
Slag or hot debris causes shield melt through during 1st stage *Note:* Prince Kalia LAS calculation.			
LAS-SHLD-FTF-SHIELD-2	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
Slag or hot debris causes shield melt through during 2nd stage *Note:* Prince Kalia LAS calculation.			
LAS-SHLD-FTF-SHIELD-L	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
Slag or hot debris causes shield melt through during launch *Note:* Prince Kalia LAS calculation.			
LAS-SHLD-FTF-SHIELD-O	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
Slag or hot debris causes shield melt through during LEO insertion *Note:* Prince Kalia LAS calculation.			
LAS-SHLD-FTF-STRUCT-1	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
Structural shield failure exposes CM during 1st stage *Note:* Prince Kalia LAS calculation.			
LAS-SHLD-FTF-STRUCT-2	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
Structural shield failure exposes CM during 2nd stage *Note:* Prince Kalia LAS calculation.			
LAS-SHLD-FTF-STRUCT-L	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
Structural shield failure exposes CM during launch *Note:* Prince Kalia LAS calculation.			
LAS-SHLD-FTF-STRUCT-O	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
Structural shield failure exposes CM during LEO insertion *Note:* Prince Kalia LAS calculation.			
LAS-SHLD-FTF-THERMAL-1	**5.00E-05**	per demand	Constrained non-informative 95th = 2.17E-4
Insulation or TPS ablation causes shield thermal failure during 1st stage *Note:* Prince Kalia LAS calculation.			
LAS-SHLD-FTF-THERMAL-2	**5.00E-05**	per demand	Constrained non-informative 95th = 2.17E-4
Insulation or TPS ablation causes shield thermal failure during 2nd stage *Note:* Prince Kalia LAS calculation.			
LAS-SHLD-FTF-THERMAL-L	**5.00E-05**	per demand	Constrained non-informative 95th = 2.17E-4
Insulation or TPS ablation causes shield thermal failure during launch *Note:* Prince Kalia LAS calculation.			
LAS-SHLD-FTF-THERMAL-O	**5.00E-05**	per demand	Constrained non-informative 95th = 2.17E-4
Insulation or TPS ablation causes shield thermal failure during LEO insertion			

Note: Prince Kalia LAS calculation.			
LAS-SOFT-FTF-MOTOR-1 Faulty motor software during 1st stage *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-SOFT-FTF-MOTOR-2 Faulty motor software during 2nd stage *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-SOFT-FTF-MOTOR-L Faulty motor software during launch *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-SOFT-FTF-MOTOR-O Faulty motor software during LEO insertion *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-SOFT-FTF-SIGNAL-1 Faulty software processing the signal during 1st stage *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-SOFT-FTF-SIGNAL-2 Faulty software processing the signal during 2nd stage *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-SOFT-FTF-SIGNAL-L Faulty software processing the signal during launch *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-SOFT-FTF-SIGNAL-O Faulty software processing the signal during LEO insertion *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-VLGC-FTF-VOTING-1 Faulty assessment of sensor voting logic during 1st stage *Note:* Prince Kalia LAS calculation.	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
LAS-VLGC-FTF-VOTING-2 Faulty assessment of sensor voting logic during 2nd stage *Note:* Prince Kalia LAS calculation.	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
LAS-VLGC-FTF-VOTING-L Faulty assessment of sensor voting logic during launch *Note:* Prince Kalia LAS calculation.	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
LAS-VLGC-FTF-VOTING-O Faulty assessment of sensor voting logic during LEO insertion *Note:* Prince Kalia LAS calculation.	**1.00E-05**	per demand	Constrained non-informative 95th = 4.35E-5
LAS-WIRE-FTF-CONNEC-1 Faulty wiring or connection during 1st stage *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-WIRE-FTF-CONNEC-2 Faulty wiring or connection during 2nd stage *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-WIRE-FTF-CONNEC-L Faulty wiring or connection during launch *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-WIRE-FTF-CONNEC-O Faulty wiring or connection during LEO insertion *Note:* Prince Kalia LAS calculation.	**1.00E-04**	per demand	Constrained non-informative 95th = 4.35E-4
LAS-WIRE-FTF-TERM-1	**1.00E-06**	per demand	Constrained non-informative

Wiring continuity problem during termination during 1st stage *Note:* Prince Kalia LAS calculation.			95th = 4.35E-6
LAS-WIRE-FTF-TERM-2	**1.00E-06**	per demand	Constrained non-informative
Wiring continuity problem during termination during 2nd stage *Note:* Prince Kalia LAS calculation.			95th = 4.35E-6
LAS-WIRE-FTF-TERM-L	**1.00E-06**	per demand	Constrained non-informative
Wiring continuity problem during termination during launch *Note:* Prince Kalia LAS calculation.			95th = 4.35E-6
LAS-WIRE-FTF-TERM-O	**1.00E-06**	per demand	Constrained non-informative
Wiring continuity problem during termination during LEO insertion *Note:* Prince Kalia LAS calculation.			95th = 4.35E-6
LAS-WIRE-FTF-WIRING-1	**1.00E-04**	per demand	Constrained non-informative
Wire damaged due to handling of flight dynamics during 1st stage *Note:* Prince Kalia LAS calculation.			95th = 4.35E-4
LAS-WIRE-FTF-WIRING-2	**1.00E-04**	per demand	Constrained non-informative
Wire damaged due to handling of flight dynamics during 2nd stage *Note:* Prince Kalia LAS calculation.			95th = 4.35E-4
LAS-WIRE-FTF-WIRING-L	**1.00E-04**	per demand	Constrained non-informative
Wire damaged due to handling of flight dynamics during launch *Note:* Prince Kalia LAS calculation.			95th = 4.35E-4
LAS-WIRE-FTF-WIRING-O	**1.00E-04**	per demand	Constrained non-informative
Wire damaged due to handling of flight dynamics during LEO insertion *Note:* Prince Kalia LAS calculation.			95th = 4.35E-4
LAUNCH	**1.00E+00**		
T = 0.0 *Note:*			
LSAM-CRW-REC-05	**5.00E-01**	per demand	Constrained non-informative
Recovery actions by crew fail during lunar surface activities *Note:* Screening HRA value.			95th = 9.99E-1
LSAM-LSAM-FTO	**7.00E-02**	per demand	Beta(0.5, 6.5)
Lunar Surface Mission *Note:* NASA has had 6 successful lunar missions (LM) out of 6 trials. Assumption: No information known about probability of a failure during a LM prior to collecting the data on six trials. Use Jeffreys noninformative prior. Posterior: P(failure of LM) => beta(0.5, 6.5) E[failure of LM] = 0.5/7 = 0.07			95th = 2.61E-1
LSAM-STGE-ASC	**5.10E-03**	per demand	Constrained non-informative
LSAM Ascent Stage Ascent *Note:* The reliabilities of the propulsion events were taken from data provided by MSFC (from ESAS). Assumed to be an ascent burn of 351 seconds.			95th = 2.21E-2
LSAM-STGE-BRN-ASCENT	**1.00E-02**	per demand	Constrained non-informative
LSAM Ascent Stage Plane Change Burn *Note:* This event uses the Z-BRN template event. Probability value from ESAS study.			95th = 4.34E-2
LSAM-STGE-BRN-DESCENT	**1.00E-02**	per demand	Constrained non-informative
LSAM Descent Plane Change Burn *Note:* This event uses the Z-BRN template event. Probability value from ESAS study.			95th = 4.34E-2
LSAM-STGE-BRN-LUNARLAND	**1.00E-02**	per demand	Constrained non-informative
LSAM Powered Descent and Landing to the Lunar Surface *Note:* Probability value from ESAS study, assuming multiple burns to reach lunar surface.			95th = 4.34E-2

LSAM-STGE-INS **4.18E-03** per demand Constrained non-informative
LSAM Ascent Stage LLO Insertion 95th = 1.82E-2
Note: This event uses the Z-INS template event. Probability value from: ESAS (upper stage burn)

LSAM-STGE-SEP **1.00E-05** per demand Constrained non-informative
LSAM Ascent Stage Ignition Separation 95th = 4.35E-5
Note: This event uses the Z-SEP template event. Probability value from ESAS study.

SM-RCS-COURSE-P-3 **9.00E-04** per demand Constrained non-informative
SM RCS mid-course corrections (phase 3) 95th = 3.91E-3
Note: P(3 thrusters | one degree of freedom in one pod) => 3-of-4 = [4! / 3!(4-3)!] * P(3 fail | CCF) = 4 * 0.28 * P(one thruster fails) Shuttle data, Thruster, RCS fails, 8E-05/demand Assume at most 10 demands per phase. 10*8E-5 = 8E-4 /phase P(one thruster fails) = 8E-4 P(LOC | RCS) = 4 * 0.28 * 8E-4 = 9E-4

SM-RCS-COURSE-P-5 **9.00E-04** per demand Constrained non-informative
SM RCS station keeping (phase 5) 95th = 3.91E-3
Note: P(3 thrusters | one degree of freedom in one pod) => 3-of-4 = [4! / 3!(4-3)!] * P(3 fail | CCF) = 4 * 0.28 * P(one thruster fails) Shuttle data, Thruster, RCS fails, 8E-05/demand Assume at most 10 demands per phase. 10*8E-5 = 8E-4 /phase P(one thruster fails) = 8E-4 P(LOC | RCS) = 4 * 0.28 * 8E-4 = 9E-4

SM-RCS-COURSE-P-7 **9.00E-04** per demand Constrained non-informative
SM RCS mid-course corrections (phase 7) 95th = 3.91E-3
Note: P(3 thrusters | one degree of freedom in one pod) => 3-of-4 = [4! / 3!(4-3)!] * P(3 fail | CCF) = 4 * 0.28 * P(one thruster fails) Shuttle data, Thruster, RCS fails, 8E-05/demand Assume at most 10 demands per phase. 10*8E-5 = 8E-4 /phase P(one thruster fails) = 8E-4 P(LOC | RCS) = 4 * 0.28 * 8E-4 = 9E-4

SM-RCS-DOCK-P-2 **9.00E-04** per demand Constrained non-informative
SM RCS rendezvous and docking (phase 2) 95th = 3.91E-3
Note: P(3 thrusters | one degree of freedom in one pod) => 3-of-4 = [4! / 3!(4-3)!] * P(3 fail | CCF) = 4 * 0.28 * P(one thruster fails) Shuttle data, Thruster, RCS fails, 8E-05/demand Assume at most 10 demands per phase. 10*8E-5 = 8E-4 /phase P(one thruster fails) = 8E-4 P(LOC | RCS) = 4 * 0.28 * 8E-4 = 9E-4

SM-RCS-DOCK-P-6 **9.00E-04** per demand Constrained non-informative
SM RCS rendezvous and docking (phase 6) 95th = 3.91E-3
Note: P(3 thrusters | one degree of freedom in one pod) => 3-of-4 = [4! / 3!(4-3)!] * P(3 fail | CCF) = 4 * 0.28 * P(one thruster fails) Shuttle data, Thruster, RCS fails, 8E-05/demand Assume at most 10 demands per phase. 10*8E-5 = 8E-4 /phase P(one thruster fails) = 8E-4 P(LOC | RCS) = 4 * 0.28 * 8E-4 = 9E-4

SM-SRAY-FTF-CCF-P-1 **0.00E+00** No distribution
CEV SM EPS Power Generation SubSys Solar Array CCF (not used in phase 1) assigned to this event.
Note:

SM-SRAY-FTF-CCF-P-2 **1.59E-04** No distribution
CEV SM EPS Power Generation SubSys Solar Array CCF assigned to this event.
Note:

SM-SRAY-FTF-CCF-P-3 **8.01E-05** No distribution
CEV SM EPS Power Generation SubSys Solar Array CCF assigned to this event.
Note:

SM-SRAY-FTF-CCF-P-4 **3.69E-04** No distribution
CEV SM EPS Power Generation SubSys Solar Array CCF assigned to this event.
Note:

SM-SRAY-FTF-CCF-P-5 **3.74E-04** No distribution
CEV SM EPS Power Generation SubSys Solar Array CCF assigned to this event.
Note:

SM-SRAY-FTF-CCF-P-6 **1.17E-05** No distribution
CEV SM EPS Power Generation SubSys Solar Array CCF assigned to this event.
Note:

SM-SRAY-FTF-CCF-P-7 **2.37E-04** No distribution
CEV SM EPS Power Generation SubSys Solar Array CCF assigned to this event.

Note:			
SM-SRAY-FTF-CCF-P-8 CEV SM EPS Power Generation SubSys Solar Array CCF (not used in Phase 8)	**0.00E+00**		No distribution assigned to this event.
Note:			
SM-SRAY-FTF-SOLAR1-P-1 SM EPS Power Generation SubSys Solar Array 1 (not used in Phase 1)	**0.00E+00**	FALSE house	House events have no uncertainty.
Note:			
SM-SRAY-FTF-SOLAR1-P-2 SM EPS Power Generation SubSys Solar Array 1	**1.59E-03**	λ=2.20E-5/hr Time=72 hr	Constrained non-informative 95th = 6.91E-3
Note:			
SM-SRAY-FTF-SOLAR1-P-3 SM EPS Power Generation SubSys Solar Array 1	**8.01E-04**	λ=2.20E-5/hr Time=36 hr	Constrained non-informative 95th = 3.48E-3
Note:			
SM-SRAY-FTF-SOLAR1-P-4 SM EPS Power Generation SubSys Solar Array 1	**3.69E-03**	λ=2.20E-5/hr Time=168 hr	Constrained non-informative 95th = 1.60E-2
Note:			
SM-SRAY-FTF-SOLAR1-P-5 SM EPS Power Generation SubSys Solar Array 1	**3.74E-03**	λ=2.20E-5/hr Time=170 hr	Constrained non-informative 95th = 1.62E-2
Note:			
SM-SRAY-FTF-SOLAR1-P-6 SM EPS Power Generation SubSys Solar Array 1	**1.17E-04**	λ=2.20E-5/hr Time=5 hr	Constrained non-informative 95th = 5.07E-4
Note:			
SM-SRAY-FTF-SOLAR1-P-7 SM EPS Power Generation SubSys Solar Array 1	**2.37E-03**	λ=2.20E-5/hr Time=108 hr	Constrained non-informative 95th = 1.03E-2
Note:			
SM-SRAY-FTF-SOLAR1-P-8 SM EPS Power Generation SubSys Solar Array 1 (not used in Phase 8)	**0.00E+00**	FALSE house	House events have no uncertainty.
Note:			
SM-SRAY-FTF-SOLAR2-P-1 SM EPS Power Generation SubSys Solar Array 2 (not used in Phase 1)	**0.00E+00**	FALSE house	House events have no uncertainty.
Note:			
SM-SRAY-FTF-SOLAR2-P-2 SM EPS Power Generation SubSys Solar Array 2	**1.59E-03**	λ=2.20E-5/hr Time=72 hr	Constrained non-informative 95th = 6.91E-3
Note:			
SM-SRAY-FTF-SOLAR2-P-3 SM EPS Power Generation SubSys Solar Array 2	**8.01E-04**	λ=2.20E-5/hr Time=36 hr	Constrained non-informative 95th = 3.48E-3
Note:			
SM-SRAY-FTF-SOLAR2-P-4 SM EPS Power Generation SubSys Solar Array 2	**3.69E-03**	λ=2.20E-5/hr Time=168 hr	Constrained non-informative 95th = 1.60E-2
Note:			
SM-SRAY-FTF-SOLAR2-P-5 SM EPS Power Generation SubSys Solar Array 2	**3.74E-03**	λ=2.20E-5/hr Time=170 hr	Constrained non-informative 95th = 1.62E-2
Note:			
SM-SRAY-FTF-SOLAR2-P-6 SM EPS Power Generation SubSys Solar Array 2	**1.17E-04**	λ=2.20E-5/hr Time=5 hr	Constrained non-informative 95th = 5.07E-4
Note:			

SM-SRAY-FTF-SOLAR2-P-7 SM EPS Power Generation SubSys Solar Array 2 *Note:*	**2.37E-03**	λ=2.20E-5/hr Time=108 hr	Constrained non-informative 95th = 1.03E-2
SM-SRAY-FTF-SOLAR2-P-8 SM EPS Power Generation SubSys Solar Array 2 (not used in Phase 8) *Note:*	**0.00E+00**	FALSE house	House events have no uncertainty.
SM-TANK-FTF-N2-1-P-1 CEV ECLSS SM N2 Storage Tank 1 (Phase 1) *Note:*	**1.00E+00**	per demand	
SM-TANK-FTF-N2-2-P-1 CEV ECLSS SM N2 Storage Tank 2 (Phase 1) *Note:*	**1.00E+00**	per demand	
SM-TANK-FTF-O2-1-P-1 CEV ECLSS SM O2 Storage Tank 1 (Phase 1) *Note:* This event uses the Z--TBD template event.	**1.23E-02**	per demand	Constrained non-informative 95th = 5.35E-2
SM-TANK-FTF-O2-2-P-1 CEV ECLSS SM O2 Storage Tank 2 (Phase 1) *Note:*	**1.00E+00**	per demand	
STRC-BE-P-1 Structures fail (phase 1) *Note:* Allocation from Mark Bigler (3E-5 total) into 1/2 in phase 1 and 1/2 in phase 8.	**1.50E-05**	per demand	Constrained non-informative 95th = 6.52E-5
STRC-BE-P-8 Structures fail (phase 8) *Note:*	**1.50E-05**	per demand	Constrained non-informative 95th = 6.52E-5
SYS-PYRO-FTF-A-DROG Pyrotechnic device A fails (Drogue Parachute) *Note:* This event uses the Z-PYRO-FTF template event. Parachute container cover pyrotechnic (NSI * IGNITER * FAILS TO DETONATE) from STS PRA Basic Events Database 2.00E-05 per demand	**2.00E-05**	per demand	Constrained non-informative 95th = 8.70E-5
SYS-PYRO-FTF-A-LAS Pyrotechnic device A fails (LAS) *Note:* This event uses the Z-PYRO-FTF template event. Parachute container cover pyrotechnic (NSI * IGNITER * FAILS TO DETONATE) from STS PRA Basic Events Database 2.00E-05 per demand	**2.00E-05**	per demand	Constrained non-informative 95th = 8.70E-5
SYS-PYRO-FTF-A-MAIN Pyrotechnic device A fails (Main Parachute) *Note:* This event uses the Z-PYRO-FTF template event. Parachute container cover pyrotechnic (NSI * IGNITER * FAILS TO DETONATE) from STS PRA Basic Events Database 2.00E-05 per demand	**2.00E-05**	per demand	Constrained non-informative 95th = 8.70E-5
SYS-PYRO-FTF-A-TPS Pyrotechnic device A fails (TPS cover) *Note:* This event uses the Z-PYRO-FTF template event. Parachute container cover pyrotechnic (NSI * IGNITER * FAILS TO DETONATE) from STS PRA Basic Events Database 2.00E-05 per demand	**2.00E-05**	per demand	Constrained non-informative 95th = 8.70E-5
SYS-PYRO-FTF-A-UPBG Pyrotechnic device A fails (Uprighting Bag) *Note:* This event uses the Z-PYRO-FTF template event. Parachute container cover pyrotechnic (NSI * IGNITER * FAILS TO DETONATE) from STS PRA Basic Events Database 2.00E-05 per demand	**2.00E-05**	per demand	Constrained non-informative 95th = 8.70E-5
SYS-PYRO-FTF-B-DROG Pyrotechnic device B fails (Drogue Parachute) *Note:* This event uses the Z-PYRO-FTF template event. Parachute container cover pyrotechnic (NSI * IGNITER * FAILS TO DETONATE) from STS PRA Basic Events Database 2.00E-05 per demand	**2.00E-05**	per demand	Constrained non-informative 95th = 8.70E-5
SYS-PYRO-FTF-B-LAS Pyrotechnic device B fails (LAS)	**2.00E-05**	per demand	Constrained non-informative 95th = 8.70E-5

Note: This event uses the Z-PYRO-FTF template event. Parachute container cover pyrotechnic (NSI * IGNITER * FAILS TO DETONATE) from STS PRA Basic Events Database 2.00E-05 per demand

SYS-PYRO-FTF-B-MAIN | **2.00E-05** | per demand | Constrained non-informative
Pyrotechnic device B fails (Main Parachute) | 95th = 8.70E-5
Note: This event uses the Z-PYRO-FTF template event. Parachute container cover pyrotechnic (NSI * IGNITER * FAILS TO DETONATE) from STS PRA Basic Events Database 2.00E-05 per demand

SYS-PYRO-FTF-B-TPS | **2.00E-05** | per demand | Constrained non-informative
Pyrotechnic device B fails (TPS cover) | 95th = 8.70E-5
Note: This event uses the Z-PYRO-FTF template event. Parachute container cover pyrotechnic (NSI * IGNITER * FAILS TO DETONATE) from STS PRA Basic Events Database 2.00E-05 per demand

SYS-PYRO-FTF-B-UPBG | **2.00E-05** | per demand | Constrained non-informative
Pyrotechnic device B fails (Uprighting Bag) | 95th = 8.70E-5
Note: This event uses the Z-PYRO-FTF template event. Parachute container cover pyrotechnic (NSI * IGNITER * FAILS TO DETONATE) from STS PRA Basic Events Database 2.00E-05 per demand

SYS-PYRO-FTF-CCF-DROG | **2.00E-06** | No distribution
Pyrotechnic device CCF (Drogue Parachute) | assigned to this event.
Note:

SYS-PYRO-FTF-CCF-MAIN | **2.00E-06** | No distribution
Pyrotechnic device CCF (Main Parachute) | assigned to this event.
Note:

SYS-PYRO-FTF-CCF-UPBG | **2.00E-06** | No distribution
Pyrotechnic device CCF (Uprighting Bag) | assigned to this event.
Note:

Z--TBD | **1.23E-02** | per demand | Constrained non-informative
To be determined (placeholder for another template) | 95th = 5.35E-2
Note: This is a TEMPLATE event. It is used by:
SM-TANK-FTF-O2-1-P-1

Z-ASC | **5.00E-03** | per demand | Constrained non-informative
General Failure Mode -- Fail to Ascend | 95th = 2.17E-2
Note: This is a TEMPLATE event. It is used by Probability value from ESAS study.

Z-BETA | **1.00E-01** | per demand | Constrained non-informative
Generic Beta CCF Factor | 95th = 4.14E-1
Note: This is a TEMPLATE event.

Z-BIU-FOD | **1.00E-03** | per demand | Constrained non-informative
Bus interface unit fails to transmit signal on demand | 95th = 4.35E-3
Note: This is a TEMPLATE event. It is used by:
CM-AVCS-SIG-1-FIRING, CM-AVCS-SIG-2-FIRING, CM-BIU-FTF-1-P1, CM-BIU-FTF-1-P2, CM-BIU-FTF-1-P3, CM-BIU-FTF-1-P4, CM-BIU-FTF-1-P5, CM-BIU-FTF-1-P6, CM-BIU-FTF-1-P7, CM-BIU-FTF-1-P8, CM-BIU-FTF-2-P1, CM-BIU-FTF-2-P2, CM-BIU-FTF-2-P3, CM-BIU-FTF-2-P4, CM-BIU-FTF-2-P5, CM-BIU-FTF-2-P6, CM-BIU-FTF-2-P7, CM-BIU-FTF-2-P8, CM-BIU-FTF-3-P1, CM-BIU-FTF-3-P2, CM-BIU-FTF-3-P3, CM-BIU-FTF-3-P4, CM-BIU-FTF-3-P5, CM-BIU-FTF-3-P6, CM-BIU-FTF-3-P7, CM-BIU-FTF-3-P8 Screening value (should be less than AVCS train failure probability ~ 2e-3)

Z-BIU-FTF | **1.50E-06** | λ=1.50E-6/hr | Constrained non-informative
Bus interface unit fails to transmit signal | Time=1 hr | 95th = 6.52E-6
Note: This is a TEMPLATE event. It is used by:
CM-SENS-FTF-BIU-1-P1, CM-SENS-FTF-BIU-1-P2, CM-SENS-FTF-BIU-1-P3, CM-SENS-FTF-BIU-1-P4, CM-SENS-FTF-BIU-1-P5, CM-SENS-FTF-BIU-1-P6, CM-SENS-FTF-BIU-1-P7, CM-SENS-FTF-BIU-1-P8, CM-SENS-FTF-BIU-2-P1, CM-SENS-FTF-BIU-2-P2, CM-SENS-FTF-BIU-2-P3, CM-SENS-FTF-BIU-2-P4, CM-SENS-FTF-BIU-2-P5, CM-SENS-FTF-BIU-2-P6, CM-SENS-FTF-BIU-2-P7, CM-SENS-FTF-BIU-2-P8, CM-SENS-FTF-BIU-3-P1, CM-SENS-FTF-BIU-3-P2, CM-SENS-FTF-BIU-3-P3, CM-SENS-FTF-BIU-3-P4, CM-SENS-FTF-BIU-3-P5, CM-SENS-FTF-BIU-3-P6, CM-SENS-FTF-BIU-3-P7, CM-SENS-FTF-BIU-3-P8. RCS thruster valve BIU, computer electronic unit assy.

Z-BKR-FTC | **5.00E-04** | per demand | Constrained non-informative
Circuit breaker fails to close | 95th = 2.17E-3

Note: This is a TEMPLATE event. It is used by:
CM-AVCS-FTC-PYRO-A-BKR, CM-AVCS-FTC-PYRO-B-BKR, LAS-AVCS-FTC-PYRO-A-BKR, LAS-AVCS-FTC-PYRO-B-BKR EGG-SSRE-8875 Generic Component Failure Data Base...Eide et al 1990

Z-BRN	**1.00E-02**	per demand	Constrained non-informative
General Failure Mode -- Fail to Perform Correction Burn			95th = 4.34E-2

Note: This is a TEMPLATE event. It is used by:
CEV-LSAM-BRN-MIDCOURSE, CEV-TLI-BRN, CEV-TLI-BRN-MIDCOURSE, LSAM-STGE-BRN-ASCENT, LSAM-STGE-BRN-DESCENT. Probability value from ESAS study.

Z-COMM-FTF	**1.70E-05**	λ=1.70E-5/hr	Constrained non-informative
Communcations fails to function		Time=1 hr	95th = 7.39E-5

Note: This is a TEMPLATE event. It is used by:
CEV-LUNAR-COM-P-1, CEV-LUNAR-COM-P-2, CEV-LUNAR-COM-P-3, CEV-LUNAR-COM-P-4, CEV-LUNAR-COM-P-5, CEV-LUNAR-COM-P-6, CEV-LUNAR-COM-P-7, CEV-LUNAR-COM-P-8
S/L-band Low Gain Antenna + mount; S-band Antenna Amplifier; S-band Prox Ops Transceiver; S-band Prox Ops antenna + mount; S-band Antenna Amplifier; S-band Prox Ops Transceiver; S-Band Low Gain Antenna; S/Ka-band Antenna dual feed; Updated MADS Support Assy, S-Band Antenna (SASA) probability = 1.7E-05

Z-COMP-FTF	**2.40E-05**	per demand	Constrained non-informative
Critical control computer fails			95th = 1.04E-4

Note: This is a TEMPLATE event. It is used by:
CM-COMP-FTF-1-P1, CM-COMP-FTF-1-P2, CM-COMP-FTF-1-P3, CM-COMP-FTF-1-P4, CM-COMP-FTF-1-P5, CM-COMP-FTF-1-P6, CM-COMP-FTF-1-P7, CM-COMP-FTF-1-P8, CM-COMP-FTF-2-P1, CM-COMP-FTF-2-P2, CM-COMP-FTF-2-P3, CM-COMP-FTF-2-P4, CM-COMP-FTF-2-P5, CM-COMP-FTF-2-P6, CM-COMP-FTF-2-P7, CM-COMP-FTF-2-P8, CM-COMP-FTF-3-P1, CM-COMP-FTF-3-P2, CM-COMP-FTF-3-P3, CM-COMP-FTF-3-P4, CM-COMP-FTF-3-P5, CM-COMP-FTF-3-P6, CM-COMP-FTF-3-P7, CM-COMP-FTF-3-P8.

Z-COMP-FTF-HAND	**8.40E-05**	λ=7.00E-7/hr	Constrained non-informative
CEV Hand Controllers		Time=120 hr	95th = 3.65E-4

Note: This is a TEMPLATE event. failure rate, rotational=6.0E-07, part#830381-551; translational=7.19E-07, part#830382-551; updated MADS, M. Bay (8/27/02)

Z-COMP-FTF-NAV	**6.00E-05**	λ=6.00E-5/hr	Constrained non-informative
CEV Navigation Equipment (INS/GPS/Star Trackers)		Time=1 hr	95th = 2.61E-4

Note: This is a TEMPLATE event.
GPS reveiver=1.63E-05, part#34204010-002 (SIGI) GPS antenna=2.76E-05, SEG20100155-3, updated MADS, M. Bay (8/27/02) Star Tracker 1.45E-05 failure rate, part#51612-3004-1, updated MADS, M. Bay (8/27/02)

Z-COMP-FTF-RECDR	**2.00E-08**	λ=2.00E-8/hr	Constrained non-informative
CEV Flight Data Recorder Systems		Time=1 hr	95th = 8.70E-8

Note: This is a TEMPLATE event. Updated MADS, part 23TBD-COR High Rate Communications Outage Recorder (HCOR)

Z-COMP-FTF-VIDEO	**1.12E-03**	λ=9.30E-6/hr	Constrained non-informative
CEV Video Guidance Systems		Time=120 hr	95th = 4.85E-3

Note: This is a TEMPLATE event.

Z-CRW	**2.60E-03**	per demand	Constrained non-informative
General Failure Mode -- Fail to Recover Crew			95th = 1.13E-2

Note: This is a TEMPLATE event. It is used by:
CEV-LSAM-CRW-TRANSFER, CEV-LSAM-CRW-TRANSFER2 Probability value from ESAS study.

Z-DCTR-FTF-LIDAR	**2.40E-04**	λ=2.00E-6/hr	Constrained non-informative
CEV Laser Detection and Ranging (LIDAR) (Phase 1)		Time=120 hr	95th = 1.04E-3

Note: This is a TEMPLATE event.

Z-DISP-FTF-CONTROL	**9.30E-06**	λ=9.30E-6/hr	Constrained non-informative
CEV control panels and displays		Time=1 hr	95th = 4.04E-5

Note: This is a TEMPLATE event. Updated MADS , part 832281-502 , Color Flat Panel Display, RWS (CFPD) , Michael Bay

Z-DOC	**1.00E-02**	per demand	Constrained non-informative
General Failure Mode -- Fail to Dock			95th = 4.34E-2

Note: This is a TEMPLATE event. It is used by Probability value from ESAS study.

Z-DPL-PARA	**7.80E-03**	per demand	Beta(2.5, 317.5)
Parachute fails to Deploy			95th = 1.72E-2

Note: This is a TEMPLATE event. It is used by:
CEV-CMOD-PAR, CEV-PARA-DPL-1, CEV-PARA-DPL-2, CEV-PARA-DPL-3
From Bayesian update of Soyuz and Shuttle (SRD) parachute data. Soyuz had 1 failure (Soyuz 1) in 93 trials (through Soyuz TMA-6, Oct. 11, 2005) Shuttle had 1 failure (STS4 lost one SRB) in 2*113 trials. Total failure = 2, total trial = 319. Using Jeffreys noninformative prior yields: beta(2.5, 317.5)

Z-ENT	**2.60E-03**	per demand	Constrained non-informative
General Failure Mode -- Fail to Reenter			95th = 1.13E-2

Note: This is a TEMPLATE event. It is used by:
CEV-CMOD-ENT Probability value from ESAS study.

Z-EPWS-FTF-BATT	**7.79E-07**	λ=7.79E-7/hr	Constrained non-informative
Battery fails to function (per hour)		Time=1 hr	95th = 3.39E-6

Note: This is a TEMPLATE event. It is used by:
CM-EPWS-FTF-BATT1-P-1, CM-EPWS-FTF-BATT1-P-2, CM-EPWS-FTF-BATT1-P-3, CM-EPWS-FTF-BATT1-P-4, CM-EPWS-FTF-BATT1-P-5, CM-EPWS-FTF-BATT1-P-6, CM-EPWS-FTF-BATT1-P-7, CM-EPWS-FTF-BATT1-P-8, CM-EPWS-FTF-BATT2-P-1, CM-EPWS-FTF-BATT2-P-2, CM-EPWS-FTF-BATT2-P-3, CM-EPWS-FTF-BATT2-P-4, CM-EPWS-FTF-BATT2-P-5, CM-EPWS-FTF-BATT2-P-6, CM-EPWS-FTF-BATT2-P-7, CM-EPWS-FTF-BATT2-P-8, CM-EPWS-FTF-BATT3-P-1, CM-EPWS-FTF-BATT3-P-2, CM-EPWS-FTF-BATT3-P-3, CM-EPWS-FTF-BATT3-P-4, CM-EPWS-FTF-BATT3-P-5, CM-EPWS-FTF-BATT3-P-6, CM-EPWS-FTF-BATT3-P-7, CM-EPWS-FTF-BATT3-P-8
From ISS PRA

Z-EPWS-FTF-DIST	**3.00E-07**	λ=3.00E-7/hr	Constrained non-informative
Fails to energize device power supply bus		Time=1 hr	95th = 1.30E-6

Note: This is a TEMPLATE event. It is used by:
CM-EPWS-FTF-A-BUS, CM-EPWS-FTF-B-BUS, CM-EPWS-FTF-DIST-1-P-1, CM-EPWS-FTF-DIST-1-P-2, CM-EPWS-FTF-DIST-1-P-3, CM-EPWS-FTF-DIST-1-P-4, CM-EPWS-FTF-DIST-1-P-5, CM-EPWS-FTF-DIST-1-P-6, CM-EPWS-FTF-DIST-1-P-7, CM-EPWS-FTF-DIST-1-P-8, CM-EPWS-FTF-DIST-2-P-1, CM-EPWS-FTF-DIST-2-P-2, CM-EPWS-FTF-DIST-2-P-3, CM-EPWS-FTF-DIST-2-P-4, CM-EPWS-FTF-DIST-2-P-5, CM-EPWS-FTF-DIST-2-P-6, CM-EPWS-FTF-DIST-2-P-7, CM-EPWS-FTF-DIST-2-P-8, CM-EPWS-FTF-DIST-3-P-1, CM-EPWS-FTF-DIST-3-P-2, CM-EPWS-FTF-DIST-3-P-3, CM-EPWS-FTF-DIST-3-P-4, CM-EPWS-FTF-DIST-3-P-5, CM-EPWS-FTF-DIST-3-P-6, CM-EPWS-FTF-DIST-3-P-7, CM-EPWS-FTF-DIST-3-P-8
Shuttle PRA I2 EPS (bus short)

Z-FTC-BKR	**1.00E+00**	per demand
Fails to close breaker to electric bus		

Note: Note currently used.

Z-GAMMA	**5.00E-01**	per demand	Constrained non-informative
Generic Gamma CCF Factor			95th = 9.99E-1

Note: This is a TEMPLATE event.

Z-HCOL-FTF	**2.30E-06**	λ=2.30E-6/hr	Constrained non-informative
CEV ATCS CM Heat Collection Devices		Time=1 hr	95th = 1.00E-5

Note: This is a TEMPLATE event. It is used by:
ATCS-HCOL-FTF-1-P-1, ATCS-HCOL-FTF-1-P-2, ATCS-HCOL-FTF-1-P-3, ATCS-HCOL-FTF-1-P-4, ATCS-HCOL-FTF-1-P-5, ATCS-HCOL-FTF-1-P-6, ATCS-HCOL-FTF-1-P-7, ATCS-HCOL-FTF-1-P-8, ATCS-HCOL-FTF-2-P-1, ATCS-HCOL-FTF-2-P-2, ATCS-HCOL-FTF-2-P-3, ATCS-HCOL-FTF-2-P-4, ATCS-HCOL-FTF-2-P-5, ATCS-HCOL-FTF-2-P-6, ATCS-HCOL-FTF-2-P-7, ATCS-HCOL-FTF-2-P-8

Z-HSNK-FTF-EVAP	**3.00E-07**	λ=3.00E-7/hr	Constrained non-informative
CEV ATCS CM Evaporative Heat Sink		Time=1 hr	95th = 1.30E-6

Note: This is a TEMPLATE event. It is used by:
ATCS-HSNK-FTF-EVAP-P-1, ATCS-HSNK-FTF-EVAP-P-2, ATCS-HSNK-FTF-EVAP-P-3, ATCS-HSNK-FTF-EVAP-P-4, ATCS-HSNK-FTF-EVAP-P-5, ATCS-HSNK-FTF-EVAP-P-6, ATCS-HSNK-FTF-EVAP-P-7, ATCS-HSNK-FTF-EVAP-P-8 This event uses the , T, T, T, T, T, T, T, T template event.

Z-HTRN-FTF	**1.00E-09**	λ=1.00E-9/hr	Constrained non-informative
CEV ATCS CM Heat Transport Devices		Time=1 hr	95th = 4.35E-9

Note: This is a TEMPLATE event. It is used by:
ATCS-HTRN-FTF-1-P-1, ATCS-HTRN-FTF-1-P-2, ATCS-HTRN-FTF-1-P-3, ATCS-HTRN-FTF-1-P-4, ATCS-HTRN-FTF-1-P-5, ATCS-HTRN-FTF-1-P-6, ATCS-HTRN-FTF-1-P-7, ATCS-HTRN-FTF-1-P-8, ATCS-HTRN-FTF-2-P-1, ATCS-HTRN-FTF-2-P-2, ATCS-HTRN-FTF-2-P-3, ATCS-HTRN-FTF-2-P-4, ATCS-HTRN-FTF-2-P-5, ATCS-HTRN-FTF-2-P-6, ATCS-HTRN-FTF-2-P-7, ATCS-HTRN-FTF-2-P-8.

Z-IGN **1.00E-04** per demand Constrained non-informative

General Failure Mode -- Fail to Ignite 95th = 4.35E-4

Note: This is a TEMPLATE event. It is used by:
CALV-EDS-IGN, CLV-STG2-IGN
Probability value from: ROCKET MOTOR FAILS TO IGNITE (PYROTECHNIC) STS PRA Basic Events Database 1.00E-4 /d

Z-INS **4.18E-03** per demand Constrained non-informative

General Failure Mode -- Fail to Insert or Inject into Orbit 95th = 1.82E-2

Note: This is a TEMPLATE event. It is used by:
CALV-EDS-INS, CEV-LSAM-INS, CLV-CEV-INS, LSAM-STGE-INS
Probability value from: ESAS (upper stage burn)

Z-LCH **4.18E-03** per demand Constrained non-informative

General Failure Mode -- Fail to Launch 95th = 1.82E-2

Note: This is a TEMPLATE event. It is used by:
CALV-SRBS-LCH-5SSME, CLV-SRBS-LCH
Probability value from: ESAS (main stage burn)

Z-LND **2.60E-03** per demand Constrained non-informative

General Failure Mode -- Fail to Land 95th = 1.13E-2

Note: This is a TEMPLATE event. It is used by:
CEV-CMOD-LND Probability value from ESAS study.

Z-ORB **1.00E-02** per demand Constrained non-informative

General Failure Mode -- Fail to Loiter in Orbit 95th = 4.34E-2

Note: This is a TEMPLATE event. It is used by:
CALV-ESD-ORB-INLEO, CALV-LSAM-ORB-INLEO, CEV-CEV—ORB
Probability value from: ESAS (Coast)

Z-PYRO-FTF **2.00E-05** per demand Constrained non-informative

Pyrotechnic device fails 95th = 8.70E-5

Note: This is a TEMPLATE event. It is used by:
SYS-PYRO-FTF-A-DROG, SYS-PYRO-FTF-A-LAS, SYS-PYRO-FTF-A-MAIN, SYS-PYRO-FTF-A-TPS, SYS-PYRO-FTF-A-UPBG, SYS-PYRO-FTF-B-DROG, SYS-PYRO-FTF-B-LAS, SYS-PYRO-FTF-B-MAIN, SYS-PYRO-FTF-B-TPS, SYS-PYRO-FTF-B-UPBG
Parachute container cover pyrotechnic (NSI * IGNITER * FAILS TO DETONATE) from STS PRA Basic Events Database 2.00E-05 per demand

Z-RAD **1.10E-02** per demand Constrained non-informative

General Failure Mode -- Fail to Rendezvous and Dock 95th = 4.77E-2

Note: This is a TEMPLATE event. It is used by:
CEV-LSAM-RAD-ASCENT, CLV-CEV-RAD
Probability value from ESAS study.

Z-RDV **1.00E-03** per demand Constrained non-informative

General Failure Mode -- Fail to Rendezvous 95th = 4.35E-3

Note: This is a TEMPLATE event. It is used by Probability value from ESAS study.

Z-SENS-FTF-AVCS **1.60E-07** λ=1.60E-7/hr Constrained non-informative

Avionics train to sensor fails Time=1 hr 95th = 6.96E-7

Note: This is a TEMPLATE event. It is used by:
CM-SENS-FTF-AVCS-1-P1, CM-SENS-FTF-AVCS-1-P2, CM-SENS-FTF-AVCS-1-P3, CM-SENS-FTF-AVCS-1-P4, CM-SENS-FTF-AVCS-1-P5, CM-SENS-FTF-AVCS-1-P6, CM-SENS-FTF-AVCS-1-P7, CM-SENS-FTF-AVCS-1-P8, CM-SENS-FTF-AVCS-2-P1, CM-SENS-FTF-AVCS-2-P2, CM-SENS-FTF-AVCS-2-P3, CM-SENS-FTF-AVCS-2-P4, CM-SENS-FTF-AVCS-2-P5, CM-SENS-FTF-AVCS-2-P6, CM-SENS-FTF-AVCS-2-P7, CM-SENS-FTF-AVCS-2-P8, CM-SENS-FTF-AVCS-3-P1, CM-SENS-FTF-AVCS-3-P2, CM-SENS-FTF-AVCS-3-P3, CM-SENS-FTF-AVCS-3-P4, CM-SENS-FTF-AVCS-3-P5, CM-SENS-FTF-AVCS-3-P6, CM-SENS-FTF-AVCS-3-P7, CM-SENS-FTF-AVCS-3-P8.

Z-SEP **1.00E-05** per demand Constrained non-informative

General Failure Mode -- Fail to Separate 95th = 4.35E-5

Note: This is a TEMPLATE event. It is used by:
CALV-SRBS-SEP-5SSME, CALV-STG2-SEP, CEV-CEV--SEP-ISS, CEV-CMOD-SEP, CEV-EDS-SEP, CEV-LSAM-SEP, CEV-LSAM-SEP-ASCENTSTAG, CLV-LAS--SEP, CLV-STG1-SEP, CLV-STG2-SEP, LSAM-STGE-SEP

Probability value from ESAS study.

Z-SRAY-FTF-SOLAR	**2.20E-05**	λ=2.20E-5/hr Time=1 hr	Constrained non-informative 95th = 9.57E-5
CEV SM EPS Power Generation SubSys Solar Array 2 (Phase 1)			
Note: This is a TEMPLATE event. ISS PRA			
Z-STR-PARA	**0.00E+00**	FALSE house	House events have no uncertainty.
Parachute structures fail			
Note: This is a TEMPLATE event. It is used by: CEV-PARA-STR			
Z-TANK-FTF-COOLANT	**3.00E-07**	λ=3.00E-7/hr Time=1 hr	Constrained non-informative 95th = 1.30E-6
CEV ATCS CM Coolant Storage			
Note: This is a TEMPLATE event. It is used by: ATCS-TANK-FTF-CM-P-1, ATCS-TANK-FTF-CM-P-2, ATCS-TANK-FTF-CM-P-3, ATCS-TANK-FTF-CM-P-4, ATCS-TANK-FTF-CM-P-5, ATCS-TANK-FTF-CM-P-6, ATCS-TANK-FTF-CM-P-7, ATCS-TANK-FTF-CM-P-8.			
Z-THSR-FTF	**9.20E-03**	per demand	Constrained non-informative 95th = 3.99E-2
Reaction Control Syst (RCS) Thruster (X Y Z) Pod fails			
Note: This is a TEMPLATE event. Failure rate from: Rotational jets=5.0E-05, from Michael Bay (8/27/02) Thruster fails off = 9.2E-03 Thruster burnthru = 9.8E-06			

Appendix C Dominant Contributors (Detailed End State Cut Sets (Detailed) REPORT

Project: CEV-PRA-R0 Case : Current
Analysis: RANDOM Units: Per Demand

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
JUST_LOC_1	11.20	1.073E-005	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			CLV-CEV-RAD	CEV Rendezvous and Docking with EDS and LSAM fails	1.1E-002
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
	10.44	1.000E-005	LAUNCH	T = 0.0	1.0E+000
			CLV-LAS--SEP	LAS Jettison from CEV	1.0E-005
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
	4.25	4.076E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			CLV-CEV-INS	CEV Earth Orbit Insertion Fails	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
	4.25	4.076E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			CLV-SRBS-LCH	CLV (5-Segment SRB) Fails to Launch with CEV	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
	4.25	4.076E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			CLV-STG1-FTO	CLV First Stage Ascent Fails	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
	4.25	4.076E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			CLV-STG2-FTO	CLV Second Stage Ascent Fails	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
	2.30	2.200E-006	LAUNCH	T = 0.0	1.0E+000
			CLV-CEV-RAD	CEV Rendezvous and Docking with EDS and LSAM fails	1.1E-002
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
	2.18	2.090E-006	LAUNCH	T = 0.0	1.0E+000
			CLV-STG1-FTO	CLV First Stage Ascent Fails	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
			LAS-CLV-HPS-PRESS-1	Dynamic pressure too high during 1st stage	5.0E-004
	1.15	1.100E-006	LAUNCH	T = 0.0	1.0E+000
			CLV-CEV-RAD	CEV Rendezvous and Docking with EDS and LSAM fails	1.1E-002
			CM-AVCS-ENG-CCF-POWER	Avionics fails to enable device power supply Bus CCF (Main Parachute)	1.0E-004
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
	0.87	8.360E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-CEV-INS	CEV Earth Orbit Insertion Fails	4.2E-003
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
	0.87	8.360E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-SRBS-LCH	CLV (5-Segment SRB) Fails to Launch with CEV	4.2E-003
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
	0.87	8.360E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-STG1-FTO	CLV First Stage Ascent Fails	4.2E-003
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
	0.87	8.360E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-STG2-FTO	CLV Second Stage Ascent Fails	4.2E-003
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
	0.70	6.692E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			CLV-CEV-RAD	CEV Rendezvous and Docking with EDS and LSAM fails	1.1E-002
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
	0.70	6.692E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			CLV-CEV-RAD	CEV Rendezvous and Docking with EDS and LSAM fails	1.1E-002
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
	0.70	6.692E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			CLV-CEV-RAD	CEV Rendezvous and Docking with EDS and LSAM fails	1.1E-002
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
	0.57	5.500E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-CEV-RAD	CEV Rendezvous and Docking with EDS and LSAM fails	1.1E-002
			CM-AVCS-FTC-PYRO-CCF-BKR	Avionics fails to close breaker to Electric Bus CCF (Main Parachute)	5.0E-005
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-CEV-INS	CEV Earth Orbit Insertion Fails	4.2E-003
			CM-AVCS-ENG-CCF-POWER	Avionics fails to enable device power supply Bus CCF (Main Parachute)	1.0E-004
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-SRBS-LCH	CLV (5-Segment SRB) Fails to Launch with CEV	4.2E-003

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			CM-AVCS-ENG-CCF-POWER	Avionics fails to enable device power supply Bus CCF (Main Parachute)	1.0E-004
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-STG1-FTO	CLV First Stage Ascent Fails	4.2E-003
			CM-AVCS-ENG-CCF-POWER	Avionics fails to enable device power supply Bus CCF (Main Parachute)	1.0E-004
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-STG2-FTO	CLV Second Stage Ascent Fails	4.2E-003
			CM-AVCS-ENG-CCF-POWER	Avionics fails to enable device power supply Bus CCF (Main Parachute)	1.0E-004
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_1	No signal from Avionics System fails ATCS (phase 1)	1.0E-004
			CLV-CEV-INS	CEV Earth Orbit Insertion Fails	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_1	No signal from Avionics System fails ATCS (phase 1)	1.0E-004
			CLV-SRBS-LCH	CLV (5-Segment SRB) Fails to Launch with CEV	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_1	No signal from Avionics System fails ATCS (phase 1)	1.0E-004
			CLV-STG1-FTO	CLV First Stage Ascent Fails	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_1	No signal from Avionics System fails ATCS (phase 1)	1.0E-004
			CLV-STG2-FTO	CLV Second Stage Ascent Fails	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-CEV-INS	CEV Earth Orbit Insertion Fails	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
			LAS-CM-CTR-RCS-O	Loss of RCS control during LEO insertion	1.0E-004
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-CEV-INS	CEV Earth Orbit Insertion Fails	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
			LAS-CM-FTF-RCS-O	Loss of RCS control function during LEO insertion	1.0E-004
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-CEV-INS	CEV Earth Orbit Insertion Fails	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
			LAS-CM-FTF-RCSTHRUST-O	Inadequate RCS thrust during LEO insertion	1.0E-004
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-CEV-INS	CEV Earth Orbit Insertion Fails	4.2E-003

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
			LAS-CM-FTF-STRUCT-O	Structural loading failure during LEO insertion	1.0E-004
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-CEV-INS	CEV Earth Orbit Insertion Fails	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
			LAS-CM-FTF-THERMAL-O	Thermal failure from aero heating of LAS blast during LEO insertion	1.0E-004
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-CEV-INS	CEV Earth Orbit Insertion Fails	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
			LAS-COMP-FTF-COMP-O	Faulty computer hardware during LEO insertion	1.0E-004
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-CEV-INS	CEV Earth Orbit Insertion Fails	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
			LAS-CRCT-FTF-CONNEC-O	Loose corroded or otherwise faulty connection during LEO insertion	1.0E-004
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-CEV-INS	CEV Earth Orbit Insertion Fails	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
			LAS-CREW-CRW-DELAY-O	Crew delayed in initiating abort during LEO insertion	1.0E-004
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-CEV-INS	CEV Earth Orbit Insertion Fails	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
			LAS-PYRO-FOD-MISFIRE-O	Pyro unit gets signal but fails to successfully fire during LEO insertion	1.0E-004
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-CEV-INS	CEV Earth Orbit Insertion Fails	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
			LAS-SENS-FTF-MOTOR-O	Faulty motor sensor during LEO insertion	1.0E-004
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-CEV-INS	CEV Earth Orbit Insertion Fails	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
			LAS-SENS-FTF-SIGNAL-O	Faulty signal sensor during LEO insertion	1.0E-004
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-CEV-INS	CEV Earth Orbit Insertion Fails	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
			LAS-SGNL-FTF-DELAYSIG-O	Signal too late for successful abort during LEO insertion	1.0E-004
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-CEV-INS	CEV Earth Orbit Insertion Fails	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
			LAS-SOFT-FTF-MOTOR-O	Faulty motor software during LEO insertion	1.0E-004
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-CEV-INS	CEV Earth Orbit Insertion Fails	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			LAS-SOFT-FTF-SIGNAL-O	Faulty software processing the signal during LEO insertion	1.0E-004
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-CEV-INS	CEV Earth Orbit Insertion Fails	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
			LAS-WIRE-FTF-CONNEC-O	Faulty wiring or connection during LEO insertion	1.0E-004
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-CEV-INS	CEV Earth Orbit Insertion Fails	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
			LAS-WIRE-FTF-WIRING-O	Wire damaged due to handling of flight dynamics during LEO insertion	1.0E-004
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-SRBS-LCH	CLV (5-Segment SRB) Fails to Launch with CEV	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
			LAS-CLV-FTF-CEVVAC-L	Vacuum holds components together during separation during launch	1.0E-004
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-SRBS-LCH	CLV (5-Segment SRB) Fails to Launch with CEV	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
			LAS-CM-CTR-RCS-L	Loss of RCS control during launch	1.0E-004
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-SRBS-LCH	CLV (5-Segment SRB) Fails to Launch with CEV	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
			LAS-CM-FTF-RCS-L	Loss of RCS control function during launch	1.0E-004
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-SRBS-LCH	CLV (5-Segment SRB) Fails to Launch with CEV	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
			LAS-CM-FTF-RCSTHRUST-L	Inadequate RCS thrust during launch	1.0E-004
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-SRBS-LCH	CLV (5-Segment SRB) Fails to Launch with CEV	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
			LAS-CM-FTF-STRUCT-L	Structural loading failure during launch	1.0E-004
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-SRBS-LCH	CLV (5-Segment SRB) Fails to Launch with CEV	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
			LAS-CM-FTF-THERMAL-L	Thermal failure from aero heating of LAS blast during launch	1.0E-004
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-SRBS-LCH	CLV (5-Segment SRB) Fails to Launch with CEV	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
			LAS-COMP-FTF-COMP-L	Faulty computer hardware during launch	1.0E-004

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-SRBS-LCH	CLV (5-Segment SRB) Fails to Launch with CEV	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
			LAS-CRCT-FTF-CONNEC-L	Loose corroded or otherwise faulty connection during launch	1.0E-004
	0.44	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CLV-SRBS-LCH	CLV (5-Segment SRB) Fails to Launch with CEV	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
			LAS-CREW-CRW-DELAY-L	Crew delayed in initiating abort during launch	1.0E-004
		9.579E-005	= Total		
JUST_LOC_2	62.02	9.000E-004	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
			SM-RCS-DOCK-P-2	SM RCS rendezvous and docking (phase 2)	9.0E-004
	10.95	1.589E-004	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
			SM-SRAY-FTF-CCF-P-2	CEV SM EPS Power Generation SubSys Solar Array CCF	1.6E-004
	10.34	1.500E-004	LAUNCH	T = 0.0	1.0E+000
			CEV-CREW-SOLAREVENT-LOC	Lethal dose to the crew due to solar particle event	1.5E-004
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	6.89	1.000E-004	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_2	No signal from Avionics System fails ATCS (phase 2)	1.0E-004
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	2.55	3.700E-005	LAUNCH	T = 0.0	1.0E+000
			ECLS_TOP_P_2	ECLS fails to provide adequate habitat (phase 2)	3.7E-005
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	1.49	2.169E-005	LAUNCH	T = 0.0	1.0E+000
			ATCS-HSNK-FTF-EVAP-P-2	CEV ATCS CM Evaporative Heat Sink (phase 2)	2.2E-005
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	1.49	2.169E-005	LAUNCH	T = 0.0	1.0E+000
			ATCS-TANK-FTF-CM-P-2	CEV ATCS CM Coolant Storage (phase 2)	2.2E-005
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	1.15	1.663E-005	LAUNCH	T = 0.0	1.0E+000
			ATCS-HCOL-FTF-CCF-P-2	CEV ATCS CM heat collection devices CCF (phase 2)	1.7E-005
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.67	9.750E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			CEV-TLI-BRN	EDS, LSAM, and CEV TLI Burn for LLO fails	1.0E-002
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.67	9.750E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			CEV-TLI-BRN-	EDS, LSAM, and CEV TLI Mid-	1.0E-002

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			MIDCOURSE	course correction burn fails	
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.34	5.000E-006	LAUNCH	T = 0.0	1.0E+000
			ATCS_EPWS_BE_P_2	No power from electric power system fails ATCS (phase 2)	5.0E-006
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.34	5.000E-006	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
			EPWS_AVCS_BE_P_2	No signal from Avionics System fails EPS (phase 2)	5.0E-006
	0.19	2.816E-006	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-BATT-CCF-P-2	CEV CM EPS Battery CCF of 1, 2, and 3 (phase 2)	2.8E-006
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.14	2.000E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN	EDS, LSAM, and CEV TLI Burn for LLO fails	1.0E-002
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.14	2.000E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN-MIDCOURSE	EDS, LSAM, and CEV TLI Mid-course correction burn fails	1.0E-002
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.08	1.200E-006	LAUNCH	T = 0.0	1.0E+000
			CM-COMP-FTF-CCF-P2	CCF of all critical control computer (phase 2)	1.2E-006
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.07	1.085E-006	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-CCF-P-2	CEV CM EPS Power Distribution CCF of 1, 2, and 3 (phase 2)	1.1E-006
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.07	1.000E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN	EDS, LSAM, and CEV TLI Burn for LLO fails	1.0E-002
			CM-AVCS-ENG-CCF-POWER	Avionics fails to enable device power supply Bus CCF (Main Parachute)	1.0E-004
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.07	1.000E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN-MIDCOURSE	EDS, LSAM, and CEV TLI Mid-course correction burn fails	1.0E-002
			CM-AVCS-ENG-CCF-POWER	Avionics fails to enable device power supply Bus CCF (Main Parachute)	1.0E-004
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.04	6.084E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			CEV-TLI-BRN	EDS, LSAM, and CEV TLI Burn for LLO fails	1.0E-002

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.04	6.084E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			CEV-TLI-BRN-MIDCOURSE	EDS, LSAM, and CEV TLI Mid-course correction burn fails	1.0E-002
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.04	6.084E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			CEV-TLI-BRN	EDS, LSAM, and CEV TLI Burn for LLO fails	1.0E-002
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.04	6.084E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			CEV-TLI-BRN-MIDCOURSE	EDS, LSAM, and CEV TLI Mid-course correction burn fails	1.0E-002
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.04	6.084E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			CEV-TLI-BRN	EDS, LSAM, and CEV TLI Burn for LLO fails	1.0E-002
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.04	6.084E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			CEV-TLI-BRN-MIDCOURSE	EDS, LSAM, and CEV TLI Mid-course correction burn fails	1.0E-002
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.03	5.000E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN	EDS, LSAM, and CEV TLI Burn for LLO fails	1.0E-002
			CM-AVCS-FTC-PYRO-CCF-BKR	Avionics fails to close breaker to Electric Bus CCF (Main Parachute)	5.0E-005
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.03	5.000E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN-MIDCOURSE	EDS, LSAM, and CEV TLI Mid-course correction burn fails	1.0E-002
			CM-AVCS-FTC-PYRO-CCF-BKR	Avionics fails to close breaker to Electric Bus CCF (Main Parachute)	5.0E-005
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.00	4.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN	EDS, LSAM, and CEV TLI Burn	1.0E-002

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
				for LLO fails	
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.00	4.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN-MIDCOURSE	EDS, LSAM, and CEV TLI Mid-course correction burn fails	1.0E-002
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.00	2.765E-008	LAUNCH	T = 0.0	1.0E+000
			ATCS-HCOL-FTF-1-P-2	CEV ATCS CM Heat Collection Devices (Loop 1) (phase 2)	1.7E-004
			ATCS-HCOL-FTF-2-P-2	CEV ATCS CM Heat Collection Devices (Loop 2) (phase 2)	1.7E-004
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.00	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN	EDS, LSAM, and CEV TLI Burn for LLO fails	1.0E-002
			CM-AVCS-ENG-A-POWER	Avionics fails to enable device power supply Bus A (Main Parachute)	1.0E-003
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.00	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN	EDS, LSAM, and CEV TLI Burn for LLO fails	1.0E-002
			CM-AVCS-ENG-B-POWER	Avionics fails to enable device power supply Bus B (Main Parachute)	1.0E-003
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.00	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN	EDS, LSAM, and CEV TLI Burn for LLO fails	1.0E-002
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			CM-AVCS-SIG-2-FIRING	Avionics fails to provide firing signal train 2 (Main Parachute)	1.0E-003
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.00	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN	EDS, LSAM, and CEV TLI Burn for LLO fails	1.0E-002
			CM-AVCS-SIG-1-FIRING	Avionics fails to provide firing signal train 1 (Main Parachute)	1.0E-003
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.00	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN-MIDCOURSE	EDS, LSAM, and CEV TLI Mid-course correction burn fails	1.0E-002

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			CM-AVCS-ENG-A-POWER	Avionics fails to enable device power supply Bus A (Main Parachute)	1.0E-003
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.00	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN-MIDCOURSE	EDS, LSAM, and CEV TLI Mid-course correction burn fails	1.0E-002
			CM-AVCS-ENG-B-POWER	Avionics fails to enable device power supply Bus B (Main Parachute)	1.0E-003
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.00	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN-MIDCOURSE	EDS, LSAM, and CEV TLI Mid-course correction burn fails	1.0E-002
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			CM-AVCS-SIG-2-FIRING	Avionics fails to provide firing signal train 2 (Main Parachute)	1.0E-003
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.00	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN-MIDCOURSE	EDS, LSAM, and CEV TLI Mid-course correction burn fails	1.0E-002
			CM-AVCS-SIG-1-FIRING	Avionics fails to provide firing signal train 1 (Main Parachute)	1.0E-003
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.00	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN	EDS, LSAM, and CEV TLI Burn for LLO fails	1.0E-002
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
			SYS-PYRO-FTF-CCF-DROG	Pyrotechnic device CCF (Drogue Parachute)	2.0E-006
	0.00	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN	EDS, LSAM, and CEV TLI Burn for LLO fails	1.0E-002
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
			SYS-PYRO-FTF-CCF-MAIN	Pyrotechnic device CCF (Main Parachute)	2.0E-006
	0.00	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN-MIDCOURSE	EDS, LSAM, and CEV TLI Mid-course correction burn fails	1.0E-002
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
			SYS-PYRO-FTF-CCF-DROG	Pyrotechnic device CCF (Drogue Parachute)	2.0E-006
	0.00	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN-MIDCOURSE	EDS, LSAM, and CEV TLI Mid-course correction burn fails	1.0E-002
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
			SYS-PYRO-FTF-CCF-MAIN	Pyrotechnic device CCF (Main Parachute)	2.0E-006
	0.00	1.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN	EDS, LSAM, and CEV TLI Burn	1.0E-002

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
				for LLO fails	
			CM-AVCS-ENG-A-POWER	Avionics fails to enable device power supply Bus A (Main Parachute)	1.0E-003
			CM-AVCS-ENG-B-POWER	Avionics fails to enable device power supply Bus B (Main Parachute)	1.0E-003
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.00	1.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN	EDS, LSAM, and CEV TLI Burn for LLO fails	1.0E-002
			CM-AVCS-ENG-A-POWER	Avionics fails to enable device power supply Bus A (Main Parachute)	1.0E-003
			CM-AVCS-SIG-2-FIRING	Avionics fails to provide firing signal train 2 (Main Parachute)	1.0E-003
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.00	1.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN	EDS, LSAM, and CEV TLI Burn for LLO fails	1.0E-002
			CM-AVCS-ENG-B-POWER	Avionics fails to enable device power supply Bus B (Main Parachute)	1.0E-003
			CM-AVCS-SIG-1-FIRING	Avionics fails to provide firing signal train 1 (Main Parachute)	1.0E-003
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.00	1.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN	EDS, LSAM, and CEV TLI Burn for LLO fails	1.0E-002
			CM-AVCS-FTC-PYRO-A-BKR	Avionics fails to close breaker to Electric Bus A (Main Parachute)	5.0E-004
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.00	1.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN	EDS, LSAM, and CEV TLI Burn for LLO fails	1.0E-002
			CM-AVCS-FTC-PYRO-B-BKR	Avionics fails to close breaker to Electric Bus B (Main Parachute)	5.0E-004
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.00	1.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN	EDS, LSAM, and CEV TLI Burn for LLO fails	1.0E-002
			CM-AVCS-SIG-1-FIRING	Avionics fails to provide firing signal train 1 (Main Parachute)	1.0E-003
			CM-AVCS-SIG-2-FIRING	Avionics fails to provide firing signal train 2 (Main Parachute)	1.0E-003
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.00	1.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN-MIDCOURSE	EDS, LSAM, and CEV TLI Mid-course correction burn fails	1.0E-002
			CM-AVCS-ENG-A-POWER	Avionics fails to enable device power supply Bus A (Main Parachute)	1.0E-003
			CM-AVCS-ENG-B-	Avionics fails to enable device	1.0E-003

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			POWER	power supply Bus B (Main Parachute)	
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.00	1.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN-MIDCOURSE	EDS, LSAM, and CEV TLI Mid-course correction burn fails	1.0E-002
			CM-AVCS-ENG-A-POWER	Avionics fails to enable device power supply Bus A (Main Parachute)	1.0E-003
			CM-AVCS-SIG-2-FIRING	Avionics fails to provide firing signal train 2 (Main Parachute)	1.0E-003
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
		1.451E-003	= Total		
JUST_LOC_3	22.79	9.750E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-BRN-MIDCOURSE	LSAM and CEV Mid-course Correction Burn	1.0E-002
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	22.79	9.750E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-LLOBURN	LSAM and CEV Burn to Slow Near LLO	1.0E-002
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	9.53	4.076E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-INS	LSAM and CEV LLO Insertion Fails	4.2E-003
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	5.92	2.535E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-TRANSFER	Crew Transfers from the CEV to LSAM	2.6E-003
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	4.67	2.000E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-BRN-MIDCOURSE	LSAM and CEV Mid-course Correction Burn	1.0E-002
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	4.67	2.000E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-LLOBURN	LSAM and CEV Burn to Slow Near LLO	1.0E-002
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	2.34	1.000E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-BRN-MIDCOURSE	LSAM and CEV Mid-course Correction Burn	1.0E-002
			CM-AVCS-ENG-CCF-POWER	Avionics fails to enable device power supply Bus CCF (Main Parachute)	1.0E-004
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
	2.34	1.000E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-LLOBURN	LSAM and CEV Burn to Slow Near LLO	1.0E-002
			CM-AVCS-ENG-CCF-POWER	Avionics fails to enable device power supply Bus CCF (Main Parachute)	1.0E-004
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	2.05	8.775E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
			SM-RCS-COURSE-P-3	SM RCS mid-course corrections (phase 3)	9.0E-004
	1.95	8.360E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-INS	LSAM and CEV LLO Insertion Fails	4.2E-003
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	1.42	6.084E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-BRN-MIDCOURSE	LSAM and CEV Mid-course Correction Burn	1.0E-002
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	1.42	6.084E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-BRN-MIDCOURSE	LSAM and CEV Mid-course Correction Burn	1.0E-002
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	1.42	6.084E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-BRN-MIDCOURSE	LSAM and CEV Mid-course Correction Burn	1.0E-002
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	1.42	6.084E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-LLOBURN	LSAM and CEV Burn to Slow Near LLO	1.0E-002
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	1.42	6.084E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-LLOBURN	LSAM and CEV Burn to Slow Near LLO	1.0E-002
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during	7.8E-003

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
				Deployment	
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	1.42	6.084E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-LLOBURN	LSAM and CEV Burn to Slow Near LLO	1.0E-002
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	1.22	5.200E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-TRANSFER	Crew Transfers from the CEV to LSAM	2.6E-003
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	1.17	5.000E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-BRN-MIDCOURSE	LSAM and CEV Mid-course Correction Burn	1.0E-002
			CM-AVCS-FTC-PYRO-CCF-BKR	Avionics fails to close breaker to Electric Bus CCF (Main Parachute)	5.0E-005
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	1.17	5.000E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-LLOBURN	LSAM and CEV Burn to Slow Near LLO	1.0E-002
			CM-AVCS-FTC-PYRO-CCF-BKR	Avionics fails to close breaker to Electric Bus CCF (Main Parachute)	5.0E-005
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	0.98	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-INS	LSAM and CEV LLO Insertion Fails	4.2E-003
			CM-AVCS-ENG-CCF-POWER	Avionics fails to enable device power supply Bus CCF (Main Parachute)	1.0E-004
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	0.61	2.600E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-TRANSFER	Crew Transfers from the CEV to LSAM	2.6E-003
			CM-AVCS-ENG-CCF-POWER	Avionics fails to enable device power supply Bus CCF (Main Parachute)	1.0E-004
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	0.59	2.543E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-INS	LSAM and CEV LLO Insertion Fails	4.2E-003
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	0.59	2.543E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-INS	LSAM and CEV LLO Insertion Fails	4.2E-003
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	0.59	2.543E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-INS	LSAM and CEV LLO Insertion Fails	4.2E-003
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	0.49	2.090E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-INS	LSAM and CEV LLO Insertion Fails	4.2E-003
			CM-AVCS-FTC-PYRO-CCF-BKR	Avionics fails to close breaker to Electric Bus CCF (Main Parachute)	5.0E-005
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	0.42	1.800E-007	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
			SM-RCS-COURSE-P-3	SM RCS mid-course corrections (phase 3)	9.0E-004
	0.37	1.582E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-TRANSFER	Crew Transfers from the CEV to LSAM	2.6E-003
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	0.37	1.582E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-TRANSFER	Crew Transfers from the CEV to LSAM	2.6E-003
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	0.37	1.582E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-TRANSFER	Crew Transfers from the CEV to LSAM	2.6E-003
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	0.30	1.300E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-TRANSFER	Crew Transfers from the CEV to LSAM	2.6E-003
			CM-AVCS-FTC-PYRO-CCF-BKR	Avionics fails to close breaker to Electric Bus CCF (Main Parachute)	5.0E-005
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	0.23	9.750E-008	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_3	No signal from Avionics System	1.0E-004

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
				fails ATCS (phase 3)	
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	0.21	9.000E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-CCF-POWER	Avionics fails to enable device power supply Bus CCF (Main Parachute)	1.0E-004
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
			SM-RCS-COURSE-P-3	SM RCS mid-course corrections (phase 3)	9.0E-004
	0.18	7.805E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
			SM-SRAY-FTF-CCF-P-3	CEV SM EPS Power Generation SubSys Solar Array CCF	8.0E-005
	0.13	5.476E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
			SM-RCS-COURSE-P-3	SM RCS mid-course corrections (phase 3)	9.0E-004
	0.13	5.476E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
			SM-RCS-COURSE-P-3	SM RCS mid-course corrections (phase 3)	9.0E-004
	0.13	5.476E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
			SM-RCS-COURSE-P-3	SM RCS mid-course corrections (phase 3)	9.0E-004
	0.11	4.500E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-FTC-PYRO-CCF-BKR	Avionics fails to close breaker to Electric Bus CCF (Main Parachute)	5.0E-005
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
			SM-RCS-COURSE-P-3	SM RCS mid-course corrections (phase 3)	9.0E-004
	0.09	4.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-BRN-MIDCOURSE	LSAM and CEV Mid-course Correction Burn	1.0E-002
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	0.09	4.000E-008	LAUNCH	T = 0.0	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			CEV-LSAM-LLOBURN	LSAM and CEV Burn to Slow Near LLO	1.0E-002
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	0.05	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-BRN-MIDCOURSE	LSAM and CEV Mid-course Correction Burn	1.0E-002
			CM-AVCS-ENG-A-POWER	Avionics fails to enable device power supply Bus A (Main Parachute)	1.0E-003
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	0.05	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-BRN-MIDCOURSE	LSAM and CEV Mid-course Correction Burn	1.0E-002
			CM-AVCS-ENG-B-POWER	Avionics fails to enable device power supply Bus B (Main Parachute)	1.0E-003
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	0.05	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-BRN-MIDCOURSE	LSAM and CEV Mid-course Correction Burn	1.0E-002
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			CM-AVCS-SIG-2-FIRING	Avionics fails to provide firing signal train 2 (Main Parachute)	1.0E-003
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	0.05	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-BRN-MIDCOURSE	LSAM and CEV Mid-course Correction Burn	1.0E-002
			CM-AVCS-SIG-1-FIRING	Avionics fails to provide firing signal train 1 (Main Parachute)	1.0E-003
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	0.05	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-LLOBURN	LSAM and CEV Burn to Slow Near LLO	1.0E-002
			CM-AVCS-ENG-A-POWER	Avionics fails to enable device power supply Bus A (Main Parachute)	1.0E-003
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	0.05	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-LLOBURN	LSAM and CEV Burn to Slow Near LLO	1.0E-002
			CM-AVCS-ENG-B-POWER	Avionics fails to enable device power supply Bus B (Main Parachute)	1.0E-003
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	0.05	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-LLOBURN	LSAM and CEV Burn to Slow Near LLO	1.0E-002
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			CM-AVCS-SIG-2-FIRING	Avionics fails to provide firing signal train 2 (Main Parachute)	1.0E-003
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	0.05	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-LLOBURN	LSAM and CEV Burn to Slow Near LLO	1.0E-002
			CM-AVCS-SIG-1-FIRING	Avionics fails to provide firing signal train 1 (Main Parachute)	1.0E-003
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	0.05	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_3	No signal from Avionics System fails ATCS (phase 3)	1.0E-004
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	0.05	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-BRN-MIDCOURSE	LSAM and CEV Mid-course Correction Burn	1.0E-002
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
			SYS-PYRO-FTF-CCF-DROG	Pyrotechnic device CCF (Drogue Parachute)	2.0E-006
	0.05	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-BRN-MIDCOURSE	LSAM and CEV Mid-course Correction Burn	1.0E-002
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
			SYS-PYRO-FTF-CCF-MAIN	Pyrotechnic device CCF (Main Parachute)	2.0E-006
		4.279E-005	= Total		
JUST_LOC_4	94.11	5.000E-003	LAUNCH	T = 0.0	1.0E+000
			CEV-CEV--ORB	CEV fails to stay in LOI (coast)	1.0E-002
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	3.47	1.845E-004	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
			SM-SRAY-FTF-CCF-P-4	CEV SM EPS Power Generation SubSys Solar Array CCF	3.7E-004
	0.94	5.000E-005	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_4	No signal from Avionics System fails ATCS (phase 4)	1.0E-004
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.47	2.520E-005	LAUNCH	T = 0.0	1.0E+000
			ATCS-HSNK-FTF-EVAP-P-4	CEV ATCS CM Evaporative Heat Sink (phase 4)	5.0E-005

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.47	2.520E-005	LAUNCH	T = 0.0	1.0E+000
			ATCS-TANK-FTF-CM-P-4	CEV ATCS CM Coolant Storage (phase 4)	5.0E-005
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.36	1.932E-005	LAUNCH	T = 0.0	1.0E+000
			ATCS-HCOL-FTF-CCF-P-4	CEV ATCS CM heat collection devices CCF (phase 4)	3.9E-005
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.06	3.272E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-EPWS-BATT-CCF-P-4	CEV CM EPS Battery CCF of 1, 2, and 3 (phase 4)	6.5E-006
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.05	2.500E-006	LAUNCH	T = 0.0	1.0E+000
			ATCS_EPWS_BE_P_4	No power from electric power system fails ATCS (phase 4)	5.0E-006
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.05	2.500E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
			EPWS_AVCS_BE_P_4	No signal from Avionics System fails EPS (phase 4)	5.0E-006
	0.02	1.260E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-EPWS-FTF-CCF-P-4	CEV CM EPS Power Distribution CCF of 1, 2, and 3 (phase 4)	2.5E-006
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.01	6.000E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-COMP-FTF-CCF-P4	CCF of all critical control computer (phase 4)	1.2E-006
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	7.462E-008	LAUNCH	T = 0.0	1.0E+000
			ATCS-HCOL-FTF-1-P-4	CEV ATCS CM Heat Collection Devices (Loop 1) (phase 4)	3.9E-004
			ATCS-HCOL-FTF-2-P-4	CEV ATCS CM Heat Collection Devices (Loop 2) (phase 4)	3.9E-004
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	8.400E-009	LAUNCH	T = 0.0	1.0E+000
			ATCS-HTRN-FTF-CCF-P-4	CEV ATCS CM heat transport devices CCF (phase 4)	1.7E-008

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	5.000E-010	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-1-P4	Bus interface unit 1 fails to transmit signal (phase 4)	1.0E-003
			CM-BIU-FTF-2-P4	Bus interface unit 2 fails to transmit signal (phase 4)	1.0E-003
			CM-BIU-FTF-3-P4	Bus interface unit 3 fails to transmit signal (phase 4)	1.0E-003
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	1.260E-010	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-1-P4	Bus interface unit 1 fails to transmit signal (phase 4)	1.0E-003
			CM-BIU-FTF-2-P4	Bus interface unit 2 fails to transmit signal (phase 4)	1.0E-003
			CM-SENS-FTF-BIU-3-P4	Sensor BIU 3 fails (phase 4)	2.5E-004
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	1.260E-010	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-1-P4	Bus interface unit 1 fails to transmit signal (phase 4)	1.0E-003
			CM-BIU-FTF-3-P4	Bus interface unit 3 fails to transmit signal (phase 4)	1.0E-003
			CM-SENS-FTF-BIU-2-P4	Sensor BIU 2 fails (phase 4)	2.5E-004
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	1.260E-010	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-2-P4	Bus interface unit 2 fails to transmit signal (phase 4)	1.0E-003
			CM-BIU-FTF-3-P4	Bus interface unit 3 fails to transmit signal (phase 4)	1.0E-003
			CM-SENS-FTF-BIU-1-P4	Sensor BIU 1 fails (phase 4)	2.5E-004
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	3.174E-011	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-1-P4	Bus interface unit 1 fails to transmit signal (phase 4)	1.0E-003
			CM-SENS-FTF-BIU-2-P4	Sensor BIU 2 fails (phase 4)	2.5E-004
			CM-SENS-FTF-BIU-3-P4	Sensor BIU 3 fails (phase 4)	2.5E-004
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	3.174E-011	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-2-P4	Bus interface unit 2 fails to transmit signal (phase 4)	1.0E-003

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			CM-SENS-FTF-BIU-1-P4	Sensor BIU 1 fails (phase 4)	2.5E-004
			CM-SENS-FTF-BIU-3-P4	Sensor BIU 3 fails (phase 4)	2.5E-004
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	3.174E-011	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-3-P4	Bus interface unit 3 fails to transmit signal (phase 4)	1.0E-003
			CM-SENS-FTF-BIU-1-P4	Sensor BIU 1 fails (phase 4)	2.5E-004
			CM-SENS-FTF-BIU-2-P4	Sensor BIU 2 fails (phase 4)	2.5E-004
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	2.520E-011	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-1-P4	Bus interface unit 1 fails to transmit signal (phase 4)	1.0E-003
			CM-BIU-FTF-2-P4	Bus interface unit 2 fails to transmit signal (phase 4)	1.0E-003
			CM-EPWS-FTF-DIST-3-P-4	CEV CM EPS Power Distribution Subsystem 3 (phase 4)	5.0E-005
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	2.520E-011	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-1-P4	Bus interface unit 1 fails to transmit signal (phase 4)	1.0E-003
			CM-BIU-FTF-3-P4	Bus interface unit 3 fails to transmit signal (phase 4)	1.0E-003
			CM-EPWS-FTF-DIST-2-P-4	CEV CM EPS Power Distribution Subsystem 2 (phase 4)	5.0E-005
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	2.520E-011	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-2-P4	Bus interface unit 2 fails to transmit signal (phase 4)	1.0E-003
			CM-BIU-FTF-3-P4	Bus interface unit 3 fails to transmit signal (phase 4)	1.0E-003
			CM-EPWS-FTF-DIST-1-P-4	CEV CM EPS Power Distribution Subsystem 1 (phase 4)	5.0E-005
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	1.344E-011	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-1-P4	Bus interface unit 1 fails to transmit signal (phase 4)	1.0E-003
			CM-BIU-FTF-2-P4	Bus interface unit 2 fails to transmit signal (phase 4)	1.0E-003
			CM-SENS-FTF-AVCS-3-P4	Avionics train 3 sensor fails (phase 4)	2.7E-005
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	1.344E-011	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			CM-BIU-FTF-1-P4	Bus interface unit 1 fails to transmit signal (phase 4)	1.0E-003
			CM-BIU-FTF-3-P4	Bus interface unit 3 fails to transmit signal (phase 4)	1.0E-003
			CM-SENS-FTF-AVCS-2-P4	Avionics train 2 sensor fails (phase 4)	2.7E-005
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	1.344E-011	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-2-P4	Bus interface unit 2 fails to transmit signal (phase 4)	1.0E-003
			CM-BIU-FTF-3-P4	Bus interface unit 3 fails to transmit signal (phase 4)	1.0E-003
			CM-SENS-FTF-AVCS-1-P4	Avionics train 1 sensor fails (phase 4)	2.7E-005
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	1.200E-011	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-1-P4	Bus interface unit 1 fails to transmit signal (phase 4)	1.0E-003
			CM-BIU-FTF-2-P4	Bus interface unit 2 fails to transmit signal (phase 4)	1.0E-003
			CM-COMP-FTF-3-P4	Critical control computer 3 fails (phase 4)	2.4E-005
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	1.200E-011	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-1-P4	Bus interface unit 1 fails to transmit signal (phase 4)	1.0E-003
			CM-BIU-FTF-3-P4	Bus interface unit 3 fails to transmit signal (phase 4)	1.0E-003
			CM-COMP-FTF-2-P4	Critical control computer 2 fails (phase 4)	2.4E-005
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	1.200E-011	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-2-P4	Bus interface unit 2 fails to transmit signal (phase 4)	1.0E-003
			CM-BIU-FTF-3-P4	Bus interface unit 3 fails to transmit signal (phase 4)	1.0E-003
			CM-COMP-FTF-1-P4	Critical control computer 1 fails (phase 4)	2.4E-005
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	7.999E-012	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-SENS-FTF-BIU-1-P4	Sensor BIU 1 fails (phase 4)	2.5E-004
			CM-SENS-FTF-BIU-2-P4	Sensor BIU 2 fails (phase 4)	2.5E-004
			CM-SENS-FTF-BIU-3-P4	Sensor BIU 3 fails (phase 4)	2.5E-004
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	6.349E-012	LAUNCH	T = 0.0	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-1-P4	Bus interface unit 1 fails to transmit signal (phase 4)	1.0E-003
			CM-EPWS-FTF-DIST-2-P-4	CEV CM EPS Power Distribution Subsystem 2 (phase 4)	5.0E-005
			CM-SENS-FTF-BIU-3-P4	Sensor BIU 3 fails (phase 4)	2.5E-004
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	6.349E-012	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-1-P4	Bus interface unit 1 fails to transmit signal (phase 4)	1.0E-003
			CM-EPWS-FTF-DIST-3-P-4	CEV CM EPS Power Distribution Subsystem 3 (phase 4)	5.0E-005
			CM-SENS-FTF-BIU-2-P4	Sensor BIU 2 fails (phase 4)	2.5E-004
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	6.349E-012	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-2-P4	Bus interface unit 2 fails to transmit signal (phase 4)	1.0E-003
			CM-EPWS-FTF-DIST-1-P-4	CEV CM EPS Power Distribution Subsystem 1 (phase 4)	5.0E-005
			CM-SENS-FTF-BIU-3-P4	Sensor BIU 3 fails (phase 4)	2.5E-004
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	6.349E-012	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-2-P4	Bus interface unit 2 fails to transmit signal (phase 4)	1.0E-003
			CM-EPWS-FTF-DIST-3-P-4	CEV CM EPS Power Distribution Subsystem 3 (phase 4)	5.0E-005
			CM-SENS-FTF-BIU-1-P4	Sensor BIU 1 fails (phase 4)	2.5E-004
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	6.349E-012	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-3-P4	Bus interface unit 3 fails to transmit signal (phase 4)	1.0E-003
			CM-EPWS-FTF-DIST-1-P-4	CEV CM EPS Power Distribution Subsystem 1 (phase 4)	5.0E-005
			CM-SENS-FTF-BIU-2-P4	Sensor BIU 2 fails (phase 4)	2.5E-004
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	6.349E-012	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-3-P4	Bus interface unit 3 fails to transmit signal (phase 4)	1.0E-003
			CM-EPWS-FTF-DIST-2-P-4	CEV CM EPS Power Distribution Subsystem 2 (phase 4)	5.0E-005
			CM-SENS-FTF-BIU-1-P4	Sensor BIU 1 fails (phase 4)	2.5E-004

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	3.386E-012	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-1-P4	Bus interface unit 1 fails to transmit signal (phase 4)	1.0E-003
			CM-SENS-FTF-AVCS-2-P4	Avionics train 2 sensor fails (phase 4)	2.7E-005
			CM-SENS-FTF-BIU-3-P4	Sensor BIU 3 fails (phase 4)	2.5E-004
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	3.386E-012	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-1-P4	Bus interface unit 1 fails to transmit signal (phase 4)	1.0E-003
			CM-SENS-FTF-AVCS-3-P4	Avionics train 3 sensor fails (phase 4)	2.7E-005
			CM-SENS-FTF-BIU-2-P4	Sensor BIU 2 fails (phase 4)	2.5E-004
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	3.386E-012	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-2-P4	Bus interface unit 2 fails to transmit signal (phase 4)	1.0E-003
			CM-SENS-FTF-AVCS-1-P4	Avionics train 1 sensor fails (phase 4)	2.7E-005
			CM-SENS-FTF-BIU-3-P4	Sensor BIU 3 fails (phase 4)	2.5E-004
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	3.386E-012	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-2-P4	Bus interface unit 2 fails to transmit signal (phase 4)	1.0E-003
			CM-SENS-FTF-AVCS-3-P4	Avionics train 3 sensor fails (phase 4)	2.7E-005
			CM-SENS-FTF-BIU-1-P4	Sensor BIU 1 fails (phase 4)	2.5E-004
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	3.386E-012	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-3-P4	Bus interface unit 3 fails to transmit signal (phase 4)	1.0E-003
			CM-SENS-FTF-AVCS-1-P4	Avionics train 1 sensor fails (phase 4)	2.7E-005
			CM-SENS-FTF-BIU-2-P4	Sensor BIU 2 fails (phase 4)	2.5E-004
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	3.386E-012	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-3-P4	Bus interface unit 3 fails to transmit signal (phase 4)	1.0E-003
			CM-SENS-FTF-AVCS-2-P4	Avionics train 2 sensor fails (phase 4)	2.7E-005

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			CM-SENS-FTF-BIU-1-P4	Sensor BIU 1 fails (phase 4)	2.5E-004
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	3.024E-012	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-1-P4	Bus interface unit 1 fails to transmit signal (phase 4)	1.0E-003
			CM-COMP-FTF-2-P4	Critical control computer 2 fails (phase 4)	2.4E-005
			CM-SENS-FTF-BIU-3-P4	Sensor BIU 3 fails (phase 4)	2.5E-004
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	3.024E-012	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-1-P4	Bus interface unit 1 fails to transmit signal (phase 4)	1.0E-003
			CM-COMP-FTF-3-P4	Critical control computer 3 fails (phase 4)	2.4E-005
			CM-SENS-FTF-BIU-2-P4	Sensor BIU 2 fails (phase 4)	2.5E-004
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	3.024E-012	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-2-P4	Bus interface unit 2 fails to transmit signal (phase 4)	1.0E-003
			CM-COMP-FTF-1-P4	Critical control computer 1 fails (phase 4)	2.4E-005
			CM-SENS-FTF-BIU-3-P4	Sensor BIU 3 fails (phase 4)	2.5E-004
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	3.024E-012	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-2-P4	Bus interface unit 2 fails to transmit signal (phase 4)	1.0E-003
			CM-COMP-FTF-3-P4	Critical control computer 3 fails (phase 4)	2.4E-005
			CM-SENS-FTF-BIU-1-P4	Sensor BIU 1 fails (phase 4)	2.5E-004
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	3.024E-012	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-3-P4	Bus interface unit 3 fails to transmit signal (phase 4)	1.0E-003
			CM-COMP-FTF-1-P4	Critical control computer 1 fails (phase 4)	2.4E-005
			CM-SENS-FTF-BIU-2-P4	Sensor BIU 2 fails (phase 4)	2.5E-004
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	3.024E-012	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-BIU-FTF-3-P4	Bus interface unit 3 fails to transmit signal (phase 4)	1.0E-003

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			CM-COMP-FTF-2-P4	Critical control computer 2 fails (phase 4)	2.4E-005
			CM-SENS-FTF-BIU-1-P4	Sensor BIU 1 fails (phase 4)	2.5E-004
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	1.600E-012	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-EPWS-FTF-DIST-1-P-4	CEV CM EPS Power Distribution Subsystem 1 (phase 4)	5.0E-005
			CM-SENS-FTF-BIU-2-P4	Sensor BIU 2 fails (phase 4)	2.5E-004
			CM-SENS-FTF-BIU-3-P4	Sensor BIU 3 fails (phase 4)	2.5E-004
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.00	1.600E-012	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-EPWS-FTF-DIST-2-P-4	CEV CM EPS Power Distribution Subsystem 2 (phase 4)	5.0E-005
			CM-SENS-FTF-BIU-1-P4	Sensor BIU 1 fails (phase 4)	2.5E-004
			CM-SENS-FTF-BIU-3-P4	Sensor BIU 3 fails (phase 4)	2.5E-004
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
		5.313E-003	= Total		
JUST_LOC_5	98.55	5.100E-003	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-STGE-ASC	LSAM Ascent Stage Ascent	5.1E-003
	0.66	3.413E-005	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-CRW-REC-05	Recovery actions by crew fail during lunar surface activities	5.0E-001
			LSAM-LSAM-FTO	Lunar Surface Mission	7.0E-002
	0.19	9.750E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-STGE-BRN-LUNARLAND	LSAM Powered Descent and Landing to the Lunar Surface	1.0E-002
	0.14	7.000E-006	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-CRW-REC-05	Recovery actions by crew fail during lunar surface activities	5.0E-001
			LSAM-LSAM-FTO	Lunar Surface Mission	7.0E-002
	0.08	4.076E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-STGE-INS	LSAM Ascent Stage LLO Insertion	4.2E-003
	0.07	3.500E-006	LAUNCH	T = 0.0	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			CM-AVCS-ENG-CCF-POWER	Avionics fails to enable device power supply Bus CCF (Main Parachute)	1.0E-004
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-CRW-REC-05	Recovery actions by crew fail during lunar surface activities	5.0E-001
			LSAM-LSAM-FTO	Lunar Surface Mission	7.0E-002
	0.04	2.129E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-CRW-REC-05	Recovery actions by crew fail during lunar surface activities	5.0E-001
			LSAM-LSAM-FTO	Lunar Surface Mission	7.0E-002
	0.04	2.129E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-CRW-REC-05	Recovery actions by crew fail during lunar surface activities	5.0E-001
			LSAM-LSAM-FTO	Lunar Surface Mission	7.0E-002
	0.04	2.129E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-CRW-REC-05	Recovery actions by crew fail during lunar surface activities	5.0E-001
			LSAM-LSAM-FTO	Lunar Surface Mission	7.0E-002
	0.04	2.000E-006	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-STGE-BRN-LUNARLAND	LSAM Powered Descent and Landing to the Lunar Surface	1.0E-002
	0.03	1.750E-006	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-FTC-PYRO-CCF-BKR	Avionics fails to close breaker to Electric Bus CCF (Main Parachute)	5.0E-005
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-CRW-REC-05	Recovery actions by crew fail during lunar surface activities	5.0E-001
			LSAM-LSAM-FTO	Lunar Surface Mission	7.0E-002
	0.02	1.000E-006	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-CCF-POWER	Avionics fails to enable device power supply Bus CCF (Main Parachute)	1.0E-004
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-STGE-BRN-LUNARLAND	LSAM Powered Descent and Landing to the Lunar Surface	1.0E-002
	0.02	8.360E-007	LAUNCH	T = 0.0	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-STGE-INS	LSAM Ascent Stage LLO Insertion	4.2E-003
	0.01	6.084E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-STGE-BRN-LUNARLAND	LSAM Powered Descent and Landing to the Lunar Surface	1.0E-002
	0.01	6.084E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-STGE-BRN-LUNARLAND	LSAM Powered Descent and Landing to the Lunar Surface	1.0E-002
	0.01	6.084E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-STGE-BRN-LUNARLAND	LSAM Powered Descent and Landing to the Lunar Surface	1.0E-002
	0.01	5.000E-007	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-FTC-PYRO-CCF-BKR	Avionics fails to close breaker to Electric Bus CCF (Main Parachute)	5.0E-005
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-STGE-BRN-LUNARLAND	LSAM Powered Descent and Landing to the Lunar Surface	1.0E-002
	0.01	4.180E-007	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-CCF-POWER	Avionics fails to enable device power supply Bus CCF (Main Parachute)	1.0E-004
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-STGE-INS	LSAM Ascent Stage LLO Insertion	4.2E-003
	0.00	2.543E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-STGE-INS	LSAM Ascent Stage LLO Insertion	4.2E-003
	0.00	2.543E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			LSAM-STGE-INS	LSAM Ascent Stage LLO Insertion	4.2E-003
	0.00	2.543E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-STGE-INS	LSAM Ascent Stage LLO Insertion	4.2E-003
	0.00	2.090E-007	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-FTC-PYRO-CCF-BKR	Avionics fails to close breaker to Electric Bus CCF (Main Parachute)	5.0E-005
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-STGE-INS	LSAM Ascent Stage LLO Insertion	4.2E-003
	0.00	1.400E-007	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-CRW-REC-05	Recovery actions by crew fail during lunar surface activities	5.0E-001
			LSAM-LSAM-FTO	Lunar Surface Mission	7.0E-002
	0.00	7.000E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-A-POWER	Avionics fails to enable device power supply Bus A (Main Parachute)	1.0E-003
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-CRW-REC-05	Recovery actions by crew fail during lunar surface activities	5.0E-001
			LSAM-LSAM-FTO	Lunar Surface Mission	7.0E-002
	0.00	7.000E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-B-POWER	Avionics fails to enable device power supply Bus B (Main Parachute)	1.0E-003
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-CRW-REC-05	Recovery actions by crew fail during lunar surface activities	5.0E-001
			LSAM-LSAM-FTO	Lunar Surface Mission	7.0E-002
	0.00	7.000E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			CM-AVCS-SIG-2-FIRING	Avionics fails to provide firing signal train 2 (Main Parachute)	1.0E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-CRW-REC-05	Recovery actions by crew fail during lunar surface activities	5.0E-001
			LSAM-LSAM-FTO	Lunar Surface Mission	7.0E-002
	0.00	7.000E-008	LAUNCH	T = 0.0	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			CM-AVCS-SIG-1-FIRING	Avionics fails to provide firing signal train 1 (Main Parachute)	1.0E-003
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-CRW-REC-05	Recovery actions by crew fail during lunar surface activities	5.0E-001
			LSAM-LSAM-FTO	Lunar Surface Mission	7.0E-002
	0.00	7.000E-008	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-CRW-REC-05	Recovery actions by crew fail during lunar surface activities	5.0E-001
			LSAM-LSAM-FTO	Lunar Surface Mission	7.0E-002
			SYS-PYRO-FTF-CCF-DROG	Pyrotechnic device CCF (Drogue Parachute)	2.0E-006
	0.00	7.000E-008	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-CRW-REC-05	Recovery actions by crew fail during lunar surface activities	5.0E-001
			LSAM-LSAM-FTO	Lunar Surface Mission	7.0E-002
			SYS-PYRO-FTF-CCF-MAIN	Pyrotechnic device CCF (Main Parachute)	2.0E-006
	0.00	4.000E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-STGE-BRN-LUNARLAND	LSAM Powered Descent and Landing to the Lunar Surface	1.0E-002
	0.00	3.500E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-A-POWER	Avionics fails to enable device power supply Bus A (Main Parachute)	1.0E-003
			CM-AVCS-ENG-B-POWER	Avionics fails to enable device power supply Bus B (Main Parachute)	1.0E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-CRW-REC-05	Recovery actions by crew fail during lunar surface activities	5.0E-001
			LSAM-LSAM-FTO	Lunar Surface Mission	7.0E-002
	0.00	3.500E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-A-POWER	Avionics fails to enable device power supply Bus A (Main Parachute)	1.0E-003
			CM-AVCS-SIG-2-FIRING	Avionics fails to provide firing signal train 2 (Main Parachute)	1.0E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-CRW-REC-05	Recovery actions by crew fail during lunar surface activities	5.0E-001
			LSAM-LSAM-FTO	Lunar Surface Mission	7.0E-002
	0.00	3.500E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-B-POWER	Avionics fails to enable device power supply Bus B (Main Parachute)	1.0E-003
			CM-AVCS-SIG-1-FIRING	Avionics fails to provide firing signal train 1 (Main Parachute)	1.0E-003

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-CRW-REC-05	Recovery actions by crew fail during lunar surface activities	5.0E-001
			LSAM-LSAM-FTO	Lunar Surface Mission	7.0E-002
	0.00	3.500E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-FTC-PYRO-A-BKR	Avionics fails to close breaker to Electric Bus A (Main Parachute)	5.0E-004
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-CRW-REC-05	Recovery actions by crew fail during lunar surface activities	5.0E-001
			LSAM-LSAM-FTO	Lunar Surface Mission	7.0E-002
	0.00	3.500E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-FTC-PYRO-B-BKR	Avionics fails to close breaker to Electric Bus B (Main Parachute)	5.0E-004
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-CRW-REC-05	Recovery actions by crew fail during lunar surface activities	5.0E-001
			LSAM-LSAM-FTO	Lunar Surface Mission	7.0E-002
	0.00	3.500E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-SIG-1-FIRING	Avionics fails to provide firing signal train 1 (Main Parachute)	1.0E-003
			CM-AVCS-SIG-2-FIRING	Avionics fails to provide firing signal train 2 (Main Parachute)	1.0E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-CRW-REC-05	Recovery actions by crew fail during lunar surface activities	5.0E-001
			LSAM-LSAM-FTO	Lunar Surface Mission	7.0E-002
	0.00	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-A-POWER	Avionics fails to enable device power supply Bus A (Main Parachute)	1.0E-003
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-STGE-BRN-LUNARLAND	LSAM Powered Descent and Landing to the Lunar Surface	1.0E-002
	0.00	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-B-POWER	Avionics fails to enable device power supply Bus B (Main Parachute)	1.0E-003
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-STGE-BRN-LUNARLAND	LSAM Powered Descent and Landing to the Lunar Surface	1.0E-002
	0.00	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			CM-AVCS-SIG-2-FIRING	Avionics fails to provide firing signal train 2 (Main Parachute)	1.0E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-STGE-BRN-LUNARLAND	LSAM Powered Descent and Landing to the Lunar Surface	1.0E-002

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
	0.00	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-SIG-1-FIRING	Avionics fails to provide firing signal train 1 (Main Parachute)	1.0E-003
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-STGE-BRN-LUNARLAND	LSAM Powered Descent and Landing to the Lunar Surface	1.0E-002
	0.00	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-STGE-BRN-LUNARLAND	LSAM Powered Descent and Landing to the Lunar Surface	1.0E-002
			SYS-PYRO-FTF-CCF-DROG	Pyrotechnic device CCF (Drogue Parachute)	2.0E-006
	0.00	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-STGE-BRN-LUNARLAND	LSAM Powered Descent and Landing to the Lunar Surface	1.0E-002
			SYS-PYRO-FTF-CCF-MAIN	Pyrotechnic device CCF (Main Parachute)	2.0E-006
	0.00	1.750E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-A-POWER	Avionics fails to enable device power supply Bus A (Main Parachute)	1.0E-003
			CM-AVCS-FTC-PYRO-B-BKR	Avionics fails to close breaker to Electric Bus B (Main Parachute)	5.0E-004
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-CRW-REC-05	Recovery actions by crew fail during lunar surface activities	5.0E-001
			LSAM-LSAM-FTO	Lunar Surface Mission	7.0E-002
	0.00	1.750E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-B-POWER	Avionics fails to enable device power supply Bus B (Main Parachute)	1.0E-003
			CM-AVCS-FTC-PYRO-A-BKR	Avionics fails to close breaker to Electric Bus A (Main Parachute)	5.0E-004
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-CRW-REC-05	Recovery actions by crew fail during lunar surface activities	5.0E-001
			LSAM-LSAM-FTO	Lunar Surface Mission	7.0E-002
	0.00	1.750E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-FTC-PYRO-A-BKR	Avionics fails to close breaker to Electric Bus A (Main Parachute)	5.0E-004
			CM-AVCS-SIG-2-FIRING	Avionics fails to provide firing signal train 2 (Main Parachute)	1.0E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-CRW-REC-05	Recovery actions by crew fail during lunar surface activities	5.0E-001
			LSAM-LSAM-FTO	Lunar Surface Mission	7.0E-002
	0.00	1.750E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-FTC-PYRO-B-BKR	Avionics fails to close breaker to Electric Bus B (Main Parachute)	5.0E-004
			CM-AVCS-SIG-1-FIRING	Avionics fails to provide firing signal train 1 (Main Parachute)	1.0E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-CRW-REC-05	Recovery actions by crew fail during lunar surface activities	5.0E-001

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			LSAM-LSAM-FTO	Lunar Surface Mission	7.0E-002
	0.00	1.672E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-STGE-INS	LSAM Ascent Stage LLO Insertion	4.2E-003
	0.00	1.000E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-A-POWER	Avionics fails to enable device power supply Bus A (Main Parachute)	1.0E-003
			CM-AVCS-ENG-B-POWER	Avionics fails to enable device power supply Bus B (Main Parachute)	1.0E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-STGE-BRN-LUNARLAND	LSAM Powered Descent and Landing to the Lunar Surface	1.0E-002
	0.00	1.000E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-A-POWER	Avionics fails to enable device power supply Bus A (Main Parachute)	1.0E-003
			CM-AVCS-SIG-2-FIRING	Avionics fails to provide firing signal train 2 (Main Parachute)	1.0E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-STGE-BRN-LUNARLAND	LSAM Powered Descent and Landing to the Lunar Surface	1.0E-002
	0.00	1.000E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-B-POWER	Avionics fails to enable device power supply Bus B (Main Parachute)	1.0E-003
			CM-AVCS-SIG-1-FIRING	Avionics fails to provide firing signal train 1 (Main Parachute)	1.0E-003
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-STGE-BRN-LUNARLAND	LSAM Powered Descent and Landing to the Lunar Surface	1.0E-002
		5.175E-003	= Total		
JUST_LOC_6	44.65	5.363E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-DOCK-REC	Recovery of Crew from LSAM/CEV Docking Problem	5.0E-001
			CEV-LSAM-RAD-ASCENT	LSAM Ascent Stage Fails to Rendezvous and Dock with CEV	1.1E-002
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	10.55	1.268E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-REC	Recovery of Crew from LSAM/CEV	5.0E-001
			CEV-LSAM-CRW-TRANSFER2	Crew fails to Transfers from LSAM Ascent Stage to CEV	2.6E-003
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	9.16	1.100E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-DOCK-REC	Recovery of Crew from LSAM/CEV Docking Problem	5.0E-001

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			CEV-LSAM-RAD-ASCENT	LSAM Ascent Stage Fails to Rendezvous and Dock with CEV	1.1E-002
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	7.31	8.775E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
			SM-RCS-DOCK-P-6	SM RCS rendezvous and docking (phase 6)	9.0E-004
	4.58	5.500E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-DOCK-REC	Recovery of Crew from LSAM/CEV Docking Problem	5.0E-001
			CEV-LSAM-RAD-ASCENT	LSAM Ascent Stage Fails to Rendezvous and Dock with CEV	1.1E-002
			CM-AVCS-ENG-CCF-POWER	Avionics fails to enable device power supply Bus CCF (Main Parachute)	1.0E-004
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	2.79	3.346E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-DOCK-REC	Recovery of Crew from LSAM/CEV Docking Problem	5.0E-001
			CEV-LSAM-RAD-ASCENT	LSAM Ascent Stage Fails to Rendezvous and Dock with CEV	1.1E-002
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	2.79	3.346E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-DOCK-REC	Recovery of Crew from LSAM/CEV Docking Problem	5.0E-001
			CEV-LSAM-RAD-ASCENT	LSAM Ascent Stage Fails to Rendezvous and Dock with CEV	1.1E-002
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	2.79	3.346E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-DOCK-REC	Recovery of Crew from LSAM/CEV Docking Problem	5.0E-001
			CEV-LSAM-RAD-ASCENT	LSAM Ascent Stage Fails to Rendezvous and Dock with CEV	1.1E-002
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	2.29	2.750E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-DOCK-REC	Recovery of Crew from LSAM/CEV Docking Problem	5.0E-001
			CEV-LSAM-RAD-ASCENT	LSAM Ascent Stage Fails to Rendezvous and Dock with CEV	1.1E-002
			CM-AVCS-FTC-PYRO-CCF-BKR	Avionics fails to close breaker to Electric Bus CCF (Main Parachute)	5.0E-005

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	2.16	2.600E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-REC	Recovery of Crew from LSAM/CEV	5.0E-001
			CEV-LSAM-CRW-TRANSFER2	Crew fails to Transfers from LSAM Ascent Stage to CEV	2.6E-003
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	1.50	1.800E-007	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
			SM-RCS-DOCK-P-6	SM RCS rendezvous and docking (phase 6)	9.0E-004
	1.08	1.300E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-REC	Recovery of Crew from LSAM/CEV	5.0E-001
			CEV-LSAM-CRW-TRANSFER2	Crew fails to Transfers from LSAM Ascent Stage to CEV	2.6E-003
			CM-AVCS-ENG-CCF-POWER	Avionics fails to enable device power supply Bus CCF (Main Parachute)	1.0E-004
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	0.81	9.750E-008	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_6	No signal from Avionics System fails ATCS (phase 6)	1.0E-004
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	0.75	9.000E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-CCF-POWER	Avionics fails to enable device power supply Bus CCF (Main Parachute)	1.0E-004
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
			SM-RCS-DOCK-P-6	SM RCS rendezvous and docking (phase 6)	9.0E-004
	0.66	7.909E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-REC	Recovery of Crew from LSAM/CEV	5.0E-001
			CEV-LSAM-CRW-TRANSFER2	Crew fails to Transfers from LSAM Ascent Stage to CEV	2.6E-003
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	0.66	7.909E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-REC	Recovery of Crew from LSAM/CEV	5.0E-001
			CEV-LSAM-CRW-TRANSFER2	Crew fails to Transfers from LSAM Ascent Stage to CEV	2.6E-003
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
	0.66	7.909E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-REC	Recovery of Crew from LSAM/CEV	5.0E-001
			CEV-LSAM-CRW-TRANSFER2	Crew fails to Transfers from LSAM Ascent Stage to CEV	2.6E-003
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	0.54	6.500E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-REC	Recovery of Crew from LSAM/CEV	5.0E-001
			CEV-LSAM-CRW-TRANSFER2	Crew fails to Transfers from LSAM Ascent Stage to CEV	2.6E-003
			CM-AVCS-FTC-PYRO-CCF-BKR	Avionics fails to close breaker to Electric Bus CCF (Main Parachute)	5.0E-005
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	0.46	5.476E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
			SM-RCS-DOCK-P-6	SM RCS rendezvous and docking (phase 6)	9.0E-004
	0.46	5.476E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
			SM-RCS-DOCK-P-6	SM RCS rendezvous and docking (phase 6)	9.0E-004
	0.46	5.476E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
			SM-RCS-DOCK-P-6	SM RCS rendezvous and docking (phase 6)	9.0E-004
	0.37	4.500E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-FTC-PYRO-CCF-BKR	Avionics fails to close breaker to Electric Bus CCF (Main Parachute)	5.0E-005
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
			SM-RCS-DOCK-P-6	SM RCS rendezvous and docking (phase 6)	9.0E-004
	0.18	2.200E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-DOCK-REC	Recovery of Crew from LSAM/CEV Docking Problem	5.0E-001
			CEV-LSAM-RAD-ASCENT	LSAM Ascent Stage Fails to Rendezvous and Dock with CEV	1.1E-002
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	0.17	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_6	No signal from Avionics System fails ATCS (phase 6)	1.0E-004
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	0.09	1.137E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
			SM-SRAY-FTF-CCF-P-6	CEV SM EPS Power Generation SubSys Solar Array CCF	1.2E-005
	0.09	1.100E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-DOCK-REC	Recovery of Crew from LSAM/CEV Docking Problem	5.0E-001
			CEV-LSAM-RAD-ASCENT	LSAM Ascent Stage Fails to Rendezvous and Dock with CEV	1.1E-002
			CM-AVCS-ENG-A-POWER	Avionics fails to enable device power supply Bus A (Main Parachute)	1.0E-003
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	0.09	1.100E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-DOCK-REC	Recovery of Crew from LSAM/CEV Docking Problem	5.0E-001
			CEV-LSAM-RAD-ASCENT	LSAM Ascent Stage Fails to Rendezvous and Dock with CEV	1.1E-002
			CM-AVCS-ENG-B-POWER	Avionics fails to enable device power supply Bus B (Main Parachute)	1.0E-003
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	0.09	1.100E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-DOCK-REC	Recovery of Crew from LSAM/CEV Docking Problem	5.0E-001
			CEV-LSAM-RAD-ASCENT	LSAM Ascent Stage Fails to Rendezvous and Dock with CEV	1.1E-002
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			CM-AVCS-SIG-2-FIRING	Avionics fails to provide firing signal train 2 (Main Parachute)	1.0E-003
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	0.09	1.100E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-DOCK-REC	Recovery of Crew from LSAM/CEV Docking Problem	5.0E-001
			CEV-LSAM-RAD-ASCENT	LSAM Ascent Stage Fails to Rendezvous and Dock with CEV	1.1E-002
			CM-AVCS-SIG-1-FIRING	Avionics fails to provide firing signal train 1 (Main Parachute)	1.0E-003
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
	0.09	1.100E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-DOCK-REC	Recovery of Crew from LSAM/CEV Docking Problem	5.0E-001
			CEV-LSAM-RAD-ASCENT	LSAM Ascent Stage Fails to Rendezvous and Dock with CEV	1.1E-002
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
			SYS-PYRO-FTF-CCF-DROG	Pyrotechnic device CCF (Drogue Parachute)	2.0E-006
	0.09	1.100E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-DOCK-REC	Recovery of Crew from LSAM/CEV Docking Problem	5.0E-001
			CEV-LSAM-RAD-ASCENT	LSAM Ascent Stage Fails to Rendezvous and Dock with CEV	1.1E-002
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
			SYS-PYRO-FTF-CCF-MAIN	Pyrotechnic device CCF (Main Parachute)	2.0E-006
	0.08	1.000E-008	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_6	No signal from Avionics System fails ATCS (phase 6)	1.0E-004
			CM-AVCS-ENG-CCF-POWER	Avionics fails to enable device power supply Bus CCF (Main Parachute)	1.0E-004
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	0.08	9.750E-009	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-SEP-ASCENTSTAG	CEV Separates from LSAM Ascent Stage	1.0E-005
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	0.05	6.084E-009	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_6	No signal from Avionics System fails ATCS (phase 6)	1.0E-004
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	0.05	6.084E-009	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_6	No signal from Avionics System fails ATCS (phase 6)	1.0E-004
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	0.05	6.084E-009	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_6	No signal from Avionics System fails ATCS (phase 6)	1.0E-004
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	0.05	5.500E-009	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-DOCK-REC	Recovery of Crew from LSAM/CEV Docking Problem	5.0E-001
			CEV-LSAM-RAD-	LSAM Ascent Stage Fails to	1.1E-002

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			ASCENT	Rendezvous and Dock with CEV	
			CM-AVCS-ENG-A-POWER	Avionics fails to enable device power supply Bus A (Main Parachute)	1.0E-003
			CM-AVCS-ENG-B-POWER	Avionics fails to enable device power supply Bus B (Main Parachute)	1.0E-003
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	0.05	5.500E-009	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-DOCK-REC	Recovery of Crew from LSAM/CEV Docking Problem	5.0E-001
			CEV-LSAM-RAD-ASCENT	LSAM Ascent Stage Fails to Rendezvous and Dock with CEV	1.1E-002
			CM-AVCS-ENG-A-POWER	Avionics fails to enable device power supply Bus A (Main Parachute)	1.0E-003
			CM-AVCS-SIG-2-FIRING	Avionics fails to provide firing signal train 2 (Main Parachute)	1.0E-003
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	0.05	5.500E-009	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-DOCK-REC	Recovery of Crew from LSAM/CEV Docking Problem	5.0E-001
			CEV-LSAM-RAD-ASCENT	LSAM Ascent Stage Fails to Rendezvous and Dock with CEV	1.1E-002
			CM-AVCS-ENG-B-POWER	Avionics fails to enable device power supply Bus B (Main Parachute)	1.0E-003
			CM-AVCS-SIG-1-FIRING	Avionics fails to provide firing signal train 1 (Main Parachute)	1.0E-003
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	0.05	5.500E-009	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-DOCK-REC	Recovery of Crew from LSAM/CEV Docking Problem	5.0E-001
			CEV-LSAM-RAD-ASCENT	LSAM Ascent Stage Fails to Rendezvous and Dock with CEV	1.1E-002
			CM-AVCS-FTC-PYRO-A-BKR	Avionics fails to close breaker to Electric Bus A (Main Parachute)	5.0E-004
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	0.05	5.500E-009	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-DOCK-REC	Recovery of Crew from LSAM/CEV Docking Problem	5.0E-001
			CEV-LSAM-RAD-ASCENT	LSAM Ascent Stage Fails to Rendezvous and Dock with CEV	1.1E-002
			CM-AVCS-FTC-PYRO-B-BKR	Avionics fails to close breaker to Electric Bus B (Main Parachute)	5.0E-004
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	0.05	5.500E-009	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-DOCK-REC	Recovery of Crew from LSAM/CEV Docking Problem	5.0E-001
			CEV-LSAM-RAD-ASCENT	LSAM Ascent Stage Fails to Rendezvous and Dock with CEV	1.1E-002
			CM-AVCS-SIG-1-FIRING	Avionics fails to provide firing signal train 1 (Main Parachute)	1.0E-003
			CM-AVCS-SIG-2-	Avionics fails to provide firing	1.0E-003

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			FIRING	signal train 2 (Main Parachute)	
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	0.04	5.200E-009	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-REC	Recovery of Crew from LSAM/CEV	5.0E-001
			CEV-LSAM-CRW-TRANSFER2	Crew fails to Transfers from LSAM Ascent Stage to CEV	2.6E-003
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	0.04	5.000E-009	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_6	No signal from Avionics System fails ATCS (phase 6)	1.0E-004
			CM-AVCS-FTC-PYRO-CCF-BKR	Avionics fails to close breaker to Electric Bus CCF (Main Parachute)	5.0E-005
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	0.04	4.875E-009	LAUNCH	T = 0.0	1.0E+000
			ATCS_EPWS_BE_P_6	No power from electric power system fails ATCS (phase 6)	5.0E-006
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	0.04	4.875E-009	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
			EPWS_AVCS_BE_P_6	No signal from Avionics System fails EPS (phase 6)	5.0E-006
	0.03	3.600E-009	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
			SM-RCS-DOCK-P-6	SM RCS rendezvous and docking (phase 6)	9.0E-004
	0.02	2.750E-009	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-DOCK-REC	Recovery of Crew from LSAM/CEV Docking Problem	5.0E-001
			CEV-LSAM-RAD-ASCENT	LSAM Ascent Stage Fails to Rendezvous and Dock with CEV	1.1E-002
			CM-AVCS-ENG-A-POWER	Avionics fails to enable device power supply Bus A (Main Parachute)	1.0E-003
			CM-AVCS-FTC-PYRO-B-BKR	Avionics fails to close breaker to Electric Bus B (Main Parachute)	5.0E-004
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	0.02	2.750E-009	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-DOCK-REC	Recovery of Crew from LSAM/CEV Docking Problem	5.0E-001
			CEV-LSAM-RAD-ASCENT	LSAM Ascent Stage Fails to Rendezvous and Dock with CEV	1.1E-002
			CM-AVCS-ENG-B-POWER	Avionics fails to enable device power supply Bus B (Main	1.0E-003

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
				Parachute)	
			CM-AVCS-FTC-PYRO-A-BKR	Avionics fails to close breaker to Electric Bus A (Main Parachute)	5.0E-004
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
	0.02	2.750E-009	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-DOCK-REC	Recovery of Crew from LSAM/CEV Docking Problem	5.0E-001
			CEV-LSAM-RAD-ASCENT	LSAM Ascent Stage Fails to Rendezvous and Dock with CEV	1.1E-002
			CM-AVCS-FTC-PYRO-A-BKR	Avionics fails to close breaker to Electric Bus A (Main Parachute)	5.0E-004
			CM-AVCS-SIG-2-FIRING	Avionics fails to provide firing signal train 2 (Main Parachute)	1.0E-003
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000
		1.201E-005	= Total		
JUST_LOC_7	27.26	1.658E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			CEV-STGE-BRN-MIDCOURSE	CEV (SM) mid-course correction burn fails	1.7E-003
			CM-RCS-REC-MIDCOURSE	Midcourse correction recovery using CM RCS	1.0E+000
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	14.43	8.775E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
			SM-RCS-COURSE-P-7	SM RCS mid-course corrections (phase 7)	9.0E-004
	13.79	8.385E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			CEV-STGE-BRN-TOEARTH	CEV (SM TEI) initial burn for Earth fails	8.6E-004
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	5.59	3.400E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-STGE-BRN-MIDCOURSE	CEV (SM) mid-course correction burn fails	1.7E-003
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			CM-RCS-REC-MIDCOURSE	Midcourse correction recovery using CM RCS	1.0E+000
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	3.80	2.314E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
			SM-SRAY-FTF-CCF-P-7	CEV SM EPS Power Generation SubSys Solar Array CCF	2.4E-004
	2.96	1.800E-007	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
			SM-RCS-COURSE-P-7	SM RCS mid-course corrections (phase 7)	9.0E-004
	2.83	1.720E-007	LAUNCH	T = 0.0	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			CEV-STGE-BRN-TOEARTH	CEV (SM TEI) initial burn for Earth fails	8.6E-004
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	2.80	1.700E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-STGE-BRN-MIDCOURSE	CEV (SM) mid-course correction burn fails	1.7E-003
			CM-AVCS-ENG-CCF-POWER	Avionics fails to enable device power supply Bus CCF (Main Parachute)	1.0E-004
			CM-RCS-REC-MIDCOURSE	Midcourse correction recovery using CM RCS	1.0E+000
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	1.70	1.034E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			CEV-STGE-BRN-MIDCOURSE	CEV (SM) mid-course correction burn fails	1.7E-003
			CM-RCS-REC-MIDCOURSE	Midcourse correction recovery using CM RCS	1.0E+000
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	1.70	1.034E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			CEV-STGE-BRN-MIDCOURSE	CEV (SM) mid-course correction burn fails	1.7E-003
			CM-RCS-REC-MIDCOURSE	Midcourse correction recovery using CM RCS	1.0E+000
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	1.70	1.034E-007	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			CEV-STGE-BRN-MIDCOURSE	CEV (SM) mid-course correction burn fails	1.7E-003
			CM-RCS-REC-MIDCOURSE	Midcourse correction recovery using CM RCS	1.0E+000
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	1.60	9.750E-008	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_7	No signal from Avionics System fails ATCS (phase 7)	1.0E-004
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	1.48	9.000E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-CCF-POWER	Avionics fails to enable device power supply Bus CCF (Main Parachute)	1.0E-004
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
			SM-RCS-COURSE-P-7	SM RCS mid-course corrections (phase 7)	9.0E-004

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
	1.41	8.600E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-STGE-BRN-TOEARTH	CEV (SM TEI) initial burn for Earth fails	8.6E-004
			CM-AVCS-ENG-CCF-POWER	Avionics fails to enable device power supply Bus CCF (Main Parachute)	1.0E-004
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	1.40	8.500E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-STGE-BRN-MIDCOURSE	CEV (SM) mid-course correction burn fails	1.7E-003
			CM-AVCS-FTC-PYRO-CCF-BKR	Avionics fails to close breaker to Electric Bus CCF (Main Parachute)	5.0E-005
			CM-RCS-REC-MIDCOURSE	Midcourse correction recovery using CM RCS	1.0E+000
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	0.90	5.476E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
			SM-RCS-COURSE-P-7	SM RCS mid-course corrections (phase 7)	9.0E-004
	0.90	5.476E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
			SM-RCS-COURSE-P-7	SM RCS mid-course corrections (phase 7)	9.0E-004
	0.90	5.476E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
			SM-RCS-COURSE-P-7	SM RCS mid-course corrections (phase 7)	9.0E-004
	0.90	5.460E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ECLS_TOP_P_7	ECLS fails to provide adequate habitat (phase 7)	5.6E-005
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	0.86	5.232E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			CEV-STGE-BRN-TOEARTH	CEV (SM TEI) initial burn for Earth fails	8.6E-004
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	0.86	5.232E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			CEV-STGE-BRN-TOEARTH	CEV (SM TEI) initial burn for Earth fails	8.6E-004
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	0.86	5.232E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			CEV-STGE-BRN-TOEARTH	CEV (SM TEI) initial burn for Earth fails	8.6E-004
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	0.78	4.746E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
			SM-SRAY-FTF-CCF-P-7	CEV SM EPS Power Generation SubSys Solar Array CCF	2.4E-004
	0.74	4.500E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-FTC-PYRO-CCF-BKR	Avionics fails to close breaker to Electric Bus CCF (Main Parachute)	5.0E-005
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
			SM-RCS-COURSE-P-7	SM RCS mid-course corrections (phase 7)	9.0E-004
	0.71	4.300E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-STGE-BRN-TOEARTH	CEV (SM TEI) initial burn for Earth fails	8.6E-004
			CM-AVCS-FTC-PYRO-CCF-BKR	Avionics fails to close breaker to Electric Bus CCF (Main Parachute)	5.0E-005
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	0.52	3.159E-008	LAUNCH	T = 0.0	1.0E+000
			ATCS-HSNK-FTF-EVAP-P-7	CEV ATCS CM Evaporative Heat Sink (phase 7)	3.2E-005
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	0.52	3.159E-008	LAUNCH	T = 0.0	1.0E+000
			ATCS-TANK-FTF-CM-P-7	CEV ATCS CM Coolant Storage (phase 7)	3.2E-005
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	0.40	2.422E-008	LAUNCH	T = 0.0	1.0E+000
			ATCS-HCOL-FTF-CCF-P-7	CEV ATCS CM heat collection devices CCF (phase 7)	2.5E-005
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	0.39	2.373E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-CCF-POWER	Avionics fails to enable device power supply Bus CCF (Main Parachute)	1.0E-004
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			SM-SRAY-FTF-CCF-P-7	CEV SM EPS Power Generation SubSys Solar Array CCF	2.4E-004
	0.33	2.000E-008	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_7	No signal from Avionics System fails ATCS (phase 7)	1.0E-004
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	0.24	1.444E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
			SM-SRAY-FTF-CCF-P-7	CEV SM EPS Power Generation SubSys Solar Array CCF	2.4E-004
	0.24	1.444E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
			SM-SRAY-FTF-CCF-P-7	CEV SM EPS Power Generation SubSys Solar Array CCF	2.4E-004
	0.24	1.444E-008	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
			SM-SRAY-FTF-CCF-P-7	CEV SM EPS Power Generation SubSys Solar Array CCF	2.4E-004
	0.20	1.187E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-FTC-PYRO-CCF-BKR	Avionics fails to close breaker to Electric Bus CCF (Main Parachute)	5.0E-005
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
			SM-SRAY-FTF-CCF-P-7	CEV SM EPS Power Generation SubSys Solar Array CCF	2.4E-004
	0.18	1.120E-008	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ECLS_TOP_P_7	ECLS fails to provide adequate habitat (phase 7)	5.6E-005
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	0.16	1.000E-008	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_7	No signal from Avionics System fails ATCS (phase 7)	1.0E-004
			CM-AVCS-ENG-CCF-POWER	Avionics fails to enable device power supply Bus CCF (Main Parachute)	1.0E-004
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	0.16	9.750E-009	LAUNCH	T = 0.0	1.0E+000
			CEV-CMOD-SEP	CM Separates and Maneuvers away from SM	1.0E-005
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	0.11	6.800E-009	LAUNCH	T = 0.0	1.0E+000
			CEV-STGE-BRN-MIDCOURSE	CEV (SM) mid-course correction burn fails	1.7E-003
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			CM-RCS-REC-MIDCOURSE	Midcourse correction recovery using CM RCS	1.0E+000
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	0.11	6.480E-009	LAUNCH	T = 0.0	1.0E+000
			ATCS-HSNK-FTF-EVAP-P-7	CEV ATCS CM Evaporative Heat Sink (phase 7)	3.2E-005
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	0.11	6.480E-009	LAUNCH	T = 0.0	1.0E+000
			ATCS-TANK-FTF-CM-P-7	CEV ATCS CM Coolant Storage (phase 7)	3.2E-005
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	0.10	6.084E-009	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_7	No signal from Avionics System fails ATCS (phase 7)	1.0E-004
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	0.10	6.084E-009	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_7	No signal from Avionics System fails ATCS (phase 7)	1.0E-004
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	0.10	6.084E-009	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_7	No signal from Avionics System fails ATCS (phase 7)	1.0E-004
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	0.09	5.600E-009	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-CCF-POWER	Avionics fails to enable device power supply Bus CCF (Main Parachute)	1.0E-004
			ECLS_TOP_P_7	ECLS fails to provide adequate habitat (phase 7)	5.6E-005
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	0.08	5.000E-009	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_7	No signal from Avionics System fails ATCS (phase 7)	1.0E-004

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			CM-AVCS-FTC-PYRO-CCF-BKR	Avionics fails to close breaker to Electric Bus CCF (Main Parachute)	5.0E-005
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	0.08	4.967E-009	LAUNCH	T = 0.0	1.0E+000
			ATCS-HCOL-FTF-CCF-P-7	CEV ATCS CM heat collection devices CCF (phase 7)	2.5E-005
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	0.08	4.875E-009	LAUNCH	T = 0.0	1.0E+000
			ATCS_EPWS_BE_P_7	No power from electric power system fails ATCS (phase 7)	5.0E-006
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	0.08	4.875E-009	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
			EPWS_AVCS_BE_P_7	No signal from Avionics System fails EPS (phase 7)	5.0E-006
	0.07	4.102E-009	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			CM-EPWS-BATT-CCF-P-7	CEV CM EPS Battery CCF of 1, 2, and 3 (phase 7)	4.2E-006
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
	0.06	3.600E-009	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_7	Loss of Crew Flag (Phase 7)	1.0E+000
			SM-RCS-COURSE-P-7	SM RCS mid-course corrections (phase 7)	9.0E-004
		6.081E-006	= Total		
JUST_LOC_8	50.47	2.600E-003	LAUNCH	T = 0.0	1.0E+000
			CEV-CMOD-CRW	Crew recovery fails after landing	2.6E-003
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	18.93	9.750E-004	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	17.47	9.000E-004	LAUNCH	T = 0.0	1.0E+000
			CM-RCS-COURSE-P-8	CM RCS attitude and spin control (phase 8)	9.0E-004
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	3.88	2.000E-004	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	1.94	1.000E-004	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-CCF-POWER	Avionics fails to enable device power supply Bus CCF (Main	1.0E-004

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
				Parachute)	
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	1.94	1.000E-004	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_8	No signal from Avionics System fails ATCS (phase 8)	1.0E-004
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	1.18	6.084E-005	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	1.18	6.084E-005	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	1.18	6.084E-005	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.97	5.000E-005	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-FTC-PYRO-CCF-BKR	Avionics fails to close breaker to Electric Bus CCF (Main Parachute)	5.0E-005
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.29	1.500E-005	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
			STRC-BE-P-8	Structures fail (phase 8)	1.5E-005
	0.10	5.000E-006	LAUNCH	T = 0.0	1.0E+000
			ATCS_EPWS_BE_P_8	No power from electric power system fails ATCS (phase 8)	5.0E-006
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.10	5.000E-006	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
			EPWS_AVCS_BE_P_8	No signal from Avionics System fails EPS (phase 8)	5.0E-006
	0.08	4.000E-006	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.04	2.000E-006	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-A-POWER	Avionics fails to enable device power supply Bus A (Main Parachute)	1.0E-003
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.04	2.000E-006	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-B-	Avionics fails to enable device	1.0E-003

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			POWER	power supply Bus B (Main Parachute)	
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.04	2.000E-006	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			CM-AVCS-SIG-2-FIRING	Avionics fails to provide firing signal train 2 (Main Parachute)	1.0E-003
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.04	2.000E-006	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-SIG-1-FIRING	Avionics fails to provide firing signal train 1 (Main Parachute)	1.0E-003
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.04	2.000E-006	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
			SYS-PYRO-FTF-CCF-DROG	Pyrotechnic device CCF (Drogue Parachute)	2.0E-006
	0.04	2.000E-006	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
			SYS-PYRO-FTF-CCF-MAIN	Pyrotechnic device CCF (Main Parachute)	2.0E-006
	0.02	1.200E-006	LAUNCH	T = 0.0	1.0E+000
			CM-COMP-FTF-CCF-P8	CCF of all critical control computer (phase 8)	1.2E-006
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.02	1.200E-006	LAUNCH	T = 0.0	1.0E+000
			ECLS_TOP_P_8	ECLS fails to provide adequate habitat (phase 8)	1.2E-006
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.02	1.000E-006	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-A-POWER	Avionics fails to enable device power supply Bus A (Main Parachute)	1.0E-003
			CM-AVCS-ENG-B-POWER	Avionics fails to enable device power supply Bus B (Main Parachute)	1.0E-003
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.02	1.000E-006	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-A-POWER	Avionics fails to enable device power supply Bus A (Main Parachute)	1.0E-003
			CM-AVCS-SIG-2-FIRING	Avionics fails to provide firing signal train 2 (Main Parachute)	1.0E-003
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.02	1.000E-006	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-B-POWER	Avionics fails to enable device power supply Bus B (Main Parachute)	1.0E-003
			CM-AVCS-SIG-1-FIRING	Avionics fails to provide firing signal train 1 (Main Parachute)	1.0E-003
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.02	1.000E-006	LAUNCH	T = 0.0	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			CM-AVCS-FTC-PYRO-A-BKR	Avionics fails to close breaker to Electric Bus A (Main Parachute)	5.0E-004
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.02	1.000E-006	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-FTC-PYRO-B-BKR	Avionics fails to close breaker to Electric Bus B (Main Parachute)	5.0E-004
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.02	1.000E-006	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-SIG-1-FIRING	Avionics fails to provide firing signal train 1 (Main Parachute)	1.0E-003
			CM-AVCS-SIG-2-FIRING	Avionics fails to provide firing signal train 2 (Main Parachute)	1.0E-003
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.01	5.400E-007	LAUNCH	T = 0.0	1.0E+000
			ATCS-HSNK-FTF-EVAP-P-8	CEV ATCS CM Evaporative Heat Sink (phase 8)	5.4E-007
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.01	5.400E-007	LAUNCH	T = 0.0	1.0E+000
			ATCS-TANK-FTF-CM-P-8	CEV ATCS CM Coolant Storage (phase 8)	5.4E-007
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.01	5.000E-007	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-A-POWER	Avionics fails to enable device power supply Bus A (Main Parachute)	1.0E-003
			CM-AVCS-FTC-PYRO-B-BKR	Avionics fails to close breaker to Electric Bus B (Main Parachute)	5.0E-004
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.01	5.000E-007	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-B-POWER	Avionics fails to enable device power supply Bus B (Main Parachute)	1.0E-003
			CM-AVCS-FTC-PYRO-A-BKR	Avionics fails to close breaker to Electric Bus A (Main Parachute)	5.0E-004
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.01	5.000E-007	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-FTC-PYRO-A-BKR	Avionics fails to close breaker to Electric Bus A (Main Parachute)	5.0E-004
			CM-AVCS-SIG-2-FIRING	Avionics fails to provide firing signal train 2 (Main Parachute)	1.0E-003
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.01	5.000E-007	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-FTC-PYRO-B-BKR	Avionics fails to close breaker to Electric Bus B (Main Parachute)	5.0E-004
			CM-AVCS-SIG-1-FIRING	Avionics fails to provide firing signal train 1 (Main Parachute)	1.0E-003
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.01	4.140E-007	LAUNCH	T = 0.0	1.0E+000
			ATCS-HCOL-FTF-CCF-P-8	CEV ATCS CM heat collection devices CCF (phase 8)	4.1E-007
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.00	2.500E-007	LAUNCH	T = 0.0	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			CM-AVCS-FTC-PYRO-A-BKR	Avionics fails to close breaker to Electric Bus A (Main Parachute)	5.0E-004
			CM-AVCS-FTC-PYRO-B-BKR	Avionics fails to close breaker to Electric Bus B (Main Parachute)	5.0E-004
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.00	7.011E-008	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-BATT-CCF-P-8	CEV CM EPS Battery CCF of 1, 2, and 3 (phase 8)	7.0E-008
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.00	2.700E-008	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-CCF-P-8	CEV CM EPS Power Distribution CCF of 1, 2, and 3 (phase 8)	2.7E-008
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.00	1.000E-009	LAUNCH	T = 0.0	1.0E+000
			CM-BIU-FTF-1-P8	Bus interface unit 1 fails to transmit signal (phase 8)	1.0E-003
			CM-BIU-FTF-2-P8	Bus interface unit 2 fails to transmit signal (phase 8)	1.0E-003
			CM-BIU-FTF-3-P8	Bus interface unit 3 fails to transmit signal (phase 8)	1.0E-003
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.00	6.000E-010	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			CM-EPWS-FTF-B-BUS	Electric Bus B fails (Main Parachute)	3.0E-007
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.00	6.000E-010	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			CM-EPWS-FTF-A-BUS	Electric Bus A fails (Main Parachute)	3.0E-007
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.00	4.000E-010	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
			SYS-PYRO-FTF-A-DROG	Pyrotechnic device A fails (Drogue Parachute)	2.0E-005
			SYS-PYRO-FTF-B-DROG	Pyrotechnic device B fails (Drogue Parachute)	2.0E-005
	0.00	4.000E-010	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
			SYS-PYRO-FTF-A-MAIN	Pyrotechnic device A fails (Main Parachute)	2.0E-005
			SYS-PYRO-FTF-B-MAIN	Pyrotechnic device B fails (Main Parachute)	2.0E-005
	0.00	4.000E-010	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
			SYS-PYRO-FTF-A-TPS	Pyrotechnic device A fails (TPS cover)	2.0E-005
			SYS-PYRO-FTF-B-TPS	Pyrotechnic device B fails (TPS cover)	2.0E-005
	0.00	3.000E-010	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-A-POWER	Avionics fails to enable device power supply Bus A (Main Parachute)	1.0E-003
			CM-EPWS-FTF-B-BUS	Electric Bus B fails (Main	3.0E-007

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
				Parachute)	
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.00	3.000E-010	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-B-POWER	Avionics fails to enable device power supply Bus B (Main Parachute)	1.0E-003
			CM-EPWS-FTF-A-BUS	Electric Bus A fails (Main Parachute)	3.0E-007
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.00	3.000E-010	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-SIG-1-FIRING	Avionics fails to provide firing signal train 1 (Main Parachute)	1.0E-003
			CM-EPWS-FTF-B-BUS	Electric Bus B fails (Main Parachute)	3.0E-007
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.00	3.000E-010	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-SIG-2-FIRING	Avionics fails to provide firing signal train 2 (Main Parachute)	1.0E-003
			CM-EPWS-FTF-A-BUS	Electric Bus A fails (Main Parachute)	3.0E-007
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.00	1.800E-010	LAUNCH	T = 0.0	1.0E+000
			ATCS-HTRN-FTF-CCF-P-8	CEV ATCS CM heat transport devices CCF (phase 8)	1.8E-010
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.00	1.500E-010	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-FTC-PYRO-A-BKR	Avionics fails to close breaker to Electric Bus A (Main Parachute)	5.0E-004
			CM-EPWS-FTF-B-BUS	Electric Bus B fails (Main Parachute)	3.0E-007
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
		5.152E-003	= Total		
JUST_LOM_1	24.80	1.000E-002	LAUNCH	T = 0.0	1.0E+000
			CALV-ESD-ORB-INLEO	EDS Fails to Loiter in LEO	1.0E-002
			ENDSTATE_LOM_1	Loss of Mission Flag (Phase 1)	1.0E+000
	24.80	1.000E-002	LAUNCH	T = 0.0	1.0E+000
			CALV-LSAM-ORB-INLEO	LSAM Fails to Loiter in LEO	1.0E-002
			ENDSTATE_LOM_1	Loss of Mission Flag (Phase 1)	1.0E+000
	10.36	4.180E-003	LAUNCH	T = 0.0	1.0E+000
			CALV-EDS-FTO	CaLV Third Stage (EDS) Ascent Fails	4.2E-003
			ENDSTATE_LOM_1	Loss of Mission Flag (Phase 1)	1.0E+000
	10.36	4.180E-003	LAUNCH	T = 0.0	1.0E+000
			CALV-EDS-INS	CaLV Third Stage Shutdown/Orbital Insertion (EOI) Fails	4.2E-003
			ENDSTATE_LOM_1	Loss of Mission Flag (Phase 1)	1.0E+000
	10.36	4.180E-003	LAUNCH	T = 0.0	1.0E+000
			CALV-SRBS-FTO-5SSME	CaLV First Stage Ascent Fails	4.2E-003
			ENDSTATE_LOM_1	Loss of Mission Flag (Phase 1)	1.0E+000
	10.36	4.180E-003	LAUNCH	T = 0.0	1.0E+000
			CALV-SRBS-LCH-	CaLV First Stage (5 SSMEs) Fail	4.2E-003

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			5SSME	to Launch	
			ENDSTATE_LOM_1	Loss of Mission Flag (Phase 1)	1.0E+000
	10.36	4.180E-003	LAUNCH	T = 0.0	1.0E+000
			CALV-STG2-FTO	CaLV Second Stage Ascent Fails	4.2E-003
			ENDSTATE_LOM_1	Loss of Mission Flag (Phase 1)	1.0E+000
	0.25	1.000E-004	LAUNCH	T = 0.0	1.0E+000
			CALV-EDS-IGN	CaLV EDS (3rd stage) Fails to Ignite	1.0E-004
			ENDSTATE_LOM_1	Loss of Mission Flag (Phase 1)	1.0E+000
	0.02	1.000E-005	LAUNCH	T = 0.0	1.0E+000
			CALV-SRBS-SEP-5SSME	CaLV SRB Fail to Separate (5 SSMEs)	1.0E-005
			ENDSTATE_LOM_1	Loss of Mission Flag (Phase 1)	1.0E+000
	0.02	1.000E-005	LAUNCH	T = 0.0	1.0E+000
			CALV-STG2-SEP	CaLV Second Stage Fails to Separate from EDS/LSAM	1.0E-005
			ENDSTATE_LOM_1	Loss of Mission Flag (Phase 1)	1.0E+000
		4.033E-002	= Total		
JUST_LOM_2	37.72	1.000E-002	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN	EDS, LSAM, and CEV TLI Burn for LLO fails	1.0E-002
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	37.72	1.000E-002	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN-MIDCOURSE	EDS, LSAM, and CEV TLI Mid-course correction burn fails	1.0E-002
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	5.66	1.500E-003	LAUNCH	T = 0.0	1.0E+000
			CEV-CREW-SOLAREVENT-LOM	Non-lethal but significant dose to the crew due to solar particle event	1.5E-003
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
	4.63	1.228E-003	LAUNCH	T = 0.0	1.0E+000
			CEV-LUNAR-COM-P-2	No input from external communications (phase 2)	1.2E-003
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	3.77	1.000E-003	LAUNCH	T = 0.0	1.0E+000
			CM-BIU-FTF-1-P2	Bus interface unit 1 fails to transmit signal (phase 2)	1.0E-003
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	3.77	1.000E-003	LAUNCH	T = 0.0	1.0E+000
			CM-BIU-FTF-2-P2	Bus interface unit 2 fails to transmit signal (phase 2)	1.0E-003
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	3.77	1.000E-003	LAUNCH	T = 0.0	1.0E+000
			CM-BIU-FTF-3-P2	Bus interface unit 3 fails to	1.0E-003

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
				transmit signal (phase 2)	
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.63	1.663E-004	LAUNCH	T = 0.0	1.0E+000
			ATCS-HCOL-FTF-1-P-2	CEV ATCS CM Heat Collection Devices (Loop 1) (phase 2)	1.7E-004
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.63	1.663E-004	LAUNCH	T = 0.0	1.0E+000
			ATCS-HCOL-FTF-2-P-2	CEV ATCS CM Heat Collection Devices (Loop 2) (phase 2)	1.7E-004
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.60	1.589E-004	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-CCF-P-2	CEV SM EPS Power Generation SubSys Solar Array CCF	1.6E-004
	0.41	1.084E-004	LAUNCH	T = 0.0	1.0E+000
			CM-SENS-FTF-BIU-1-P2	Sensor BIU 1 fails (phase 2)	1.1E-004
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.41	1.084E-004	LAUNCH	T = 0.0	1.0E+000
			CM-SENS-FTF-BIU-3-P2	Sensor BIU 3 fails (phase 2)	1.1E-004
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.38	1.000E-004	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_2	No signal from Avionics System fails ATCS (phase 2)	1.0E-004
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.14	3.700E-005	LAUNCH	T = 0.0	1.0E+000
			ECLS_TOP_P_2	ECLS fails to provide adequate habitat (phase 2)	3.7E-005
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.09	2.400E-005	LAUNCH	T = 0.0	1.0E+000
			CM-COMP-FTF-1-P2	Critical control computer 1 fails (phase 2)	2.4E-005
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.09	2.400E-005	LAUNCH	T = 0.0	1.0E+000
			CM-COMP-FTF-2-P2	Critical control computer 2 fails (phase 2)	2.4E-005
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.09	2.400E-005	LAUNCH	T = 0.0	1.0E+000
			CM-COMP-FTF-3-P2	Critical control computer 3 fails (phase 2)	2.4E-005
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.08	2.169E-005	LAUNCH	T = 0.0	1.0E+000
			ATCS-HSNK-FTF-EVAP-P-2	CEV ATCS CM Evaporative Heat Sink (phase 2)	2.2E-005
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.08	2.169E-005	LAUNCH	T = 0.0	1.0E+000
			ATCS-TANK-FTF-CM-P-2	CEV ATCS CM Coolant Storage (phase 2)	2.2E-005
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.06	1.663E-005	LAUNCH	T = 0.0	1.0E+000
			ATCS-HCOL-FTF-CCF-P-2	CEV ATCS CM heat collection devices CCF (phase 2)	1.7E-005
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.04	1.157E-005	LAUNCH	T = 0.0	1.0E+000
			CM-SENS-FTF-AVCS-1-P2	Avionics train 1 sensor fails (phase 2)	1.2E-005
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.04	1.157E-005	LAUNCH	T = 0.0	1.0E+000
			CM-SENS-FTF-AVCS-3-P2	Avionics train 3 sensor fails (phase 2)	1.2E-005
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.04	1.000E-005	LAUNCH	T = 0.0	1.0E+000
			CEV-EDS-SEP	EDS Separates from LSAM and CEV	1.0E-005
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.03	7.040E-006	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-BATT-DCCF-P-2	CEV CM EPS Battery degraded CCF 2 of 3 (phase 2)	7.0E-006
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.02	5.000E-006	LAUNCH	T = 0.0	1.0E+000
			ATCS_EPWS_BE_P_2	No power from electric power system fails ATCS (phase 2)	5.0E-006
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
	0.02	5.000E-006	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			EPWS_AVCS_BE_P_2	No signal from Avionics System fails EPS (phase 2)	5.0E-006
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.01	2.816E-006	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-BATT-CCF-P-2	CEV CM EPS Battery CCF of 1, 2, and 3 (phase 2)	2.8E-006
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.01	2.711E-006	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-DCCF-P-2	CEV CM EPS Power Distribution degraded CCF 2 of 3 (phase 2)	2.7E-006
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.00	1.085E-006	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-CCF-P-2	CEV CM EPS Power Distribution CCF of 1, 2, and 3 (phase 2)	1.1E-006
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.00	7.230E-008	LAUNCH	T = 0.0	1.0E+000
			ATCS-HTRN-FTF-1-P-2	CEV ATCS CM Heat Transport Devices (Loop 1) (phase 2)	7.2E-008
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.00	7.230E-008	LAUNCH	T = 0.0	1.0E+000
			ATCS-HTRN-FTF-2-P-2	CEV ATCS CM Heat Transport Devices (Loop 2) (phase 2)	7.2E-008
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.00	7.230E-009	LAUNCH	T = 0.0	1.0E+000
			ATCS-HTRN-FTF-CCF-P-2	CEV ATCS CM heat transport devices CCF (phase 2)	7.2E-009
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.00	4.705E-010	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-DIST-1-P-2	CEV CM EPS Power Distribution Subsystem 1 (phase 2)	2.2E-005
			CM-EPWS-FTF-DIST-2-P-2	CEV CM EPS Power Distribution Subsystem 2 (phase 2)	2.2E-005
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.00	4.705E-010	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-DIST-1-P-2	CEV CM EPS Power Distribution Subsystem 1 (phase 2)	2.2E-005
			CM-EPWS-FTF-DIST-3-P-2	CEV CM EPS Power Distribution Subsystem 3 (phase 2)	2.2E-005
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.00	4.705E-010	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-DIST-2-P-2	CEV CM EPS Power Distribution Subsystem 2 (phase 2)	2.2E-005
			CM-EPWS-FTF-DIST-3-P-2	CEV CM EPS Power Distribution Subsystem 3 (phase 2)	2.2E-005
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.00	8.012E-015	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT1-P-2	CEV CM EPS Battery 1 (phase 2)	5.6E-005
			CM-EPWS-FTF-BATT2-P-2	CEV CM EPS Battery 2 (phase 2)	5.6E-005
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-2	SM EPS Power Generation SubSys Solar Array 1	1.6E-003
			SM-SRAY-FTF-SOLAR2-P-2	SM EPS Power Generation SubSys Solar Array 2	1.6E-003
	0.00	8.012E-015	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT1-P-2	CEV CM EPS Battery 1 (phase 2)	5.6E-005
			CM-EPWS-FTF-BATT3-P-2	CEV CM EPS Battery 3 (phase 2)	5.6E-005
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-2	SM EPS Power Generation SubSys Solar Array 1	1.6E-003
			SM-SRAY-FTF-SOLAR2-P-2	SM EPS Power Generation SubSys Solar Array 2	1.6E-003
	0.00	8.012E-015	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT2-P-2	CEV CM EPS Battery 2 (phase 2)	5.6E-005
			CM-EPWS-FTF-BATT3-P-2	CEV CM EPS Battery 3 (phase 2)	5.6E-005
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-2	SM EPS Power Generation SubSys Solar Array 1	1.6E-003
			SM-SRAY-FTF-SOLAR2-P-2	SM EPS Power Generation SubSys Solar Array 2	1.6E-003
	0.00	3.086E-015	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT1-P-2	CEV CM EPS Battery 1 (phase 2)	5.6E-005
			CM-EPWS-FTF-DIST-2-P-2	CEV CM EPS Power Distribution Subsystem 2 (phase 2)	2.2E-005
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-2	SM EPS Power Generation SubSys Solar Array 1	1.6E-003
			SM-SRAY-FTF-SOLAR2-P-2	SM EPS Power Generation SubSys Solar Array 2	1.6E-003

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
	0.00	3.086E-015	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT1-P-2	CEV CM EPS Battery 1 (phase 2)	5.6E-005
			CM-EPWS-FTF-DIST-3-P-2	CEV CM EPS Power Distribution Subsystem 3 (phase 2)	2.2E-005
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-2	SM EPS Power Generation SubSys Solar Array 1	1.6E-003
			SM-SRAY-FTF-SOLAR2-P-2	SM EPS Power Generation SubSys Solar Array 2	1.6E-003
	0.00	3.086E-015	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT2-P-2	CEV CM EPS Battery 2 (phase 2)	5.6E-005
			CM-EPWS-FTF-DIST-1-P-2	CEV CM EPS Power Distribution Subsystem 1 (phase 2)	2.2E-005
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-2	SM EPS Power Generation SubSys Solar Array 1	1.6E-003
			SM-SRAY-FTF-SOLAR2-P-2	SM EPS Power Generation SubSys Solar Array 2	1.6E-003
	0.00	3.086E-015	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT2-P-2	CEV CM EPS Battery 2 (phase 2)	5.6E-005
			CM-EPWS-FTF-DIST-3-P-2	CEV CM EPS Power Distribution Subsystem 3 (phase 2)	2.2E-005
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-2	SM EPS Power Generation SubSys Solar Array 1	1.6E-003
			SM-SRAY-FTF-SOLAR2-P-2	SM EPS Power Generation SubSys Solar Array 2	1.6E-003
	0.00	3.086E-015	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT3-P-2	CEV CM EPS Battery 3 (phase 2)	5.6E-005
			CM-EPWS-FTF-DIST-1-P-2	CEV CM EPS Power Distribution Subsystem 1 (phase 2)	2.2E-005
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-2	SM EPS Power Generation SubSys Solar Array 1	1.6E-003
			SM-SRAY-FTF-SOLAR2-P-2	SM EPS Power Generation SubSys Solar Array 2	1.6E-003
	0.00	3.086E-015	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT3-P-2	CEV CM EPS Battery 3 (phase 2)	5.6E-005
			CM-EPWS-FTF-DIST-2-P-2	CEV CM EPS Power Distribution Subsystem 2 (phase 2)	2.2E-005
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-2	SM EPS Power Generation SubSys Solar Array 1	1.6E-003

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			SM-SRAY-FTF-SOLAR2-P-2	SM EPS Power Generation SubSys Solar Array 2	1.6E-003
		2.651E-002	= Total		
JUST_LOM_3	23.71	1.000E-003	LAUNCH	T = 0.0	1.0E+000
			CM-BIU-FTF-1-P3	Bus interface unit 1 fails to transmit signal (phase 3)	1.0E-003
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	23.71	1.000E-003	LAUNCH	T = 0.0	1.0E+000
			CM-BIU-FTF-2-P3	Bus interface unit 2 fails to transmit signal (phase 3)	1.0E-003
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	23.71	1.000E-003	LAUNCH	T = 0.0	1.0E+000
			CM-BIU-FTF-3-P3	Bus interface unit 3 fails to transmit signal (phase 3)	1.0E-003
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	14.67	6.186E-004	LAUNCH	T = 0.0	1.0E+000
			CEV-LUNAR-COM-P-3	No input from external communications (phase 3)	6.2E-004
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	2.37	1.000E-004	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_3	No signal from Avionics System fails ATCS (phase 3)	1.0E-004
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	1.98	8.372E-005	LAUNCH	T = 0.0	1.0E+000
			ATCS-HCOL-FTF-1-P-3	CEV ATCS CM Heat Collection Devices (Loop 1) (phase 3)	8.4E-005
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	1.98	8.372E-005	LAUNCH	T = 0.0	1.0E+000
			ATCS-HCOL-FTF-2-P-3	CEV ATCS CM Heat Collection Devices (Loop 2) (phase 3)	8.4E-005
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	1.90	8.005E-005	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-CCF-P-3	CEV SM EPS Power Generation SubSys Solar Array CCF	8.0E-005
	1.29	5.460E-005	LAUNCH	T = 0.0	1.0E+000
			CM-SENS-FTF-BIU-1-P3	Sensor BIU 1 fails (phase 3)	5.5E-005
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_	The landing system does not fail	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			WORKS		
	1.29	5.460E-005	LAUNCH	T = 0.0	1.0E+000
			CM-SENS-FTF-BIU-3-P3	Sensor BIU 3 fails (phase 3)	5.5E-005
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.57	2.400E-005	LAUNCH	T = 0.0	1.0E+000
			CM-COMP-FTF-1-P3	Critical control computer 1 fails (phase 3)	2.4E-005
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.57	2.400E-005	LAUNCH	T = 0.0	1.0E+000
			CM-COMP-FTF-2-P3	Critical control computer 2 fails (phase 3)	2.4E-005
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.57	2.400E-005	LAUNCH	T = 0.0	1.0E+000
			CM-COMP-FTF-3-P3	Critical control computer 3 fails (phase 3)	2.4E-005
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.46	1.930E-005	LAUNCH	T = 0.0	1.0E+000
			ECLS_TOP_P_3	ECLS fails to provide adequate habitat (phase 3)	1.9E-005
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.26	1.092E-005	LAUNCH	T = 0.0	1.0E+000
			ATCS-HSNK-FTF-EVAP-P-3	CEV ATCS CM Evaporative Heat Sink (phase 3)	1.1E-005
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.26	1.092E-005	LAUNCH	T = 0.0	1.0E+000
			ATCS-TANK-FTF-CM-P-3	CEV ATCS CM Coolant Storage (phase 3)	1.1E-005
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.20	8.372E-006	LAUNCH	T = 0.0	1.0E+000
			ATCS-HCOL-FTF-CCF-P-3	CEV ATCS CM heat collection devices CCF (phase 3)	8.4E-006
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.14	5.824E-006	LAUNCH	T = 0.0	1.0E+000
			CM-SENS-FTF-AVCS-1-P3	Avionics train 1 sensor fails (phase 3)	5.8E-006
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.14	5.824E-006	LAUNCH	T = 0.0	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			CM-SENS-FTF-AVCS-3-P3	Avionics train 3 sensor fails (phase 3)	5.8E-006
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.12	5.000E-006	LAUNCH	T = 0.0	1.0E+000
			ATCS_EPWS_BE_P_3	No power from electric power system fails ATCS (phase 3)	5.0E-006
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.12	5.000E-006	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			EPWS_AVCS_BE_P_3	No signal from Avionics System fails EPS (phase 3)	5.0E-006
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.08	3.544E-006	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-BATT-DCCF-P-3	CEV CM EPS Battery degraded CCF 2 of 3 (phase 3)	3.5E-006
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.03	1.418E-006	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-BATT-CCF-P-3	CEV CM EPS Battery CCF of 1, 2, and 3 (phase 3)	1.4E-006
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.03	1.365E-006	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-DCCF-P-3	CEV CM EPS Power Distribution degraded CCF 2 of 3 (phase 3)	1.4E-006
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.01	5.460E-007	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-CCF-P-3	CEV CM EPS Power Distribution CCF of 1, 2, and 3 (phase 3)	5.5E-007
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.00	3.640E-008	LAUNCH	T = 0.0	1.0E+000
			ATCS-HTRN-FTF-1-P-3	CEV ATCS CM Heat Transport Devices (Loop 1) (phase 3)	3.6E-008
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.00	3.640E-008	LAUNCH	T = 0.0	1.0E+000
			ATCS-HTRN-FTF-2-P-3	CEV ATCS CM Heat Transport Devices (Loop 2) (phase 3)	3.6E-008
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.00	3.640E-009	LAUNCH	T = 0.0	1.0E+000
			ATCS-HTRN-FTF-CCF-P-3	CEV ATCS CM heat transport devices CCF (phase 3)	3.6E-009

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.00	1.193E-010	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-DIST-1-P-3	CEV CM EPS Power Distribution Subsystem 1 (phase 3)	1.1E-005
			CM-EPWS-FTF-DIST-2-P-3	CEV CM EPS Power Distribution Subsystem 2 (phase 3)	1.1E-005
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.00	1.193E-010	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-DIST-1-P-3	CEV CM EPS Power Distribution Subsystem 1 (phase 3)	1.1E-005
			CM-EPWS-FTF-DIST-3-P-3	CEV CM EPS Power Distribution Subsystem 3 (phase 3)	1.1E-005
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.00	1.193E-010	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-DIST-2-P-3	CEV CM EPS Power Distribution Subsystem 2 (phase 3)	1.1E-005
			CM-EPWS-FTF-DIST-3-P-3	CEV CM EPS Power Distribution Subsystem 3 (phase 3)	1.1E-005
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.00	5.152E-016	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT1-P-3	CEV CM EPS Battery 1 (phase 3)	2.8E-005
			CM-EPWS-FTF-BATT2-P-3	CEV CM EPS Battery 2 (phase 3)	2.8E-005
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-3	SM EPS Power Generation SubSys Solar Array 1	8.0E-004
			SM-SRAY-FTF-SOLAR2-P-3	SM EPS Power Generation SubSys Solar Array 2	8.0E-004
	0.00	5.152E-016	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT1-P-3	CEV CM EPS Battery 1 (phase 3)	2.8E-005
			CM-EPWS-FTF-BATT3-P-3	CEV CM EPS Battery 3 (phase 3)	2.8E-005
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-3	SM EPS Power Generation SubSys Solar Array 1	8.0E-004
			SM-SRAY-FTF-SOLAR2-P-3	SM EPS Power Generation SubSys Solar Array 2	8.0E-004
	0.00	5.152E-016	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT2-P-3	CEV CM EPS Battery 2 (phase 3)	2.8E-005
			CM-EPWS-FTF-BATT3-P-3	CEV CM EPS Battery 3 (phase 3)	2.8E-005
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-3	SM EPS Power Generation SubSys Solar Array 1	8.0E-004
			SM-SRAY-FTF-SOLAR2-P-3	SM EPS Power Generation SubSys Solar Array 2	8.0E-004
	0.00	1.984E-016	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT1-P-3	CEV CM EPS Battery 1 (phase 3)	2.8E-005
			CM-EPWS-FTF-DIST-2-P-3	CEV CM EPS Power Distribution Subsystem 2 (phase 3)	1.1E-005
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-3	SM EPS Power Generation SubSys Solar Array 1	8.0E-004
			SM-SRAY-FTF-SOLAR2-P-3	SM EPS Power Generation SubSys Solar Array 2	8.0E-004
	0.00	1.984E-016	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT1-P-3	CEV CM EPS Battery 1 (phase 3)	2.8E-005
			CM-EPWS-FTF-DIST-3-P-3	CEV CM EPS Power Distribution Subsystem 3 (phase 3)	1.1E-005
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-3	SM EPS Power Generation SubSys Solar Array 1	8.0E-004
			SM-SRAY-FTF-SOLAR2-P-3	SM EPS Power Generation SubSys Solar Array 2	8.0E-004
	0.00	1.984E-016	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT2-P-3	CEV CM EPS Battery 2 (phase 3)	2.8E-005
			CM-EPWS-FTF-DIST-1-P-3	CEV CM EPS Power Distribution Subsystem 1 (phase 3)	1.1E-005
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-3	SM EPS Power Generation SubSys Solar Array 1	8.0E-004
			SM-SRAY-FTF-SOLAR2-P-3	SM EPS Power Generation SubSys Solar Array 2	8.0E-004
	0.00	1.984E-016	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT2-P-3	CEV CM EPS Battery 2 (phase 3)	2.8E-005
			CM-EPWS-FTF-DIST-3-P-3	CEV CM EPS Power Distribution Subsystem 3 (phase 3)	1.1E-005
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-3	SM EPS Power Generation SubSys Solar Array 1	8.0E-004
			SM-SRAY-FTF-SOLAR2-P-3	SM EPS Power Generation SubSys Solar Array 2	8.0E-004
	0.00	1.984E-016	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT3-P-3	CEV CM EPS Battery 3 (phase 3)	2.8E-005
			CM-EPWS-FTF-DIST-	CEV CM EPS Power Distribution	1.1E-005

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			1-P-3	Subsystem 1 (phase 3)	
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-3	SM EPS Power Generation SubSys Solar Array 1	8.0E-004
			SM-SRAY-FTF-SOLAR2-P-3	SM EPS Power Generation SubSys Solar Array 2	8.0E-004
	0.00	1.984E-016	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT3-P-3	CEV CM EPS Battery 3 (phase 3)	2.8E-005
			CM-EPWS-FTF-DIST-2-P-3	CEV CM EPS Power Distribution Subsystem 2 (phase 3)	1.1E-005
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-3	SM EPS Power Generation SubSys Solar Array 1	8.0E-004
			SM-SRAY-FTF-SOLAR2-P-3	SM EPS Power Generation SubSys Solar Array 2	8.0E-004
		4.218E-003	= Total		
JUST_LOM_4	36.19	2.852E-003	LAUNCH	T = 0.0	1.0E+000
			CEV-LUNAR-COM-P-4	No input from external communications (phase 4)	2.9E-003
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	12.69	1.000E-003	LAUNCH	T = 0.0	1.0E+000
			CM-BIU-FTF-1-P4	Bus interface unit 1 fails to transmit signal (phase 4)	1.0E-003
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	12.69	1.000E-003	LAUNCH	T = 0.0	1.0E+000
			CM-BIU-FTF-2-P4	Bus interface unit 2 fails to transmit signal (phase 4)	1.0E-003
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	12.69	1.000E-003	LAUNCH	T = 0.0	1.0E+000
			CM-BIU-FTF-3-P4	Bus interface unit 3 fails to transmit signal (phase 4)	1.0E-003
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	4.90	3.863E-004	LAUNCH	T = 0.0	1.0E+000
			ATCS-HCOL-FTF-1-P-4	CEV ATCS CM Heat Collection Devices (Loop 1) (phase 4)	3.9E-004
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	4.90	3.863E-004	LAUNCH	T = 0.0	1.0E+000
			ATCS-HCOL-FTF-2-P-4	CEV ATCS CM Heat Collection Devices (Loop 2) (phase 4)	3.9E-004
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	4.68	3.689E-004	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
			SM-SRAY-FTF-CCF-P-4	CEV SM EPS Power Generation SubSys Solar Array CCF	3.7E-004
	3.20	2.520E-004	LAUNCH	T = 0.0	1.0E+000
			CM-SENS-FTF-BIU-1-P4	Sensor BIU 1 fails (phase 4)	2.5E-004
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	3.20	2.520E-004	LAUNCH	T = 0.0	1.0E+000
			CM-SENS-FTF-BIU-3-	Sensor BIU 3 fails (phase 4)	2.5E-004

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			P4		
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	1.27	1.000E-004	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_4	No signal from Avionics System fails ATCS (phase 4)	1.0E-004
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	0.64	5.040E-005	LAUNCH	T = 0.0	1.0E+000
			ATCS-HSNK-FTF-EVAP-P-4	CEV ATCS CM Evaporative Heat Sink (phase 4)	5.0E-005
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	0.64	5.040E-005	LAUNCH	T = 0.0	1.0E+000
			ATCS-TANK-FTF-CM-P-4	CEV ATCS CM Coolant Storage (phase 4)	5.0E-005
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	0.49	3.863E-005	LAUNCH	T = 0.0	1.0E+000
			ATCS-HCOL-FTF-CCF-P-4	CEV ATCS CM heat collection devices CCF (phase 4)	3.9E-005
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	0.34	2.688E-005	LAUNCH	T = 0.0	1.0E+000
			CM-SENS-FTF-AVCS-1-P4	Avionics train 1 sensor fails (phase 4)	2.7E-005
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	0.34	2.688E-005	LAUNCH	T = 0.0	1.0E+000
			CM-SENS-FTF-AVCS-3-P4	Avionics train 3 sensor fails (phase 4)	2.7E-005
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	0.30	2.400E-005	LAUNCH	T = 0.0	1.0E+000
			CM-COMP-FTF-1-P4	Critical control computer 1 fails (phase 4)	2.4E-005
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	0.30	2.400E-005	LAUNCH	T = 0.0	1.0E+000
			CM-COMP-FTF-2-P4	Critical control computer 2 fails (phase 4)	2.4E-005
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	0.30	2.400E-005	LAUNCH	T = 0.0	1.0E+000
			CM-COMP-FTF-3-P4	Critical control computer 3 fails (phase 4)	2.4E-005
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	0.21	1.636E-005	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-BATT-DCCF-P-4	CEV CM EPS Battery degraded CCF 2 of 3 (phase 4)	1.6E-005
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	0.08	6.544E-006	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-BATT-CCF-P-4	CEV CM EPS Battery CCF of 1, 2, and 3 (phase 4)	6.5E-006
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	0.08	6.300E-006	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-DCCF-P-4	CEV CM EPS Power Distribution degraded CCF 2 of 3 (phase 4)	6.3E-006
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	0.06	5.000E-006	LAUNCH	T = 0.0	1.0E+000
			ATCS_EPWS_BE_P_4	No power from electric power system fails ATCS (phase 4)	5.0E-006
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
	0.06	5.000E-006	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
			EPWS_AVCS_BE_P_4	No signal from Avionics System fails EPS (phase 4)	5.0E-006
	0.03	2.520E-006	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-CCF-P-4	CEV CM EPS Power Distribution CCF of 1, 2, and 3 (phase 4)	2.5E-006
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	0.00	1.680E-007	LAUNCH	T = 0.0	1.0E+000
			ATCS-HTRN-FTF-1-P-4	CEV ATCS CM Heat Transport Devices (Loop 1) (phase 4)	1.7E-007
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	0.00	1.680E-007	LAUNCH	T = 0.0	1.0E+000
			ATCS-HTRN-FTF-2-P-4	CEV ATCS CM Heat Transport Devices (Loop 2) (phase 4)	1.7E-007
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	0.00	1.680E-008	LAUNCH	T = 0.0	1.0E+000
			ATCS-HTRN-FTF-CCF-P-4	CEV ATCS CM heat transport devices CCF (phase 4)	1.7E-008
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	0.00	2.540E-009	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-DIST-1-P-4	CEV CM EPS Power Distribution Subsystem 1 (phase 4)	5.0E-005
			CM-EPWS-FTF-DIST-2-P-4	CEV CM EPS Power Distribution Subsystem 2 (phase 4)	5.0E-005
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	0.00	2.540E-009	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-DIST-1-P-4	CEV CM EPS Power Distribution Subsystem 1 (phase 4)	5.0E-005
			CM-EPWS-FTF-DIST-3-P-4	CEV CM EPS Power Distribution Subsystem 3 (phase 4)	5.0E-005
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	0.00	2.540E-009	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-DIST-2-P-4	CEV CM EPS Power Distribution Subsystem 2 (phase 4)	5.0E-005
			CM-EPWS-FTF-DIST-3-P-4	CEV CM EPS Power Distribution Subsystem 3 (phase 4)	5.0E-005
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	0.00	2.331E-013	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT1-P-4	CEV CM EPS Battery 1 (phase 4)	1.3E-004
			CM-EPWS-FTF-BATT2-P-4	CEV CM EPS Battery 2 (phase 4)	1.3E-004
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-4	SM EPS Power Generation SubSys Solar Array 1	3.7E-003
			SM-SRAY-FTF-SOLAR2-P-4	SM EPS Power Generation SubSys Solar Array 2	3.7E-003
	0.00	2.331E-013	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT1-P-4	CEV CM EPS Battery 1 (phase 4)	1.3E-004
			CM-EPWS-FTF-BATT3-P-4	CEV CM EPS Battery 3 (phase 4)	1.3E-004
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-4	SM EPS Power Generation SubSys Solar Array 1	3.7E-003

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			SM-SRAY-FTF-SOLAR2-P-4	SM EPS Power Generation SubSys Solar Array 2	3.7E-003
	0.00	2.331E-013	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT2-P-4	CEV CM EPS Battery 2 (phase 4)	1.3E-004
			CM-EPWS-FTF-BATT3-P-4	CEV CM EPS Battery 3 (phase 4)	1.3E-004
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-4	SM EPS Power Generation SubSys Solar Array 1	3.7E-003
			SM-SRAY-FTF-SOLAR2-P-4	SM EPS Power Generation SubSys Solar Array 2	3.7E-003
	0.00	8.976E-014	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT1-P-4	CEV CM EPS Battery 1 (phase 4)	1.3E-004
			CM-EPWS-FTF-DIST-2-P-4	CEV CM EPS Power Distribution Subsystem 2 (phase 4)	5.0E-005
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-4	SM EPS Power Generation SubSys Solar Array 1	3.7E-003
			SM-SRAY-FTF-SOLAR2-P-4	SM EPS Power Generation SubSys Solar Array 2	3.7E-003
	0.00	8.976E-014	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT1-P-4	CEV CM EPS Battery 1 (phase 4)	1.3E-004
			CM-EPWS-FTF-DIST-3-P-4	CEV CM EPS Power Distribution Subsystem 3 (phase 4)	5.0E-005
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-4	SM EPS Power Generation SubSys Solar Array 1	3.7E-003
			SM-SRAY-FTF-SOLAR2-P-4	SM EPS Power Generation SubSys Solar Array 2	3.7E-003
	0.00	8.976E-014	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT2-P-4	CEV CM EPS Battery 2 (phase 4)	1.3E-004
			CM-EPWS-FTF-DIST-1-P-4	CEV CM EPS Power Distribution Subsystem 1 (phase 4)	5.0E-005
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-4	SM EPS Power Generation SubSys Solar Array 1	3.7E-003
			SM-SRAY-FTF-SOLAR2-P-4	SM EPS Power Generation SubSys Solar Array 2	3.7E-003
	0.00	8.976E-014	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT2-P-4	CEV CM EPS Battery 2 (phase 4)	1.3E-004
			CM-EPWS-FTF-DIST-3-P-4	CEV CM EPS Power Distribution Subsystem 3 (phase 4)	5.0E-005
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-4	SM EPS Power Generation SubSys Solar Array 1	3.7E-003
			SM-SRAY-FTF-SOLAR2-P-4	SM EPS Power Generation SubSys Solar Array 2	3.7E-003
	0.00	8.976E-014	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT3-P-4	CEV CM EPS Battery 3 (phase 4)	1.3E-004
			CM-EPWS-FTF-DIST-1-P-4	CEV CM EPS Power Distribution Subsystem 1 (phase 4)	5.0E-005
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			SM-SRAY-FTF-SOLAR1-P-4	SM EPS Power Generation SubSys Solar Array 1	3.7E-003
			SM-SRAY-FTF-SOLAR2-P-4	SM EPS Power Generation SubSys Solar Array 2	3.7E-003
	0.00	8.976E-014	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT3-P-4	CEV CM EPS Battery 3 (phase 4)	1.3E-004
			CM-EPWS-FTF-DIST-2-P-4	CEV CM EPS Power Distribution Subsystem 2 (phase 4)	5.0E-005
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-4	SM EPS Power Generation SubSys Solar Array 1	3.7E-003
			SM-SRAY-FTF-SOLAR2-P-4	SM EPS Power Generation SubSys Solar Array 2	3.7E-003
		7.879E-003	= Total		
JUST_LOM_5	81.88	3.500E-002	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			LSAM-CRW-REC-05	Recovery actions by crew fail during lunar surface activities	5.0E-001
			LSAM-LSAM-FTO	Lunar Surface Mission	7.0E-002
	6.76	2.889E-003	LAUNCH	T = 0.0	1.0E+000
			CEV-LUNAR-COM-P-5	No input from external communications (phase 5)	2.9E-003
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	2.34	1.000E-003	LAUNCH	T = 0.0	1.0E+000
			CM-BIU-FTF-1-P5	Bus interface unit 1 fails to transmit signal (phase 5)	1.0E-003
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	2.34	1.000E-003	LAUNCH	T = 0.0	1.0E+000
			CM-BIU-FTF-2-P5	Bus interface unit 2 fails to transmit signal (phase 5)	1.0E-003
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	2.34	1.000E-003	LAUNCH	T = 0.0	1.0E+000
			CM-BIU-FTF-3-P5	Bus interface unit 3 fails to transmit signal (phase 5)	1.0E-003
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.92	3.914E-004	LAUNCH	T = 0.0	1.0E+000
			ATCS-HCOL-FTF-1-P-5	CEV ATCS CM Heat Collection Devices (Loop 1) (phase 5)	3.9E-004
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.92	3.914E-004	LAUNCH	T = 0.0	1.0E+000
			ATCS-HCOL-FTF-2-P-5	CEV ATCS CM Heat Collection Devices (Loop 2) (phase 5)	3.9E-004
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.87	3.737E-004	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-CCF-P-5	CEV SM EPS Power Generation SubSys Solar Array CCF	3.7E-004
	0.60	2.553E-004	LAUNCH	T = 0.0	1.0E+000
			CM-SENS-FTF-BIU-1-P5	Sensor BIU 1 fails (phase 5)	2.6E-004
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.60	2.553E-004	LAUNCH	T = 0.0	1.0E+000
			CM-SENS-FTF-BIU-3-P5	Sensor BIU 3 fails (phase 5)	2.6E-004
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.23	1.000E-004	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_5	No signal from Avionics System fails ATCS (phase 5)	1.0E-004
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.20	8.700E-005	LAUNCH	T = 0.0	1.0E+000
			ECLS_TOP_P_5	ECLS fails to provide adequate habitat (phase 5)	8.7E-005
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.12	5.106E-005	LAUNCH	T = 0.0	1.0E+000
			ATCS-HSNK-FTF-EVAP-P-5	CEV ATCS CM Evaporative Heat Sink (phase 5)	5.1E-005
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.12	5.106E-005	LAUNCH	T = 0.0	1.0E+000
			ATCS-TANK-FTF-CM-P-5	CEV ATCS CM Coolant Storage (phase 5)	5.1E-005
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.09	3.914E-005	LAUNCH	T = 0.0	1.0E+000
			ATCS-HCOL-FTF-CCF-P-5	CEV ATCS CM heat collection devices CCF (phase 5)	3.9E-005
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.06	2.723E-005	LAUNCH	T = 0.0	1.0E+000
			CM-SENS-FTF-AVCS-1-P5	Avionics train 1 sensor fails (phase 5)	2.7E-005
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
	0.06	2.723E-005	LAUNCH	T = 0.0	1.0E+000
			CM-SENS-FTF-AVCS-3-P5	Avionics train 3 sensor fails (phase 5)	2.7E-005
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.06	2.400E-005	LAUNCH	T = 0.0	1.0E+000
			CM-COMP-FTF-1-P5	Critical control computer 1 fails (phase 5)	2.4E-005
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.06	2.400E-005	LAUNCH	T = 0.0	1.0E+000
			CM-COMP-FTF-2-P5	Critical control computer 2 fails (phase 5)	2.4E-005
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.06	2.400E-005	LAUNCH	T = 0.0	1.0E+000
			CM-COMP-FTF-3-P5	Critical control computer 3 fails (phase 5)	2.4E-005
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.04	1.657E-005	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-BATT-DCCF-P-5	CEV CM EPS Battery degraded CCF 2 of 3 (phase 5)	1.7E-005
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.02	6.630E-006	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-BATT-CCF-P-5	CEV CM EPS Battery CCF of 1, 2, and 3 (phase 5)	6.6E-006
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.01	6.382E-006	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-DCCF-P-5	CEV CM EPS Power Distribution degraded CCF 2 of 3 (phase 5)	6.4E-006
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.01	5.000E-006	LAUNCH	T = 0.0	1.0E+000
			ATCS_EPWS_BE_P_5	No power from electric power system fails ATCS (phase 5)	5.0E-006
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.01	5.000E-006	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			EPWS_AVCS_BE_P_5	No signal from Avionics System fails EPS (phase 5)	5.0E-006
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.01	2.553E-006	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-CCF-	CEV CM EPS Power Distribution	2.6E-006

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			P-5	CCF of 1, 2, and 3 (phase 5)	
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.00	1.702E-007	LAUNCH	T = 0.0	1.0E+000
			ATCS-HTRN-FTF-1-P-5	CEV ATCS CM Heat Transport Devices (Loop 1) (phase 5)	1.7E-007
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.00	1.702E-007	LAUNCH	T = 0.0	1.0E+000
			ATCS-HTRN-FTF-2-P-5	CEV ATCS CM Heat Transport Devices (Loop 2) (phase 5)	1.7E-007
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.00	1.702E-008	LAUNCH	T = 0.0	1.0E+000
			ATCS-HTRN-FTF-CCF-P-5	CEV ATCS CM heat transport devices CCF (phase 5)	1.7E-008
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.00	2.607E-009	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-DIST-1-P-5	CEV CM EPS Power Distribution Subsystem 1 (phase 5)	5.1E-005
			CM-EPWS-FTF-DIST-2-P-5	CEV CM EPS Power Distribution Subsystem 2 (phase 5)	5.1E-005
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.00	2.607E-009	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-DIST-1-P-5	CEV CM EPS Power Distribution Subsystem 1 (phase 5)	5.1E-005
			CM-EPWS-FTF-DIST-3-P-5	CEV CM EPS Power Distribution Subsystem 3 (phase 5)	5.1E-005
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.00	2.607E-009	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-DIST-2-P-5	CEV CM EPS Power Distribution Subsystem 2 (phase 5)	5.1E-005
			CM-EPWS-FTF-DIST-3-P-5	CEV CM EPS Power Distribution Subsystem 3 (phase 5)	5.1E-005
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.00	2.455E-013	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT1-P-5	CEV CM EPS Battery 1 (phase 5)	1.3E-004
			CM-EPWS-FTF-BATT2-P-5	CEV CM EPS Battery 2 (phase 5)	1.3E-004
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-5	SM EPS Power Generation SubSys Solar Array 1	3.7E-003
			SM-SRAY-FTF-	SM EPS Power Generation	3.7E-003

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			SOLAR2-P-5	SubSys Solar Array 2	
	0.00	2.455E-013	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT1-P-5	CEV CM EPS Battery 1 (phase 5)	1.3E-004
			CM-EPWS-FTF-BATT3-P-5	CEV CM EPS Battery 3 (phase 5)	1.3E-004
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-5	SM EPS Power Generation SubSys Solar Array 1	3.7E-003
			SM-SRAY-FTF-SOLAR2-P-5	SM EPS Power Generation SubSys Solar Array 2	3.7E-003
	0.00	2.455E-013	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT2-P-5	CEV CM EPS Battery 2 (phase 5)	1.3E-004
			CM-EPWS-FTF-BATT3-P-5	CEV CM EPS Battery 3 (phase 5)	1.3E-004
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-5	SM EPS Power Generation SubSys Solar Array 1	3.7E-003
			SM-SRAY-FTF-SOLAR2-P-5	SM EPS Power Generation SubSys Solar Array 2	3.7E-003
	0.00	9.455E-014	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT1-P-5	CEV CM EPS Battery 1 (phase 5)	1.3E-004
			CM-EPWS-FTF-DIST-2-P-5	CEV CM EPS Power Distribution Subsystem 2 (phase 5)	5.1E-005
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-5	SM EPS Power Generation SubSys Solar Array 1	3.7E-003
			SM-SRAY-FTF-SOLAR2-P-5	SM EPS Power Generation SubSys Solar Array 2	3.7E-003
	0.00	9.455E-014	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT1-P-5	CEV CM EPS Battery 1 (phase 5)	1.3E-004
			CM-EPWS-FTF-DIST-3-P-5	CEV CM EPS Power Distribution Subsystem 3 (phase 5)	5.1E-005
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-5	SM EPS Power Generation SubSys Solar Array 1	3.7E-003
			SM-SRAY-FTF-SOLAR2-P-5	SM EPS Power Generation SubSys Solar Array 2	3.7E-003
	0.00	9.455E-014	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT2-P-5	CEV CM EPS Battery 2 (phase 5)	1.3E-004
			CM-EPWS-FTF-DIST-1-P-5	CEV CM EPS Power Distribution Subsystem 1 (phase 5)	5.1E-005
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-	SM EPS Power Generation	3.7E-003

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			SOLAR1-P-5	SubSys Solar Array 1	
			SM-SRAY-FTF-SOLAR2-P-5	SM EPS Power Generation SubSys Solar Array 2	3.7E-003
	0.00	9.455E-014	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT2-P-5	CEV CM EPS Battery 2 (phase 5)	1.3E-004
			CM-EPWS-FTF-DIST-3-P-5	CEV CM EPS Power Distribution Subsystem 3 (phase 5)	5.1E-005
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-5	SM EPS Power Generation SubSys Solar Array 1	3.7E-003
			SM-SRAY-FTF-SOLAR2-P-5	SM EPS Power Generation SubSys Solar Array 2	3.7E-003
	0.00	9.455E-014	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT3-P-5	CEV CM EPS Battery 3 (phase 5)	1.3E-004
			CM-EPWS-FTF-DIST-1-P-5	CEV CM EPS Power Distribution Subsystem 1 (phase 5)	5.1E-005
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-5	SM EPS Power Generation SubSys Solar Array 1	3.7E-003
			SM-SRAY-FTF-SOLAR2-P-5	SM EPS Power Generation SubSys Solar Array 2	3.7E-003
	0.00	9.455E-014	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-FTF-BATT3-P-5	CEV CM EPS Battery 3 (phase 5)	1.3E-004
			CM-EPWS-FTF-DIST-2-P-5	CEV CM EPS Power Distribution Subsystem 2 (phase 5)	5.1E-005
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-SOLAR1-P-5	SM EPS Power Generation SubSys Solar Array 1	3.7E-003
			SM-SRAY-FTF-SOLAR2-P-5	SM EPS Power Generation SubSys Solar Array 2	3.7E-003
		4.275E-002	= Total		
LOC	29.75	5.100E-003	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-STGE-ASC	LSAM Ascent Stage Ascent	5.1E-003
	29.17	5.000E-003	LAUNCH	T = 0.0	1.0E+000
			CEV-CEV--ORB	CEV fails to stay in LOI (coast)	1.0E-002
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	15.17	2.600E-003	LAUNCH	T = 0.0	1.0E+000
			CEV-CMOD-CRW	Crew recovery fails after landing	2.6E-003
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	5.69	9.750E-004	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	5.25	9.000E-004	LAUNCH	T = 0.0	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			CM-RCS-COURSE-P-8	CM RCS attitude and spin control (phase 8)	9.0E-004
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	5.25	9.000E-004	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
			SM-RCS-DOCK-P-2	SM RCS rendezvous and docking (phase 2)	9.0E-004
	1.17	2.000E-004	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	1.08	1.845E-004	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
			SM-SRAY-FTF-CCF-P-4	CEV SM EPS Power Generation SubSys Solar Array CCF	3.7E-004
	0.93	1.589E-004	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
			SM-SRAY-FTF-CCF-P-2	CEV SM EPS Power Generation SubSys Solar Array CCF	1.6E-004
	0.88	1.500E-004	LAUNCH	T = 0.0	1.0E+000
			CEV-CREW-SOLAREVENT-LOC	Lethal dose to the crew due to solar particle event	1.5E-004
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.58	1.000E-004	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-CCF-POWER	Avionics fails to enable device power supply Bus CCF (Main Parachute)	1.0E-004
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.58	1.000E-004	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_2	No signal from Avionics System fails ATCS (phase 2)	1.0E-004
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.58	1.000E-004	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_8	No signal from Avionics System fails ATCS (phase 8)	1.0E-004
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.35	6.084E-005	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.35	6.084E-005	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-1	Parachute #1 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.35	6.084E-005	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-2	Parachute #2 Fails during Deployment	7.8E-003
			CEV-PARA-DPL-3	Parachute #3 Fails during Deployment	7.8E-003

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.29	5.000E-005	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-FTC-PYRO-CCF-BKR	Avionics fails to close breaker to Electric Bus CCF (Main Parachute)	5.0E-005
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.29	5.000E-005	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_4	No signal from Avionics System fails ATCS (phase 4)	1.0E-004
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.22	3.700E-005	LAUNCH	T = 0.0	1.0E+000
			ECLS_TOP_P_2	ECLS fails to provide adequate habitat (phase 2)	3.7E-005
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.20	3.413E-005	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-CRW-REC-05	Recovery actions by crew fail during lunar surface activities	5.0E-001
			LSAM-LSAM-FTO	Lunar Surface Mission	7.0E-002
	0.15	2.520E-005	LAUNCH	T = 0.0	1.0E+000
			ATCS-HSNK-FTF-EVAP-P-4	CEV ATCS CM Evaporative Heat Sink (phase 4)	5.0E-005
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.15	2.520E-005	LAUNCH	T = 0.0	1.0E+000
			ATCS-TANK-FTF-CM-P-4	CEV ATCS CM Coolant Storage (phase 4)	5.0E-005
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.13	2.169E-005	LAUNCH	T = 0.0	1.0E+000
			ATCS-HSNK-FTF-EVAP-P-2	CEV ATCS CM Evaporative Heat Sink (phase 2)	2.2E-005
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.13	2.169E-005	LAUNCH	T = 0.0	1.0E+000
			ATCS-TANK-FTF-CM-P-2	CEV ATCS CM Coolant Storage (phase 2)	2.2E-005
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.11	1.932E-005	LAUNCH	T = 0.0	1.0E+000
			ATCS-HCOL-FTF-CCF-P-4	CEV ATCS CM heat collection devices CCF (phase 4)	3.9E-005
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.10	1.663E-005	LAUNCH	T = 0.0	1.0E+000
			ATCS-HCOL-FTF-CCF-P-2	CEV ATCS CM heat collection devices CCF (phase 2)	1.7E-005
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.09	1.500E-005	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			STRC-BE-P-8	Structures fail (phase 8)	1.5E-005
	0.06	1.073E-005	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			CLV-CEV-RAD	CEV Rendezvous and Docking with EDS and LSAM fails	1.1E-002
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
	0.06	1.000E-005	LAUNCH	T = 0.0	1.0E+000
			CLV-LAS--SEP	LAS Jettison from CEV	1.0E-005
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
	0.06	9.750E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-BRN-MIDCOURSE	LSAM and CEV Mid-course Correction Burn	1.0E-002
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	0.06	9.750E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-LLOBURN	LSAM and CEV Burn to Slow Near LLO	1.0E-002
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	0.06	9.750E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			CEV-TLI-BRN	EDS, LSAM, and CEV TLI Burn for LLO fails	1.0E-002
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.06	9.750E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			CEV-TLI-BRN-MIDCOURSE	EDS, LSAM, and CEV TLI Mid-course correction burn fails	1.0E-002
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.06	9.750E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-STGE-BRN-LUNARLAND	LSAM Powered Descent and Landing to the Lunar Surface	1.0E-002
	0.04	7.000E-006	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-SIG-CCF-ARMING	Avionics fails to provide arming signal CCF (Main Parachute)	2.0E-004
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-CRW-REC-05	Recovery actions by crew fail during lunar surface activities	5.0E-001
			LSAM-LSAM-FTO	Lunar Surface Mission	7.0E-002
	0.03	5.363E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-CRW-DOCK-REC	Recovery of Crew from LSAM/CEV Docking Problem	5.0E-001
			CEV-LSAM-RAD-ASCENT	LSAM Ascent Stage Fails to Rendezvous and Dock with CEV	1.1E-002
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_6	Loss of Crew Flag (Phase 6)	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
	0.03	5.000E-006	LAUNCH	T = 0.0	1.0E+000
			ATCS_EPWS_BE_P_2	No power from electric power system fails ATCS (phase 2)	5.0E-006
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
	0.03	5.000E-006	LAUNCH	T = 0.0	1.0E+000
			ATCS_EPWS_BE_P_8	No power from electric power system fails ATCS (phase 8)	5.0E-006
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
	0.03	5.000E-006	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
			EPWS_AVCS_BE_P_2	No signal from Avionics System fails EPS (phase 2)	5.0E-006
	0.03	5.000E-006	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000
			EPWS_AVCS_BE_P_8	No signal from Avionics System fails EPS (phase 8)	5.0E-006
	0.02	4.076E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-LSAM-INS	LSAM and CEV LLO Insertion Fails	4.2E-003
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_3	Loss of Crew Flag (Phase 3)	1.0E+000
	0.02	4.076E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			CLV-CEV-INS	CEV Earth Orbit Insertion Fails	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
	0.02	4.076E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			CLV-SRBS-LCH	CLV (5-Segment SRB) Fails to Launch with CEV	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
	0.02	4.076E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			CLV-STG1-FTO	CLV First Stage Ascent Fails	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
	0.02	4.076E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			CLV-STG2-FTO	CLV Second Stage Ascent Fails	4.2E-003
			ENDSTATE_LOC_1	Loss of Crew Flag (Phase 1)	1.0E+000
	0.02	4.076E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-PARA-DPL-CCF	CCF of 2 Parachutes (out of 3) during Deployment	9.8E-004
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-STGE-INS	LSAM Ascent Stage LLO Insertion	4.2E-003
	0.02	4.000E-006	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-SIG-1-ARMING	Avionics fails to provide arming signal train 1 (Main Parachute)	2.0E-003
			CM-AVCS-SIG-2-ARMING	Avionics fails to provide arming signal train 2 (Main Parachute)	2.0E-003
			ENDSTATE_LOC_8	Loss of Crew Flag (Phase 8)	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
	0.02	3.500E-006	LAUNCH	T = 0.0	1.0E+000
			CM-AVCS-ENG-CCF-POWER	Avionics fails to enable device power supply Bus CCF (Main Parachute)	1.0E-004
			ENDSTATE_LOC_5	Loss of Crew Flag (Phase 5)	1.0E+000
			LSAM-CRW-REC-05	Recovery actions by crew fail during lunar surface activities	5.0E-001
			LSAM-LSAM-FTO	Lunar Surface Mission	7.0E-002
	0.02	3.272E-006	LAUNCH	T = 0.0	1.0E+000
			CEV-CRW-REC-P-4	Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-001
			CM-EPWS-BATT-CCF-P-4	CEV CM EPS Battery CCF of 1, 2, and 3 (phase 4)	6.5E-006
			ENDSTATE_LOC_4	Loss of Crew Flag (Phase 4)	1.0E+000
	0.02	2.816E-006	LAUNCH	T = 0.0	1.0E+000
			CM-EPWS-BATT-CCF-P-2	CEV CM EPS Battery CCF of 1, 2, and 3 (phase 2)	2.8E-006
			ENDSTATE_LOC_2	Loss of Crew Flag (Phase 2)	1.0E+000
		1.714E-002	= Total		
LOM	30.04	3.500E-002	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			LSAM-CRW-REC-05	Recovery actions by crew fail during lunar surface activities	5.0E-001
			LSAM-LSAM-FTO	Lunar Surface Mission	7.0E-002
	8.58	1.000E-002	LAUNCH	T = 0.0	1.0E+000
			CALV-ESD-ORB-INLEO	EDS Fails to Loiter in LEO	1.0E-002
			ENDSTATE_LOM_1	Loss of Mission Flag (Phase 1)	1.0E+000
	8.58	1.000E-002	LAUNCH	T = 0.0	1.0E+000
			CALV-LSAM-ORB-INLEO	LSAM Fails to Loiter in LEO	1.0E-002
			ENDSTATE_LOM_1	Loss of Mission Flag (Phase 1)	1.0E+000
	8.58	1.000E-002	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN	EDS, LSAM, and CEV TLI Burn for LLO fails	1.0E-002
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	8.58	1.000E-002	LAUNCH	T = 0.0	1.0E+000
			CEV-TLI-BRN-MIDCOURSE	EDS, LSAM, and CEV TLI Mid-course correction burn fails	1.0E-002
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	3.59	4.180E-003	LAUNCH	T = 0.0	1.0E+000
			CALV-EDS-FTO	CaLV Third Stage (EDS) Ascent Fails	4.2E-003
			ENDSTATE_LOM_1	Loss of Mission Flag (Phase 1)	1.0E+000
	3.59	4.180E-003	LAUNCH	T = 0.0	1.0E+000
			CALV-EDS-INS	CaLV Third Stage Shutdown/Orbital Insertion (EOI) Fails	4.2E-003
			ENDSTATE_LOM_1	Loss of Mission Flag (Phase 1)	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
	3.59	4.180E-003	LAUNCH	T = 0.0	1.0E+000
			CALV-SRBS-FTO-5SSME	CaLV First Stage Ascent Fails	4.2E-003
			ENDSTATE_LOM_1	Loss of Mission Flag (Phase 1)	1.0E+000
	3.59	4.180E-003	LAUNCH	T = 0.0	1.0E+000
			CALV-SRBS-LCH-5SSME	CaLV First Stage (5 SSMEs) Fail to Launch	4.2E-003
			ENDSTATE_LOM_1	Loss of Mission Flag (Phase 1)	1.0E+000
	3.59	4.180E-003	LAUNCH	T = 0.0	1.0E+000
			CALV-STG2-FTO	CaLV Second Stage Ascent Fails	4.2E-003
			ENDSTATE_LOM_1	Loss of Mission Flag (Phase 1)	1.0E+000
	2.48	2.889E-003	LAUNCH	T = 0.0	1.0E+000
			CEV-LUNAR-COM-P-5	No input from external communications (phase 5)	2.9E-003
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	2.45	2.852E-003	LAUNCH	T = 0.0	1.0E+000
			CEV-LUNAR-COM-P-4	No input from external communications (phase 4)	2.9E-003
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	1.29	1.500E-003	LAUNCH	T = 0.0	1.0E+000
			CEV-CREW-SOLAREVENT-LOM	Non-lethal but significant dose to the crew due to solar particle event	1.5E-003
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
	1.05	1.228E-003	LAUNCH	T = 0.0	1.0E+000
			CEV-LUNAR-COM-P-2	No input from external communications (phase 2)	1.2E-003
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.86	1.000E-003	LAUNCH	T = 0.0	1.0E+000
			CM-BIU-FTF-1-P2	Bus interface unit 1 fails to transmit signal (phase 2)	1.0E-003
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.86	1.000E-003	LAUNCH	T = 0.0	1.0E+000
			CM-BIU-FTF-1-P3	Bus interface unit 1 fails to transmit signal (phase 3)	1.0E-003
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.86	1.000E-003	LAUNCH	T = 0.0	1.0E+000
			CM-BIU-FTF-1-P4	Bus interface unit 1 fails to transmit signal (phase 4)	1.0E-003
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	0.86	1.000E-003	LAUNCH	T = 0.0	1.0E+000
			CM-BIU-FTF-1-P5	Bus interface unit 1 fails to transmit signal (phase 5)	1.0E-003
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.86	1.000E-003	LAUNCH	T = 0.0	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			CM-BIU-FTF-2-P2	Bus interface unit 2 fails to transmit signal (phase 2)	1.0E-003
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.86	1.000E-003	LAUNCH	T = 0.0	1.0E+000
			CM-BIU-FTF-2-P3	Bus interface unit 2 fails to transmit signal (phase 3)	1.0E-003
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.86	1.000E-003	LAUNCH	T = 0.0	1.0E+000
			CM-BIU-FTF-2-P4	Bus interface unit 2 fails to transmit signal (phase 4)	1.0E-003
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	0.86	1.000E-003	LAUNCH	T = 0.0	1.0E+000
			CM-BIU-FTF-2-P5	Bus interface unit 2 fails to transmit signal (phase 5)	1.0E-003
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.86	1.000E-003	LAUNCH	T = 0.0	1.0E+000
			CM-BIU-FTF-3-P2	Bus interface unit 3 fails to transmit signal (phase 2)	1.0E-003
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.86	1.000E-003	LAUNCH	T = 0.0	1.0E+000
			CM-BIU-FTF-3-P3	Bus interface unit 3 fails to transmit signal (phase 3)	1.0E-003
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.86	1.000E-003	LAUNCH	T = 0.0	1.0E+000
			CM-BIU-FTF-3-P4	Bus interface unit 3 fails to transmit signal (phase 4)	1.0E-003
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	0.86	1.000E-003	LAUNCH	T = 0.0	1.0E+000
			CM-BIU-FTF-3-P5	Bus interface unit 3 fails to transmit signal (phase 5)	1.0E-003
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.53	6.186E-004	LAUNCH	T = 0.0	1.0E+000
			CEV-LUNAR-COM-P-3	No input from external communications (phase 3)	6.2E-004
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.34	3.914E-004	LAUNCH	T = 0.0	1.0E+000
			ATCS-HCOL-FTF-1-P-5	CEV ATCS CM Heat Collection Devices (Loop 1) (phase 5)	3.9E-004
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.34	3.914E-004	LAUNCH	T = 0.0	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
			ATCS-HCOL-FTF-2-P-5	CEV ATCS CM Heat Collection Devices (Loop 2) (phase 5)	3.9E-004
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.33	3.863E-004	LAUNCH	T = 0.0	1.0E+000
			ATCS-HCOL-FTF-1-P-4	CEV ATCS CM Heat Collection Devices (Loop 1) (phase 4)	3.9E-004
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	0.33	3.863E-004	LAUNCH	T = 0.0	1.0E+000
			ATCS-HCOL-FTF-2-P-4	CEV ATCS CM Heat Collection Devices (Loop 2) (phase 4)	3.9E-004
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	0.32	3.737E-004	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-CCF-P-5	CEV SM EPS Power Generation SubSys Solar Array CCF	3.7E-004
	0.32	3.689E-004	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
			SM-SRAY-FTF-CCF-P-4	CEV SM EPS Power Generation SubSys Solar Array CCF	3.7E-004
	0.22	2.553E-004	LAUNCH	T = 0.0	1.0E+000
			CM-SENS-FTF-BIU-1-P5	Sensor BIU 1 fails (phase 5)	2.6E-004
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.22	2.553E-004	LAUNCH	T = 0.0	1.0E+000
			CM-SENS-FTF-BIU-3-P5	Sensor BIU 3 fails (phase 5)	2.6E-004
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.22	2.520E-004	LAUNCH	T = 0.0	1.0E+000
			CM-SENS-FTF-BIU-1-P4	Sensor BIU 1 fails (phase 4)	2.5E-004
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	0.22	2.520E-004	LAUNCH	T = 0.0	1.0E+000
			CM-SENS-FTF-BIU-3-P4	Sensor BIU 3 fails (phase 4)	2.5E-004
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	0.14	1.663E-004	LAUNCH	T = 0.0	1.0E+000
			ATCS-HCOL-FTF-1-P-2	CEV ATCS CM Heat Collection Devices (Loop 1) (phase 2)	1.7E-004
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.14	1.663E-004	LAUNCH	T = 0.0	1.0E+000
			ATCS-HCOL-FTF-2-P-2	CEV ATCS CM Heat Collection Devices (Loop 2) (phase 2)	1.7E-004
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
	0.14	1.589E-004	LAUNCH	T = 0.0	1.0E+000
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
			SM-SRAY-FTF-CCF-P-2	CEV SM EPS Power Generation SubSys Solar Array CCF	1.6E-004
	0.09	1.084E-004	LAUNCH	T = 0.0	1.0E+000
			CM-SENS-FTF-BIU-1-P2	Sensor BIU 1 fails (phase 2)	1.1E-004
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.09	1.084E-004	LAUNCH	T = 0.0	1.0E+000
			CM-SENS-FTF-BIU-3-P2	Sensor BIU 3 fails (phase 2)	1.1E-004
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.09	1.000E-004	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_2	No signal from Avionics System fails ATCS (phase 2)	1.0E-004
			ENDSTATE_LOM_2	Loss of Mission Flag (Phase 2)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.09	1.000E-004	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_3	No signal from Avionics System fails ATCS (phase 3)	1.0E-004
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.09	1.000E-004	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_4	No signal from Avionics System fails ATCS (phase 4)	1.0E-004
			ENDSTATE_LOM_4	Loss of Mission Flag (Phase 4)	1.0E+000
	0.09	1.000E-004	LAUNCH	T = 0.0	1.0E+000
			ATCS_AVCS_BE_P_5	No signal from Avionics System fails ATCS (phase 5)	1.0E-004
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.09	1.000E-004	LAUNCH	T = 0.0	1.0E+000
			CALV-EDS-IGN	CaLV EDS (3rd stage) Fails to Ignite	1.0E-004
			ENDSTATE_LOM_1	Loss of Mission Flag (Phase 1)	1.0E+000
	0.07	8.700E-005	LAUNCH	T = 0.0	1.0E+000
			ECLS_TOP_P_5	ECLS fails to provide adequate habitat (phase 5)	8.7E-005
			ENDSTATE_LOM_5	Loss of Mission Flag (Phase 5)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
	0.07	8.372E-005	LAUNCH	T = 0.0	1.0E+000
			ATCS-HCOL-FTF-1-P-3	CEV ATCS CM Heat Collection Devices (Loop 1) (phase 3)	8.4E-005
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000

End State	Cut Set %	Prob./Freq.	Basic Event	Description	Probability
	0.07	8.372E-005	LAUNCH	T = 0.0	1.0E+000
			ATCS-HCOL-FTF-2-P-3	CEV ATCS CM Heat Collection Devices (Loop 2) (phase 3)	8.4E-005
			ENDSTATE_LOM_3	Loss of Mission Flag (Phase 3)	1.0E+000
			LANDING_SYSTEM_WORKS	The landing system does not fail	1.0E+000
		1.165E-001	= Total		

Appendix D – LOC End State Importance Measures

This appendix contains the importance measures for the LOC end state cut sets results. Each row of the importance measure table provides the basic event name and description, nominal probability, Fussell-Vesely (F-V, expressed as a %), the risk reduction ratio (RRR, expressed via a green bar), and the risk increase ratio (RIR, expressed as a red bar). The results shown are for basic events with a F-V of 1E-6 and greater.

LEGEND

Basic Event Name	Prob.	F-V	RRR / RIR
Basic event description			

Basic Event Name	Prob.	F-V	RRR	RIR
ENDSTATE_LOC_4 Loss of Crew Flag (Phase 4)	1.0	30.6%	1.4	1.0
CEV-CRW-REC-P-4 Recovery of Crew given failure of CEV in Lunar Loiter	5.0E-01	30.6%	1.4	1.3
ENDSTATE_LOC_5 Loss of Crew Flag (Phase 5)	1.0	29.8%	1.4	1.0
ENDSTATE_LOC_8 Loss of Crew Flag (Phase 8)	1.0	29.7%	1.4	1.0
LSAM-STGE-ASC LSAM Ascent Stage Ascent	5.1E-03	29.4%	1.4	58.3
CEV-CEV--ORB CEV fails to stay in LOI (coast)	1.0E-02	28.8%	1.4	29.5
CEV-CMOD-CRW Crew recovery fails after landing	2.6E-03	15.0%	1.2	58.3
ENDSTATE_LOC_2 Loss of Crew Flag (Phase 2)	1.0	8.3%	1.1	1.0

CEV-PARA-DPL-CCF CCF of 2 Parachutes (out of 3) during Deployment	**9.8E-04**	6.4%	1.1 58.3
SM-RCS-DOCK-P-2 SM RCS rendezvous and docking (phase 2)	**9.0E-04**	5.2%	1.1 58.3
CM-RCS-COURSE-P-8 CM RCS attitude and spin control (phase 8)	**9.0E-04**	5.2%	1.1 58.3
CM-AVCS-SIG-CCF-ARMING Avionics fails to provide arming signal CCF (Main Parachute)	**2.0E-04**	1.3%	1.0 58.3
SM-SRAY-FTF-CCF-P-4 CEV SM EPS Power Generation SubSys Solar Array CCF	**3.7E-04**	1.1%	1.0 29.7
SM-SRAY-FTF-CCF-P-2 CEV SM EPS Power Generation SubSys Solar Array CCF	**1.6E-04**	0.9%	1.0 58.3
CEV-CREW-SOLAREVENT-LOC Lethal dose to the crew due to solar particle event	**1.5E-04**	0.9%	1.0 58.3
CEV-PARA-DPL-1 Parachute #1 Fails during Deployment	**7.8E-03**	0.8%	1.0 2.0
CEV-PARA-DPL-3 Parachute #3 Fails during Deployment	**7.8E-03**	0.8%	1.0 2.0
CEV-PARA-DPL-2 Parachute #2 Fails during Deployment	**7.8E-03**	0.8%	1.0 2.0
CM-AVCS-ENG-CCF-POWER Avionics fails to enable device power supply Bus CCF (Main Parachute)	**1.0E-04**	0.7%	1.0 58.3
ATCS_AVCS_BE_P_2 No signal from Avionics System fails ATCS (phase 2)	**1.0E-04**	0.6%	1.0 58.3

ATCS_AVCS_BE_P_8 No signal from Avionics System fails ATCS (phase 8)	**1.0E-04**	0.6%	1.0 58.3
ENDSTATE_LOC_1 Loss of Crew Flag (Phase 1)	**1.0**	0.5%	1.0 1.0
CM-AVCS-FTC-PYRO-CCF-BKR Avionics fails to close breaker to Electric Bus CCF (Main Parachute)	**5.0E-05**	0.3%	1.0 58.3
LSAM-CRW-REC-05 Recovery actions by crew fail during lunar surface activities	**5.0E-01**	0.3%	1.0 1.0
LSAM-LSAM-FTO Lunar Surface Mission	**7.0E-02**	0.3%	1.0 1.0
ATCS_AVCS_BE_P_4 No signal from Avionics System fails ATCS (phase 4)	**1.0E-04**	0.3%	1.0 29.7
ENDSTATE_LOC_3 Loss of Crew Flag (Phase 3)	**1.0**	0.2%	1.0 1.0
ECLS_TOP_P_2 ECLS fails to provide adequate habitat (phase 2)	**3.7E-05**	0.2%	1.0 58.3
ATCS-TANK-FTF-CM-P-4 CEV ATCS CM Coolant Storage (phase 4)	**5.0E-05**	0.1%	1.0 29.7
ATCS-HSNK-FTF-EVAP-P-4 CEV ATCS CM Evaporative Heat Sink (phase 4)	**5.0E-05**	0.1%	1.0 29.7
ATCS-TANK-FTF-CM-P-2 CEV ATCS CM Coolant Storage (phase 2)	**2.2E-05**	0.1%	1.0 58.3
ATCS-HSNK-FTF-EVAP-P-2 CEV ATCS CM Evaporative Heat Sink (phase 2)	**2.2E-05**	0.1%	1.0 58.3

ATCS-HCOL-FTF-CCF-P-4 CEV ATCS CM heat collection devices CCF (phase 4)	**3.9E-05**	0.1%	1.0 29.7
CLV-STG1-FTO CLV First Stage Ascent Fails	**4.2E-03**	0.1%	1.0 1.3
CLV-CEV-RAD CEV Rendezvous and Docking with EDS and LSAM fails	**1.1E-02**	Less than 1% (9.7E-04)	1.0 1.1
CLV-SRBS-LCH CLV (5-Segment SRB) Fails to Launch with CEV	**4.2E-03**	Less than 1% (9.6E-04)	1.0 1.2
ATCS-HCOL-FTF-CCF-P-2 CEV ATCS CM heat collection devices CCF (phase 2)	**1.7E-05**	Less than 1% (9.5E-04)	1.0 58.3
CLV-CEV-INS CEV Earth Orbit Insertion Fails	**4.2E-03**	Less than 1% (9.3E-04)	1.0 1.2
CLV-STG2-FTO CLV Second Stage Ascent Fails	**4.2E-03**	Less than 1% (9.3E-04)	1.0 1.2
CEV-TLI-BRN-MIDCOURSE EDS, LSAM, and CEV TLI Mid-course correction burn fails	**1.0E-02**	Less than 1% (8.8E-04)	1.0 1.1
CEV-LSAM-BRN-MIDCOURSE LSAM and CEV Mid-course Correction Burn	**1.0E-02**	Less than 1% (8.8E-04)	1.0 1.1
CEV-LSAM-LLOBURN LSAM and CEV Burn to Slow Near LLO	**1.0E-02**	Less than 1% (8.8E-04)	1.0 1.1
CEV-TLI-BRN EDS, LSAM, and CEV TLI Burn for LLO fails	**1.0E-02**	Less than 1% (8.8E-04)	1.0 1.1
LSAM-STGE-BRN-LUNARLAND LSAM Powered Descent and Landing to the Lunar Surface	**1.0E-02**	Less than 1% (8.8E-04)	1.0 1.1

STRC-BE-P-8 Structures fail (phase 8)	**1.5E-05**	Less than 1% (8.6E-04)	1.0 58.3
ENDSTATE_LOC_6 Loss of Crew Flag (Phase 6)	**1.0**	Less than 1% (6.9E-04)	1.0 1.0
CM-AVCS-SIG-1-ARMING Avionics fails to provide arming signal train 1 (Main Parachute)	**2.0E-03**	Less than 1% (5.9E-04)	1.0 1.3
CM-AVCS-SIG-2-ARMING Avionics fails to provide arming signal train 2 (Main Parachute)	**2.0E-03**	Less than 1% (5.9E-04)	1.0 1.3
CLV-LAS--SEP LAS Jettison from CEV	**1.0E-05**	Less than 1% (5.7E-04)	1.0 58.3
CEV-LSAM-RAD-ASCENT LSAM Ascent Stage Fails to Rendezvous and Dock with CEV	**1.1E-02**	Less than 1% (4.8E-04)	1.0 1.0
CEV-LSAM-CRW-DOCK-REC Recovery of Crew from LSAM/CEV Docking Problem	**5.0E-01**	Less than 1% (4.8E-04)	1.0 1.0
CEV-LSAM-INS LSAM and CEV LLO Insertion Fails	**4.2E-03**	Less than 1% (3.7E-04)	1.0 1.1
LSAM-STGE-INS LSAM Ascent Stage LLO Insertion	**4.2E-03**	Less than 1% (3.7E-04)	1.0 1.1
ENDSTATE_LOC_7 Loss of Crew Flag (Phase 7)	**1.0**	Less than 1% (3.5E-04)	1.0 1.0
CM-AVCS-SIG-1-FIRING Avionics fails to provide firing signal train 1 (Main Parachute)	**1.0E-03**	Less than 1% (2.9E-04)	1.0 1.3
CM-AVCS-ENG-A-POWER Avionics fails to enable device power supply Bus A (Main Parachute)	**1.0E-03**	Less than 1% (2.9E-04)	1.0 1.3

CM-AVCS-SIG-2-FIRING	**1.0E-03**	Less than 1% (2.9E-04)	1.0 1.3
Avionics fails to provide firing signal train 2 (Main Parachute)			
CM-AVCS-ENG-B-POWER	**1.0E-03**	Less than 1% (2.9E-04)	1.0 1.3
Avionics fails to enable device power supply Bus B (Main Parachute)			
EPWS_AVCS_BE_P_2	**5.0E-06**	Less than 1% (2.9E-04)	1.0 58.3
No signal from Avionics System fails EPS (phase 2)			
ATCS_EPWS_BE_P_2	**5.0E-06**	Less than 1% (2.9E-04)	1.0 58.3
No power from electric power system fails ATCS (phase 2)			
ATCS_EPWS_BE_P_8	**5.0E-06**	Less than 1% (2.9E-04)	1.0 58.3
No power from electric power system fails ATCS (phase 8)			
EPWS_AVCS_BE_P_8	**5.0E-06**	Less than 1% (2.9E-04)	1.0 58.3
No signal from Avionics System fails EPS (phase 8)			
CEV-LSAM-CRW-TRANSFER	**2.6E-03**	Less than 1% (2.3E-04)	1.0 1.1
Crew Transfers from the CEV to LSAM			
CM-EPWS-BATT-CCF-P-4	**6.5E-06**	Less than 1% (1.9E-04)	1.0 29.7
CEV CM EPS Battery CCF of 1, 2, and 3 (phase 4)			
CM-EPWS-BATT-CCF-P-2	**2.8E-06**	Less than 1% (1.6E-04)	1.0 58.3
CEV CM EPS Battery CCF of 1, 2, and 3 (phase 2)			
CM-RCS-REC-MIDCOURSE	**1.0**	Less than 1% (1.5E-04)	1.0 1.0
Midcourse correction recovery using CM RCS			
CEV-STGE-BRN-MIDCOURSE	**1.7E-03**	Less than 1% (1.5E-04)	1.0 1.1
CEV (SM) mid-course correction burn fails			
CM-AVCS-FTC-PYRO-B-BKR	**5.0E-04**	Less than 1% (1.5E-04)	1.0 1.3
Avionics fails to close breaker to Electric Bus B (Main Parachute)			

CM-AVCS-FTC-PYRO-A-BKR Avionics fails to close breaker to Electric Bus A (Main Parachute)	**5.0E-04**	Less than 1% (1.5E-04)	1.0 1.3
EPWS_AVCS_BE_P_4 No signal from Avionics System fails EPS (phase 4)	**5.0E-06**	Less than 1% (1.4E-04)	1.0 29.7
ATCS_EPWS_BE_P_4 No power from electric power system fails ATCS (phase 4)	**5.0E-06**	Less than 1% (1.4E-04)	1.0 29.7
SYS-PYRO-FTF-CCF-MAIN Pyrotechnic device CCF (Main Parachute)	**2.0E-06**	Less than 1% (1.3E-04)	1.0 58.3
SYS-PYRO-FTF-CCF-DROG Pyrotechnic device CCF (Drogue Parachute)	**2.0E-06**	Less than 1% (1.3E-04)	1.0 58.3
LAS-CLV-HPS-PRESS-1 Dynamic pressure too high during 1st stage	**5.0E-04**	Less than 1% (1.2E-04)	1.0 1.2
CEV-LSAM-CRW-REC Recovery of Crew from LSAM/CEV	**5.0E-01**	Less than 1% (1.1E-04)	1.0 1.0
CEV-LSAM-CRW-TRANSFER2 Crew fails to Transfers from LSAM Ascent Stage to CEV	**2.6E-03**	Less than 1% (1.1E-04)	1.0 1.0
ATCS_AVCS_BE_P_1 No signal from Avionics System fails ATCS (phase 1)	**1.0E-04**	Less than 1% (1.1E-04)	1.0 2.0
SM-RCS-COURSE-P-7 SM RCS mid-course corrections (phase 7)	**9.0E-04**	Less than 1% (7.9E-05)	1.0 1.1
SM-RCS-COURSE-P-3 SM RCS mid-course corrections (phase 3)	**9.0E-04**	Less than 1% (7.9E-05)	1.0 1.1
SM-RCS-DOCK-P-6 SM RCS rendezvous and docking (phase 6)	**9.0E-04**	Less than 1% (7.9E-05)	1.0 1.1

CEV-STGE-BRN-TOEARTH CEV (SM TEI) initial burn for Earth fails	**8.6E-04**	Less than 1% (7.6E-05)	1.0 1.1
CM-EPWS-FTF-CCF-P-4 CEV CM EPS Power Distribution CCF of 1, 2, and 3 (phase 4)	**2.5E-06**	Less than 1% (7.2E-05)	1.0 29.7
CM-COMP-FTF-CCF-P2 CCF of all critical control computer (phase 2)	**1.2E-06**	Less than 1% (6.9E-05)	1.0 58.3
CM-COMP-FTF-CCF-P8 CCF of all critical control computer (phase 8)	**1.2E-06**	Less than 1% (6.9E-05)	1.0 58.3
ECLS_TOP_P_8 ECLS fails to provide adequate habitat (phase 8)	**1.2E-06**	Less than 1% (6.9E-05)	1.0 58.3
CM-EPWS-FTF-CCF-P-2 CEV CM EPS Power Distribution CCF of 1, 2, and 3 (phase 2)	**1.1E-06**	Less than 1% (6.2E-05)	1.0 58.3
ATCS-TANK-FTF-CM-P-1 CEV ATCS CM Coolant Storage (phase 1)	**3.6E-05**	Less than 1% (3.8E-05)	1.0 2.0
ATCS-HSNK-FTF-EVAP-P-1 CEV ATCS CM Evaporative Heat Sink (phase 1)	**3.6E-05**	Less than 1% (3.8E-05)	1.0 2.0
CM-COMP-FTF-CCF-P4 CCF of all critical control computer (phase 4)	**1.2E-06**	Less than 1% (3.4E-05)	1.0 29.7
ATCS-HSNK-FTF-EVAP-P-8 CEV ATCS CM Evaporative Heat Sink (phase 8)	**5.4E-07**	Less than 1% (3.1E-05)	1.0 58.3
ATCS-TANK-FTF-CM-P-8 CEV ATCS CM Coolant Storage (phase 8)	**5.4E-07**	Less than 1% (3.1E-05)	1.0 58.3
ATCS-HCOL-FTF-CCF-P-1 CEV ATCS CM heat collection devices CCF (phase 1)	**2.8E-05**	Less than 1% (2.9E-05)	1.0 2.0

LAS-CM-FTF-RCS-2 Loss of RCS control function during 2nd stage	**1.0E-04**	Less than 1% (2.5E-05)	1.0 1.2
LAS-COMP-FTF-COMP-2 Faulty computer hardware during 2nd stage	**1.0E-04**	Less than 1% (2.5E-05)	1.0 1.2
LAS-SENS-FTF-SIGNAL-2 Faulty signal sensor during 2nd stage	**1.0E-04**	Less than 1% (2.5E-05)	1.0 1.2
LAS-SGNL-FTF-DELAYSIG-2 Signal too late for successful abort during 2nd stage	**1.0E-04**	Less than 1% (2.5E-05)	1.0 1.2
LAS-CM-FTF-THERMAL-2 Thermal failure from aero heating of LAS blast during 2nd stage	**1.0E-04**	Less than 1% (2.5E-05)	1.0 1.2
LAS-CREW-CRW-DELAY-2 Crew delayed in initiating abort during 2nd stage	**1.0E-04**	Less than 1% (2.5E-05)	1.0 1.2
LAS-PYRO-FOD-MISFIRE-2 Pyro unit gets signal but fails to successfully fire during 2nd stage	**1.0E-04**	Less than 1% (2.5E-05)	1.0 1.2
LAS-SENS-FTF-MOTOR-2 Faulty motor sensor during 2nd stage	**1.0E-04**	Less than 1% (2.5E-05)	1.0 1.2
LAS-CM-CTR-RCS-2 Loss of RCS control during 2nd stage	**1.0E-04**	Less than 1% (2.5E-05)	1.0 1.2
LAS-WIRE-FTF-WIRING-2 Wire damaged due to handling of flight dynamics during 2nd stage	**1.0E-04**	Less than 1% (2.5E-05)	1.0 1.2
LAS-CM-FTF-RCSTHRUST-2 Inadequate RCS thrust during 2nd stage	**1.0E-04**	Less than 1% (2.5E-05)	1.0 1.2
LAS-SOFT-FTF-MOTOR-2 Faulty motor software during 2nd stage	**1.0E-04**	Less than 1% (2.5E-05)	1.0 1.2

LAS-CRCT-FTF-CONNEC-2	**1.0E-04**	Less than 1% (2.5E-05)	1.0 1.2
Loose corroded or otherwise faulty connection during 2nd stage			
LAS-WIRE-FTF-CONNEC-2	**1.0E-04**	Less than 1% (2.5E-05)	1.0 1.2
Faulty wiring or connection during 2nd stage			
LAS-SOFT-FTF-SIGNAL-2	**1.0E-04**	Less than 1% (2.5E-05)	1.0 1.2
Faulty software processing the signal during 2nd stage			
LAS-CM-FTF-STRUCT-2	**1.0E-04**	Less than 1% (2.5E-05)	1.0 1.2
Structural loading failure during 2nd stage			
LAS-CLV-FTF-CEVVAC-1	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Vacuum holds components together during separation during 1st stage			
LAS-WIRE-FTF-WIRING-1	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Wire damaged due to handling of flight dynamics during 1st stage			
LAS-CM-FTF-THERMAL-1	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Thermal failure from aero heating of LAS blast during 1st stage			
LAS-CM-FTF-STRUCT-1	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Structural loading failure during 1st stage			
LAS-SOFT-FTF-MOTOR-1	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Faulty motor software during 1st stage			
LAS-CM-FTF-RCS-1	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Loss of RCS control function during 1st stage			
LAS-CM-CTR-RCS-1	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Loss of RCS control during 1st stage			
LAS-WIRE-FTF-CONNEC-1	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Faulty wiring or connection during 1st stage			

LAS-SOFT-FTF-SIGNAL-1	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Faulty software processing the signal during 1st stage			
LAS-CRCT-FTF-CONNEC-1	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Loose corroded or otherwise faulty connection during 1st stage			
LAS-CM-FTF-RCSTHRUST-1	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Inadequate RCS thrust during 1st stage			
LAS-PYRO-FOD-MISFIRE-O	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Pyro unit gets signal but fails to successfully fire during LEO insertion			
LAS-SENS-FTF-MOTOR-O	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Faulty motor sensor during LEO insertion			
LAS-SENS-FTF-SIGNAL-O	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Faulty signal sensor during LEO insertion			
LAS-SGNL-FTF-DELAYSIG-O	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Signal too late for successful abort during LEO insertion			
LAS-WIRE-FTF-WIRING-O	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Wire damaged due to handling of flight dynamics during LEO insertion			
LAS-WIRE-FTF-CONNEC-O	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Faulty wiring or connection during LEO insertion			
LAS-SOFT-FTF-MOTOR-O	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Faulty motor software during LEO insertion			
LAS-COMP-FTF-COMP-1	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Faulty computer hardware during 1st stage			
LAS-SOFT-FTF-SIGNAL-O	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Faulty software processing the signal during LEO insertion			

LAS-CM-FTF-RCSTHRUST-O Inadequate RCS thrust during LEO insertion	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
LAS-CM-FTF-STRUCT-O Structural loading failure during LEO insertion	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
LAS-CREW-CRW-DELAY-O Crew delayed in initiating abort during LEO insertion	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
LAS-CM-FTF-RCS-O Loss of RCS control function during LEO insertion	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
LAS-PYRO-FOD-MISFIRE-1 Pyro unit gets signal but fails to successfully fire during 1st stage	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
LAS-SENS-FTF-MOTOR-1 Faulty motor sensor during 1st stage	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
LAS-SENS-FTF-SIGNAL-1 Faulty signal sensor during 1st stage	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
LAS-CM-CTR-RCS-O Loss of RCS control during LEO insertion	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
LAS-CREW-CRW-DELAY-1 Crew delayed in initiating abort during 1st stage	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
LAS-CM-FTF-THERMAL-O Thermal failure from aero heating of LAS blast during LEO insertion	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
LAS-SGNL-FTF-DELAYSIG-1 Signal too late for successful abort during 1st stage	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
LAS-COMP-FTF-COMP-O Faulty computer hardware during LEO insertion	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2

LAS-CRCT-FTF-CONNEC-O	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Loose corroded or otherwise faulty connection during LEO insertion			
LAS-CRCT-FTF-CONNEC-L	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Loose corroded or otherwise faulty connection during launch			
LAS-CM-CTR-RCS-L	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Loss of RCS control during launch			
LAS-CREW-CRW-DELAY-L	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Crew delayed in initiating abort during launch			
LAS-COMP-FTF-COMP-L	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Faulty computer hardware during launch			
LAS-CM-FTF-RCSTHRUST-L	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Inadequate RCS thrust during launch			
LAS-CM-FTF-RCS-L	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Loss of RCS control function during launch			
LAS-CLV-FTF-CEVVAC-L	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Vacuum holds components together during separation during launch			
LAS-CM-FTF-THERMAL-L	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Thermal failure from aero heating of LAS blast during launch			
LAS-CM-FTF-STRUCT-L	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Structural loading failure during launch			
LAS-PYRO-FOD-MISFIRE-L	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Pyro unit gets signal but fails to successfully fire during launch			
LAS-SENS-FTF-MOTOR-L	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
Faulty motor sensor during launch			

LAS-SENS-FTF-SIGNAL-L Faulty signal sensor during launch	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
LAS-SGNL-FTF-DELAYSIG-L Signal too late for successful abort during launch	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
LAS-WIRE-FTF-WIRING-L Wire damaged due to handling of flight dynamics during launch	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
LAS-SOFT-FTF-MOTOR-L Faulty motor software during launch	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
LAS-SOFT-FTF-SIGNAL-L Faulty software processing the signal during launch	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
LAS-WIRE-FTF-CONNEC-L Faulty wiring or connection during launch	**1.0E-04**	Less than 1% (2.4E-05)	1.0 1.2
ATCS-HCOL-FTF-CCF-P-8 CEV ATCS CM heat collection devices CCF (phase 8)	**4.1E-07**	Less than 1% (2.4E-05)	1.0 58.3
CLV-STG2-IGN CLV Second Stage (J2-S) Ignition	**1.0E-04**	Less than 1% (2.2E-05)	1.0 1.2
SM-SRAY-FTF-CCF-P-7 CEV SM EPS Power Generation SubSys Solar Array CCF	**2.4E-04**	Less than 1% (2.1E-05)	1.0 1.1
LAS-MOTR-FTF-MISWIRE-2 Miswired motor during 2nd stage	**8.0E-05**	Less than 1% (2.0E-05)	1.0 1.2
LAS-MOTR-FTF-MISWIRE-O Miswired motor during LEO insertion	**8.0E-05**	Less than 1% (1.9E-05)	1.0 1.2
LAS-MOTR-FTF-MISWIRE-1 Miswired motor during 1st stage	**8.0E-05**	Less than 1% (1.9E-05)	1.0 1.2

LAS-MOTR-FTF-MISWIRE-L	**8.0E-05**	Less than 1% (1.9E-05)	1.0 1.2
Miswired motor during launch			
LAS-CLV-FTF-CMSMVAC-2	**5.0E-05**	Less than 1% (1.2E-05)	1.0 1.2
Vacuum lock between SM and CM modules during 2nd stage			
LAS-BATT-FTF-SEPAR-2	**5.0E-05**	Less than 1% (1.2E-05)	1.0 1.2
Battery failure or low / loss of power during separation during 2nd stage			
LAS-CLV-SNG-COMPNT-2	**5.0E-05**	Less than 1% (1.2E-05)	1.0 1.2
Component interference or snagging during 2nd stage			
LAS-LAS-FTF-STRUCT-2	**5.0E-05**	Less than 1% (1.2E-05)	1.0 1.2
Thermal weakening leading to structual failure during 2nd stage			
LAS-SHLD-FTF-THERMAL-2	**5.0E-05**	Less than 1% (1.2E-05)	1.0 1.2
Insulation or TPS ablation causes shield thermal failure during 2nd stage			
LAS-CLV-FTF-SEPAR-2	**5.0E-05**	Less than 1% (1.2E-05)	1.0 1.2
Interference or snagging causing nonseparation or out of control movement on CM during 2nd stage			
LAS-CLV-FTF-CMSMVAC-1	**5.0E-05**	Less than 1% (1.2E-05)	1.0 1.2
Vacuum lock between SM and CM modules during 1st stage			
LAS-LAS-FTF-STRUCT-O	**5.0E-05**	Less than 1% (1.2E-05)	1.0 1.2
Thermal weakening leading to structual failure during LEO insertion			
LAS-CLV-SNG-COMPNT-1	**5.0E-05**	Less than 1% (1.2E-05)	1.0 1.2
Component interference or snagging during 1st stage			
LAS-SHLD-FTF-THERMAL-1	**5.0E-05**	Less than 1% (1.2E-05)	1.0 1.2
Insulation or TPS ablation causes shield thermal failure during 1st stage			
LAS-CLV-FTF-CMSMVAC-O	**5.0E-05**	Less than 1% (1.2E-05)	1.0 1.2
Vacuum lock between SM and CM modules during LEO insertion			

LAS-CLV-FTF-SEPAR-O	**5.0E-05**	Less than 1% (1.2E-05)	1.0 1.2
Interference or snagging causing nonseparation or out of control movement on CM during LEO insertion			
LAS-CLV-SNG-COMPNT-O	**5.0E-05**	Less than 1% (1.2E-05)	1.0 1.2
Component interference or snagging during LEO insertion			
LAS-LAS-FTF-STRUCT-1	**5.0E-05**	Less than 1% (1.2E-05)	1.0 1.2
Thermal weakening leading to structual failure during 1st stage			
LAS-SHLD-FTF-THERMAL-O	**5.0E-05**	Less than 1% (1.2E-05)	1.0 1.2
Insulation or TPS ablation causes shield thermal failure during LEO insertion			
LAS-CLV-FTF-SEPAR-1	**5.0E-05**	Less than 1% (1.2E-05)	1.0 1.2
Interference or snagging causing nonseparation or out of control movement on CM during 1st stage			
LAS-BATT-FTF-SEPAR-1	**5.0E-05**	Less than 1% (1.2E-05)	1.0 1.2
Battery failure or low / loss of power during separation during 1st stage			
LAS-BATT-FTF-SEPAR-O	**5.0E-05**	Less than 1% (1.2E-05)	1.0 1.2
Battery failure or low / loss of power during separation during LEO insertion			
LAS-CLV-SNG-COMPNT-L	**5.0E-05**	Less than 1% (1.2E-05)	1.0 1.2
Component interference or snagging during launch			
LAS-BATT-FTF-SEPAR-L	**5.0E-05**	Less than 1% (1.2E-05)	1.0 1.2
Battery failure or low / loss of power during separation during launch			
LAS-CLV-FTF-CMSMVAC-L	**5.0E-05**	Less than 1% (1.2E-05)	1.0 1.2
Vacuum lock between SM and CM modules during launch			
LAS-CLV-FTF-SEPAR-L	**5.0E-05**	Less than 1% (1.2E-05)	1.0 1.2
Interference or snagging causing nonseparation or out of control movement on CM during launch			
LAS-LAS-FTF-STRUCT-L	**5.0E-05**	Less than 1% (1.2E-05)	1.0 1.2
Thermal weakening leading to structual failure during launch			

LAS-SHLD-FTF-THERMAL-L	**5.0E-05**	Less than 1% (1.2E-05)	1.0 1.2
Insulation or TPS ablation causes shield thermal failure during launch			
ATCS_AVCS_BE_P_7	**1.0E-04**	Less than 1% (8.8E-06)	1.0 1.1
No signal from Avionics System fails ATCS (phase 7)			
ATCS_AVCS_BE_P_6	**1.0E-04**	Less than 1% (8.8E-06)	1.0 1.1
No signal from Avionics System fails ATCS (phase 6)			
ATCS_AVCS_BE_P_3	**1.0E-04**	Less than 1% (8.8E-06)	1.0 1.1
No signal from Avionics System fails ATCS (phase 3)			
SM-SRAY-FTF-CCF-P-3	**8.0E-05**	Less than 1% (7.0E-06)	1.0 1.1
CEV SM EPS Power Generation SubSys Solar Array CCF			
ECLS_TOP_P_1	**6.2E-05**	Less than 1% (5.4E-06)	1.0 1.1
ECLS fails to provide adequate habitat (phase 1)			
EPWS_AVCS_BE_P_1	**5.0E-06**	Less than 1% (5.3E-06)	1.0 2.0
No signal from Avionics System fails EPS (phase 1)			
ATCS_EPWS_BE_P_1	**5.0E-06**	Less than 1% (5.3E-06)	1.0 2.0
No power from electric power system fails ATCS (phase 1)			
CM-EPWS-BATT-CCF-P-1	**4.7E-06**	Less than 1% (4.9E-06)	1.0 2.0
CEV CM EPS Battery CCF of 1, 2, and 3 (phase 1)			
ECLS_TOP_P_7	**5.6E-05**	Less than 1% (4.9E-06)	1.0 1.1
ECLS fails to provide adequate habitat (phase 7)			
ATCS-HCOL-FTF-2-P-4	**3.9E-04**	Less than 1% (4.3E-06)	1.0 1.0
CEV ATCS CM Heat Collection Devices (Loop 2) (phase 4)			
ATCS-HCOL-FTF-1-P-4	**3.9E-04**	Less than 1% (4.3E-06)	1.0 1.0
CEV ATCS CM Heat Collection Devices (Loop 1) (phase 4)			

CM-EPWS-BATT-CCF-P-8	**7.0E-08**	Less than 1% (4.0E-06)	1.0 58.3
CEV CM EPS Battery CCF of 1, 2, and 3 (phase 8)			
LAS-MOTR-FTF-STRUCT-2	**1.5E-05**	Less than 1% (3.7E-06)	1.0 1.2
Motor case or nozzle burn through or structural failure in first 2 sec during 2nd stage			
LAS-MOTR-FTF-STRUCT-O	**1.5E-05**	Less than 1% (3.6E-06)	1.0 1.2
Motor case or nozzle burn through or structural failure in first 2 sec during LEO insertion			
LAS-MOTR-FTF-STRUCT-1	**1.5E-05**	Less than 1% (3.6E-06)	1.0 1.2
Motor case or nozzle burn through or structural failure in first 2 sec during 1st stage			
LAS-MOTR-FTF-STRUCT-L	**1.5E-05**	Less than 1% (3.6E-06)	1.0 1.2
Motor case or nozzle burn through or structural failure in first 2 sec during launch			
ATCS-TANK-FTF-CM-P-7	**3.2E-05**	Less than 1% (2.8E-06)	1.0 1.1
CEV ATCS CM Coolant Storage (phase 7)			
ATCS-HSNK-FTF-EVAP-P-7	**3.2E-05**	Less than 1% (2.8E-06)	1.0 1.1
CEV ATCS CM Evaporative Heat Sink (phase 7)			
CLV-STG1-SEP	**1.0E-05**	Less than 1% (2.6E-06)	1.0 1.3
CLV First Stage & Second Stage Separation			
LAS-SGNL-FTF-AUTOSIG-2	**1.0E-05**	Less than 1% (2.5E-06)	1.0 1.2
Signal auto initiated during 2nd stage			
LAS-LAS-FTF-TOWER-2	**1.0E-05**	Less than 1% (2.5E-06)	1.0 1.2
Stuctural tower or attachments during 2nd stage			
LAS-SGNL-FTF-RANGE-2	**1.0E-05**	Less than 1% (2.5E-06)	1.0 1.2
Range safety signal initiated during 2nd stage			
LAS-SHLD-FTF-SHIELD-2	**1.0E-05**	Less than 1% (2.5E-06)	1.0 1.2
Slag or hot debris causes shield melt through during 2nd stage			

LAS-SHLD-FTF-STRUCT-2	**1.0E-05**	Less than 1% (2.5E-06)	1.0 1.2
Structural shield failure exposes CM during 2nd stage			
LAS-PROP-FTF-STRUCT-2	**1.0E-05**	Less than 1% (2.5E-06)	1.0 1.2
Main propellant grain inhibitor or bond structural failure during 2nd stage			
LAS-CM-FTF-RCSPROP-2	**1.0E-05**	Less than 1% (2.5E-06)	1.0 1.2
Inadequate amount of RCS propellant during 2nd stage			
LAS-IGNT-FTF-IGNIT-2	**1.0E-05**	Less than 1% (2.5E-06)	1.0 1.2
PIC failure in conjunction with spurious ignition signal to ignition train during 2nd stage			
LAS-BATT-FTF-SIGNAL-2	**1.0E-05**	Less than 1% (2.5E-06)	1.0 1.2
Battery failure or low / loss of power on abort signal during 2nd stage			
LAS-CRCT-FTF-PIC-2	**1.0E-05**	Less than 1% (2.5E-06)	1.0 1.2
Both A and B PIC circuits report false arming during 2nd stage			
LAS-CLV-FTF-ATTITUDE-2	**1.0E-05**	Less than 1% (2.5E-06)	1.0 1.2
Vehicle in wrong abort attitude during 2nd stage			
LAS-VLGC-FTF-VOTING-2	**1.0E-05**	Less than 1% (2.5E-06)	1.0 1.2
Faulty assessment of sensor voting logic during 2nd stage			
LAS-SGNL-FTF-RANGE-1	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Range safety signal initiated during 1st stage			
LAS-BATT-FTF-SIGNAL-O	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Battery failure or low / loss of power on abort signal during LEO insertion			
LAS-CLV-FTF-ATTITUDE-1	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Vehicle in wrong abort attitude during 1st stage			
LAS-SHLD-FTF-STRUCT-1	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Structural shield failure exposes CM during 1st stage			

LAS-SHLD-FTF-SHIELD-1	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Slag or hot debris causes shield melt through during 1st stage			
LAS-VLGC-FTF-VOTING-1	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Faulty assessment of sensor voting logic during 1st stage			
LAS-CM-FTF-RCSPROP-O	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Inadequate amount of RCS propellant during LEO insertion			
LAS-SGNL-FTF-AUTOSIG-1	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Signal auto initiated during 1st stage			
LAS-IGNT-FTF-IGNIT-1	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
PIC failure in conjunction with spurious ignition signal to ignition train during 1st stage			
LAS-CRCT-FTF-PIC-O	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Both A and B PIC circuits report false arming during LEO insertion			
LAS-PROP-FTF-STRUCT-1	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Main propellant grain inhibitor or bond structural failure during 1st stage			
LAS-CRCT-FTF-PIC-1	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Both A and B PIC circuits report false arming during 1st stage			
LAS-SGNL-SPU-LIGHT-1	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Lightening hit causes signal during 1st stage			
LAS-LAS-FTF-TOWER-O	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Stuctural tower or attachments during LEO insertion			
LAS-CLV-FTF-ATTITUDE-O	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Vehicle in wrong abort attitude during LEO insertion			
LAS-IGNT-FTF-IGNIT-O	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
PIC failure in conjunction with spurious ignition signal to ignition train during LEO insertion			

LAS-SGNL-INT-NOISE-1	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Environmental or background (RF EMI and ESD) during 1st stage			
LAS-CM-FTF-RCSPROP-1	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Inadequate amount of RCS propellant during 1st stage			
LAS-BATT-FTF-SIGNAL-1	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Battery failure or low / loss of power on abort signal during 1st stage			
LAS-IGNT-SPU-LIGHT-1	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Lightening (direct strike) causes premature operation during 1st stage			
LAS-SGNL-FTF-AUTOSIG-O	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Signal auto initiated during LEO insertion			
LAS-VLGC-FTF-VOTING-O	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Faulty assessment of sensor voting logic during LEO insertion			
LAS-SHLD-FTF-STRUCT-O	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Structural shield failure exposes CM during LEO insertion			
LAS-SHLD-FTF-SHIELD-O	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Slag or hot debris causes shield melt through during LEO insertion			
LAS-SGNL-FTF-RANGE-O	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Range safety signal initiated during LEO insertion			
LAS-LAS-FTF-TOWER-1	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Stuctural tower or attachments during 1st stage			
LAS-PROP-FTF-STRUCT-O	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Main propellant grain inhibitor or bond structural failure during LEO insertion			
LAS-CRCT-FTF-PIC-L	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Both A and B PIC circuits report false arming during launch			

LAS-BATT-FTF-SIGNAL-L	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Battery failure or low / loss of power on abort signal during launch			
LAS-IGNT-FTF-IGNIT-L	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
PIC failure in conjunction with spurious ignition signal to ignition train during launch			
LAS-IGNT-FTF-STATIC-L	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Static discharge causes premature operation during launch			
LAS-IGNT-SPU-LIGHT-L	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Lightening (direct strike) causes premature operation during launch			
LAS-LAS-FTF-TOWER-L	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Stuctural tower or attachments during launch			
LAS-CM-FTF-RCSPROP-L	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Inadequate amount of RCS propellant during launch			
LAS-VLGC-FTF-VOTING-L	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Faulty assessment of sensor voting logic during launch			
LAS-SHLD-FTF-SHIELD-L	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Slag or hot debris causes shield melt through during launch			
LAS-SHLD-FTF-STRUCT-L	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Structural shield failure exposes CM during launch			
LAS-SGNL-INT-NOISE-L	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Environmental or background (RF EMI and ESD) during launch			
LAS-SGNL-SPU-LIGHT-L	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Lightening hit causes signal during launch			
LAS-SGNL-FTF-RANGE-L	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
Range safety signal initiated during launch			

LAS-SGNL-FTF-AUTOSIG-L Signal auto initiated during launch	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
LAS-PROP-FTF-STRUCT-L Main propellant grain inhibitor or bond structural failure during launch	**1.0E-05**	Less than 1% (2.4E-06)	1.0 1.2
CLV-STG2-SEP CEV (CM+SM) separation from CLV second stage fails	**1.0E-05**	Less than 1% (2.2E-06)	1.0 1.2
ATCS-HCOL-FTF-CCF-P-7 CEV ATCS CM heat collection devices CCF (phase 7)	**2.5E-05**	Less than 1% (2.2E-06)	1.0 1.1
CM-EPWS-FTF-CCF-P-1 CEV CM EPS Power Distribution CCF of 1, 2, and 3 (phase 1)	**1.8E-06**	Less than 1% (1.9E-06)	1.0 2.0
ECLS_TOP_P_3 ECLS fails to provide adequate habitat (phase 3)	**1.9E-05**	Less than 1% (1.7E-06)	1.0 1.1
ATCS-HCOL-FTF-2-P-2 CEV ATCS CM Heat Collection Devices (Loop 2) (phase 2)	**1.7E-04**	Less than 1% (1.6E-06)	1.0 1.0
ATCS-HCOL-FTF-1-P-2 CEV ATCS CM Heat Collection Devices (Loop 1) (phase 2)	**1.7E-04**	Less than 1% (1.6E-06)	1.0 1.0
CM-EPWS-FTF-CCF-P-8 CEV CM EPS Power Distribution CCF of 1, 2, and 3 (phase 8)	**2.7E-08**	Less than 1% (1.5E-06)	1.0 58.3
STRC-BE-P-1 Structures fail (phase 1)	**1.5E-05**	Less than 1% (1.3E-06)	1.0 1.1
CM-COMP-FTF-CCF-P1 CCF of all critical control computer (phase 8)	**1.2E-06**	Less than 1% (1.3E-06)	1.0 2.0
SM-SRAY-FTF-CCF-P-6 CEV SM EPS Power Generation SubSys Solar Array CCF	**1.2E-05**	Less than 1% (1.0E-06)	1.0 1.1

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Appendix E – LOM End State Importance Measures

This appendix contains the importance measures for the LOM end state cut sets results. Each row of the importance measure table provides the basic event name and description, nominal probability, Fussell-Vesely (F-V, expressed as a %), the risk reduction ratio (RRR, expressed via a green bar), and the risk increase ratio (RIR, expressed as a red bar). The results shown are for basic events with a F-V of 1E-6 and greater.

LEGEND

Basic Event Name	Prob.	F-V	RRR RIR
Basic event description			

LANDING_SYSTEM_WORKS The landing system does not fail	1.0	57.7%	2.4 1.0
ENDSTATE_LOM_5 Loss of Mission Flag (Phase 5)	1.0	33.9%	1.5 1.0
ENDSTATE_LOM_1 Loss of Mission Flag (Phase 1)	1.0	31.9%	1.5 1.0
LSAM-LSAM-FTO Lunar Surface Mission	7.0E-02	27.5%	1.4 4.7
LSAM-CRW-REC-05 Recovery actions by crew fail during lunar surface activities	5.0E-01	27.5%	1.4 1.3
ENDSTATE_LOM_2 Loss of Mission Flag (Phase 2)	1.0	20.7%	1.3 1.0
CALV-ESD-ORB-INLEO EDS Fails to Loiter in LEO	1.0E-02	7.7%	1.1 8.6
			1.1 8.6

CEV-TLI-BRN-MIDCOURSE EDS, LSAM, and CEV TLI Mid-course correction burn fails	**1.0E-02**	7.7%	
CEV-TLI-BRN EDS, LSAM, and CEV TLI Burn for LLO fails	**1.0E-02**	7.7%	1.1 8.6
CALV-LSAM-ORB-INLEO LSAM Fails to Loiter in LEO	**1.0E-02**	7.7%	1.1 8.6
ENDSTATE_LOM_4 Loss of Mission Flag (Phase 4)	**1.0**	6.0%	1.1 1.0
ENDSTATE_LOM_3 Loss of Mission Flag (Phase 3)	**1.0**	3.2%	1.0 1.0
CALV-EDS-FTO CaLV Third Stage (EDS) Ascent Fails	**4.2E-03**	3.2%	1.0 8.6
CALV-SRBS-FTO-5SSME CaLV First Stage Ascent Fails	**4.2E-03**	3.2%	1.0 8.6
CALV-EDS-INS CaLV Third Stage Shutdown/Orbital Insertion (EOI) Fails	**4.2E-03**	3.2%	1.0 8.6
CALV-SRBS-LCH-5SSME CaLV First Stage (5 SSMEs) Fail to Launch	**4.2E-03**	3.2%	1.0 8.6
CALV-STG2-FTO CaLV Second Stage Ascent Fails	**4.2E-03**	3.2%	1.0 8.6
CEV-LUNAR-COM-P-5 No input from external communications (phase 5)	**2.9E-03**	2.2%	1.0 8.6
CEV-LUNAR-COM-P-4 No input from external communications (phase 4)	**2.9E-03**	2.2%	1.0 8.6

CEV-CREW-SOLAREVENT-LOM	**1.5E-03**	1.1%	1.0 8.6
Non-lethal but significant dose to the crew due to solar particle event			
CEV-LUNAR-COM-P-2	**1.2E-03**	0.9%	1.0 8.6
No input from external communications (phase 2)			
CM-BIU-FTF-1-P5	**1.0E-03**	0.8%	1.0 8.6
Bus interface unit 1 fails to transmit signal (phase 5)			
CM-BIU-FTF-3-P2	**1.0E-03**	0.8%	1.0 8.6
Bus interface unit 3 fails to transmit signal (phase 2)			
CM-BIU-FTF-3-P4	**1.0E-03**	0.8%	1.0 8.6
Bus interface unit 3 fails to transmit signal (phase 4)			
CM-BIU-FTF-1-P3	**1.0E-03**	0.8%	1.0 8.6
Bus interface unit 1 fails to transmit signal (phase 3)			
CM-BIU-FTF-1-P2	**1.0E-03**	0.8%	1.0 8.6
Bus interface unit 1 fails to transmit signal (phase 2)			
CM-BIU-FTF-2-P3	**1.0E-03**	0.8%	1.0 8.6
Bus interface unit 2 fails to transmit signal (phase 3)			
CM-BIU-FTF-3-P5	**1.0E-03**	0.8%	1.0 8.6
Bus interface unit 3 fails to transmit signal (phase 5)			
CM-BIU-FTF-2-P4	**1.0E-03**	0.8%	1.0 8.6
Bus interface unit 2 fails to transmit signal (phase 4)			
CM-BIU-FTF-2-P5	**1.0E-03**	0.8%	1.0 8.6
Bus interface unit 2 fails to transmit signal (phase 5)			
CM-BIU-FTF-2-P2	**1.0E-03**	0.8%	1.0 8.6
Bus interface unit 2 fails to transmit signal (phase 2)			

CM-BIU-FTF-1-P4 Bus interface unit 1 fails to transmit signal (phase 4)	**1.0E-03**	0.8%	1.0 8.6
CM-BIU-FTF-3-P3 Bus interface unit 3 fails to transmit signal (phase 3)	**1.0E-03**	0.8%	1.0 8.6
CEV-LUNAR-COM-P-3 No input from external communications (phase 3)	**6.2E-04**	0.5%	1.0 8.6
ATCS-HCOL-FTF-1-P-5 CEV ATCS CM Heat Collection Devices (Loop 1) (phase 5)	**3.9E-04**	0.3%	1.0 8.6
ATCS-HCOL-FTF-2-P-5 CEV ATCS CM Heat Collection Devices (Loop 2) (phase 5)	**3.9E-04**	0.3%	1.0 8.6
ATCS-HCOL-FTF-2-P-4 CEV ATCS CM Heat Collection Devices (Loop 2) (phase 4)	**3.9E-04**	0.3%	1.0 8.6
ATCS-HCOL-FTF-1-P-4 CEV ATCS CM Heat Collection Devices (Loop 1) (phase 4)	**3.9E-04**	0.3%	1.0 8.6
SM-SRAY-FTF-CCF-P-5 CEV SM EPS Power Generation SubSys Solar Array CCF	**3.7E-04**	0.3%	1.0 8.6
SM-SRAY-FTF-CCF-P-4 CEV SM EPS Power Generation SubSys Solar Array CCF	**3.7E-04**	0.3%	1.0 8.6
CM-SENS-FTF-BIU-3-P5 Sensor BIU 3 fails (phase 5)	**2.6E-04**	0.2%	1.0 8.6
CM-SENS-FTF-BIU-1-P5 Sensor BIU 1 fails (phase 5)	**2.6E-04**	0.2%	1.0 8.6
CM-SENS-FTF-BIU-1-P4 Sensor BIU 1 fails (phase 4)	**2.5E-04**	0.2%	1.0 8.6

CM-SENS-FTF-BIU-3-P4 Sensor BIU 3 fails (phase 4)	**2.5E-04**	0.2%	1.0 8.6
ATCS-HCOL-FTF-2-P-2 CEV ATCS CM Heat Collection Devices (Loop 2) (phase 2)	**1.7E-04**	0.1%	1.0 8.6
ATCS-HCOL-FTF-1-P-2 CEV ATCS CM Heat Collection Devices (Loop 1) (phase 2)	**1.7E-04**	0.1%	1.0 8.6
SM-SRAY-FTF-CCF-P-2 CEV SM EPS Power Generation SubSys Solar Array CCF	**1.6E-04**	0.1%	1.0 8.6
CM-SENS-FTF-BIU-3-P2 Sensor BIU 3 fails (phase 2)	**1.1E-04**	Less than 1% (8.2E-04)	1.0 8.6
CM-SENS-FTF-BIU-1-P2 Sensor BIU 1 fails (phase 2)	**1.1E-04**	Less than 1% (8.2E-04)	1.0 8.6
ATCS_AVCS_BE_P_4 No signal from Avionics System fails ATCS (phase 4)	**1.0E-04**	Less than 1% (7.6E-04)	1.0 8.6
ATCS_AVCS_BE_P_2 No signal from Avionics System fails ATCS (phase 2)	**1.0E-04**	Less than 1% (7.6E-04)	1.0 8.6
ATCS_AVCS_BE_P_5 No signal from Avionics System fails ATCS (phase 5)	**1.0E-04**	Less than 1% (7.6E-04)	1.0 8.6
ATCS_AVCS_BE_P_3 No signal from Avionics System fails ATCS (phase 3)	**1.0E-04**	Less than 1% (7.6E-04)	1.0 8.6
CALV-EDS-IGN CaLV EDS (3rd stage) Fails to Ignite	**1.0E-04**	Less than 1% (7.6E-04)	1.0 8.6
ECLS_TOP_P_5 ECLS fails to provide adequate habitat (phase 5)	**8.7E-05**	Less than 1% (6.6E-04)	1.0 8.6

ATCS-HCOL-FTF-1-P-3 CEV ATCS CM Heat Collection Devices (Loop 1) (phase 3)	**8.4E-05**	Less than 1% (6.4E-04)	1.0 8.6
ATCS-HCOL-FTF-2-P-3 CEV ATCS CM Heat Collection Devices (Loop 2) (phase 3)	**8.4E-05**	Less than 1% (6.4E-04)	1.0 8.6
SM-SRAY-FTF-CCF-P-3 CEV SM EPS Power Generation SubSys Solar Array CCF	**8.0E-05**	Less than 1% (6.1E-04)	1.0 8.6
CM-SENS-FTF-BIU-3-P3 Sensor BIU 3 fails (phase 3)	**5.5E-05**	Less than 1% (4.1E-04)	1.0 8.6
CM-SENS-FTF-BIU-1-P3 Sensor BIU 1 fails (phase 3)	**5.5E-05**	Less than 1% (4.1E-04)	1.0 8.6
ATCS-HSNK-FTF-EVAP-P-5 CEV ATCS CM Evaporative Heat Sink (phase 5)	**5.1E-05**	Less than 1% (3.9E-04)	1.0 8.6
ATCS-TANK-FTF-CM-P-5 CEV ATCS CM Coolant Storage (phase 5)	**5.1E-05**	Less than 1% (3.9E-04)	1.0 8.6
ATCS-TANK-FTF-CM-P-4 CEV ATCS CM Coolant Storage (phase 4)	**5.0E-05**	Less than 1% (3.8E-04)	1.0 8.6
ATCS-HSNK-FTF-EVAP-P-4 CEV ATCS CM Evaporative Heat Sink (phase 4)	**5.0E-05**	Less than 1% (3.8E-04)	1.0 8.6
ATCS-HCOL-FTF-CCF-P-5 CEV ATCS CM heat collection devices CCF (phase 5)	**3.9E-05**	Less than 1% (3.0E-04)	1.0 8.6
ATCS-HCOL-FTF-CCF-P-4 CEV ATCS CM heat collection devices CCF (phase 4)	**3.9E-05**	Less than 1% (2.9E-04)	1.0 8.6
ECLS_TOP_P_2 ECLS fails to provide adequate habitat (phase 2)	**3.7E-05**	Less than 1% (2.8E-04)	1.0 8.6

CM-SENS-FTF-AVCS-3-P5 Avionics train 3 sensor fails (phase 5)	**2.7E-05**	Less than 1% (2.1E-04)	1.0 8.6
CM-SENS-FTF-AVCS-1-P5 Avionics train 1 sensor fails (phase 5)	**2.7E-05**	Less than 1% (2.1E-04)	1.0 8.6
CM-SENS-FTF-AVCS-3-P4 Avionics train 3 sensor fails (phase 4)	**2.7E-05**	Less than 1% (2.0E-04)	1.0 8.6
CM-SENS-FTF-AVCS-1-P4 Avionics train 1 sensor fails (phase 4)	**2.7E-05**	Less than 1% (2.0E-04)	1.0 8.6
CM-COMP-FTF-1-P5 Critical control computer 1 fails (phase 5)	**2.4E-05**	Less than 1% (1.8E-04)	1.0 8.6
CM-COMP-FTF-3-P5 Critical control computer 3 fails (phase 5)	**2.4E-05**	Less than 1% (1.8E-04)	1.0 8.6
CM-COMP-FTF-2-P5 Critical control computer 2 fails (phase 5)	**2.4E-05**	Less than 1% (1.8E-04)	1.0 8.6
CM-COMP-FTF-1-P4 Critical control computer 1 fails (phase 4)	**2.4E-05**	Less than 1% (1.8E-04)	1.0 8.6
CM-COMP-FTF-3-P4 Critical control computer 3 fails (phase 4)	**2.4E-05**	Less than 1% (1.8E-04)	1.0 8.6
CM-COMP-FTF-2-P4 Critical control computer 2 fails (phase 4)	**2.4E-05**	Less than 1% (1.8E-04)	1.0 8.6
CM-COMP-FTF-1-P2 Critical control computer 1 fails (phase 2)	**2.4E-05**	Less than 1% (1.8E-04)	1.0 8.6
CM-COMP-FTF-3-P2 Critical control computer 3 fails (phase 2)	**2.4E-05**	Less than 1% (1.8E-04)	1.0 8.6

CM-COMP-FTF-1-P3 Critical control computer 1 fails (phase 3)	**2.4E-05**	Less than 1% (1.8E-04)	1.0 8.6
CM-COMP-FTF-2-P2 Critical control computer 2 fails (phase 2)	**2.4E-05**	Less than 1% (1.8E-04)	1.0 8.6
CM-COMP-FTF-3-P3 Critical control computer 3 fails (phase 3)	**2.4E-05**	Less than 1% (1.8E-04)	1.0 8.6
CM-COMP-FTF-2-P3 Critical control computer 2 fails (phase 3)	**2.4E-05**	Less than 1% (1.8E-04)	1.0 8.6
ATCS-TANK-FTF-CM-P-2 CEV ATCS CM Coolant Storage (phase 2)	**2.2E-05**	Less than 1% (1.6E-04)	1.0 8.6
ATCS-HSNK-FTF-EVAP-P-2 CEV ATCS CM Evaporative Heat Sink (phase 2)	**2.2E-05**	Less than 1% (1.6E-04)	1.0 8.6
ECLS_TOP_P_3 ECLS fails to provide adequate habitat (phase 3)	**1.9E-05**	Less than 1% (1.5E-04)	1.0 8.6
ATCS-HCOL-FTF-CCF-P-2 CEV ATCS CM heat collection devices CCF (phase 2)	**1.7E-05**	Less than 1% (1.3E-04)	1.0 8.6
CM-EPWS-BATT-DCCF-P-5 CEV CM EPS Battery degraded CCF 2 of 3 (phase 5)	**1.7E-05**	Less than 1% (1.3E-04)	1.0 8.6
CM-EPWS-BATT-DCCF-P-4 CEV CM EPS Battery degraded CCF 2 of 3 (phase 4)	**1.6E-05**	Less than 1% (1.2E-04)	1.0 8.6
CM-SENS-FTF-AVCS-3-P2 Avionics train 3 sensor fails (phase 2)	**1.2E-05**	Less than 1% (8.8E-05)	1.0 8.6
CM-SENS-FTF-AVCS-1-P2 Avionics train 1 sensor fails (phase 2)	**1.2E-05**	Less than 1% (8.8E-05)	1.0 8.6

ATCS-TANK-FTF-CM-P-3 CEV ATCS CM Coolant Storage (phase 3)	**1.1E-05**	Less than 1% (8.3E-05)	1.0 8.6
ATCS-HSNK-FTF-EVAP-P-3 CEV ATCS CM Evaporative Heat Sink (phase 3)	**1.1E-05**	Less than 1% (8.3E-05)	1.0 8.6
CALV-SRBS-SEP-5SSME CaLV SRB Fail to Separate (5 SSMEs)	**1.0E-05**	Less than 1% (7.6E-05)	1.0 8.6
CALV-STG2-SEP CaLV Second Stage Fails to Separate from EDS/LSAM	**1.0E-05**	Less than 1% (7.6E-05)	1.0 8.6
CEV-EDS-SEP EDS Separates from LSAM and CEV	**1.0E-05**	Less than 1% (7.6E-05)	1.0 8.6
ATCS-HCOL-FTF-CCF-P-3 CEV ATCS CM heat collection devices CCF (phase 3)	**8.4E-06**	Less than 1% (6.3E-05)	1.0 8.6
CM-EPWS-BATT-DCCF-P-2 CEV CM EPS Battery degraded CCF 2 of 3 (phase 2)	**7.0E-06**	Less than 1% (5.3E-05)	1.0 8.6
CM-EPWS-BATT-CCF-P-5 CEV CM EPS Battery CCF of 1, 2, and 3 (phase 5)	**6.6E-06**	Less than 1% (5.0E-05)	1.0 8.6
CM-EPWS-BATT-CCF-P-4 CEV CM EPS Battery CCF of 1, 2, and 3 (phase 4)	**6.5E-06**	Less than 1% (5.0E-05)	1.0 8.6
CM-EPWS-FTF-DCCF-P-5 CEV CM EPS Power Distribution degraded CCF 2 of 3 (phase 5)	**6.4E-06**	Less than 1% (4.8E-05)	1.0 8.6
CM-EPWS-FTF-DCCF-P-4 CEV CM EPS Power Distribution degraded CCF 2 of 3 (phase 4)	**6.3E-06**	Less than 1% (4.8E-05)	1.0 8.6
CM-SENS-FTF-AVCS-1-P3 Avionics train 1 sensor fails (phase 3)	**5.8E-06**	Less than 1% (4.4E-05)	1.0 8.6

CM-SENS-FTF-AVCS-3-P3	**5.8E-06**	Less than 1% (4.4E-05)	1.0 8.6
Avionics train 3 sensor fails (phase 3)			
ATCS_EPWS_BE_P_3	**5.0E-06**	Less than 1% (3.8E-05)	1.0 8.6
No power from electric power system fails ATCS (phase 3)			
EPWS_AVCS_BE_P_3	**5.0E-06**	Less than 1% (3.8E-05)	1.0 8.6
No signal from Avionics System fails EPS (phase 3)			
ATCS_EPWS_BE_P_5	**5.0E-06**	Less than 1% (3.8E-05)	1.0 8.6
No power from electric power system fails ATCS (phase 5)			
EPWS_AVCS_BE_P_5	**5.0E-06**	Less than 1% (3.8E-05)	1.0 8.6
No signal from Avionics System fails EPS (phase 5)			
ATCS_EPWS_BE_P_4	**5.0E-06**	Less than 1% (3.8E-05)	1.0 8.6
No power from electric power system fails ATCS (phase 4)			
EPWS_AVCS_BE_P_4	**5.0E-06**	Less than 1% (3.8E-05)	1.0 8.6
No signal from Avionics System fails EPS (phase 4)			
ATCS_EPWS_BE_P_2	**5.0E-06**	Less than 1% (3.8E-05)	1.0 8.6
No power from electric power system fails ATCS (phase 2)			
EPWS_AVCS_BE_P_2	**5.0E-06**	Less than 1% (3.8E-05)	1.0 8.6
No signal from Avionics System fails EPS (phase 2)			
CM-EPWS-BATT-DCCF-P-3	**3.5E-06**	Less than 1% (2.7E-05)	1.0 8.6
CEV CM EPS Battery degraded CCF 2 of 3 (phase 3)			
CM-EPWS-BATT-CCF-P-2	**2.8E-06**	Less than 1% (2.1E-05)	1.0 8.6
CEV CM EPS Battery CCF of 1, 2, and 3 (phase 2)			
CM-EPWS-FTF-DCCF-P-2	**2.7E-06**	Less than 1% (2.1E-05)	1.0 8.6
CEV CM EPS Power Distribution degraded CCF 2 of 3 (phase 2)			

CM-EPWS-FTF-CCF-P-5	**2.6E-06**	Less than 1% (1.9E-05)	1.0 8.6
CEV CM EPS Power Distribution CCF of 1, 2, and 3 (phase 5)			
CM-EPWS-FTF-CCF-P-4	**2.5E-06**	Less than 1% (1.9E-05)	1.0 8.6
CEV CM EPS Power Distribution CCF of 1, 2, and 3 (phase 4)			
CM-EPWS-BATT-CCF-P-3	**1.4E-06**	Less than 1% (1.1E-05)	1.0 8.6
CEV CM EPS Battery CCF of 1, 2, and 3 (phase 3)			
CM-EPWS-FTF-DCCF-P-3	**1.4E-06**	Less than 1% (1.0E-05)	1.0 8.6
CEV CM EPS Power Distribution degraded CCF 2 of 3 (phase 3)			
CM-EPWS-FTF-CCF-P-2	**1.1E-06**	Less than 1% (8.2E-06)	1.0 8.6
CEV CM EPS Power Distribution CCF of 1, 2, and 3 (phase 2)			
CM-EPWS-FTF-CCF-P-3	**5.5E-07**	Less than 1% (4.1E-06)	1.0 8.6
CEV CM EPS Power Distribution CCF of 1, 2, and 3 (phase 3)			
ATCS-HTRN-FTF-2-P-5	**1.7E-07**	Less than 1% (1.3E-06)	1.0 8.6
CEV ATCS CM Heat Transport Devices (Loop 2) (phase 5)			
ATCS-HTRN-FTF-1-P-5	**1.7E-07**	Less than 1% (1.3E-06)	1.0 8.6
CEV ATCS CM Heat Transport Devices (Loop 1) (phase 5)			
ATCS-HTRN-FTF-2-P-4	**1.7E-07**	Less than 1% (1.3E-06)	1.0 8.6
CEV ATCS CM Heat Transport Devices (Loop 2) (phase 4)			
ATCS-HTRN-FTF-1-P-4	**1.7E-07**	Less than 1% (1.3E-06)	1.0 8.6
CEV ATCS CM Heat Transport Devices (Loop 1) (phase 4)			

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