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Basic

Launch Services Program

LAUNCH SERVICES PROGRAM RISK MANAGEMENT PLAN

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Section 1 Introduction

This plan provides the guidelines for managing risk in the Launch Services Program. It addresses the overall risk management process, including methods and tools used, as well as identifying roles and responsibilities for its implementation. In addition to meeting the requirements of this document, STS based launch services risks will also meet the requirements of NSTS 07700, Vol. 1, Program Description and Requirements Baseline.

1.1 Purpose and Scope

This plan is part of the Launch Services Program Management Plan suite of documents, and is applicable to all functions and supporting organizations within the Launch Services Program. The purpose of this document is to provide program personnel a clear, concise definition of how the program will identify and manage risk. The risk management process, as defined in this plan, anticipates, mitigates, and controls risk by focusing Program resources where they are needed to ensure Program success in accordance with success criteria stated in the Launch Services Program Management Plan. Risk management practices for the Launch Services Program have been, and will continue to be, incorporated into existing processes, and applied to all supporting infrastructure (facilities, systems, software, etc.) managed or utilized by the Launch Services Program to accomplish Program objectives.

1.2 Related Documents and Standards

The "Launch Services Program Management Plan" (Draft) directs the overall activities of the Launch Services program. This Program Risk Management Plan is required by, and is subordinate to, that document.

1.3 Authority

NPR 7120.5, "NASA Program and Project Management Processes and Requirements."

1.4 References

- ANSI/ASQC Q9001-2000, Quality Management Systems, Requirements
- Continuous Risk Management Guidebook, Carnegie Mellon University, Software Engineering Institute, 1996
- NPD 1440.6, NASA Records Management
- NPR 2810.1, Security of Information Technology
- NPD 7120.4, Program/Project Management
- NPD 8700.1, NASA Policy for Safety and Mission Success
- NPR 1441.1, Records Retention Schedule
- NPR 8000.4, Risk Management Procedures and Guidelines
- NPR 8715.3, NASA Safety Manual
- NSTS 07700, Vol. 1, Program Description and Requirements Baseline

Section 2 Risk Management Practice

2.1 Overview

The Launch Services Program utilizes a continuous risk management approach, illustrated in Figure 1. Six primary activities are performed in the risk management process:

- Risk Identification – a continuous process of clear description of risks in terms of both the undesirable conditions that exist, as well as the potential consequences of those conditions. In addition, risk identification includes identification of all the necessary information to place the risk in the context of the Program. The Program's employees should challenge even those things that have long worked successfully. Sources for Risk Identification are described in Appendix B. Among those sources are the Launch Service Program's Launch Service Contractors. Launch Service Contractors' risks will be identified in accordance with this plan and the 5x5 matrix contained herein (see Section 4.1.3). Risks identified by the Launch Service Contractors will be handled identically to those identified by someone within the Launch Services Program.
- Risk Analysis - an estimation of the probability, impact, and mitigation timeframe of the risks, classification into sets of related risks, and prioritization of risks relative to each other or to relevant criteria, and ranked in terms of Program impact. Methods of analyzing and classifying risks by program elements, as well as risk analysis inputs, are described in Section 4.2.
- Risk Planning (Risk Resolution) – planning the action that should be taken, and assigning the responsibility to respond to the identified risks. The planning approaches for responding to risk are as follows: accept, mitigate, research, or monitor. All risk planning activities are described in Section 4.3.
- Risk Tracking - acquiring/updating, compiling, analyzing, and organizing risk data; reporting tracking results, verifying and validating mitigation actions. Tracking also

includes risk trending to determine whether particular risks are increasing, decreasing, or staying the same over time. Risk tracking is described in Section 4.4.

- Risk Control - analyzing tracking results, deciding how to proceed (continue risk tracking, close the risk, replan the risk, invoke contingency plans), and executing control decisions. Periodic review of all risks, as well as other control methods, are described in Section 4.5.
- Communication/Documentation – Risk Management documentation shall be readily accessible to the entire team, e.g., in an automated form and under configuration control. Managing Organizations within the Launch Services Program will define the threshold that will trigger communication or elevation of a risk to the Launch Services Program Risk Control Board. The defined, approved thresholds are noted in Section 4.6.1. When a risk reaches that threshold, the Managing Organization will forward the risk to the Risk Control Board.
- The risk management records are maintained in accordance with ANSI/ASQC Q9001-2000, Quality Management Systems, Requirements. Action shall be taken to assure that open, clear, and on-going risk information is communicated across all levels of the Program. A formal audit trail shall establish the origin of, and rationale for, all risk-related decisions. Communication and documentation details are described in Section 4.6.



Figure 1 – Launch Services Risk Management Process

2.2 Risk Categories:

The mission of the Launch Services Program is to provide highly reliable, on-time, and cost-effective launch services. Risk categories involve those things that might deny the program the ability to accomplish that mission or other critical objectives. Risk categories for the Launch Services Program include:

- Cost Risk
 - Budget (adequacy of resources)
 - Legal, political, or environmental concerns
- Schedule Risk
 - Vehicle hardware/software delivery
 - Mission integration issues
 - Schedule maintenance
 - Launch window & availability
 - Spacecraft or spacecraft products delivery
- Technical Performance Risk
 - Critical skills retention
 - Technology readiness
 - ELV Residual Technical risk

- Safety Risk
 - Safety and Flight Assurance
 - Insight & approval requirements
 - Process and documentation control

Section 3 Organization & Responsibilities

3.1 Risk Organizational Chart

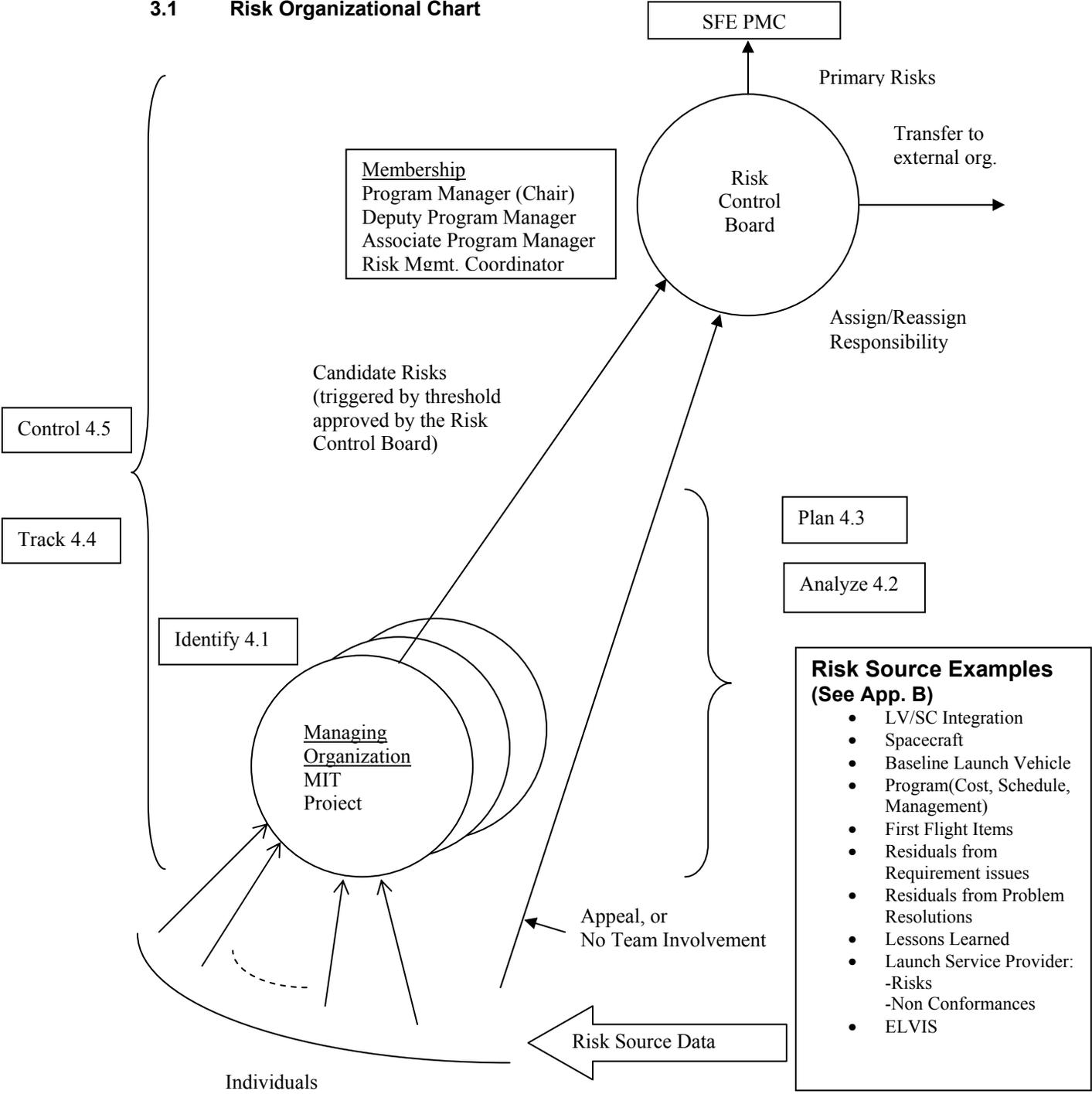


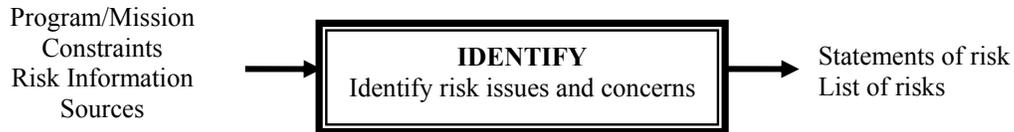
Figure 2 – Launch Services Program Risk Organization

3.2 Responsibilities

The Launch Services Program shall provide training to its personnel on the risk process and use of the Risk Management Database. See LSP-P-353.01, Launch Services Program Risk Management Process.

Section 4 Process Details

4.1 Identifying Risks



4.1.1 Purpose

The purpose of identifying risks is to search for and locate risks early enough to effectively manage them before they become problems. All Program personnel are responsible for identifying and reporting risks. It is the policy of the Launch Services Program that any risk to the Program identified during the course of doing business should be assessed regardless of the timeframe. Specifically, risks dealing with Program schedule and resources will be assessed over the life of the Period of Performance (POP) (5-year life cycle). During the Advance Planning phase, risks will be identified as they are encountered. Mission risks will be identified from Launch Vehicle Authority to Proceed.

4.1.2 Description

Risk identification is an organized, thorough approach to seek out the real risks associated with the Launch Services Program. The risk statement must identify a condition and a consequence. The condition is a single phrase or sentence that briefly describes the key circumstances or situations that have caused concern, doubt, anxiety, or uncertainty. The consequence is a single phrase or sentence that describes the key, negative potential outcome(s) of the current condition.

Given the **condition**, there is a possibility that **consequence(s)** will occur.

Additional information on the condition or consequence of the risk is provided as context. The context should be articulated and recorded so any uncertainties are understood.

Care should be taken to distinguish between problems and risks. Risks represent potential future concerns, where the potential undesired event has not yet occurred. A problem is something undesirable (e.g., an event) that has occurred (e.g., a risk has materialized) and requires corrective action. Program-related situations that are imminent in their probability/timeframe should be treated as problems rather than risks. It should be noted that during the resolution of a problem, new risks can be created (e.g., when an engineering issue or problem is closed without returning the item to print or restoring form, fit, or function, there is a residual risk present).

The impact and probability of the consequence will be determined in the analysis process.

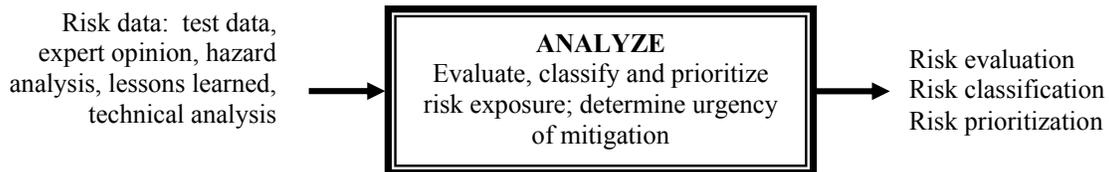
4.1.3 Tools and Processes

Potential risks are identified by individuals or teams across all levels of the functional and administrative organizations. If a potential risk is determined by the Managing Organization to be valid (a threat to the Program as determined by the Program Success Criteria), the risk issues and concerns, captured on Risk Information Sheets (RIS), are maintained in a risk management system database. Data required on the RIS varies, dependent upon its required level of attention. Those risks elevated to the Risk Control Board require more extensive data on the RIS.

Risk information sources are noted in Appendix B. Risks identified by the Launch Service Contractors will be reported to the Contracting Officer's Technical Representative (COTR). The COTR will then provide those risks to the appropriate Managing Organization within the Launch Services Program, where the risks will then be processed as if entered by an individual within the Launch Services Program. Once a risk has been identified, and a risk owner assigned, it becomes

the responsibility of the risk owner (team lead or designated person assigned to mitigate the risk) to coordinate the analysis of the risk as described in Section 4.2, Analyzing Risks.

4.2 Analyzing Risks



4.2.1 Purpose

The purpose of analyzing risks is to ascertain, classify, and prioritize risk exposure.

4.2.2 Description

Analysis is the process of examining the risks in detail to determine, classify, and prioritize risk exposure, and to determine the mitigation timeframe and urgency for mitigation.

The results of the analysis are subsequently recorded on the Risk Information Sheet (RIS) by the person (or team) assigned to mitigate the risk.

Risk classification is performed by an individual or a team in order to more effectively manage a set of risks. It is based on how the risks relate to each other within a given scenario. This includes grouping risks based on shared characteristics or identifying relationships among the risks. Risk owners will coordinate the analysis of the risk. Factors to be used in this analysis are shown in Table 1 "Launch Services Risk Analysis Criteria." Based on the assessment of impact and probability, the risk will be assigned a color code (Green representing Low Risk exposure, Yellow representing Medium Risk exposure, and Red representing High Risk exposure) that relates to its seriousness (see Figure 3 – Launch Services Risk Exposure Matrix). This code is automatically recorded on the RIS by the risk database system.

4.2.3 Tools and Processes

RISK ANALYSIS CRITERIA

Probability Classification					
Level	1	2	3	4	5
Label	Very Low	Low	Moderate	High	Very High
Guidance for Probability Level Selection	*1-5%	6-10%	11-50%	51-90%	91-<100%
	Probability of occurrence is very low. Existing processes and mitigation efforts are strong and very likely to prevent this risk scenario	Probability of occurrence is low. Existing processes and mitigation efforts are usually sufficient to prevent this risk scenario; additional actions may be required.	Probability of occurrence is moderate. Existing processes and mitigation efforts may prevent this risk scenario, but additional actions will be required.	Probability of occurrence is high. Existing processes and mitigation efforts cannot prevent this risk scenario; a different process or mitigation effort might.	Probability of occurrence is very high. Existing processes and mitigation efforts cannot prevent this risk scenario; no alternative processes or mitigation efforts are available.

Impact Classification					
Level	1	2	3	4	5
Label	Very Low	Low	Moderate	High	Very High
Safety	No injury or significant damage to flight HW/SW or GSE	Slight injury or small damage to flight HW/SW or GSE	Serious injury/ illness or significant damage to flight HW/SW or GSE	Permanent disability or major damage to flight HW/SW or GSE	Loss of life, flight HW/SW or GSE
Schedule	Minimal or no impact	Delay in a single key milestone	Delay in multiple key milestones	Delay in critical path key milestones	Slip or launch/ completion date
Cost	<\$200K	\$200K - \$500K	\$500K - \$1M	\$1M - \$10M	>\$10M
Technical Performance	Minimal or no impact	Moderate impact due to reduced performance or data, with same approach retained; acceptable loss of vehicle/ mission capability	Moderate impact due to reduced performance or data, using available workarounds; can meet mission requirements with some degradation (e.g., loss of redundancy)	Major impacts due to degraded performance or data, with workarounds to be established; significant degradation of mission requirements (e.g., partial mission loss per success criteria)	Unacceptable technical impacts; technical goals cannot be met; loss of mission (e.g., mission success criteria will not be met)

*Percentages are for comparative purposes only.

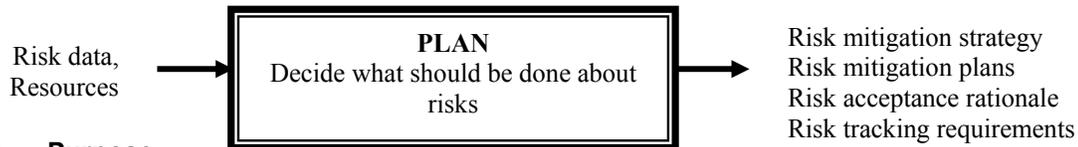
Table 1 – Launch Services Risk Analysis Criteria

Probability of Occurrence	5 91-<100%	1x5	2x5	3x5	4x5	5x5
	4 51-90%	1x4	2x4	3x4	4x4	5x4
	3 11-50%	1x3	2x3	3x3	4x3	5x3
	2 6-10%	1x2	2x2	3x2	4x2	5x2
	1 1-5%	1x1	2x1	3x1	4x1	5x1
		1	2	3	4	5
		Impact				

Figure 3 – Launch Services Risk Exposure Matrix

Risks are prioritized according to their risk exposure (the combination of the impact of the risk and the probability of its occurrence), and then by its urgency (timeframe to start and complete mitigation). Based on the level of risk identified through the analysis process, and the assessment by the risk owner, a strategy is formulated for risk mitigation. Methods of risk planning, including risk planning approaches (e.g., research, accept, monitor, mitigate), are discussed in Section 4.3 – Risk Planning.

4.3 Risk Planning



4.3.1 Purpose

The purpose of planning (risk resolution) is to convert risk analysis data into decision-making information and actions, with the intent of implementation.

4.3.2 Description

Planning is the process of deciding what, if anything, should be done to eliminate or mitigate a risk or set of related risks. Planning determines responsibility, level of approach, appropriate actions, and resources required to mitigate the risk.

4.3.3 Tools and Processes

New risks are identified to the Managing Organization, or to the Risk Control Board if no Managing Organization is apparent, and brought to a team lead's or manager's attention through periodic project and team meetings, through weekly database reports created by the Risk Management Coordinator, and during quarterly database reviews facilitated by the Risk Management Coordinator. The team leads and managers determine whether to keep the risk or transfer accountability. If necessary, a risk may be transferred to an external organization best suited to handle the risk.

Each red or yellow risk is assigned, by the Managing Organization, or by the Risk Control Board if no Managing Organization is apparent, to a responsible individual or team for risk mitigation and status. During risk planning, the person or team responsible for mitigating the risk must determine, and present to the Risk Control Board, the extent of the planning needed to draft and finalize the mitigation plan.

4.3.3.1 Risk Research, Monitoring & Mitigation

The primary activity in risk planning is to determine the appropriate risk planning approach for each risk. Regardless of the risk planning approach selected, the rationale for the approach should be documented on the Risk Information Sheet (RIS). There are four planning approaches: Research, Accept, Watch/Monitor, and Mitigate. The Research planning approach involves actions needed to better understand the risk before a decision to Accept, Watch/Monitor, or Mitigate the risk can be made. The Accept planning approach is selected when the probability of risk occurrence is so low that the Program does not intend to take further action on the risk. The Watch/Monitor planning approach is selected when the potential for risk occurrence is not on the immediate Program horizon, or existing conditions are not favorable for taking action on the risk. The Mitigate planning approach is selected when the Program determines that it is necessary to deal with the risk to reduce the risk impact and/or the risk probability.

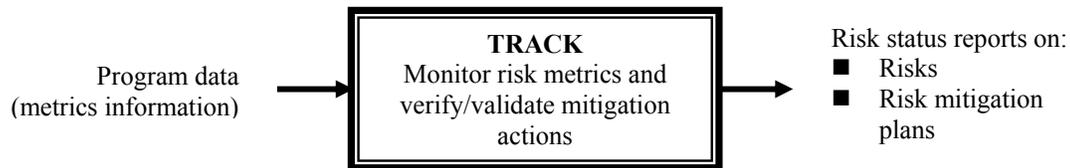
For risks that are to be accepted, the risk acceptance rationale should be documented on the RIS. For risks that are to be monitored (the Watch planning approach), a threshold should be identified, which, if encountered, would require reassessment of the risk. For risks that are to be mitigated, the risk mitigation strategy must address key elements such as the risk identifier number and risk statement, the risk owner, risk mitigation actions that will be taken by designated assignees, risk success/closure criteria, related risks (if any), due dates and schedules, and cost of the mitigation strategy/actions. If warranted, a contingency plan (in the event the proposed mitigation is unsuccessful) and initiation threshold may be specified.

For risks that are determined through analysis to require elevation for approval, the risk mitigation strategy must be developed, presented to, and approved by the Risk Control Board.

When analysis shows that risks are Green or Yellow, the responsible Managing Organization shall determine the appropriate level of risk planning based on their assessment. When Yellow and Green risks are elevated to the Risk Control Board (not including the general quarterly review of all open risks), the risk planning approach (and any risk mitigation strategy) must be developed and presented to the Risk Control Board for review.

The progress of the risk mitigation will be followed through the tracking process, as described in Section 4.4 - Tracking Risks.

4.4 Tracking Risks



4.4.1 Purpose

The purpose of risk tracking is to collect accurate, timely, and relevant risk information in a clear and easily understood manner appropriate to the person/team receiving the status report. The status report is used during the control process to make decisions on managing the risks.

4.4.2 Description

Risk tracking is the process in which risk data are acquired, compiled, and reported by the person or team assigned to monitoring risks. Risk tracking further verifies and validates mitigation actions. Tracking information and reports can include quantitative indicator data as well as more subjective information. Risk tracking shall be integrated with existing Launch Services Program management processes.

4.4.3 Tools and Processes

Status of the risk mitigation plan is kept in the Risk Information Sheet (RIS) status block.

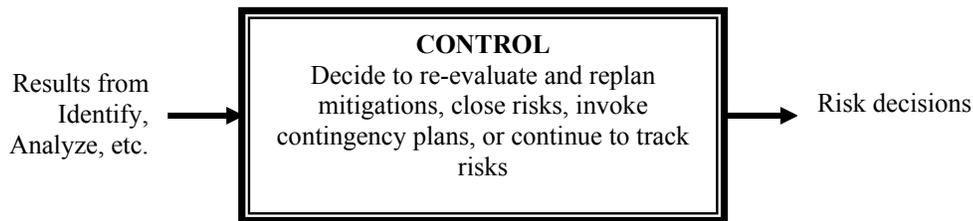
The risk tracking database is used to acquire, compile, and report data on the risks and applicable mitigation plans. The risk tracking database is a listing of the risks and key data from the corresponding RIS. This information can provide the decision-maker with an overview of how well current mitigation efforts are progressing, and if additional management action is required.

Additional risk management status reports are developed for various established and agreed upon indicators, triggers, and measures. The intent of these indicators, triggers, and measures is to use, where feasible, existing Program data (e.g., performance, cost, schedule) to assess the effectiveness of the mitigation effort associated with specific risks. Indicators are representations of measurement data that provide insight into a process, or show status of the management of a risk. Triggers define thresholds for the indicators, and specify when a mitigation action must take place. Measures reflect the characteristic of a risk, and define a standard way of measuring some attributes of a risk.

The risks are tracked at the Managing Organization and Risk Control Board (Program Manager, Deputy Program Manager, Associate Program Manager) levels to determine if the consequences have worsened, improved, or remain the same. The risk tracking spreadsheets are applicable at all levels. The indicators, triggers, and measures are dependent on the management level.

The tracking tools will be used during the control process, addressed in Section 4.5 - Controlling Risks.

4.5 Controlling Risks



4.5.1 Purpose

The purpose of controlling risks is to make informed, timely, and effective decisions regarding risks and their mitigation plans.

Risk control is the process of deciding what to do about risks, and implementing those decisions, based on tracking information. Resulting actions may include: changing the risk mitigation strategy formulated earlier; closing the risk; accepting and monitoring a residual risk; accepting a residual risk and ceasing to track it further; invoking a contingency plan when the original risk mitigation strategy is found to be ineffective; deciding to continue with the original risk mitigation strategy and continue to track the risk over time; or carrying the risk over to another mission. The Risk Management Coordinator is responsible for ensuring the appropriate risk process controls are followed. The Risk Management Coordinator is also in charge of managing the Launch Services Risk Management Database, preparing the reports for each group/forum, monitoring timely risk closure, reporting metrics on the overall risk process, and continuously improving the risk management process.

4.5.2 Description

The key steps to risk control are to analyze tracking data, decide how to proceed, and execute risk control decisions. Changes to risks, the transformation of risks to problems, the change to an accepted risk due to worsening or improved consequences, or plans that are not mitigating the risks, will require adjustments in risk mitigation plans, actions, or techniques. Analysis of metrics/trends is also performed to determine successful risk control.

4.5.3 Tools and Processes

Decisions are made by the Managing Organizations or the Risk Control Board to close risks, continue tracking the risk over time, re-plan or re-focus the risk mitigation strategy, invoke contingency plans, or carryover the risk to another mission. The Managing Organizations will review all new risks, and forward those requiring mitigation strategy approval to the Risk Control Board. Other risks will be forwarded for attention, as needed. If treatment of a risk does not eliminate it entirely, the risk that remains is referred to as a residual risk. The Risk Control Board will review all yellow and red residual risks, and be informed of all green residual risks. The Risk Control Board consists of the Program Manager (Chairman/Risk Manager, or his designee), Deputy Program Manager, Associate Program Manager, and the Risk Management Coordinator. Additionally, forums such as the Mission Integration Team, Branch Staff, and Engineering meetings may be used to review and discuss risks associated with their respective responsibilities. These groups will be provided weekly summaries generated from the Launch Services Risk Management database. The Risk Management Coordinator will support the Managing Organizations and Risk Control Board.

4.5.4 Risk Elevation

When resources to mitigate the risk are beyond the scope of existing resources, changes to contracts (Launch Service Contractor or Mission Support Contractor) are required, significant involvement by personnel external to Launch Services (e.g., outside expertise) is required, or schedule relief is required, then the Risk Manager will elevate the risk to the appropriate level.

Some risks may need to be elevated beyond the Program to NASA Headquarters, or transferred to other Centers' management, and/or the Payload Customer. Criteria for elevating beyond the Program include:

- When the risk mitigation has not been, or cannot be, performed in a timely manner so as to ensure a safe launch
- When risk mitigation has been performed, but has not lowered the consequence of the risk
- When NASA Headquarters needs to commit resources (budget or personnel), or provide schedule relief to perform risk mitigation
- When the risk has a broad based customer impact (e.g., delay of several launches, fleet shutdown, etc.)

Risks elevated beyond the Program level will be briefed at the Quarterly SFE PMC, and will include status of on-going, long-term risk mitigation activities and definition of new major risks. A special meeting may be required to close risks elevated beyond the Program.

4.5.5 Risk Closure

The Risk Control Board will present primary (Red) risks to the SFE PMC for downgrade and/or closure. Closure of Green and Yellow risks is delegated to the Risk Owners/Managing Organizations.

Risks will be considered closed when:

- Mitigation criteria indicated on the Risk Identification Sheet are met, and no further risk exists
- The risk becomes a problem and is transferred to the appropriate functional organization
- The conditions and/or the consequences for the risk have been eliminated

4.5.6 Risk Acceptance

A risk may be accepted if it does not pose a threat to Program success in accordance with success criteria stated in the Launch Services Program Management Plan. Generally, a risk is determined to be acceptable if the analysis shows it has both a low impact and a low probability of occurrence.

Other acceptance criteria are as follows:

- Everything within reason has been done that can be done and a risk still exists, but the probability of occurrence and/or impact are low enough that it does not threaten Program success, and it is prudent to accept the risk rather than expend any further resources.

Rationale for the risk acceptance will be recorded on the Risk Information Sheet. Only the Launch Services Program Risk Manager, with concurrence of the SFE PMC, is permitted to accept residual critical and catastrophic safety risks. The SFE Program Management Council (PMC) must concur in the formal acceptance of primary risks (those at high probability/high impact level or higher). Characterization of a primary risk as "acceptable" shall be supported by the rationale, with the concurrence of the SFE PMC, that all reasonable mitigation options (within cost, schedule, and technical constraints) have been instituted.

After a risk is accepted, the acceptance rationale should be periodically reviewed to ensure there have been no changes in rationale that would cause the risk planning approach to be reassessed. The risk will remain in the risk management database for historical and statistical analysis purposes, and will be presented at the LVLRR, the IMAR, and Payload Carrier reviews, as appropriate. After acceptance, the risk will be reported in the next Weekly Risk Update Report.

4.5.7 Risk Withdrawal

A risk may be withdrawn for administrative purposes if it is found to be an invalid risk, if it was issued under an incorrect classification (e.g., Vehicle instead of Mission) and will be reissued under the correct classification, or, if prior to beginning work on the risk, it is found to be a problem being tracked in the Engineering Review System. Other instances may arise, and will be reviewed on a case-by-case basis for withdrawal.

4.5.8 Collection of Performance Measures

Reports can show status for the overall risk management process. This data can be quantitative or qualitative. Examples of indicators that may be used include the number of high (Red), medium (Yellow), and low (Green) priority risks, the amount of time required to close a risk, the types of mitigation processes adopted, the time to get a mitigation strategy started, the number of open and closed risks, the number of problems that result from unresolved risks, the number of recurring similar risks, and the number of risks that have a classification change from the original classification. These measurements are also used to evaluate and improve the Launch Services Program risk management process, including the risk analysis criteria shown in Table 2.

A number of performance measures will document Program risk management trends using data contained in the Risk Management Database. The following metric information is provided:

- Number of new risks entered
- Number of high, medium, and low risks
- Total number of open risks
- Risk activity by month
- Program risk summary
- Risks per category, trends

Other metric information that may be used as needed are:

- Percent of high risks with mitigation plans
- Number of high, medium, and low risks without mitigation plans
- Percent mitigation plans completed
- Interval to close/transfer items

4.6 Communicating and Documenting Risks

4.6.1 Purpose

The purpose of risk communication is to provide information and feedback internal and external to the Program on the risk activities, current risks, and emerging risks. The communication is both formal and informal, and open communication is encouraged by management. The Launch Services Program will fully comply with NASA policy by fully addressing risks and risk acceptance at SFE PMC Reviews, other major milestone review activities, and operational readiness reviews (ref. NPD 8700.1A).

Managing Organization (MO) communication and elevation thresholds, approved by the Risk Control Board (RCB), provide guidance to the MO's to assist in risk processing. The thresholds are as follows:

Communicate –

- Managing Organization recognizes awareness by RCB is needed.

Elevate –

- Risk requires resource assistance from the RCB
- Risk is beyond the control of the MO (may require transfer of ownership)
- Risk requires approval of RCB
 - Primary Risks (Red) (Fig. 3 Risk Matrix boxes 3x5, 4x5, 5x5, 4x4, 5x4, and 5x3)
 - From ATP through Launch (Primary Risks, plus those that fall within Fig. 3 Risk Matrix boxes 5x2, 4x3, and 4x2)
 - Launch Campaign through Launch (all open/accepted Red and Yellow risks)

4.6.2 Description

Risk communication is the process by which risk information is conveyed between all levels of the Launch Services Program team (existing forums are shown in Table 2, Launch Services Program Risk Forums). Members of the team are empowered to openly share issues and concerns. The process allows all Launch Services personnel to understand the importance of proactive risk identification, and the mitigation alternatives to prevent or control these risks before they become problems.

The following forums are used within the Launch Services Program to communicate risks:

Forum	Subjects	Risk Management Actions
Launch Services Program Review	Overall launch manifest, ELV calendar, ELV Missions, facility occupancy, core vehicle engineering issues, advanced mission work	Present status of primary risks Identify new risks as appropriate Present summary of mission/core vehicle on each mission chart (weekly/monthly)
Readiness Reviews ¹	Review of all major topics prior to launch of a mission	Review all significant open mission risks and plans, plus yellow and red accepted risks
Managing Organization Meetings	Review of all risks, closures, and contractor risks	Status, prioritize, downgrade, and close risks (other than red); Determine method of obtaining resources from the Program (if required)
Risk Control Board	All red and significant risks per threshold in Section 4.6.1	Status, prioritize, downgrade, and close risks Determine method of obtaining resources
Quarterly Risk Review	Review Red and Yellow risks per Plan	Status, prioritize, downgrade, and close risks Determine method of obtaining resources from the Program (if required)

Table 2 - Launch Services Program Risk Forums

The results of forums are displayed on the Risk Bulletin Board. The Risk Bulletin Board was developed specifically to address Launch Services Program Risks. The board displays current red risks and risk reports. The Risk Management Coordinator maintains the Risk Bulletin Board for the Launch Services community.

4.6.3 Risk Management Database

The Risk Management Database is accessible by all individuals and teams within the Launch Services Program at KSC and CCAFS, and by those who support through the matrixed organizations. It is populated through the Risk Information Sheet (RIS), and is used to generate the tracking summary spreadsheets and additional special request reports. The historical data is maintained in order to keep track of lessons-learned, and support trending activities. A Microsoft Access database is used to collect risks and generate reports. Personnel not at KSC or CCAFS have access to risk data through the Risk Management Coordinator.

The Risk Management Coordinator shall implement a system for documentation and tracking of risk decisions. Because risk management is a continuous process, the required documentation should be accessible and easy to update. Documentation of the inputs, analyses, and outputs of each element of the Risk Management process should be collected and maintained as quality records as defined by ISO 9001.

¹ Germane ELV risks will be presented at: LVLRR; IMAR; FRR; and LRR

Information entered on the RIS should be as complete as possible. For each risk, the following information may be included:

- (1) Description of the risk, including source, primary causes and contributors, actions embedded in the program to date to reduce or control it, and information collected for tracking purposes.
- (2) Primary consequences, should the undesired event occur.
- (3) Estimate of the probability (qualitative or quantitative) of occurrence, together with the uncertainty of the estimate.
- (4) Significant cost impacts, given its occurrence.
- (5) Significant schedule impacts, given its occurrence.
- (6) Potential additional mitigation measures, including a cost comparison that addresses the probability of occurrence times the cost of occurrence, versus the cost of risk mitigation.
- (7) In the event of an attempt to accept a Red risk, characterization of the risk as "acceptable" or "unacceptable" shall be supported by the rationale, with the concurrence of the SFE PMC, that all reasonable mitigation options (within cost, schedule, and technical constraints) have been instituted.

GLOSSARY

Accept: One of the four basic risk planning approaches. This approach is selected when the probability of risk occurrence is so low that the Program does not intend to take further action on the risk.

Analyze: One of the six functions of the risk management paradigm. The Analyze function is a process in which risks are examined in further detail to determine the extent of the risks, how they relate to each other, and which ones are most important. Analyzing risks has three basic activities:

- Evaluating the attributes of the risk
- Classifying the risks
- Prioritizing (ranking) risks

Communicate: Exchange or sharing of information about risks. One of the six functions of the risk management paradigm. The Communicate function is a process in which risk information is conveyed between all levels of a project team. Risk communication deals with the ideas of probability and negative consequences. It is present in all of the other functions of the risk management paradigm, and is essential for the management of risks within an organization. Communication must fit within an organization's culture, and expose the risks that are present in an organization's projects.

Consequence: The outcome of an event. In a *risk statement*, the consequence phrase is the phrase at the end of the statement. Consequence is an attribute of a risk.

Context: Context provides additional detail regarding the events, circumstances, and interrelationships within the project that may affect the risk. This description is more detailed than can be captured in the basic statement of risk, and includes the rationale behind the chosen timeframe.

Continuous Risk Management: Continuous Risk Management is the engineering and programmatic practice with processes, methods, and tools for managing risks in a project or program. It provides a disciplined environment for proactive decision-making to

- Assess continuously what could go wrong (risks)
- Determine which risks are important
- Implement strategies to deal with those risks
- Measure the effectiveness of implemented strategies

Control: One of the six functions of the risk management paradigm. Action implementing risk management decisions. The Control function is a process that takes the tracking status reports for the watched and mitigated project risks and decides what to do with them based on the reported data. The person who has *accountability* for a risk normally makes the control decision for that risk. The general process of controlling risks includes:

- Analyzing the status reports
- Deciding how to proceed
- Executing the decisions

Identify: One of the six functions of the risk management paradigm. The Identify function is a process of transforming uncertainties and issues about the project into distinct (tangible) risks that can be described and measured. Identifying risks involves two activities:

- Capturing a statement of risk
- Capturing the *context* of a risk

Impact: The loss or effect on the project or program if the risk occurs. Impact is an attribute of a risk.

Managing Organization: The functional organization responsible for the risk subject matter. The Managing Organization (MO) provides oversight and management ownership for mitigation and closure activities for risks that threaten successful fulfillment of its assigned responsibilities, and for which it has authority over the resources required to provide mitigation. The MO will elevate risks to

the Launch Services Program Risk Control Board for consideration as a Program risk if the threat to the Program cannot be adequately managed within the MO's resources.

In the Launch Services Program, all MOs (i.e., existing Divisions and Offices, MITs, and Projects) are responsible for performing risk management for all of the activities under their purview.

Mitigate: One of the four basic risk planning approaches. To lessen the negative consequence of the risk. It may also involve shifting the timeframe when action must be taken. Mitigation may be accomplished through engineering, schedule, or budgetary changes to designs, processes, or procedures, or alternate paths and approaches.

Mitigation Timeframe: The period when action is required to mitigate the risk. Timeframe is an attribute of a risk.

Plan: One of the six functions of the risk management paradigm. The Plan function is a process for determining what should be done with a risk. It produces an action plan for individual or sets of related risks. Planning answers the questions:

- Is it my risk? (responsibility)
- What can I do? (approach)
- How much and what should I do? (scope and actions)

Primary Risk: Those undesirable events having both high probability and high impact/severity, or higher (source NPG 7120.5). The Space Flight Enterprise (SFE) PMC must concur with acceptance of all primary risks. In the Launch Services Program, risks that are Red in the risk exposure matrix are designated as Primary Risks.

Probability: The likelihood the risk will occur. Probability is an attribute of a risk.

Problem: A risk consequence that has materialized, or is imminent in its probability/timeframe. ELV technical items in review under the Engineering Review Process are considered technical problems until the review is complete. The process for handling problems is not within the scope of risk management. Problems require corrective action(s).

Program Risk: Risk that can no longer be managed through the resources of the Managing Organization, and requires elevation to the Launch Services Program for management.

Research: One of the four basic risk planning approaches. The Research planning approach involves actions needed to better understand the risk before a decision to Accept, Watch/Monitor, or Mitigate the risk can be made.

Residual Risk: If treatment of a risk does not eliminate it entirely, the risk that remains is referred to as a residual risk.

Risk: The possibility of suffering loss.

A *risk* is the combination of 1) the probability (qualitative or quantitative) that a program or project will experience an undesired event such as cost overrun, schedule slippage, safety mishap, compromise of security, or failure to achieve a technological breakthrough; and 2) the consequences, impact or severity of the undesired event were it to occur. (source NPG 7120.5)

Risk is characterized by the following:

- Uncertainty is involved ($0 < \text{probability} < 1$).
- A loss is associated with it (life, money, property, reputation, and so forth).
- It is manageable - in the sense that human action can be applied to change its form or degree.

A Launch Services Program risk is any risk that poses a threat to vehicle safety, Program-controlled cost, Program-controlled schedule, or Program success, and for which an acceptable resolution is deemed unlikely without focused management effort and/or additional resources being provided.

Risk Control Board (RCB): The Launch Services Program's Risk Control Board membership consists of: The Program Manager (Chair), the Deputy Program Manager, the Associate Program Manager and the Risk Management Coordinator. The RCB will review the Program's Red and significant Yellow Risks, from the Program's perspective, making changes as appropriate. The RCB will review the mitigation plans for Red risks, revising and/or approving them, and providing resources as appropriate. The RCB will report all validated Red risks to the SFE PMC, and obtain their approval for the closure or acceptance of those risks. The RCB will scrutinize and facilitate the management of all risks, and assign resources and actions as appropriate.

Risk Exposure: *Risk exposure* is the product of probability and impact. The impact describes the effect on the Program and mission if the risk occurs and is not eliminated or mitigated. The probability is the likelihood the risk will occur.

Risk Management: An organized, systematic decision-making process that efficiently identifies, analyzes, plans, tracks, controls, communicates, and documents risks to increase the likelihood of achieving program/project goals.(source: NPG 7120.5)

Risk Manager: The Launch Services Program's Risk Manager is the Program Manager, or the person delegated by the Program Manager to serve as Risk Manager.

Risk Owner (RO): The person(s) assigned responsibility for managing the analysis, planning for, tracking, controlling, communicating, and documenting a risk issue in their area(s) of responsibility. The RO is responsible for providing current status of the risk and its mitigation plan, and for recommending closure or acceptance with justifying rationale.

Risk Reduction: Actions taken to lessen the probability or negative consequences, or both, associated with a risk.

Track: One of the six functions of the risk management paradigm. The Track function is a process in which risk data are monitored by the person(s) responsible for tracking watched and mitigated risks. Tracking risks includes three activities:

- Acquiring tracking data
- Compiling tracking data
- Reporting tracking data

Urgency: Urgency is an important mitigation consideration for any risk. Urgency is determined by two dates:

- The date on which risk mitigation activities must be complete, and
- The date mitigation activities must begin.

Watch: One of the four basic risk planning approaches. The Watch approach is selected when the potential for risk occurrence is not on the immediate Program horizon, or existing conditions are not favorable for taking action on the risk.

APPENDIX A

A.1 Risk Information Sheet Field Descriptions

Field Name	Description
ID	Unique identifier automatically assigned to the risk when entered in the database
Date	Date the risk is officially submitted (XX = day, YYY = month, ZZZZ = year) (automatically assigned by database when the originator clicks on the "submit rec" button)
Risk Statement	Short description of the risk situation. Must be in the format of "condition: consequence:" (Required for all risks)
Originator	Person who identified the risk (Required for all risks)
Class	A general classification of the identified risk used for sorting purposes – Administrative, Mission Specific, Vehicle, Contract (ELVIS), or Program (Required for all risks)
Category	Cost, Safety, Schedule, Technical
Risk Planning Approach	Research, Watch, Accept, Mitigate
Mission	Mission name associated with the risk, if applicable (Required for all risks; NA if not applicable)
Vehicle	Specific vehicle associated with the risk, if applicable (Required for all risks; NA if not applicable)
Assigned to	Designated person responsible for mitigating the risk (Risk Owner)
Timeframe	1) Date when risk mitigation must begin 2) Date when risk mitigation must be completed (Required for all risks; can be the scheduled launch date)
Probability	The probability the risk will develop into a problem (Required for all risks)
Impact	The impact if the risk develops into a problem (Required for all risks)
Risk Analysis Rating (R, Y, G)	Generated automatically by the risk database. Represents the overall level of the risk, as defined by probability and impact
Context	Additional information provided to clarify the condition and consequences in the risk statement. This section should include the source of the risk, and the data that identified the date when risk mitigation must be completed (NA if not applicable).
Mitigation Strategy	The overall strategy for mitigating the risk (required for risks elevated from the Managing Organization).
Mitigation Plan	Outline of activities required to mitigate the risks, stated in numbered items. Includes success/closure criteria (required for risks elevated from the Managing Organization).
Status	Running status and dates of the mitigation actions and closures. Changes in responsibility are also captured (used as needed).
Approval	Approval for mitigation strategies or closure/acceptance/withdrawal.
Closing Date	Date the risk was closed.
Closing Rationale	Rationale for closure/acceptance/withdrawal of the risk.

APPENDIX B

B.1 Risk Sources (not all-inclusive)

- Launch Services Program Mission Risk Profile
- Program Risks (Cost, Schedule, Management)
- First Flight and Mission-unique Item Risks
- Residual Risk from Requirement Issues
- Residual Risk from Problem Resolutions
- Launch Vehicle/Spacecraft Integration Risks
- Spacecraft Risks
- Baseline Launch Vehicle Risks
- Adverse Trends
- Audits and Surveillance Performed
- Cost and Schedule Implementation
- Hardware/Software Maturity
- Historical (Past Performance) Data/Experience
- Legal and Regulatory Constraints
- Lessons Learned
- Maintainability or Spares Analysis
- Mishaps/Close Calls
- Nonconformance Reports
- Proposed Changes
- Resource Allocations, Constraints, or Conflicts
- Risk Analysis from Other Teams
- Safety and Reliability Analyses (e.g., Hazard Analysis, Failure Modes and Effects Analysis (FMEA), Fault Tree Analysis)
- Simulations and Models
- Test Data Results
- Waivers/Variations