GODDARD TECHNICAL STANDARD

GSFC-STD-0002

Goddard Space Flight Center
Greenbelt, MD 20771

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RISK MANAGEMENT REPORTING

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DOCUMENT HISTORY LOG

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Baseline	-	05-08-2009	Initial Release

FOREWORD

This standard is published by the Goddard Space Flight Center (GSFC) to provide uniform engineering and technical requirements for processes, procedures, practices, and methods that have been endorsed as standard for NASA programs and projects, including requirements for selection, application, and design criteria of an item.

This standard establishes a method of constructing risk statements, assigning criticality to risks, and preparing project level reporting of risk status.

Requests for information, corrections, or additions to this standard should be submitted via "Feedback" in the GSFC Technical Standards System at http://standards.gsfc.nasa.gov.

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TABLE OF CONTENTS

SECTION **PAGE**

LIST OF FIGURES

FIGURE **PAGE**

Document Title

1. SCOPE

1.1 Purpose

The purpose of this standard is to establish the method of risk management reporting, including construction of project risk statements, assignment of criticality to risks, and preparation of project reporting of risk status.

1.2 Applicability

This standard is applicable to space flight projects (risk A, B, C and D) managed by the Goddard Space Flight Center using NPR 7120.5. Reporting on institutional risks, and range safety risk assessments will be addressed by separate documents.

This standard may be cited in contract, program, and other Agency documents as a technical requirement. Mandatory requirements are indicated by the word "shall." Tailoring of this standard for application to a specific program or project shall be approved by the Technical Authority for that program or project.

2. APPLICABLE DOCUMENTS

a. NPR 8000.4A, Agency Risk Management Procedural Requirements

b. NPR 7120.5D, NASA Space Flight Program and Project Management Requirements

c. NPR 8705.4, Risk Classification for Payloads

d. GPR 7120.4B, Risk Management (in revision)

3. ACRONYMS AND DEFINITIONS

3.1 Acronyms and Abbreviations

ATK – Alliant Techsystems, Inc.

IRAS – Intersatellite Ranging and Alarm System

DSN – Deep Space Network

USN – Universal Space Network

TDRS – Tracking and Data Relay Satellite

ADP – Axial Double Probe

MMS – Magnetospheric Multi-Scale Mission

3.2 Definitions

Approach –There are four defined approaches to a risk:

- Accept – as a residual risk
- Watch – monitor for positive or negative trends
- Research – conduct inquiries to better understand the likelihood and consequences
- Mitigate – take action to minimize the likelihood or consequences

Condition – a statement of current key circumstances or situations that may result in an adverse consequence

Consequence – the worst credible impact that may result from an event

Criticality – the severity (high, medium or low) of a consequence

Likelihood – the probability that an event will occur

Risk – a combination of the likelihood and consequences of an adverse event

Risk Matrix Standard Scale – a set of standard scales and associated definitions that are used to rank the likelihood of risk event occurrence and the criticality of its consequences.

4. REQUIREMENTS

4.1. RISK DATA CHART

A risk focus chart, Figure 1, shall be prepared for each risk. The Risk focus chart shall include:

- Rank based on criticality to the project
- ID number
- Criticality
- Trend
- Risk Statement
- Approach and Plan
- Current status
- Estimated closure date

Rank, Title, ID, Criticality, Trend`	Risk Statement	Approach/Plan	Status
1. **Axial Boom Comm Interference (MMS-78)** **Criticality** **M** ⟷	Given the **Condition:** the ADP boom causes interference with the current design of the communications and IRAS transmit/receive antennas; There is a probability of **Consequence:** IRAS cross link communications and communications to the ground will be compromised. **Context:** (The axial boom design was stiffened to withstand thruster firing during maneuvering and apogee raising. Interference could cause loss of lock every 20-second spin cycle)	**Mitigate – February 2009** • Assess interference of ADP boom with S-Band ground communications system – December 2008 • Conduct testing with a similar boom design to validate the model – December 2008 • Develop alternative antenna designs if needed - February 2009	• RF test will be run at ATK using an existing boom similar to the MMS design –Purpose of the test is to validate the spacecraft com model –Test planning meeting held at ATK on 11/7 • GSFC communications engineers are contacting DSN, USN, and TDRS to determine if the networks can accommodate the existing design • IRAS team is examining antenna options

Risk Criticality	H	M	L

Figure 1, Risk Focus Charts

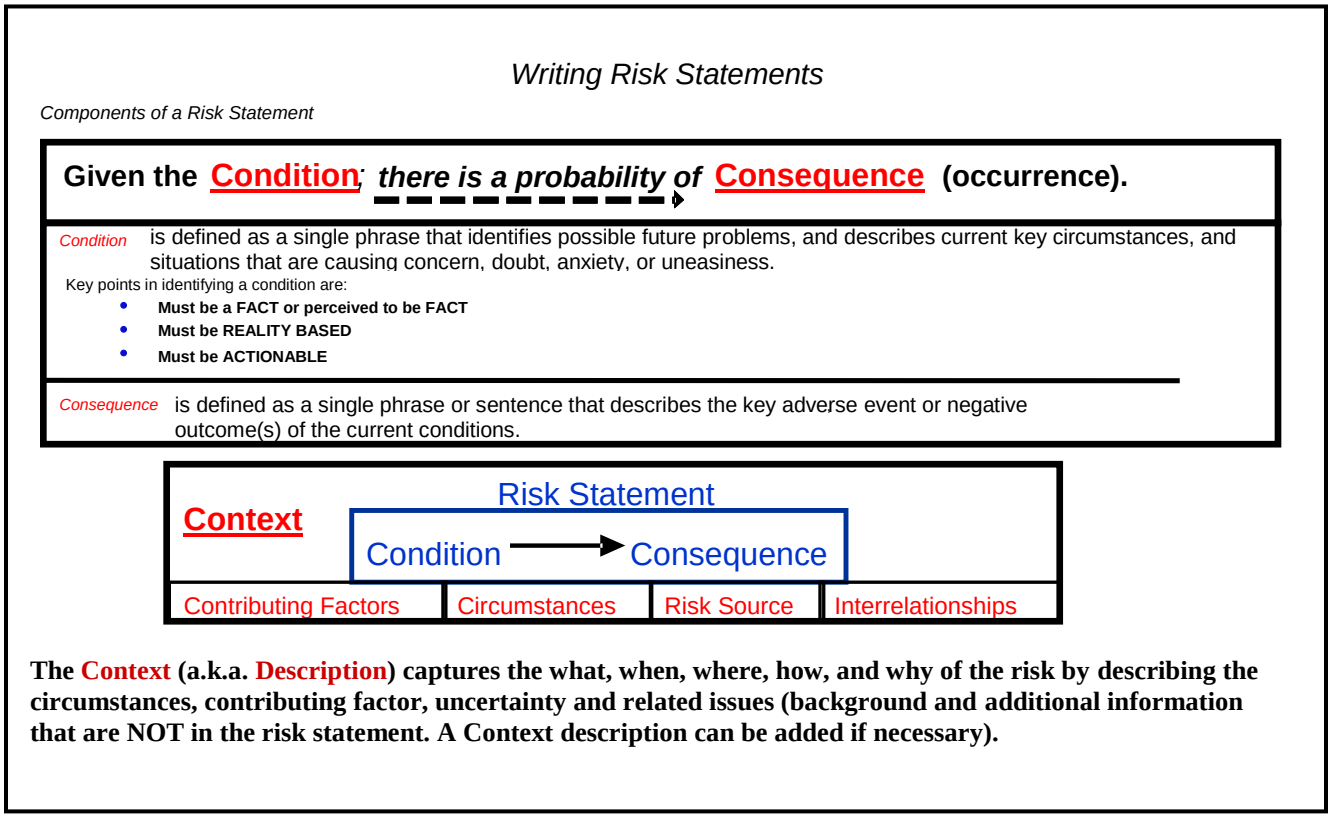
4.2. RISK STATEMENT

A Risk Statement is prepared for each risk. There are two essential components:

- Description of the **condition** that exists and the circumstance or situation that is raises a concern
- Description of the **consequence** that may result from the current condition

There are a number of constructs that may be used in developing the risk statement, but the preferred construct is as follows: "Given that a condition exists, there is a possibility that a consequence will occur." Figure 2 illustrates a preferred format for risk statement writing.

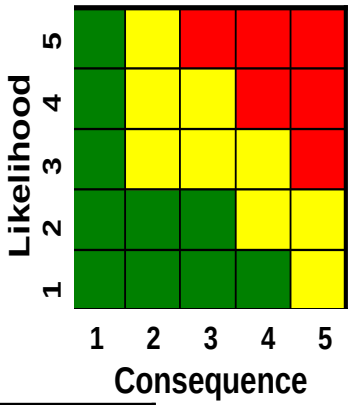
Regardless of the construct used, it is essential that context be provided that allows the reader to understand the current situation, and why it is believed that the described consequence may result.



4.3. Risk Matrix Standard Scale

A risk criticality of high, medium, or low is assigned to each risk using the Goddard Risk Matrix Standard Scale, Figure 3. The instructions for the use of the scale are provided in Figure 4.

Likelihood	Safety (Estimated likelihood of safety event occurrence)	Technical (Estimated likelihood of not meeting performance requirements)	Cost/Schedule (Estimated likelihood of not meeting cost or schedule commitment)
5 Very High	($P_{SE} > 10^{-1}$)	($P_T > 50\%$)	($P_{CS} > 75\%$)
4 High	($10^{-2} < P_{SE} \leq 10^{-1}$)	($25\% < P_T \leq 50\%$)	($50\% < P_{CS} \leq 75\%$)
3 Moderate	($10^{-3} < P_{SE} \leq 10^{-2}$)	($15\% < P_T \leq 25\%$)	($25\% < P_{CS} \leq 50\%$)
2 Low	($10^{-6} < P_{SE} \leq 10^{-3}$)	($2\% < P_T \leq 15\%$)	($10\% < P_{CS} \leq 25\%$)
1 Very Low	($P_{SE} \leq 10^{-6}$)	($0.1\% < P_T \leq 2\%$)	($P_{CS} \leq 10\%$)



Consequence Categories					
Risk	1 Very Low	2 Low	3 Moderate	4 High	5 Very High
Safety	Negligible or No impact.	Could cause the need for only minor first aid treatment .	May cause minor injury or occupational illness or minor property damage.	May cause severe injury or occupational illness or major property damage.	May cause death or permanently disabling injury or destruction of property.
Technical	No impact to full mission success criteria	Minor impact to full mission success criteria	Moderate impact to full mission success criteria. Minimum mission success criteria is achievable with margin	Major impact to full mission success criteria. Minimum mission success criteria is achievable	Minimum mission success criteria is not achievable
Schedule	Negligible or no schedule impact	Minor impact to schedule milestones; accommodates within reserves; no impact to critical path	Impact to schedule milestones; accommodates within reserves; moderate impact to critical path	Major impact to schedule milestones; major impact to critical path	Cannot meet schedule and program milestones
Cost	<2% increase over allocated and negligible impact on reserve	Between 2% and 5% increase over allocated and can handle with reserve	Between 5% and 7% increase over allocated and can not handle with reserve	Between 7% and 10% increase over allocated, and/or exceeds proper reserves	>10% increase over allocated, and/or can't handle with reserves

HIGH RISK

MODERATE RISK

LOW RISK

Figure 3, GSFC Risk Matrix Standard Scale

Purpose: **The Risk 5x5 is a qualitative tool used for executive level management reporting and independent assessment to communicate individual and composite risk in the context of mission success. This tool is not intended for rigorous risk assessment needs and should be used in conjunction with other analytical tools and risk analysis techniques for a complete understanding of any risk insight which may have implications over mission successes. Users should concentrate on and assess all the consequences of risk.**

Likelihood Scale Explained **(Estimated likelihood value P should be based on analytic techniques whenever possible.)**

Safety: **Use this scale specifically for safety related risk. The 5 groups of likelihood bins come directly from the NASA Safety Manual NPR 8715.3. The specified probability ranges (or likelihood bins) are the likelihood that an identified hazardous event will occur. These types of events should result directly in safety impacts, either as a mishap, an incident or accident based on assessments of such factors as location, exposure in terms of cycles or hours of operation, and affected population.**

Technical: **This scale of likelihood bins is used for ranking technical type of risks, which are measured using different scales from safety risks. A technical risk issue or event is primarily measured based on the likelihood of occurrence of such an event in terms of not meeting required minimum technical performances of a mission, or drifting from a specified design and performance margin. Percentage values are used here to better indicate likelihood of any events of technical risk impact.**

Cost/Schedule: **This scale of likelihood bins is used for ranking any programmatic type of risks, such as Cost and Schedule. These risks are measured similarly as technical risks except using a slightly different likelihood scale. A Cost or Schedule risk issue or event is primarily measured based on the likelihood of occurrence of any such events in terms of not meeting program budget constraints or schedule requirement. Percentage values are used here to better indicate likelihood of any events of Cost/Schedule risk impact.**

Consequences Scale Explained

Safety: **Use this consequence scale to rank the severity levels of safety related risk consequences which result directly from occurrence of any hazardous events that have safety impact only.**

Technical: **Use this consequence scale to rank the severity levels of technical or mission performance related risk consequences that result directly from occurrence of any technical or mission operational events that have direct risk impact on meeting technical requirement or suffer from degraded design/operating margin or mission performance.**

Cost/Schedule: **Use this consequence scale to rank the severity levels of programmatic type of risks, such as Cost/Schedule related consequences, that result directly from occurrence of any events (either technical or programmatic) having direct risk impact on established Cost/Schedule requirements or degraded program performance, etc.**

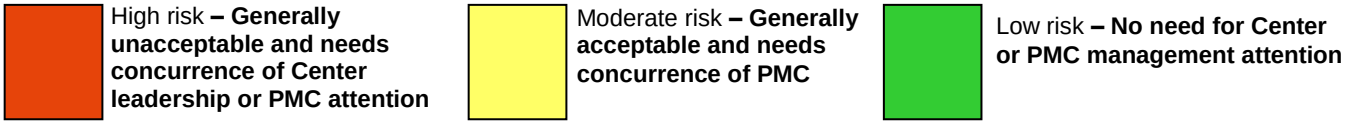
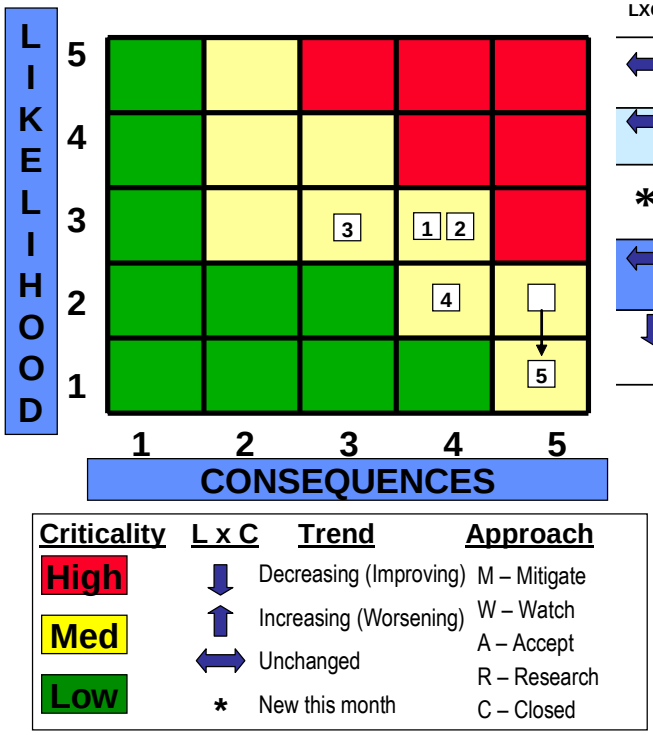


Figure 4, GSFC Risk Matrix Standard Scale Instructions

4.4. Top Risk List

Figure 5 is an example of a Top Risk List chart that is used to present a summary of the most important risks for a project. Although a project may be tracking many risks, the risk matrix presented for management review typically includes the top ten ranked risks.



LXC	Rank	ID	Approach	Risk Title
⟷	1	MMS-78	M	Axial Boom Comm Interference
⟷	2	MMS-75	M	Complete IRAS TRL 6 Test
*	3	MMS-81	M	HV801 High Voltage Optocouplers
⟷	4	MMS-76	M	KTH Quality Assurance
↓	5	MMS-68	M	Axial Boom Stability Requirements

Figure 5, Top Risk Report Chart