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Version: 2.0



Geostationary Operational Environmental Satellite (GOES)

GOES-R Series Risk Management Plan

August 2013



U.S. Department of Commerce (DOC)
National Oceanic and Atmospheric Administration (NOAA)
NOAA Satellite and Information Service (NESDIS)
National Aeronautics and Space Administration (NASA)

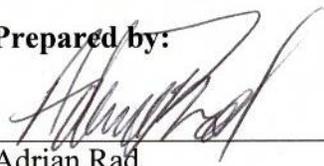
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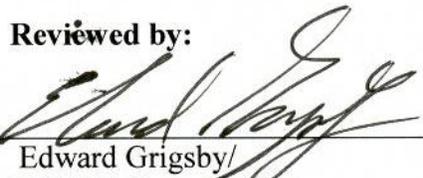


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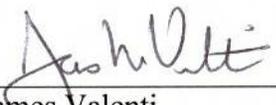
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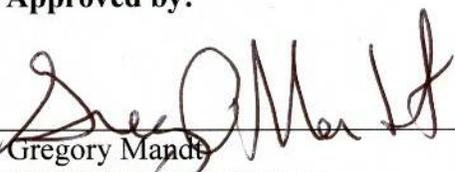


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1 Introduction

1.1 Background

Risk is characterized by the combination of the probability or likelihood that the program will experience an event and the consequences, impact, or severity of the event, were it to occur. Risk Management (RM) is a continuous, iterative, and proactive process to manage risk and achieve mission success. The process involves identifying, analyzing, planning, tracking, controlling, documenting, and communicating risks effectively. RM begins in the End-to-End Systems Architecture Definition phase and continues through the operations and disposal phase with the disposition and tracking of existing residual and new risks.

This document establishes the RM Plan for the NOAA National Environmental Satellite, Data, and Information Service (NESDIS), GOES-R Program and NASA Goddard Space Flight Center (GSFC) GOES-R Series Program/Project Office. The GOES-R Series program/projects utilize RM as a decision-making tool to ensure safety and to enable program success. Decisions are made based on an orderly risk management effort that includes the identification, assessment, mitigation, and disposition of risks throughout the program's life cycle. Applying the RM process also ensures that risk communication and documentation are maintained across the program. (*CCR 1204*)(*CCR 1796*)

The GOES-R Series System Program Director (SPD) is taking a proactive approach to managing risk. In the initial planning phases, risk identification was initiated and continues throughout the GOES-R Series Program life cycle with the goal to reduce unexpected events that require workarounds, contingency or fallback plans, and additional funding. It is anticipated that changes and improvements will be necessary over time as the risk management process is further defined and implemented by the program. This plan has been prepared for the GOES-R Series Program for all mission phases including End-to-End Systems Architecture Study, Program Definition and Risk Reduction (PDRR), Acquisition and Operations (A&O), and Disposal. Future iterations of the plan may be required as the mission evolves.

1.2 Mission Description

The mission of the GOES-R series satellites is to provide continuous, near real-time meteorological, oceanographic, solar, and space environment data. The GOES-R satellite series is the follow-on to the GOES N-P series to meet new requirements validated through a rigorous screening and verification process. It presents an opportunity to explore new instruments, satellite design, and system architectures utilizing improved communication and instrument technologies. GOES-R represents an increase in the number of products, increased spatial resolutions and improved refresh rates. Details on the GOES-R mission and concept of operations are provided in the GOES-R Mission Requirements Document (MRD), 410-R-MRD-

0070, and the GOES-R Series Concept of Operations (CONOPS), P417-R-CONOPS-0008. (CCR 1204) (CCR 2428A)

1.3 Purpose and Scope

The purpose of this document is to describe the overall process, procedures, organizational roles, and tools that will be used to support the GOES-R Series Program. The GOES-R Series Risk Management Plan (RMP) is intended to complement the overall NOAA GOES-R Series Program Management of which RM will be an integral part.

This plan establishes the process for managing risks during all phases of the GOES-R Series Program. The scope of this plan also includes risks associated with the use of program (Government and Contractor) financial resources, facilities, procedures, equipment and personnel (civil servants, contractors, affiliated organizations, instrument developers, researchers, etc.) that have been assigned to or are directly associated with the GOES-R Series Program.

1.4 Assumptions, Constraints, and Policies

1.4.1 Assumptions

- Individuals, functional teams, Integrated Product Teams (IPT)/Integrated Development Teams (IDT), Working Groups, and affiliated organizations play a significant role in the GOES-R Series Program throughout all of phases of the mission. For this reason, the risk management process is built around the significant participation of these individuals and teams working in concert on this program. (CCR 1796)
- Increasing attention on risk-related concerns will continue. The emphasis on RM in management reviews and the need to communication risks with stakeholders and senior management will continue. (CCR 1796)
- A consolidated systems approach to End-to-End Architecture Study, PDRR, and A&O will continue along established development timelines.

1.4.2 Constraints

- Design, development, and delivery schedules are essentially constrained by the Launch Readiness Date (LRD) and Ground System Readiness Date. *(CCR 1204)(CCR 1796)(CCR 2428A)*
- Program expenditures are constrained by the baseline budget limits and funding profiles.
- International contributions and exchanges must be conducted under International Traffic in Arms Regulations (ITAR) potentially limiting the flow of some information or data.
- GOES-R Series Program affiliated organizations will operate under separate RMPs as required in existing agreements, contracts, or other documentation and will interface with the GOES-R Series Program RM process as described in this plan. All related risk management processes are constrained to be compatible with the GOES-R Series Program RMP.
- Existing technological, funding, and schedule constraints will not allow for the complete elimination or mitigation of all risks. A certain level of risk will need to be accepted. These accepted risks (residual risks) shall be documented with final review and approval by the GOES-R Series SPD and other NOAA/NASA senior level management to include the NOAA NESDIS, Department of Commerce (DOC) General Counsel, and NASA GSFC Center Management Council (CMC) and NOAA NESDIS governing Program Management Council (PMC), as required. *(CCR 1204)*

1.4.3 Policies and Guidelines

- This GOES-R Series Program RMP will, as a minimum, be: reviewed annually; modified as required after the selection of A&O contractors, etc.; and updated to reflect process changes during the different phases of the program's lifecycle. *(CCR 1204)*
- To the extent possible, the GOES-R Series Program will address commonality and related risks with other related programs, utilize lessons learned from historical data, and review other affiliated organization's risk management processes for compatibility with this plan.
- All personnel (i.e. scientists, engineers, managers and technicians) supporting the GOES-R Series Program are responsible for adhering to risk management policies and guidelines, as documented in this plan. All GOES-R Series Program personnel shall be provided open access to identify risks directly to the program through the process defined in this plan.

- Risks (associated with technical performance, requirements, budgets, cost, schedules, or other concerns) are the responsibility of the individual project managers, affiliated organizations, element, subsystem leads or managers. Each is required to take action to identify, assess and mitigate risks within their area of control and report risks to the GOES-R Series Program on a regular basis. (*CCR 1796*)
- Contractors shall, as a minimum, provide the GOES-R Series Program with sufficient access and documentation to demonstrate effective implementation of their RM processes and shall periodically report their risks as part of the agreed upon management procedures. They will also facilitate risk monitoring/tracking, insight and audits by the program. All other RMPs will be subordinate to the GOES-R Series Program RMP, to the extent required to establish consistency and maintain compatibility.
- Joint risk management activities conducted by projects and/or affiliated organizations working on the GOES-R Series Program shall be planned, coordinated, and conducted in a manner that is consistent with the RM approach established by this plan.
- All changes to the baseline GOES-R Series Program RMP will be made in accordance with GOES-R Configuration Management procedures. Changes to all other affiliated organization(s) risk management processes should be communicated to the GOES-R Series Program in a timely manner to ensure consistency and compatibility with this plan.
- Risk documentation and communication at all levels within the GOES-R Series Program shall be considered open and transparent in nature. Risk information shall be available for review (through risk lists, risk databases, and other means), but will remain subject to security, proprietary information, company confidential and/or ITAR restrictions that are imposed on all other program documentation.
- To maximize the effectiveness of the RM program, RM training and familiarization shall be made available to the GOES-R Series Program team. As a minimum, the GOES-R Series program/project personnel are expected to have a basic understanding and working knowledge of the RM processes and methodologies.
- This GOES-R Series Program RMP is consistent with the risk management policies and guidelines established by the GOES-R Management Control Plan (MCP), P410-R-PLN-0067, as derived from ISO 17666, “Space Systems – Risk Management”, NPR 7120.5, “NASA Space Flight Program and Project Management Requirements”, and NPR 8000.4, “Agency Risk Management Procedural Requirements”. (*CCR 1204*) (*CCR 2428A*)

1.5 Related Documents and Standards

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This RMP is intended to complement the overall GOES-R Series program management process. The RMP is consistent with the requirements and guidelines of the following documents.

- NOAA Administrative Order (NAO)-208-3, Major System Acquisitions
- 410-R-PLN-0067, GOES-R Management Control Plan (MCP)
- 410-R-MRD-0070, GOES-R Series Mission Requirements Document (MRD)
- P417-R-CONOPS-0008, GOES-R Concept of Operations (CONOPS),
- 410-R-PLN-0069, GOES-R Program Systems Engineering Management Plan (SEMP)
- P417-R-MAP-0080, GOES-R Mission Assurance Plan (MAP)
- P417-R-PLN-0154, GOES-R Systems Safety Program Plan (SSPP)
- NASA Procedural Requirements (NPR) 7120.5, “NASA Space Flight Program and Project Management Requirements”
- NPR 8000.4, “Agency Risk Management Procedural Requirements”
- NPR 8705.4, “Risk Classification for NASA Payloads”
- NPR 8705.5, “Technical Probabilistic Risk Assessment (PRA) Procedures for Safety and Mission Success for NASA Program and Projects”
- NPR 8715.3, “NASA Safety Manual”
- ISO 17666, “Space Systems - Risk Management”
- ANSI/EIA-748, “Standard for Earned Value Management Systems Intent Guide”
(CCR 1204) (CCR 2428A)

1.6 Definitions

Accepted Risk	A risk (an unplanned event) that is understood and agreed to by the program, organization partners, sponsors, stakeholders, and customer(s) sufficient to achieve the defined success criteria within the approved level of resources. A risk is accepted when its impact is deemed “acceptable” (does not drive a change to the baseline), and/or no additional resources are expended to mitigate the risk. In other words, it is decided that no further action will be taken to reduce the risk.
Affiliated Organization	Other Government agencies, other NOAA facilities, or research institutions that provide support (acquisition, design, development, financial resources, facilities, materials, procedures, equipment and personnel) to or are otherwise associated with the GOES-R Series Program, Flight or Ground Segment Projects, or contractors. (CCR 1204)

Candidate (or Candidate Risk)	Candidate is a concern that is mature enough to be considered for elevation to a risk. If the concern is not validated as a risk, no immediate action is taken. Instead, a timetable is set up for specific times to re-evaluate the concern, if needed, for a change in status. These “triggers” might be at regular time intervals, or at specific points in the lifecycle, such as at major reviews. (CCR 1796) (CCR 2428A)
Closed Risk	Risk either fully mitigated or otherwise retired.
Concern	The initial level of documentation that includes “worries” or potential risks. It is a potential risk that has been identified and is pending adjudication by the governing risk review body. Likelihood and Consequence are not assigned to concerns. The concern lacks definition or maturity. Concerns are sometimes referred to as Watch Items (WI). (CCR 1796) (CCR 2428A)
Expected Value (or Expected Utility)	The product of two numbers, probability and impact (value or amount at stake other than a monetary value, i.e. utility).
Initial Risk List	An initial set of risks identified by GOES-R Series Program. These risks will be identified through brainstorming sessions and interviews conducted by the Risk Management Coordinator with the Program team, and will include preliminary analysis of Program schedules, technical performance, budgets, and resource allocations.
Issue:	A current problem, failure, event, or other incident that is impacting the organization. It may be a risk that has been realized (100% likelihood/probability) or a newly identified issue. (CCR 1796)
Joint Risks	Risks related to the GOES-R Series Program, contractors, or affiliated organizations collectively involving coordinated risk handling/action. These risks may include risks crossing all segments or risk impacting multiple risk areas.
Product Development Lead (PDL)	The leader of the contractor and/or civil servant team responsible for the development of a GOES-R product as part of the flight project or Ground Segment project. Responsible for assigning risks to team members, including study and development contractors, and also verifying that new risks submitted to the team have been routed correctly and vetted through the risk management process described in this plan. (CCR 1204)
Qualitative Risk Analysis	A subjective assessment of risks to determine: which risk events warrant a response; the probability and impact of all risks; the probability of each risk occurring based on past experience; the impact of each risk, which risks to

analyze more fully using quantification; and the overall risk ranking for the program. (CCR 1204)

Quantitative Risk Analysis A numerical analysis of the probability and consequences (amount at stake or impacts) of the highest risks on the program.

Risk quantification involves the following activities:

- Further investigation into the highest risks on the program
- Determination of the type of probability distribution that will be used – e.g., triangular, normal, beta, uniform, or log normal distribution.
- Interviewing experts (data elicitation)
- Sensitivity analysis – determine which risks have the most impact on the program
- Monte Carlo analysis (computer based simulation)
- Decision Tree analysis

Residual Risk The element of a risk remaining after a risk has been mitigated. A residual risk is any accepted risk with the capacity to affect GOES-R’s ability to meet systems requirements. Residual risks may include:

- Risks produced by rare events such as those resulting from anomalies, failures, or acceptance of risks imposed by critical maneuvers or other transitions/changes in state of a system.
- Any technical risk accepted on the basis that mitigation options are not viable or are outside GOES-R control.

(CCR 1796)

Risk The combination of the likelihood that a program will experience an uncertain event and the consequence of the event, were it to occur. Note: Positive-outcome events and/or extremely low probability/impact-outcome events can similarly be considered. Any circumstance or situation that impacts; public safety, program controlled cost; program controlled schedule; or major mission objectives, and for which an acceptable resolution is deemed unlikely without focused management effort.

Risk Action Plan (Risk Mitigation Plan) A formal plan to determine the action needed to address a risk. In the GOES-R Series Program Risk Management database, each action plan will be entered as a data item.

Risk Categories Sometimes referred to as sources of risk or common categories of risks experienced by an organization or program. The categories help analyze and identify risks on each program. Some categories of risks are:

- Technical risks (e.g., operations or performance)
- Program management risks

	<ul style="list-style-type: none">▪ Organizational risks▪ External risks (e.g., legal or environmental)
Risk Exposure	The qualitative combination of Likelihood (Probability) and Consequence (Impact) components of a risk using a Risk Rating Matrix to prioritize risk to a program.
Risk Factors/Risk Attributes	The major characteristics of the risk that include: <ul style="list-style-type: none">▪ Probability that a risk will occur or anticipated frequency of risk event (how often)▪ Range of possible outcomes (what) (impact, severity, or amount at stake)▪ Anticipated timing or timeframe (when)▪ Expected Value (EV) (How much money?) or Expected Utility (EU) (What non-monetary value?)
Risk Fallback Plan	A formal plan devised to identify specific action to be taken if the Risk Action Plan (Risk Mitigation Plan) is not effective. In the GOES-R Series Program Risk Management database, each fallback plan will be entered as a data item.
Risk Identification	A risk management activity that determines which uncertain events or conditions might affect the program and documenting their characteristics
Risk Management	A process involving the following six steps: <ul style="list-style-type: none">▪ Risk Management Planning▪ Risk Identification▪ Risk Assessment and Analysis (Qualitative and Quantitative)▪ Risk Handling/Action▪ Risk Tracking and Control▪ Risk Documentation and Communication
Risk Management Board (RMB)	Management board that is the official forum for formal evaluation, deliberation, classification and control of program/project(s) risks. (CCR 1796)(CCR 2428A)
Risk Originator	The individual that first identifies and records the risk in the Risk Management database.
Risk Owner	An individual assigned by the Program or Project Manager through the RMB to implement action/ mitigation plan activities needed to close or accept a specific risk with the authority and resources to action on a pre-approved plan once triggers are reached.

Risk Rating Matrix (Risk Matrix)	A matrix used to qualitatively sort or rate risks so a determination can be made as to which risks will move on through the risk process. Use of this matrix results in a more consistent evaluation of low, medium, or high making the risk rating process more repeatable across the program.
Risk Research	An extension of the Risk Identification in the case where specific research is warranted before completing the risk identification step and deciding between specific risk handling approaches. The risk action plan in the RM database then takes the form of a research plan with a commitment for the research report to be delivered by a specific date with other specific triggers and metrics also required.
Risk Handling/Action Planning	Determining approaches that make the negative risk smaller or eliminate it entirely, as well as finding ways to make opportunities more likely or greater in benefit. This process involves: <ul style="list-style-type: none">▪ Strategies agreed upon in advance by all parties▪ Primary backup strategies are selected▪ Risks assigned to individuals, the Risk Owner, to take responsibility▪ Strategies reviewed over the life of the program for appropriateness and effectiveness▪ Triggers notifying the Risk Owner to take pre-planned, pre-approved action
Risk Response Strategies	Activities needed to close or accept a specific risk. These strategies also referred to as risk action approaches involve developing options and determining actions to address the risk. This may include changing the planned approach to completing the objectives – e.g., changes to the Work Breakdown Structure (WBS), schedule, or budget. In each case, communication of risks and strategies is necessary as part of the risk handling/action planning. These strategies are documented in the risk action plan and the risk database. The strategies include: <ul style="list-style-type: none">▪ Research (part of the identify & analysis process)▪ Watch (monitoring with no other actions being taken or planned unless condition changes in a negative way) (<i>CCR 2428A</i>)▪ Eliminate (Risk Avoidance)▪ Mitigation (Risk Control)▪ Acceptance▪ Transfer
Risk Tolerance	The amount of risk that is acceptable (tolerance level). For example: “a risk that affects our reputation will not be tolerated”, or “a risk of a two week delay is okay, but nothing more.”

Risk/Watch Triggers	The early warning signs or indirect manifestations (trends) for each risk on a program that indicate action needs to be taken. Risk triggers are part of the risk handling/action plan providing the “go-ahead” for implementing the pre-approved action plan. Triggers are also used to track concerns to be elevated to proposed risks. <i>(CCR 1796)</i>
Team	Integrated Product Team (IPT)/Integrated Development Team (IDT) or Working Group (WG). A (generally small) formal or informal GOES-R Series Program group, working on a specific task, service, product, or functional discipline. Under GOES-R Series Program Risk Management, risks are assigned to Risk Owners to be worked with support from subject matter expertise and the program team. <i>(CCR 1796)</i>
Team Lead	The leader of a group or team who is responsible to assign risks to group members and also to verify that new risks submitted to his or her team have been routed correctly. Note: If a given risk appears to pertain to at least two subgroups belonging to a single team higher in the organization, than the risk should be reassigned to the “higher” team after which it becomes the responsibility of that team lead or manager.
Watch Item	May refer to a Concern that is being monitored or a Risk with a Handling Strategy/Approach of Watch assigned to it. . See definition of Concern and Risk Response Strategy. <i>(CCR 1796) (CCR 2428A)</i>

2 Risk Management Philosophy & Integration

2.1 Risk Management Philosophy

The RM process begins with the development of this plan in which the general risk management paradigms are tailored to the GOES-R Series Program; resources are allocated; a support organization and functional responsibilities defined; and a risk management process is established. As summarized in Table 2-1, Risk Management Data Inputs and Outputs, the following activities are performed in the risk management process:

- Risk Management planning: The up-front activities necessary to execute a successful risk management program.
- Identifying risks: A continuous effort to identify and document risks as they are found,
- Assessment/Analyzing risks: An estimation of the probability, impact, and timeframe of the risks, and classifying sets of related risks, and prioritization of risks relative to each other,
- Handling/Action planning: A decision about what to do with the risks, which, for important risks, will include pre-authorized action (mitigation and fallback) plans for Risk Owners,
- Tracking and controlling risks: Collecting and reporting status information about risks and their mitigation plans (where appropriate) and taking corrective action as needed.
- Communicating and documenting risks: Continuous at each step of the process to provide support for decision-making and risk traceability.

This process is consistent with the NASA Continuous Risk Management (CRM) paradigm and implementation guidelines represented in Figure 2-1, based on NPR 8000.4. These risk management activities will be carried out as part of the day-to-day activities of the program and segment as well as during key program and segment management meetings. A summary of the data inputs and outputs in each function of the process is provided in Table 2-1.

Risk Step	Inputs	Output
RM Implementation Planning	Program Constraints and Assumptions, Program Organization, Mission Concept, High-Level Requirements, WBS, Top-Level Schedule, Policy Requirements	Risk Management Plan Risk Organization Risk Criteria
Identification	Individual and Group Concerns, Program Data, Brainstorming Historical Data and Lessons Learned Information	Risk Contexts and Statements Risk List
Assessment/Analysis	Risk Statement and List of Risks	Risk Consequences, Statements, Impacts, Probability, Timeframe, Classifications and Priority Rank; Master Risk List, Identification of Groups of Risks Expected Value
Handling/Action	Outputs of Analysis Step, Program Resources, Goals, and Constraints (Cost and Schedule)	Risk Action Plans, Risk and Mitigation Metrics, Program Schedule and Budget revisions reflecting commitments to risk action plans
Tracking/Control	Action Plans, Metrics, Risk Analysis	Status Reports regarding Risks and Mitigation Plans
	Outputs of Action and Tracking Steps	Program Decisions- Risk specific including Re-Planning, Closure, Contingency, or De-scoping
Communication and Documentation	Outputs of all RM Steps, Supporting information and documentation	Risk Management Database reports, status reports, tracking logs, and presentations

Table 2 - 1 Risk Management Data Inputs and Outputs

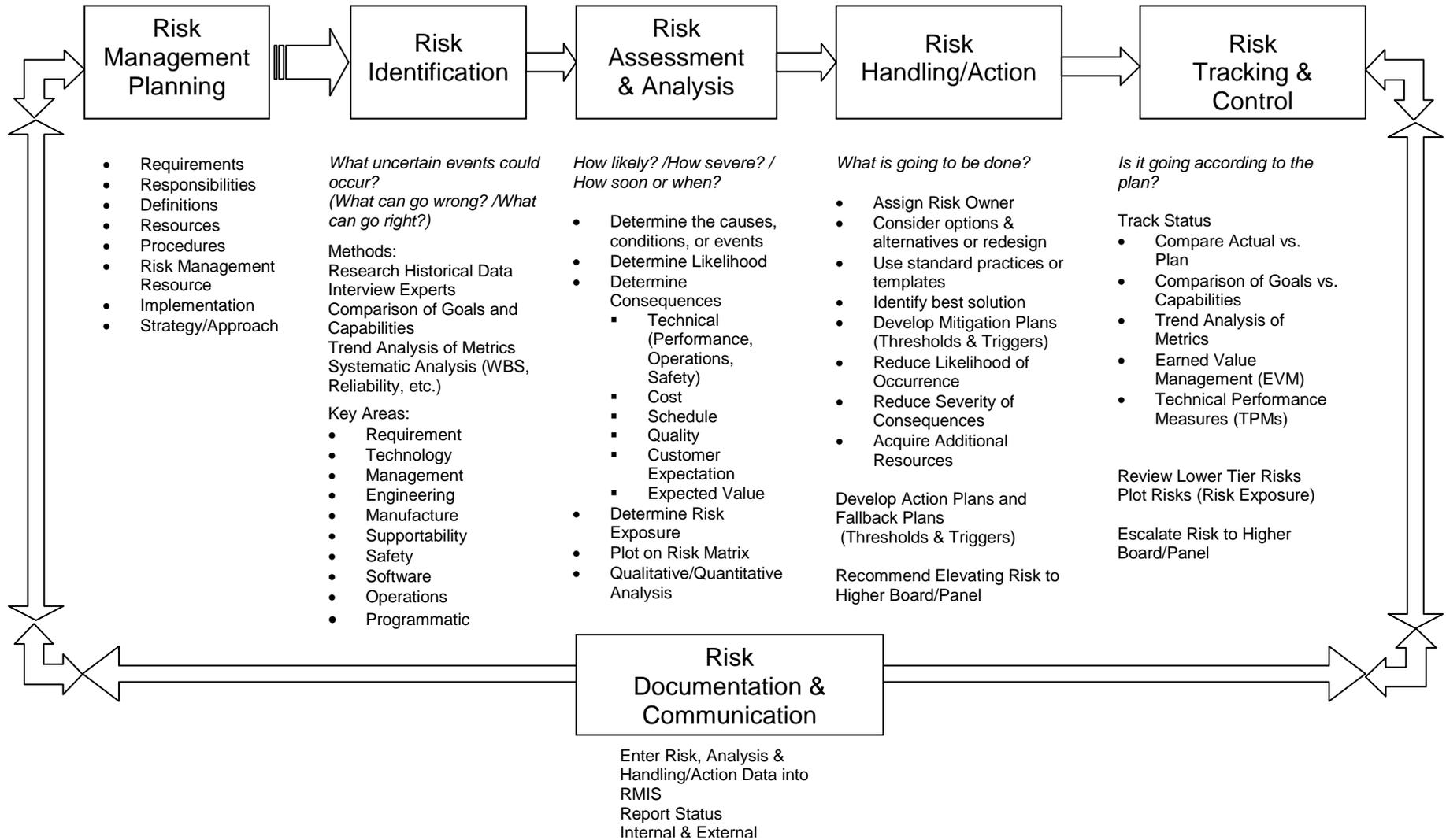


Figure 2 - 1 Risk Management Functions (CCR 2428A)

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2.2 Risk Management Integration

The GOES-R Series Program Risk Management philosophy defines a multi-layer approach for risk management that allows cognizant projects, segment organizations, contractors, teams, groups, and organizations (i.e., Independent Product Teams (IPTs)/Integrated Development Teams (IDT), Working Groups, etc.), to retain authority and control over risks for their areas of responsibility while supporting existing management and decision making processes. (*CCR 1796*)

Program risks will be identified addressing technical, cost, and schedule impacts related to the:

- Successful design, development, fabrication/manufacture, integration, tests, deployment and operations of the GOES-R system;
- Performance and reliability of the GOES-R Series End-to-End System.
- Activities and resources including staff, contractors, and facilities, at NOAA and NASA, at other government agencies, developer organizations (domestic and international), and other foreign or international government or research agencies that may enter into partnership with the NOAA in support of the GOES-R Series Program mission.

Risks managed by affiliated organizations are considered within the purview of GOES-R Series SPD and will be tracked within the GOES-R Series Program Risk Management process. Responsibilities and actions to resolve joint risks will be conducted in concert with the respective managing organizations, in accordance with existing agreements and/or contractor requirements.

GOES-R Project and GOES-R Series Program Figure 2-2 depict the integrated risk management process flow describing the risk information flow between the Program and Project Risk Management Boards (RMBs). The risk management process has multiple tiers: Program, Program Systems Engineering, Flight Project and Ground Segment Project. This integrated approach ensures that risks are identified, evaluated, and managed from an end-to-end system perspective through the programs life-cycle. The continuous risk management process has inherent interrelationships with schedule, financial, Earned Value Management (EVM), and other business reporting systems. (*CCR 1204*)(*CCR 1796*)

Program risks must be submitted to the Program-Level Risk Management Board (RMB). Program risks are those risks that significantly impact program objectives affecting public safety, integrity of the hardware and software, or mission success, that pose a threat to key milestones such as launch dates or other key integration dates, or that require substantial Program resources.

A program risk, for example, may address the timeliness and volatility of end-user requirement definition. Such a concern would potentially have wide ranging implication throughout the program with possible impacts on space segment, ground segment, and product generation design and development.

Similarly, project risks shall be submitted to the Project-Level Risk Management Board (RMB). Project risks are those risks that significantly impact either the Flight Project or the Ground Segment Project objectives affecting public safety, integrity of the hardware and software, or mission success, that pose a threat to key milestones such as launch dates or other key integration dates, or that require substantial project resources. For example, project risks are more focused on meeting a specific technical performance requirements of a communication system design for a given radio frequency (RF) range by addressing interrelationships among elements such as antenna size and type, location of satellite and/or ground station, and other related design trades to optimize technical performance with identified constraints. (*CCR 1204*)

The RM process also provides options for reevaluating and updating risk handling/actions, planning, tracking, and other activities of the RM process. The primary methods for modifying RM implementation will be through the periodic updates to this plan and through inputs to the RMBs.

2.3 Risk-Informed Decision Making (CCR 2428A)

The overall risk management has been expanded to include Risk-Informed Decision Making (RIDM) in concert with the CRM process. The RIDM process supports decision-making at each management level tier using available quantitative and qualitative risk information.

RIDM is invoked for key decisions such as architecture and design decisions, make-buy decisions, source selection in major procurements, and budget reallocation typically involving requirements-setting or rebaselining of requirements. RIDM is applicable throughout the project life cycle whenever trade studies are conducted and is consistent with the decision analysis process described in NASA/SP-2007-6105, NASA Systems Engineering Handbook.

This approach is particularly useful when a threat entails high stakes, complexity, uncertainty, multiple attributes or competing objectives, or a diverse range of stakeholder.

RIDM consists of the following three major steps:

- 1) Identification of decision alternatives, recognizing opportunities where they arise, and considering a sufficient number and diversity of performance measures to constitute a comprehensive set for decision-making purposes.
- 2) Risk analysis of decision alternatives to support ranking consistent with criteria and risk assessment definitions provided in this plan.
- 3) Selection of a decision alternative informed by (not solely based on) risk analysis results.

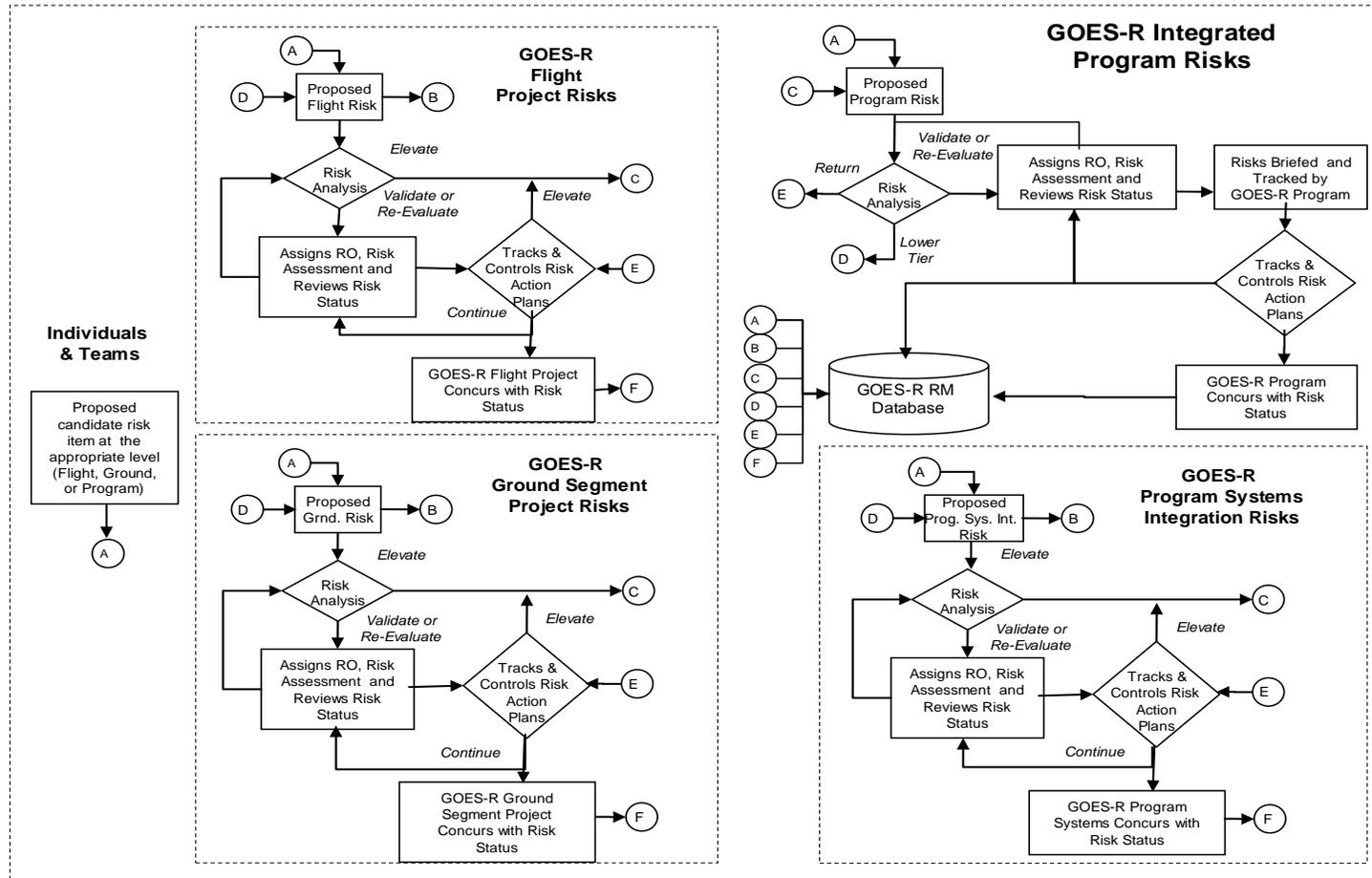


Figure 2 - 2 Integrated Risk Management Process Flow (CCR 1204)

Check the VSDE at <https://goessp.ndc.nasa.gov> to verify correct version prior to use.

3 GOES-R Series Program Risk Management Functional Structure and Responsibilities

3.1 Program Risk Management Structure

This section describes the GOES-R Series Program RM functional structure and responsibilities. The GOES-R Series SPD has overall technical and programmatic responsibility for RM from initial planning through implementation to disposal. In general, the responsibility of project RM implementation is delegated to the Flight Project Manager/Ground Segment Project Manager, Risk Management Coordinator, the RMBs, Risk Owner(s) as assigned, and effectively to each team and individual. *(CCR 1204)(CCR 1796)*

The GOES-R Series Program RMB, Flight Project RMB, Ground Segment Project RMB, the Risk Management Coordinator, teams, and the Risk Owner are functional elements that support the process. The GOES-R Series Program RM is structured around the RMBs as depicted in Figure 3-1 and Figure 3-2. Each manager and lead is responsible for assuring that their teams and contractors are full participants in the RM process. The Flight Project Manager/Ground Segment Project Manager, along with the other managers are responsible for integrating the contractors' and affiliated organizations' RM processes into the overall GOES-R Series Program process. It should be noted that prior to selection, contractor risk information, as all other design information, shall be considered confidential and proprietary. *(CCR 1204)(CCR 1796)*

As shown in Figure 3-1, Figure 3-2, and Figure 3-3, program/project responsibilities for risk management are overlapping. The responsibilities are summarized in Table 3-1. More detailed descriptions of roles and responsibilities for selected key personnel are provided in the subsequent paragraphs.

The RM process provides options for reevaluating and updating each previously implemented risk such as consolidating risk sets into single risks, re-writing risk descriptions and contexts (making them more precise or to reflect the most current information) and revising risk analysis information. The GOES-R Series Program RMB, at any time during the process, can request that ad-hoc team be convened to address one or more specific critical risks from end-to-end and across segments, groups, teams, or functional areas.

3.2 GOES-R Series Program/Project(s) Risk Management Board (RMB)

The RMB is the official forum for formal evaluation, deliberation, classification and control for all program risks. The Program RMB consists of the core members that include the GOES-R Series SPD (Chair), GOES-R Series Deputy SPD (Alternate Chair), Flight Project Manager,

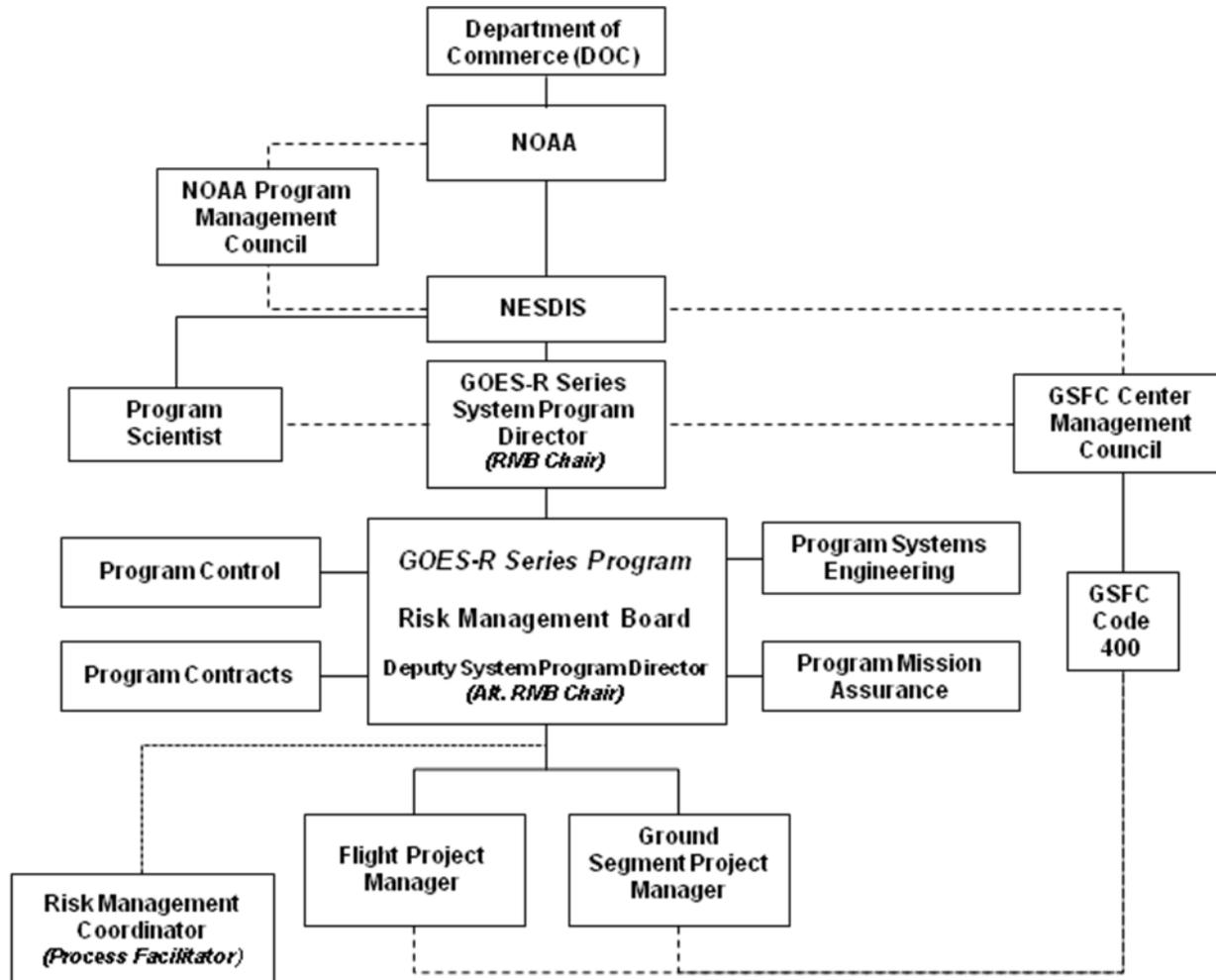


Figure 3 - 1 Program Risk Management Functional Structure
 (CCR 1204) (CCR 1796)

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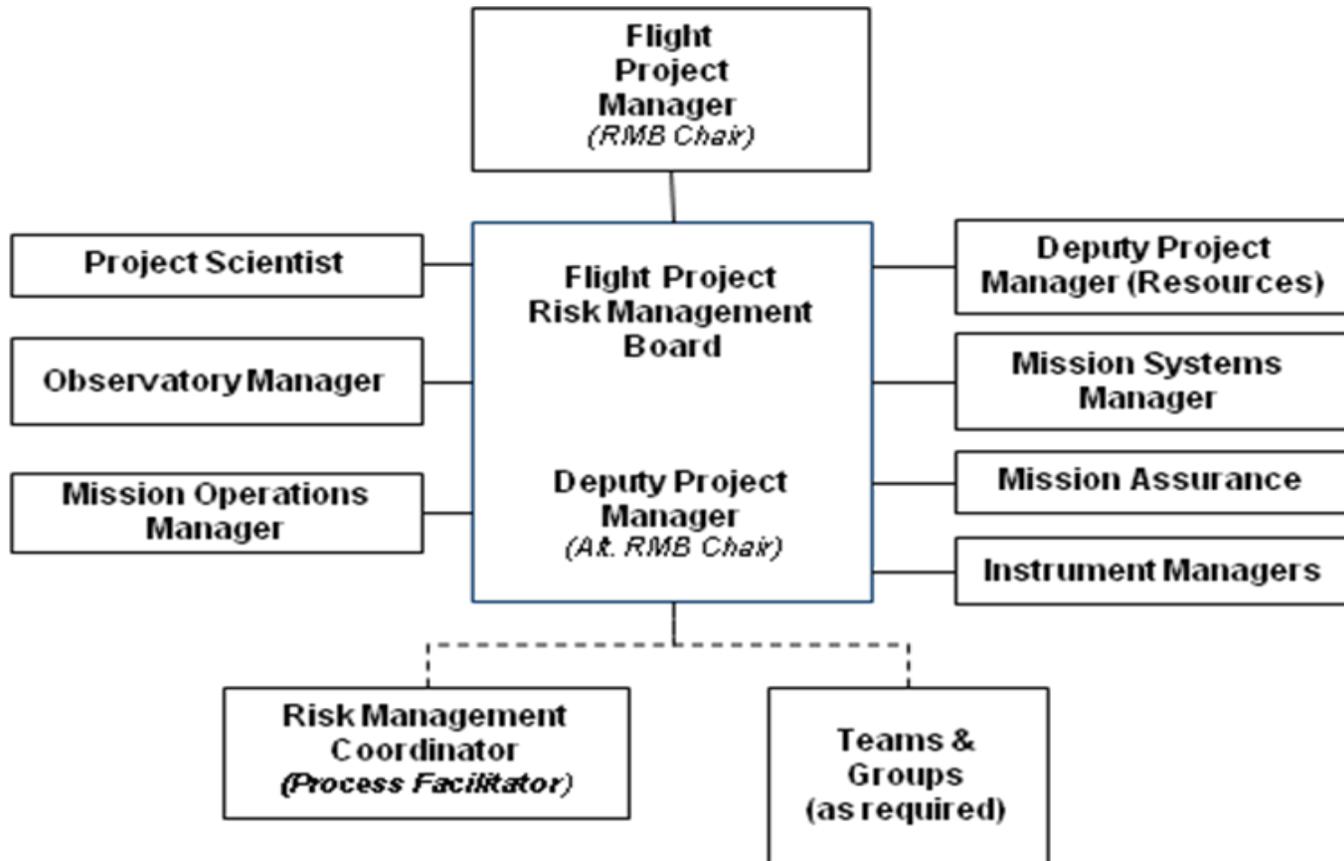


Figure 3 - 2 Flight Project Risk Management Functional Structure (CCR 1204) (CCR 1796)

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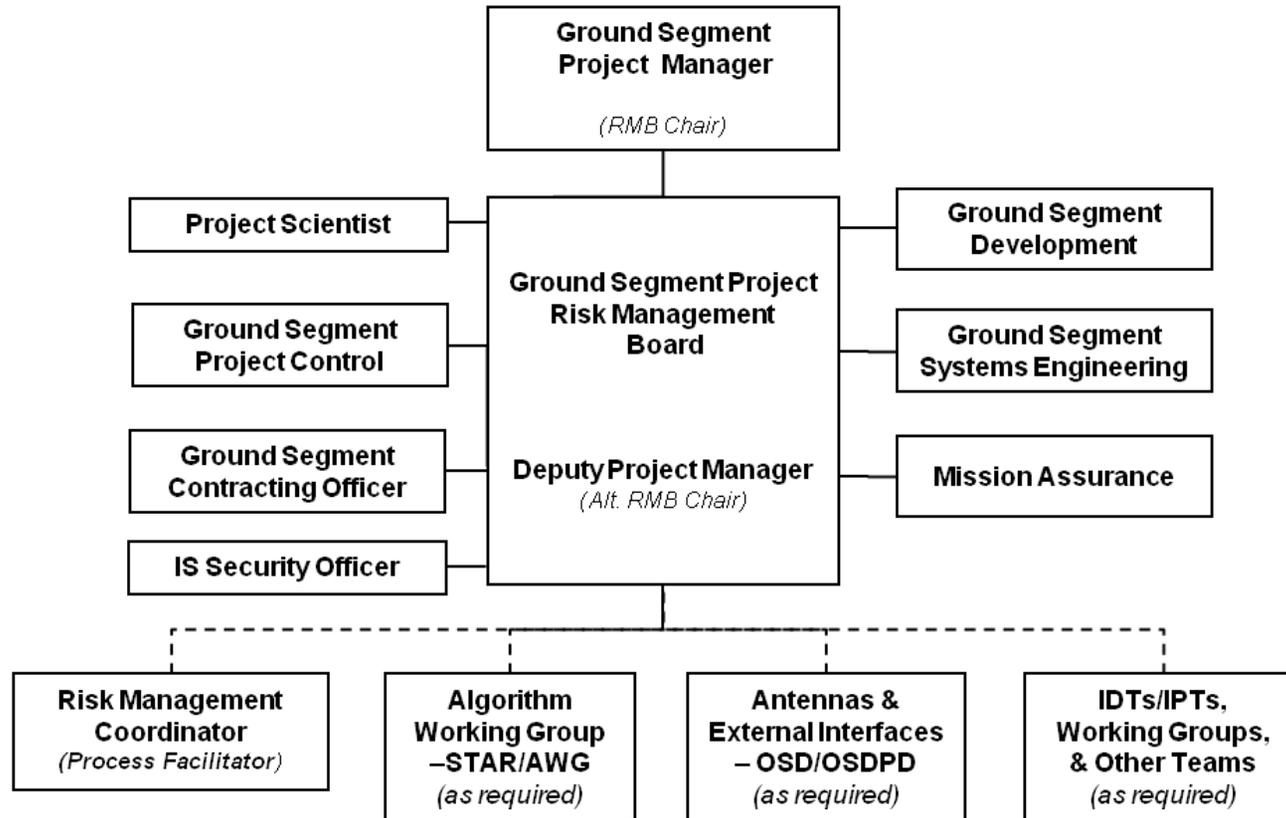


Figure 3 - 3 Ground Segment Project Risk Management Functional Structure
(CCR 1204) (CCR 1796)

Check the VSDE at <https://goessp.ndc.nasa.gov> to verify correct version prior to use.

Who	Responsibilities
Individuals, Teams, Systems Engineering, and Mission Assurance	<ul style="list-style-type: none"> • Identify new risks • Estimate probability, impact, and timeframe • Classify risks • Recommend approach and actions • Track risks and mitigation plans (acquire, compile, and report)
System Program Director or Project Manager	<ul style="list-style-type: none"> • Final authority for risk closure and/or risk acceptance • Final review and approval for control decisions (analyze, decide, execute) for program risks • Authorize expenditure of Program or Segment resources for mitigation • Final review and approval for assignments or changes in responsibility for risks and mitigation plans within the Program or Segment (e.g., moving responsibility for a risk from spacecraft to instrument) • Communicate significant risks or changes to senior management.
Risk Management Board (RMBs) & Senior Management Team	<ul style="list-style-type: none"> • Review risk information from all areas and determine validity of the risks (consolidation, reclassification, transfer to action items/non-conformance, etc.) • Reprioritize all risks to determine significant risk for overall program and in each area (software, hardware, etc.) • Accept, revise, or propose additional action plans • Make control decisions (analyze, decide, execute) for risks • Make recommendations for additional trade studies or research. • Make recommendations to SPD or Project Manager regarding expenditure of resources for mitigation • Assign or change responsibility for each risk, mitigation plan, and fallback plan • Communicate significant risks or changes to the SPD and Project Manager • Make recommendations to SPD or Project Manager regarding risk closure and/or acceptance • Compile documentation on all of the significant risks identified and effectiveness of mitigation strategies in reducing and/or eliminating the risks as historical data to be used as lessons learned.
Risk Owner	<ul style="list-style-type: none"> • Individual assigned by the SPD or Project Manager through the RMB • Conduct assessments and communicate those results to the RMB. • Develop and implement of all plans and activities needed to close or accept a specific risk. • Communicate handling/action effectiveness or any significant changes to the RMB via the Risk Management Coordinator • Document progress and status of risk mitigation • Make recommendations to RMB regarding risk closure and/or acceptance • Develop and implement action plans • Document effectiveness of mitigation strategies in reducing and/or eliminating the risk assigned as historical data to be used as lessons learned.
Systems Engineering and Risk Management Coordinator	<ul style="list-style-type: none"> • Utilize Historical data and other lessons learned information to identify/mitigate potential risks • Ensure accuracy of probability/impact/timeframe estimates and the classification • Review recommendations on approach and actions • Build action plans (determine approach, define scope and actions) • Report significant risks and issues to the RMB • Collect and report general risk management measures/metrics

Table 3 - 1 Risk Management Responsibilities
(CCR 1796)

Ground Segment Project Manager, Contracting Officer, Program Control Manager, Program Scientist, Program Systems Engineer, and Risk Management Coordinator (See Figure 3-1). Functional area specialist and other program personnel will participate as needed. As the GOES-R Series Program evolves, the membership of the board may be augmented with other individuals or be otherwise changed. The final authority for the membership of the Program RMB resides with the GOES-R Series SPD. (*CCR 1204*)

The Flight Project Manager/Ground Segment Project Managers are chairs of their separate project-level RMBs. Deputy Project Managers, Observatory Manager, Instrument Managers, Systems Engineering Managers (Flight and Ground Segment), Mission Assurance and Project Control (Deputy Project Manager –Resources) will be participating members. (See Figure 3-2 and Figure 3-3) The Risk Management Coordinator provides support to all the boards and facilitates board meeting and risk documentation activities. (*CCR 1204*)

Functional area specialist and other project personnel will participate as needed. Membership of the board may be augmented with other individuals or be otherwise changed. The final authority for the membership of the project-level RMBs resides with the cognizant project manager. (*CCR 1204*)

The Program & Project RMB is responsible for:

- Reviewing any risks and issues that have arisen since the last RMB meeting.
- Validating and prioritizing risks from the current set of risks, reviewing risk descriptions and risk analyses provided by individuals or teams.
- Reviewing and adjusting risk action planning (mitigation plans, mitigation time frames, etc.) proposed by teams, for the same set of risks, and reassigning risks when necessary.
- Performing the risk control function for the program as a whole (given risk tracking information, mitigation or fallback plans, de-scope plans, etc., for individual risks).
- Initiating trade studies or other research regarding particular risks, as needed.
- Providing recommendations on how to allocate available resources across the current set of risks supporting a balanced risk reduction approach.
- Assigning a Risk Owner for each risk identified
- Assigning and coordinating resources to implement and maintain the GOES-R Series Program tailored RM process. (*CCR 1796*)

Additionally, the RMB shall reconcile risks that have been proposed by segments, teams, or individuals but which are (or appear to be) mutually incompatible. The RMB shall also consolidate duplicated risks and resolve incompatibilities or conflicts in a balanced and comprehensive manner. Resources shall be applied to reduce each risk commensurate with the risk exposure.

Working group meetings provide another ad hoc forum in addition to the RMB for risk management communication. The Risk Management Coordinator convenes an informal working group on an as needed basis. The working group membership is open to any member of the

program team interested in the details of the RM process. In particular, Risk Managers for any segment, contractor, or affiliated organization are invited to participate, but may not attend working groups where information from another contractor/subcontractor will be discussed. The scope of discussion for these meetings includes: *(CCR 1204)*

- Effectiveness of the current risk management process, at the detailed level, and possible changes and/or improvements.
- Risk data input templates and risk data reporting formats
- Rating scales for risk probability and risk impact.
- Details of any current, high-level risks that are critical to the program.
- Risk identification, information development and documentation to clarify terminology, point of view, operating constraints, and risk mitigation goals to facilitate risk communication across the program.

3.3 Program/Project Managers

Within the GOES-R Series Program, there are multiple levels of risk management responsibilities. The GOES-R Series System Program Director (SPD) is responsible for the overall performance and operation of the program and retains ultimate responsibility for accepting risk and for allocating resources across the program to eliminate, reduce, or mitigate risks. The GOES-R Project Managers are responsible for all aspects of the project implementation lifecycle including conformance to GOES-R technical, cost, and schedule requirements. The high-level strategies of addressing the highest priority (and in many cases most visible) risks will, in general, be the shared responsibilities between the SPD, the Flight Project Manager, and Ground Segment Project Managers. *(CCR 1204)*

The GOES-R Series SPD, Flight Project Manager, and Ground Segment Project Manager, as RMB Chairs, are responsible for: *(CCR 1204)*

- Prioritizing mitigation strategies based on overall risk exposure, constraints, and available resources.
- Authorizing expenditures of resources to eliminate or mitigate risks, at their level of authority.
- Resolving conflicts or disputes among lower tier organizations and teams.
- Communicating risk metrics/measures, significant risks, and status to higher-level management.
- Coordinating the acceptance of risk with senior level management.
- Setting policy regarding the communication of GOES-R Series program/project risks.
- Delegating risk management responsibilities to the lower tier management or IPTs/IDTs, as necessary.

3.4 Deputy Program/Project Managers

In the absence of the Program Manager/Project Managers, the Deputy Program Manager/Deputy Project Managers assumes decision-making authority for all program or project functions and activities. The Program Manager/ Deputy Project Managers are core member and are the alternate chair of their respective Risk Management Boards.

3.5 Program/Project Scientist

The Program/Project Scientist is charged with providing the link between the operational user community of GOES-R and the GOES-R Program Office. The GOES-R Series Program/Project Scientist Lead is a member of the Program and Project RMBs; is considered a representative of science, stakeholder, and customer community; and, is responsible for ensuring that risks related to these areas are managed and communicated in an appropriate manner.

3.6 Contracting Officer

The Contracting Officer is responsible for:

- Coordinating with the Risk Management Coordinator in evaluating, documenting, and communicating the overall program risk status for KDPs and program acquisition milestones by comparing implementation status to baseline cost, schedule, and technical performance.
- Consolidating results of the different phases for the program including requirements, WBS, contractual deliverables, and development paths for all levels of the program particularly those that cut across segments to ensure the effectiveness of acquisition strategies in support of the program's overall risk handling/action approaches.
(CCR 1204)

3.7 Program/Project Control Manager

Program/Project Control provides the expertise required to manage the business and financial aspects of all GOES-R programs and activities and is responsible for the day-to-day monitoring, management and control of financial management activities. Project Control Management duties are the responsibility of the Deputy Flight Project Manager for Resources. The Program/Project Control Manager is responsible for (CCR 1796):

- Maintaining the resources, budget, and integrated network schedule for the program.
- Tracking the variances between baseline and actual resource allocation, cost, and milestones/critical path.
- Supports studies of alternative approaches in support of the risk prioritization and mitigation strategies.
- Providing analysts to assist in the review, interpretation and detailed planning for risk handling/action.

- Coordinating with the management, Contracting Officer, and Risk Management Coordinator in evaluating, documenting, and communicating the overall program risk status for KDPs and program acquisition milestones by comparing implementation status to baseline cost, schedule, and technical performance.
- Allocating budget for risk management following Program Manager/Project Managers approval.

3.8 Program Systems Engineer

The Program Systems Engineer is responsible for:

- Performing architecture studies, program-level trade studies of evolving technologies to identify potential candidates for improving mission performance as of the overall program risk prioritization and mitigation strategies.
- Assessing the potential risks to achieving mission performance objectives.
- Tracking program-level end-to-end to integration, technical, and systems risks

The Program Systems Engineer chairs a program-level systems integration RMB. Systems Engineering Managers (Flight and Ground Segment), Mission Assurance, and Program Systems Engineering leads are participating members. (See Figure 3-4). The Risk Management Coordinator provides support to the board and facilitates board meeting and risk documentation activities. (*CCR 1204*)

3.9 Observatory Manager

The Flight Project's Observatory Manager is responsible for the coordination and integration of elements of the GOES-R series observatory including spacecraft and instruments. During the A&O phase, the Project Observatory Manager is responsibility for the day-to-day communication and coordination with the spacecraft contractor. The Project Observatory Manager is delegated as the GOES-R Series Point of Contact (POC) regarding spacecraft risks and related matters. The Observatory Manager is a core member of the Flight Project Risk Management Boards. (*CCR 1204*) (*CCR 1796*)

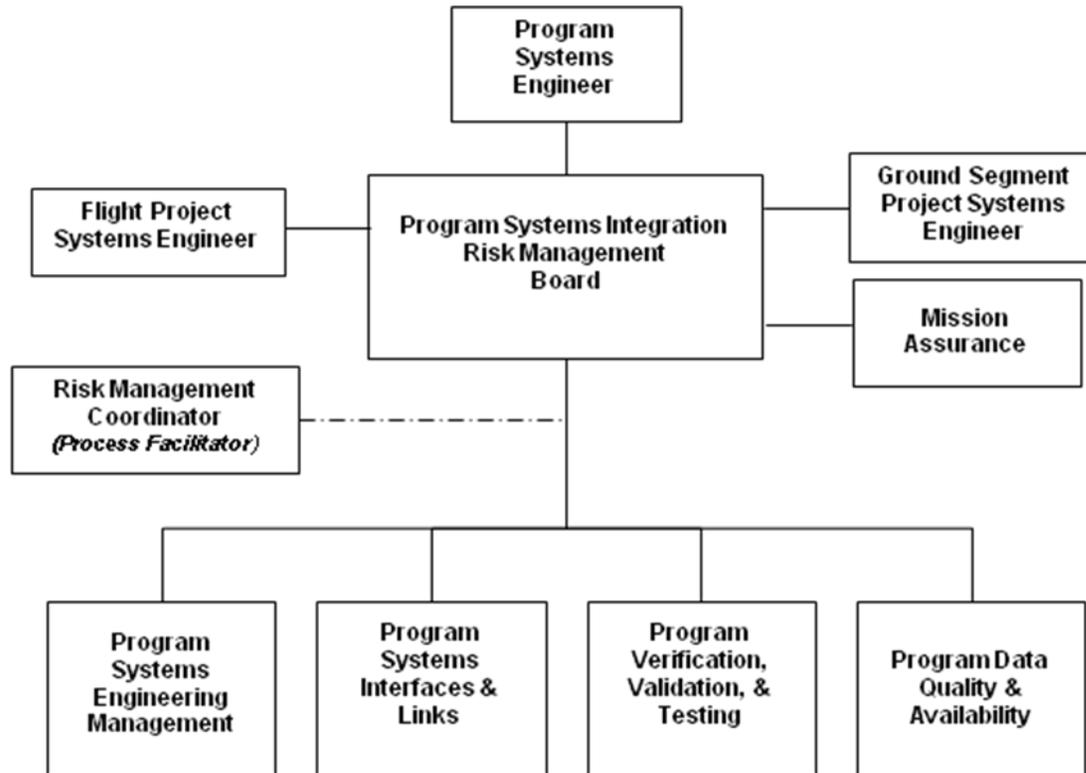


Figure 3 - 4 Program Systems Integration Risk Management Functional Structure
(CCR 1204)

3.10 Flight and Ground Segment Project Systems Engineer (CCR 1204)

The Project Systems Managers/Systems Engineers (Flight and Ground Segment) are responsible for: (CCR 1204) (CCR 1796)

- Performing trade studies, systems analyses, requirements definition/verification, and interface definition/control as part of the project-level risk prioritization and mitigation.
- Assessing the potential risks to achieving technical performance objectives.
- Tracking project-level risks.

3.11 Instrument Managers and Instrument Systems Engineers (CCR 1796)

The Instrument Managers and Instrument Systems Engineers are responsible for fully integrating instrument design and development activities into the GOES-R Series Risk Management process. The Instrument Systems Engineers along with individual Instrument Managers shall ensure that instrument developers, whether already selected or as part of an on-going competitive environment, are active participants in this process and provide for the following: (CCR 1204)(CCR 1796)

- Comprehensive risk management process is implemented by instrument developers;
- Rigorous management and systems engineering processes (resource management, cost & budget tracking, critical path/schedule tracking, configuration management, systems assurance, process control, requirements definition, interface control, integration & testing, etc.) are integrated with the risk management process.
- Common rating scales and compatible tools are used to coordinate these activities ensuring the timely communication and documentation of risk information to the GOES-R Series Program and Projects;
- Identification and mitigation of risks with technical, programmatic, cost, or schedule impacts
- Risk mitigations implemented with the allocation of resources proportional to the risk exposure (i.e., highest risk get the most resource for mitigation) with the established constraints of cost, schedule, and technical reserves (mass, power, volume, etc.); and,
- Reporting on overall risk assessments and other risk management activities at formal reviews and with routine reporting top risks through the Instrument Systems Manager(s) to the GOES-R Series risk management boards.

3.12 Mission Assurance

Mission Assurance is responsible for ensuring spacecraft, instruments, and ground system equipment (hardware and software) meet their intended performance objectives. These disciplines include: quality assurance; system safety; software assurance; technical review; reliability; workmanship standards and processes; parts; materials contamination and control; and (in conjunction with the Systems Engineering), testing and validation. The Chief Safety and Mission Assurance Officer (CSO) is the NASA GSFC Systems Safety and Mission Assurance

representative to the GOES-R Series Program/Projects and is responsible for identifying and managing mission assurance activities using allocated resources. The CSO plays a critical role in risk management. The CSO is responsible for: *(CCR 1204)(CCR 02428A)*

- Implementing system safety and mission assurance activities early in formulation and concept development process to minimize risks inherent in accomplishing mission objectives.
- Providing a unique focus on safety, reliability and quality assurance requirements that supports and complements the risk mitigation strategies implemented by the GOES-R Series Program/Project.
- Providing an independent overview of the risk management program status at major external reviews
- Assuring compliance with the risk management policies and guidelines.
- Assigning and coordinating required mission assurance resources to support the risk management process.

3.13 Risk Management Coordinator

A Risk Management Coordinator is assigned functional responsibility for supporting and facilitating the RM process for the GOES-R Series Program and is responsible for:

- Assisting in the development, implementation, and maintenance of the GOES-R Series Program Risk Management Plan.
- Communicating the objectives of RM and implementation details to all program organizations and team members.
- Serving as the facilitator to the RMB, by scheduling meetings, preparing the agenda, identifying specific risks to be presented, and tracking action items as assigned by the board.
- Ensuring that the RM database and other risk related documents are maintained.
- Coordinating the GOES-R Series Program risk process with RM, resource assessment, and other programmatic, technical and functional disciplines.
- Providing informal and formal risk management training as required.
- Coordinate with Systems Engineering and Mission Assurance in implementing the risk management process.
- Identifies, coordinates, and implements risk process improvements

3.14 Individuals and Integrated Product Teams (IPTs)/Integrated Development Teams (IDTs), Working Groups, or other Teams (CCR 1796)

The critical expertise for risk identification, analysis, and action planning is found in the GOES-R Series Program teams, developer teams, and each individual team member working within a specific instrument, discipline, subsystem, or element. Therefore, these teams and individuals are the primary source for identifying potential risks and associated mitigation strategies.

Each project has the flexibility to organize its RM activities with its teams as it chooses, including, for example, approaches to risk identification and analysis. However, to ensure

standard risk communication among teams and with management, a common report format, risk exposure ranking (likelihood & consequence), adherence to the GOES-R Series Program risk guidelines, and the use of the GOES-R Series Program RM database to document the risks, will be required. (CCR 1796)

Risks are similar to requirements in that they are hierarchical. At the team level, this hierarchy can be considered to have two levels. The first level contains risks that the team expects to be able to address within the scope of their normal activities, using already allocated resources. These risks may be termed internal team risks and will be formally reported and tracked using the program's risk process (and risk database) allowing for management oversight. The second level contains risks that are not totally under the team's control such as risks related to interfaces or functional/shared responsibility with other teams. The team cannot fully control the risk or mitigation activity for such a risk. Because these risks cross team responsibilities, they require the coordination and resources of one or more higher levels of the program. These risks, or joint risks, need to be escalated to the next higher-level team/RMB for additional analysis and mitigation. (CCR 1796) (CCR 2428A)

3.15 Risk Owner

Each risk is assigned a Risk Owner who will be responsible for carrying out the risk response (i.e., "own the risk"). Early risk identification and mitigation planning allows for predetermined action to be taken when a trigger (early warning) occurs resulting in more effective response minimizing cost, time, and other impacts on the program. Risk Owners will be delegated the authority and resources to implement a pre-approved plan for action. The Risk Owner is an individual who has been assigned responsibility for:

- Implementing all plans and activities (preauthorized mitigation plans & fallback plans) needed to close or accept a specific risk.
- Communicating handling/action effectiveness or any significant changes to the RMB via the Risk Management Coordinator
- Documenting progress and status of risk mitigation
- Making recommendations to RMB regarding risk closure and/or acceptance
- At the completion of the risk handling/action, documenting the overall effectiveness of mitigation strategies in reducing and/or eliminating the risk assigned as historical data to be used as lessons learned.

3.16 Affiliated Organizations

Affiliated organizations shall be integrated into the GOES-R Series Program/Project RM process, within the constraints established by formal agreements. The method of integrating these organizations into the process will be tailored. Some elements of the approach are summarized as follows. Affiliated organizations shall:

- Identify risks with technical, safety, programmatic, cost, or schedule impacts and communicate these risks to the program/project.

- Report on overall risk assessments and other risk management activities at status reviews, and other venues, as agreed upon.

The scope of risks addressed by the GOES-R Series Program/Projects will include joint risks related to the use of dedicated facilities and resources other than those operated by NOAA/NASA. The exact process for reviewing such joint risks and deriving appropriate joint risk action will be documented in the respective agreements are established. These negotiations will also be done in accordance with any pre-existing agreements.

3.17 Contractors

Contractors shall be integrated into the GOES-R Series Program/Project RM process, within the constraints established by formal agreements and contracts. Contractors are responsible for:

- Implementing a RM process and participating in the GOES-R Series RM process.
- Implementing a rigorous programmatic and systems engineering process (resource management, cost and budget tracking, critical path/schedule tracking, configuration management, systems assurance, process control, requirements definition, interface control, integration and testing, etc.).
- Using a common rating scale and compatible tools to coordinate these activities to ensure the timely communication and documentation of risk information to the GOES-R Series Program.
- Identifying risks with technical, safety, programmatic, cost, or schedule impacts.
- Implementing mitigations and allocating resources proportional to the risk exposure (i.e., highest risks get the most resources for mitigation) with the established constraints of cost, schedule, and technical reserves (mass, power, volume, etc.).
- Reporting on overall risk assessments and other risk management activities at status reviews, and other venues, as agreed upon.

This shared process will be greatly facilitated by aligning the RM processes in the various organizations including the use of common rating scales, common terminology, and frequent communication, informal as well as formal.

3.18 Ground Segment Project (GSP) Information Systems Security Officer (ISSO) (CCR 1796) (CCR 2428A)

The GSP Information Technology (IT) security program manager /computer security officer is responsible for the Ground Segment's security programs, including risk management. Therefore, the ISSO plays a leading role in introducing an appropriate, structured methodology to help identify, evaluate, and minimize risks to the IT systems that support the organization's mission. The ISSO also acts as major consultant in support of management to ensure that this activity takes place on an ongoing basis. (CCR 1796)

4 Risk Management Process Details

4.1 Process Flow (Concerns, Risks, & Issues) (CCR 1796)

This section provides the details on the RM process. The GOES-R Series RM will incorporate a web-based RMIS to compile and track risk data gathered from a variety of sources. All program members are encouraged to use the RMIS to track risks for their level, segment, or system.

The GOES-R Series program, project organizations, contractors and other affiliated organizations shall identify the risks in their respective areas and implement mitigation strategies (corrective actions, action plans, mitigation plans, fall-back plans, etc.) to control these risks. Periodically the risks for each of these organizations shall be reported to the GOES-R management (program or projects), combined with other identified risks as applicable, and further prioritized to generate the top risks for the overall GOES-R Series Program. Only a selected number of risks for the overall GOES-R Series Program shall have additional resources expended for mitigation. The remaining risks shall be monitored and managed within established program constraints. The status of all identified risks, however, will continue to be tracked with appropriate re-evaluation initiated if required.

The GOES-R Risk Management process has established a spectrum of progressively increasing levels of documentation associated with identifying, tracking, and reporting on potential concerns, identified risks, and issues. The levels of documentation include items defined as concerns, candidate risks, risks, and issues. (CCR 2428A)

The initial or lowest-level items that lack definition or are too far “over the horizon” are labeled “concerns.” These include “worries” or potential risks. These items represent a credible uncertainty but lack details or maturity. An individual, team, or group may identify a concern to one or more of the organization's goals. Pertinent information about the concern is collected and documented that allows appropriate personnel to understand the concern and to evaluate the details to qualify/quantify the potential risk. (CCR 2428A)

As more details are developed these items, candidate or proposed risks, are considered for adjudication by the cognizant review body. Once sanctioned or validated as “risk” these items are tracked and managed by the appropriate risk management board.

The highest level items are defined as “issues”. These are items include new problems that have arisen or risks that have been realized. Each level represents greater likelihood of occurring and requires higher levels of authorizations and scrutiny, see Figure 4 - 1. (CCR 1796)

4.2 Risk Identification

The risk identification process is designed to identify potential concerns before they become issues or problems and to document and communicate this information throughout the program. Table 4-1 summarizes the risk identification process. (CCR 1796)

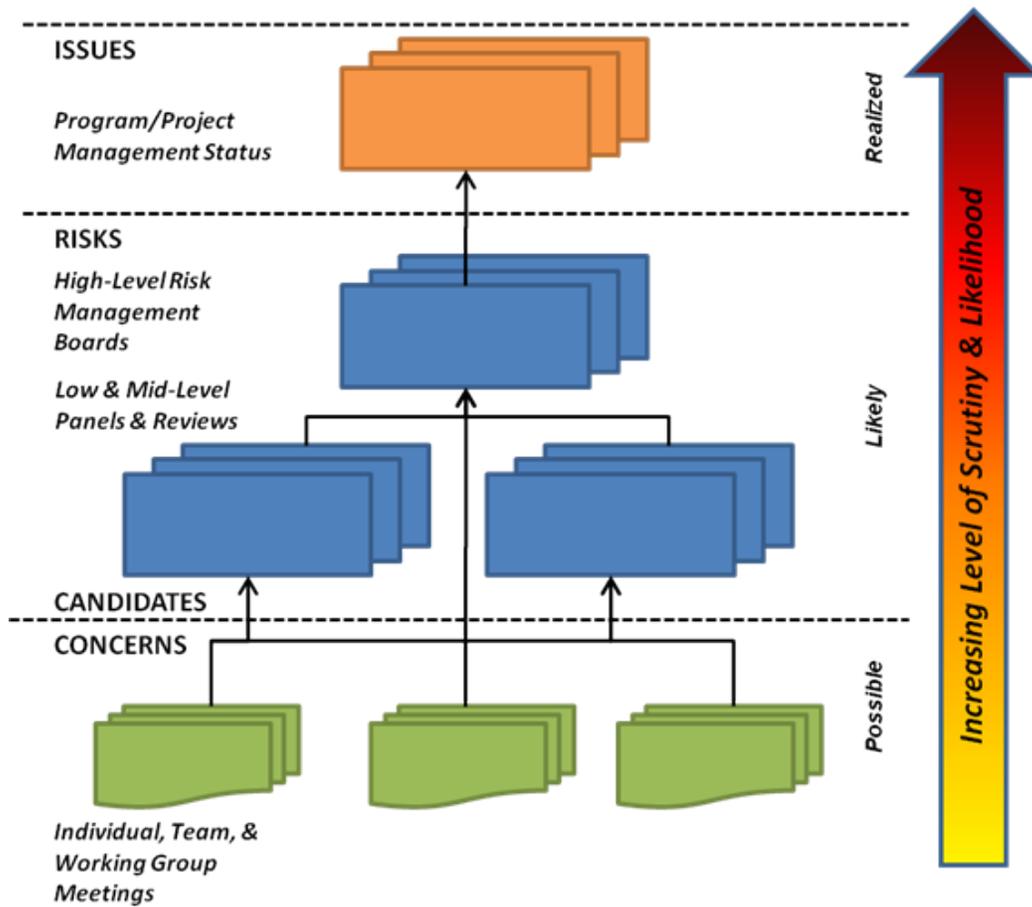


Figure 4 - 1 Concerns, Risks, & Issues Information Flow
 (CCR 1796)

Step	Action
1	New concern is identified.
2	Statement of concern is written in the proper format (condition, context, and consequence).
3	Additional information regarding the concern is captured in the context.
4	Risk statement and context of the new risk are recorded on Risk Information Sheet (RIS).
5	Risk statement and context of the new risk are entered in the risk database.
6	New concern is automatically assigned a unique identifier by the risk database.
7	Risk Management Coordinator and Leads review concerns entered into the database monthly.

Table 4 - 1 Risk Identification
 (CCR 1796)

Risk identification is a continuous process with new risks added and existing risks updated as the program moves through each phase of the life cycle. In some cases additional identification actions, or risk research, may be taken to further investigate risks. Risk Research provides additional information or understanding before further action is taken.

In each of the program phases (End-to-End Systems Architecture Study, PDRR and A&O), a comprehensive list of risks is identified using techniques such as brainstorming, interviews, and taxonomy based risk surveys. All identified risks are submitted to RMB for validation (determining if it is a risk) and evaluation. During the A&O phase, specific risks and/or proposed mitigation approaches identified by the contractors shall remain confidential and proprietary. The categories (sources) of risk are: technical risk, contract risk, schedule risk, budget risk, safety/environmental risk, and sustainability risk. Other categories will be added as required. Risk identification will involve the review of historical documentation from past GOES acquisition efforts (such as program background information, past lessons learned, program charter, scope statement, teams, the Work Breakdown Structure (WBS) the network diagram, cost and time estimates, staffing plan, and acquisition planning) to assist in identifying common sources of technical risks (e.g., operations or performance), program management risks, organizational risks, and external risks (e.g., legal or environmental). (*CCR 1204*)

The risk list is reviewed and updated periodically at major milestones. These risks are identified from inputs to the Risk Management Information System (RMIS), as part of meetings routinely held by the program/projects and as needed, through brainstorming sessions and interviews conducted by the Risk Management Coordinator with GOES-R Series team. These proposed risks, identified as Candidates are more fully developed before being validated or sanctioned as risks and incorporated into the formal GOES-R Series Program Risk List. The Risk Management Coordinator, the Risk Originator, Team Lead and the Risk Owner (if already identified) modify to wording, and otherwise make changes to the item. Once validated changes to the risk content can only be made by the board, while updates to the risk status will continue to be made by the Risk Owner. (*CCR 1204*) (*CCR 1796*) (*CCR 2428A*)

Any potential new risks identified during any program-related meeting are added to the RMIS with notification provided to the Risk Management Coordinator. It is the responsibility of the meeting leader to make sure that this is accomplished (e.g., assigning a formal action to develop the subject risk). (*CCR 1204*)

Any individual, team, or group can identify and submit risk information to the RMB for evaluation. All risk information/risk submittals (whether accepted as valid risks or otherwise dispositioned) are documented and retained as part of the official program records. (*CCR 1204*)

All new and candidate risk information will be reported to the program/projects RMBs, as appropriate, by the Risk Management Coordinator at the next scheduled RMB meeting. Action to be taken by the program/project RMBs for newly identified items will include validating new risks, rejecting items not considered valid risks, requiring additional research to more fully develop a potential risk, and assigning a Risk Owner. Those issues, concerns or problems deemed not truly risks will be rejected as risks with rejection rationale documented in the RMIS,

and placed under other reporting and tracking functions as needed (problems and corrective actions, program action items, etc). Validated risks will continue to be tracked on the Concerns/Candidates List until board action is taken and a Risk Owner is identified. At that time the validated risk will be assigned a Risk Identification number with status tracked on the Risk List. The RMB will monitor all concern attributes for early warnings of critical changes in impact, probability, time frame or other aspects. The warnings are defined in terms of “triggers that, if they occur, indicate that action is warranted. (CCR 1796)

A Watch or Watch Item when used colloquially may refer to a Concern that is being monitored or a Risk with a Handling Strategy/Approach of Watch assigned to it. For the GOES-R risk management process the preferred use of the term, Watch Items, is for risks that either do not have mitigation steps or have mitigations that may occur significantly in the future given certain circumstances. (CCR 2428A)

4.3 Risk Assessment & Analysis

Risk assessment and analysis is used to ascertain as accurately as possible the validity of a candidate or proposed risk, the likelihood of that risk, the magnitude of the consequence of such an event, and timing for mitigating the risk(s). The following steps are used to analyze risks. Table 4-2 summarized the risk assessment & analysis process. (CCR 1796)

Step	Action
1	Evaluate to determine if there is a valid risk related to issue, concern, or problem identified. A risk is deemed valid if it truly represents a credible condition with some level of uncertainty having an impact on the program.
2	Risk attributes (impact, probability, timeframe, and Expected Value) are assigned using qualitative assessment
3	Risk attributes are entered into the risk database.
4	Risk attributes are reviewed and corrected periodically by the Risk Management Coordinator and the RMB.
5	Candidate or Proposed Risks are validated, assigned a Risk Id, and prioritized in their respective areas by the GOES-R Series SPD, Project Manager, and the RMB.
6	Top significant risks are further evaluated using quantitative analysis, as needed

Table 4 - 2 Analyzing and Classifying Risks
 (CCR 1796)

Initial Classification. An initial classification of risks shall include organizational levels (spacecraft, ground segment, systems engineering, etc.), and mission consequence (safety, performance, or program execution) with subcategories of impact (technical, cost, and schedule). Risk attributes of likelihood, consequence, and timeframe are initially estimated for a candidate risk by the Risk Originator and entered at the same time the concern is proposed to be elevated to a risk and documented. The Risk Management Coordinator will work with the Risk Originator to further develop the risk and determine attributes of the risks. (CCR 1796)

Validation, Elevation, & Escalation. In each successive level of review, the RMBs evaluate the validity of all proposed risks submitted. A candidate risk is deemed valid and is elevated to a risk if it truly represents a credible condition that includes a level of uncertainty with a consequence to the program. A candidate risk may be rejected if it is determined that the concern is something other than a risk (problem or failure), has no merit, or has no impact to the program. Similarly, escalated risks may be returned for resolution at the “lower level”. (CCR 1796) (CCR 2428A)

A risk may be escalated to the attention of higher level management for three reasons: a) the risk exposure is high (red risk); b) the risk spans more than one segment, product area, or discipline, and must therefore be addressed at the next higher level in the organization; or, c) resources and/or authority beyond those available in the original area are required to address the risk. (CCR 2428A)

Risk Assessment. Risk may be assessed either qualitatively or quantitatively. To reduce the subjective factor in making such assessments, the GOES-R Series Program risk management process utilizes rating scales for each of these measures defined in advance – with each of five impact, likelihood, and timeframe levels described in Tables 4-3, 4-4, and 4-5. The impact of a risk event can be to cost, schedule and/or technical performance simultaneously. For any risk, it is the impact with the most severe rating that is used to determine the risk exposure.

Safety related risks are addressed in detailed in the appropriate system safety, environmental, and occupational health and safety processes and documentation as described in the GOES-R Systems Safety Program Plan, P417-R-PLN-0154. Safety risks that are already addressed and reported by the safety process will not need to also be reported through the risk management unless: the safety risk cannot be mitigated; the recommended safety hazard reductions are not being implemented; or, if implemented, would result in significant technical, cost, or schedule impact. (CCR 1204) (CCR 2428A)

Reliability and Probabilistic Risk analyses and documentation are established in a series of Mission Assurance Requirements (MARs) for all of the GOES-R elements as applicable, Failure Modes and Effects Analysis (FMEA), Fault Tree Analysis (FTA) and Probabilistic Risk Assessment (PRA) shall be used to support the qualitative and quantitative assessment of risk inherent in the system design and associated development and operations activities to (CCR 2428A):

- a. Evaluate alternative design concepts, redundancy and cross-strapping approaches, and part substitutions.
- b. Identify the elements of the design that are the greatest detractors of system reliability.
- c. Identify those potential mission limiting elements and components that will require special attention in part selection, testing, environmental isolation, and/or special operations.
- d. Assist in evaluating the ability of the design to achieve the mission life requirement and other reliability goals and requirements as applicable.
- e. Evaluate the impact of proposed engineering change and waiver requests on reliability.

The results of these risk assessments shall be used to support project management decisions with respect to safety and mission success, and programmatic commitments. Accepted risks/residual risks are linked to the results of the FMEA/Critical Items List (CIL), FTA, and PRA where applicable. (CCR 2428)

Qualitative Risk Assessment. The Risk Matrix shown in Figure 4-2 allows a qualitative measurement of the likelihood and consequence of a risk to be made. Using this approach the GOES-R Series Program ranks risks and provides relative “values” of the likelihood of occurrence and potential consequence of each risk. After the probability and the impact of the risk are separately analyzed, these two factors are combined to arrive at a measure of the risk exposure using the Risk Assessment Classification (RAC). A risk exposure shall be determined for each risk. The intersection of the probability rating with the impact rating on the risk matrix will be used to derive this risk exposure. The purpose of the risk exposure is to allow for a common classification of High, Medium, or Low (Red, Yellow, or Green) for all risks regardless of source, type, or consequence.

For each risk identified and validated by a RMB, an individual shall be assigned responsibility as the Risk Owner. A risk action plan shall be developed documenting the activities, dates, deadlines, and risk triggers. Expected Values (EV) for the risk occurring shall be determined qualitatively and included in the risk documentation. Table 4 - 6 provides a sample Risk List, based on a WBS, that integrates technical, schedule, and cost risk with cost impact assessed using EV. EV is used when considering cost as the measure of worth. For decisions where “value” is multi-dimensional, a Multi-Criteria Decision Making (MCDM) approach may be used. Usually these arise because there are multiple objectives being evaluated or the objectives are not readily converted into dollar values (\$). For example, program decisions are generally related to technical performance, cost, and time. The use of the MCDM approach provides a means for understanding and assessing tradeoffs such as: “spend an additional \$1 million to complete a program on time” or “complete the program on time and within budget, but with reduced technical performance”.

Quantitative Analysis. In general, qualitative methods will be considered adequate for making risk management decisions. However, quantitative methods will be used when more precise analysis and understanding of the risk or allocation of resources for risk reduction is needed based on a prioritized list. When warranted, the RMB may request that comprehensive quantitative analyses be conducted to determine risks attributes. The RMB will need to decide whether the risk identification and classification determined using qualitative methods is adequate, or whether the increased precision of quantitative analyses (such as a more detailed reliability analyses, Monte Carlo modeling, etc.) or testing (test-to-failure, life-testing, etc.) is needed. In making this determination, the RMB will need to balance the (relatively) higher cost of risk analysis against the value of the additional insight. The allocation of additional resources for analysis of some risks may limit the availability of resources for mitigating other risks.

Rank	Consequence (Impact)	Description
5	Very High	<p>Cost – Greater than 10% increase over allocated Program, Project or Segment funding and/or exceeds available reserves.</p> <p>Schedule – Major slip in the critical path or any element on the critical path that exceeds reserves Major slip that affects the award of the follow-on phase Major slip that affects the launch date or delays scheduling to other segments</p> <p>Technical– Key Performance Parameter (KPP) and/or other mission objectives cannot be met. Minimum mission success criteria are not achievable. Major new technology development is required</p> <p>Safety- May cause death or permanently disabling injury or destruction of property</p>
4	High	<p>Cost - > 7% ≤ 10% increase over allocated Program, Project or Segment level funding, and/or threatens to reduce reserves below prudent levels.</p> <p>Schedule – Moderate impact to critical path or any slip in non-critical path elements of > 3 months ≤ 4 months or major milestones that threatens to reduce reserves below prudent levels.</p> <p>Technical – Significant impact to meeting KPPs and/or other mission objectives. Minimum mission success criteria are achievable. Moderate new technology development is required.</p> <p>Safety- May cause severe injury or occupational illness or major property damage</p>
3	Moderate	<p>Cost - > 5% but ≤ 7% increase over allocated Program, Project or Segment level funding, and can be handled within available reserves.</p> <p>Schedule - Any slip in non-critical path elements of > 2 months ≤ 3 months, accommodated within reserves</p> <p>Technical – Moderate impact to meeting KPPs and/or other mission objectives. Minimum mission success criteria are achievable with margin. May require some new technology development.</p> <p>Safety- May cause minor injury or occupational illness or minor property damage</p>
2	Low	<p>Cost - ≥ 2% but ≤ 5% increase over allocated Program, Project or Segment funding, and can be handled within available reserves.</p> <p>Schedule - Any slip in non-critical path elements of ≥ 1 month ≤ 2 month</p> <p>Technical– Minor impact to meeting KPPs and/or other mission objectives. Minor impact to full mission success criteria. No new technology development required. May require minor modifications to existing technologies.</p> <p>Safety - Could cause the need for only minor first aid treatment</p>
1	Very Low	<p>Cost – < 2% increase over allocated Program or Segment/Sub segment funding, and can be handled within available reserves.</p> <p>Schedule – Minimal or no slip in non-critical path elements. No impact to schedule reserve</p> <p>Technical– No impact to meeting KPPs and/or other mission objectives. No technology development or modifications required.</p> <p>Safety- Negligible or no safety impact</p>

**Table 4 - 3 Risk Impacts
 (CCR 1204) CCR 2428A)**

Rank	Likelihood (Probability)	Safety (Likelihood of safety event occurrence)	Technical (Estimated Likelihood of not meeting mission technical performance requirements)	Cost/Schedule (Estimated Likelihood of not meeting allocated Cost/Schedule requirements or margin)
5	Very High	$P_S > 10^{-1}$	$P_T > 50\%$	$P_{CS} > 75\%$
4	High	$10^{-2} < P_S \leq 10^{-1}$	$25\% < P_T \leq 50\%$	$50\% < P_{CS} \leq 75\%$
3	Moderate	$10^{-3} < P_S \leq 10^{-2}$	$15\% < P_T \leq 25\%$	$25\% < P_{CS} \leq 50\%$
2	Low	$10^{-5} < P_S \leq 10^{-3}$	$2\% < P_T \leq 15\%$	$10\% < P_{CS} \leq 25\%$
1	Very Low	$10^{-6} < P_S \leq 10^{-5}$	$0.1\% < P_T \leq 2\%$	$10\% < P_{CS} \leq 10\%$

**Table 4 - 4 Risk Probability
(CCR 1204) (CCR 2428A)**

Rank	Timeframe	Description
5	Imminent	Mitigation action to start immediately, within 1 month
4	Near Term	Mitigation action to start in 1 to 2 months
3	Mid Term	Mitigation action to start in 2 to 4 months
2	Far Term	Mitigation action to start in 4 to 6 months
1	Very Long Term	Mitigation action to start in 6 and beyond

Table 4 - 5 Risk Timeframe

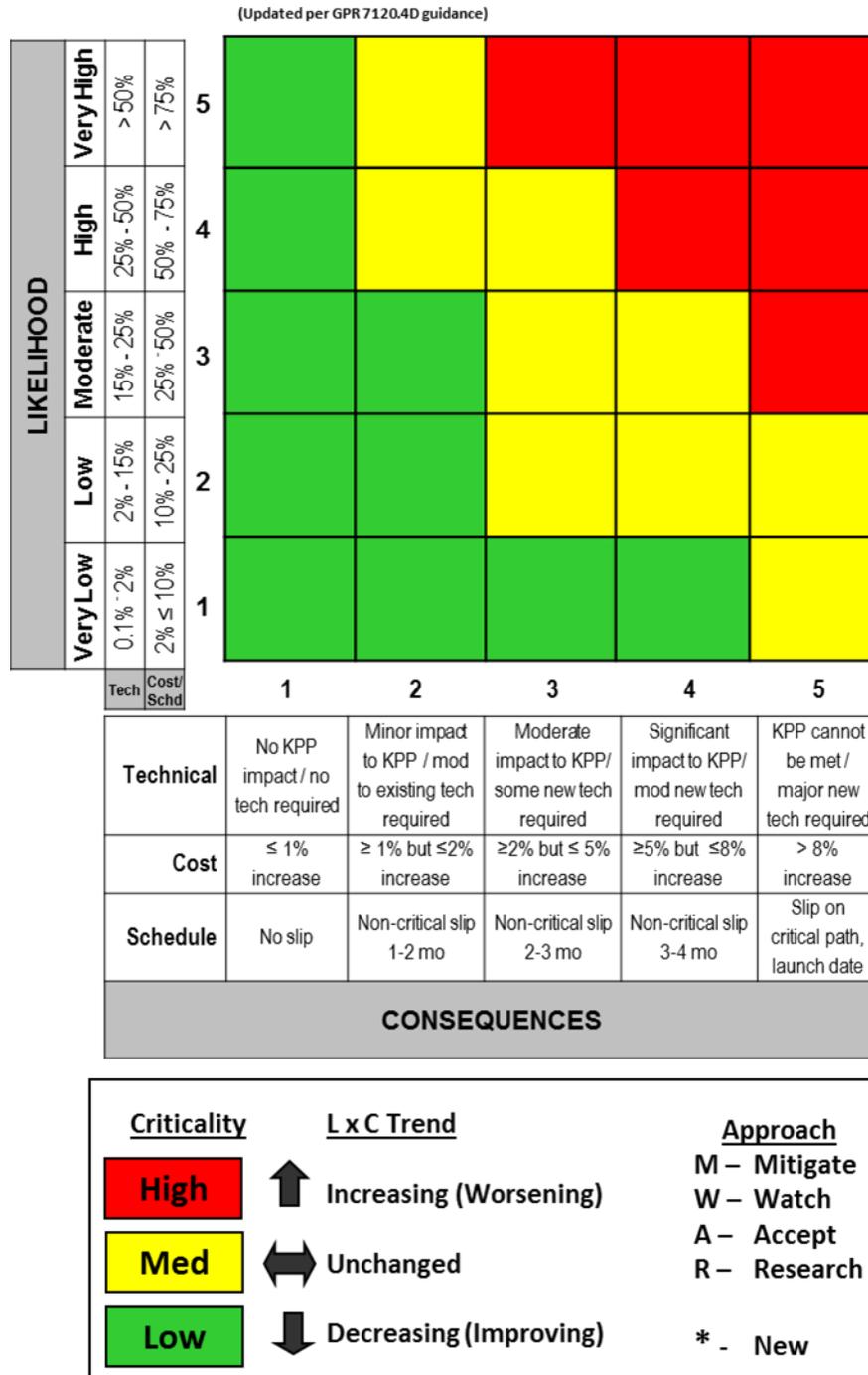


Figure 4 - 2 Risk Matrix
 (CCR 1796) (CCR 2428A)

Risk Id	Area	Technical	Schedule	Cost	Expected Risk Impact (\$100K)
1	Technical Performance	High	Medium	High	3.5
2	Instrument Development	High	High	Medium	3.0
3	Data System Reliability	High	High	Medium	2.7
4	Antenna Development	Medium	Medium	Low	2.0
5	COTS Procurement	Low	Low	Medium	0.5

Table 4 - 6 Sample Risk List

4.4 Risk Handling/Action

Risk handling/action takes the input from the risk analysis function and formulates action plans to address them. The risk must first be assigned to an individual, Risk Owner, with the ability and knowledge to address the risk. As newly identified risks are brought to RMB’s attention through meetings, database reports or other communication, the appropriate action to handle the risk needs to be determined. Table 4-7 identifies the steps in the risk handling/action planning process.

A number of possible actions can be taken. A given action shall include trigger points at which decisions are pre-planned. These decision points are established in advance to address such things as intermediate risk reduction level or the initiation fallback plan. One of the following actions will be implemented for each risk identified:

- **Research:** Once a risk is validated there may be situations where more detailed information is required before specific action is determined. If sufficiently detailed this action may require developing a formal research plan.
- **Watch:** All open risks are watched for changes in status or attributes. The owner will identify “triggers or events/dates that may cause a change in risk attributes.
- **Eliminate (Risk Avoidance):** This strategy involves a change in the concept, requirements, specifications and/or practices that eliminate the risk. Simply stated, it eliminates the sources of the risk.
- **Mitigation (Risk Control):** These two terms refer to taking action to reduce the risk exposure, by reducing the probability of occurrence, the impact, or both. The owner will be required to develop and implement a risk mitigation plan. The plan will provide sufficient details addressing resources, dependencies, cost, and schedule to mitigate the risk.
- **Acceptance:** The consequences of a risk, if it were to occur, are accepted; however, no further resources are allocated to risk mitigation. Risk assumption is a conscious decision to accept the associated level of risk, without engaging in any special efforts to control it. A general cost or schedule reserve may be set aside to deal with any problems that may

occur due to risks that have been accepted. All risks that have been accepted (not completely eliminated) are considered residual risks.

- Transfer: The action of shifting risk from one party to another. An example includes purchasing insurance coverage to offset the risk of a launch vehicle failure. All proposed risk transference shall be reviewed and approved by the SPD.

Step	Action
1	Risk Owner assigned responsibility for risk(s) by the SPD.
2	Risk Owner recommends approach to be taken. Possible actions: avoidance, mitigation/control, transfer, or acceptance.
3	An action plan shall be prepared with triggers identified and anticipated intermediate risk mitigation levels identified.
4	A fallback plan shall also be created with triggers identified anticipated intermediate risk mitigation levels identified.
5	Expected Values (EV) or Expected Utilities (EU) for the risk occurring, action planning, and fallback planning, if applicable, shall be quantitatively determined, revised and included in the risk documentation
6	All action plans and fallback plans are reviewed and resources allocated by the SPD.

Table 4 - 7 Risk Handling/Action Planning Steps

The GOES-R Series Program has established the following risk mitigation precedence:

- avoidance or mitigation/control of all safety risks,
- avoidance or mitigation/control of significant performance risk with consideration given to risk acceptance or risk transfer.
- avoidance, acceptance, transfer, and mitigation/control of programmatic risks balanced against the consequence to safety and performance.

The SPD and Project Managers shall ensure that resources for mitigating each of the risks is appropriately allocated. Responsibility for a risk means that the assigned Risk Owner is responsible for the status and mitigation of the risk. The Risk Owner is allowed to take predetermined action when triggers are reached resulting in quicker action with a decrease in the need for meetings when a problem arises. (*CCR 1204*)

4.5 Tracking and Controlling Risks

Risk tracking and monitoring is the collection of status data for risks with currently implemented action plans. The data is collected for general progress, but also specifically for the metrics identified in the risk handling/action planning step. The responsible Risk Owner supported by subject matter experts and other team members has the responsibility for specifying such metrics, with review by the GOES-R Series Program RMB. Table 4-8 identifies the steps in the risk handling/action planning process.

The Risk Owner for a risk in the top set of risks shall provide routine status reports to the SPD during program meetings scheduled on a quarterly basis. The status for each significant program

risk shall be reported each week at the appropriate management meetings. Status on all risks and WI shall also be reported periodically. On a monthly basis, Risk Owners assigned responsibilities for risks shall update the status of risks. Re-planning, Accepting or Closing a risk shall require review, and approval by the RMB. Re-planning shall require modification and resubmission of the RIS. Invoking a fallback plan shall require a formal notification by the Risk Owner to the RMB. Accepting or Closing a risk shall require review and approval by the GOES-R Series Program RMB with final approval from the SPD.

The RMB has the overall responsibility for risk control by reviewing current risk mitigation status, reviewing the current allocation of resources to risk activities, and considering whether to recommend changes to risk handling/action strategy or allocation. On matters related to resource allocation (assigning personnel, providing funding, or providing other resource such as facilities or equipment) the RMB is used by the SPD to advise and recommend. The SPD has the final decision authority and controls the allocation of all resources.

Step	Action
1	Risk Owner tracks risk attributes, triggers, and other related data.
2	Risk Owner implements the approach (avoidance, control/mitigation, transfer, or accept) determined by the RMB to address the risk, exercising the pre-approved Handling/Action Plan when specific trigger is reached using pre-authorized resources.
3	Risk Owner tracks progress, risk attributes and triggers and reports risk mitigation status to RMB identifying intermediate risk mitigation levels and availability of resources as appropriate.
4	If necessary, Risk Owner implements pre-approved Fallback Plan when a specific trigger is reached using pre-authorized resources
5	Risk Owner tracks progress, risk attributes and triggers and reports risk mitigation status to RMB identifying intermediate risk mitigation levels and availability of resources as appropriate.
6	Risk Owner completes action and provides recommendations for risk disposition to RMB & SPD (accept, close, re-evaluate, continue mitigation, etc.).
7	Risk Owner provides Risk Management Coordinator with lessons learned.
8	RMB, Risk Management Coordinator, and Risk Owner continue to track residual risk (accepted risk) for changes in attributes.

Table 4 - 8 Risk Tracking and Control Steps

4.6 Documenting & Communicating Risks

Documenting and communicating risks on the program provides personnel with an understanding of the risk handling/action strategies, risk mitigation alternatives, and overall risk status. Successful risk documentation and communication raises the level of understanding of relevant concerns and actions. Risk Management (RM) documentation and communication have the following characteristics: (CCR 1796)

- Free flow of information between individuals, groups, segments, and management.
- Inclusion of formal, informal, and impromptu communications.
- Value of individual contributions.

Risk Management is integrated into all GOES-R Series program management and technical meetings, communication, and documentation. The management of risk is not considered to be separate from other GOES-R Series program management activities. As risk information becomes available, the SPD, PMs, other managers and RMBs will conduct additional reviews to ascertain if new risks exist. Risk documentation and communication at all levels within the GOES-R Series Program shall be considered open and transparent in nature. Contractor risk information shall remain confidential and proprietary. Risk information shall be available for review (through risk lists, risk databases, and other means), but will remain subject to security, proprietary information, company confidential and/or ITAR restrictions similar to that imposed on all other program documentation and communication. (CCR 1204)

4.6.1 Risk Management Information System (RMIS)

The most direct means for communicating and documenting risks is through the GOES-R Series Program RM database. Other methods (verbal, electronic mail, written, etc.) for communicating risks should be directed to the Risk Management Coordinator for action. The system contains all of the information necessary to satisfy the program risk documentation and reporting requirements. The RMIS stores and allows retrieval of risk-related data. The GOES-R Program has implemented the Integrated Risk Management Application (IRMA) as the RM database. It provides data for creating reports and serves as the repository for all current and historical information related to risk.

Data are entered into the RMIS directly or can be forwarded to Risk Management using the Risk Information Sheet (RIS). The RIS gives members of the program team, both Government and contractors, a standard format for reporting risk-related information. The RIS should be used when any potential risk is identified. When first entered into the database, all potential risks are designated as Concerns. Once the Concerns have been sufficiently developed and ready for consideration as potential risks, the items are designated as Candidate Risks. After risk validation, a Risk Identification number is assigned with updates made as information becomes available as the assessment, handling/action, and tracking/control functions are executed. Watch or Watch Item (WI) is a term used to describe monitoring of an identified risk and its attributes for early warning of critical changes in consequences, likelihood, timeframe, or other indications that might reveal a risk event is imminent. (CCR 1796) (CCR 2428A)

All risk information shall be documented in the risk database. The risk database is accessible by all program personnel for identifying new risks. The responsible person (Risk Owner) must document lessons learned before closing the risk. Those lessons learned shall be reviewed for concurrence by the SPD before being entering into the historical documentation archive.

4.6.2 Risk & Issue Reporting (CCR 1204)

The Risk Management Coordinator will use data from the RMIS to create reports for senior management and retrieve data for day-to-day management of the program. The risk management database produces a set of standard reports for periodic reporting and has the ability to create ad hoc reports in response to special queries. If IPTs or functional managers need additional reports, they should work with the Risk Management Coordinator to create them. Access to the reporting

generation features will be controlled. However, any member of the team may obtain a password to gain access to the risk information contained in the database. Figure 4-3 provides an example risk-reporting format. Figure 4-4 provides an example issue-reporting format. (*CCR 1796*)

Each month a cycle of risks and issues reporting is conducted. As shown in Figure 4-5, the latest status on risks and issues reporting begins at the lowest-tier with progressive reviews and elevations through Flight Project RMB, Ground Segment RMB, and Systems Engineering & Integration RMB culminating in program level risk and issue review and decision-making at the Program RMB. (*CCR 1204*) (*CCR 1796*)

Using the Flight Project risk and issue information flow as an example, each instrument vendors risk lists and issues are reviewed in detailed with the Instrument Manager, Risk Manager, and Instrument Systems Engineer at least once a month. These reviews are conducted as an instrument level working group meetings for those months when a Payload Management Status Review (PMSR) are not scheduled. Instrument vendors provide formal management status reporting to Flight Project Management during PMSR including detailed discussion of risks and issues. Next, each Instrument Manager provides Flight Project Management with overall monthly instrument status including risks and issues reporting summarizing and expanding on vendor report status. At the Flight Project RMB the status all project level risks and issues are review and updated as needed. Each of the reported lower level risks (Systems Engineering, Instruments, and Observatory) is assessed for relevance and/or elevation to the project level. Inputs from this meeting are used to prepare the project's Monthly Status Review (MSR) to be reported to the GOES-R Program RMB, and the NASA GSFC Center Management Council (CMC) and summarized at the NOAA Program Management Council (PMC). Concurrently, the status of program level risks are reviewed and updated at the Program Systems Integration RMB. Risk and issue information is coordinated throughout the process and through active participation representatives from cognizant organizations. At the GOES-R Program RMB program level risks are review and current status of risks and issues is reported by Flight Project, Ground Segment Project, and Program Systems Engineering. GOES-R Program level risks are reported at the PMC. (*CCR 1204*)

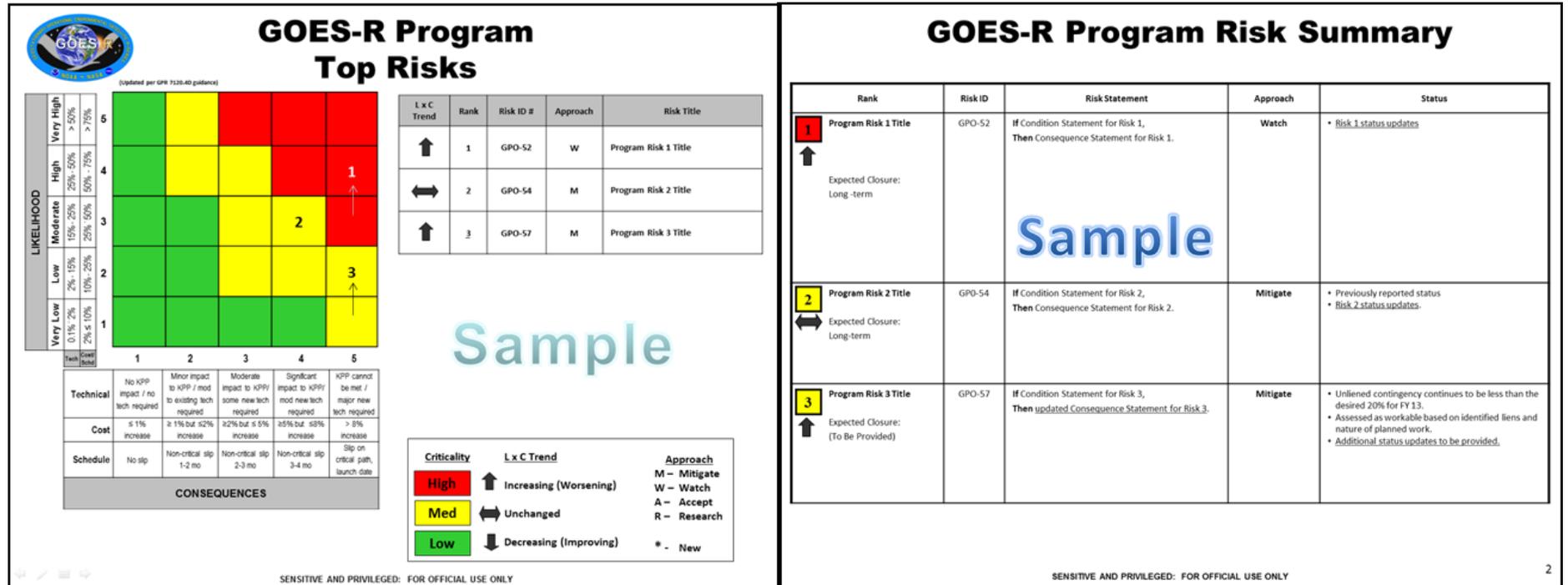


Figure 4 - 3 Risk Reporting Example
 (CCR 1204) (CCR 1796) (CCR 2428A)

Check the VSDE at <https://goessp.ndc.nasa.gov> to verify correct version prior to use.



GOES-R PROGRAM ISSUES

As of Date

Issue Title

Y	PROBLEMS/ISSUES	PROGRAMMATIC IMPACT	ACTION	DATE	
				ESTAB. <small>(Actual Date)</small>	COMP. <small>(Planned Date)</small>
	A statement that provides details on the nature of the problem and the reasons why it should be considered an issue.	The Programmatic statement provides a description of what impact the issue has or will have on the program or project.	<ul style="list-style-type: none"> An action plan containing a description of the corrective action or the steps on how the issue will be resolved. 		

CURRENT STATUS

- The Status field indicates if the issue record is open or closed.
- The Current Status contains the latest information on the status of the Issue.
- Open indicates the issue is actively being worked.
- Closed indicates the issue has been resolved in some manner and is no longer being worked on.

Issue Id #

Figure 4 - 4 Issue Reporting Example
(CCR 1796)

Check the VSDE at <https://goessp.ndc.nasa.gov> to verify correct version prior to use.

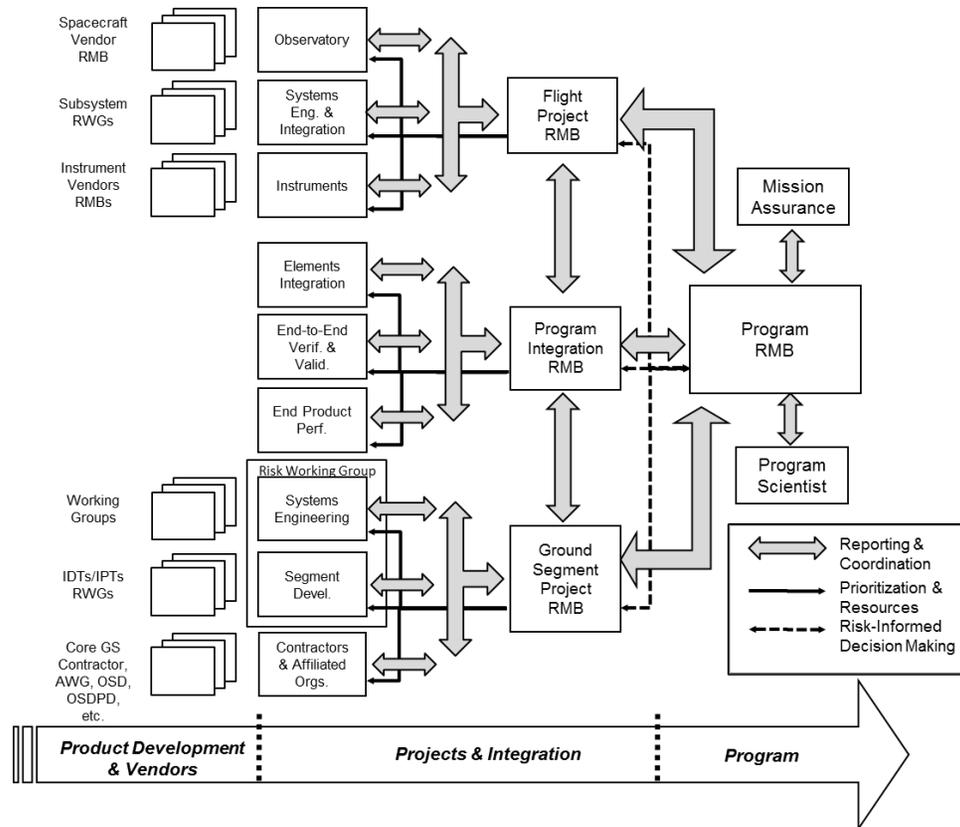


Figure 4 - 5 Risk & Issue Reporting and Elevation Flow
(CCR 1204) (CCR 1796) (CCR 2428A)

Check the VSDE at <https://goessp.ndc.nasa.gov> to verify correct version prior to use.

4.6.3 Non-Conformance/Failure Reporting & Residual Risk Tracking (CCR 1796)

A mission level problem/failure review & reporting is established by the GOES-R Mission Assurance process. The GOES-R Program Mission Assurance process is documented in the “GOES R Series Mission Assurance Plan (MAP)”, 410-R-MAP- 0080. The GOES-R MAP requires that the Spacecraft, Instrument and Ground Segment Prime Contractors implement a Quality Management System (QMS) that is compliant with, or exceeding the minimum requirements of ANSI/ISO/ASQC Q9001 Rev 2000, Quality Management Systems, and AS 9100. One of the elements of the QMS is the problem/failure reporting process.

Each contractor QMS is required to have an anomaly/incident review process that refers failures that are critical to the performance of the system to a failure review board (FRB). The FRB consists of the appropriate functional and project representatives needed to ensure timely determination, implementation and close out of the recommended disposition which could be scrap, rework, return to supplier, repair, use-as-is [upon concurrence with the Government Quality Assurance (QA) organization], or request for a waiver. This formal board is established to ensure timely reporting, determination, and corrective action implementation for all reported failures. A process for recurrence control of problems through a closed-loop corrective and preventive action system is also required. As part of the FRB evaluation, for each formal failure review an assessment is made of the level, if any, of residual risk(s) remaining following the implementation of corrective actions.

All risks that have been accepted (not completely eliminated) are considered residual risks. A process has been established to determine if any residual risks identified from the failure review process should be incorporated into the risk management and issue reporting processes. Figure 4-6 illustrates the flow of residual risk information.

Project management and mission assurance representatives are notified of all non-conformances, incidence reports, failures and anomalies reported by any of the GOES-R contractors. In general, on-site GOES-R representatives are the first to be apprised of the in-plant non-conformance/incident report. These reports are submitted and tracked on the designated tracking system and documented in the associated GOES-R/contractor portal. Based on the significance the incident/anomaly a decision is made if formal Failure Review Board (FRB) is convened.

Due to the potential seriousness of the incident or impact to mission success, it is often the case that formal risks or issues are identified and reported by the GOES-R Program or cognizant Project Management, prior to the work of the FRB is complete.

When any risk or issue managed within the GOES-R Program or associated projects is proposed to be closed or accepted and assessment is made as to whether or not there are any residual risks remaining. If residual risks are identified then a further assessment is made to determine if it should be carried as a new risk with appropriate handling strategies implements (research, mitigate, or watch) or if it should be accepted without further action.

A residual risk is any accepted risk with the capacity to affect GOES-R's ability to meet systems requirements. System Initial Operating Capability (IOC)/ System Full Operational Capability (FOC)) documented in the Mission Requirements Document (MRD), 410-R-MRD-0070. Residual risks may include:

- Risks produced by rare events such as those resulting from anomalies, failures, or acceptance of risks imposed by critical maneuvers or other transitions/changes in state of a system.
- Any technical risk accepted on the basis that mitigation options are not viable or are outside GOES-R control.

A residual risk is always an accepted risk. Residual risks cannot be further mitigated without undue impact to cost, schedule or technical performance. At launch, the overall level of residual risk for the space segment elements of the GOES-R systems must fall within the level specified by NPR 8705.4 "Risk Classification for NASA Payloads". Similarly, the overall level performance capabilities of the ground segment elements including any residual risk must comply with systems requirements for IOC/FOC."

Risks that are proposed as closed/accepted are documented with full justification of why the risk was being accepted. In addition, any remaining residual risks will further document the potential implications either for on-orbit performance or for meeting IOC/FOC. After this, the risk will be evaluated through the RMB process. Based on the recommendations from that meeting a decision will be made by the board for final approval or other action to be taken. These items will be made part of the Residual Risk List for associated GOES-R elements. (CCR 1796)

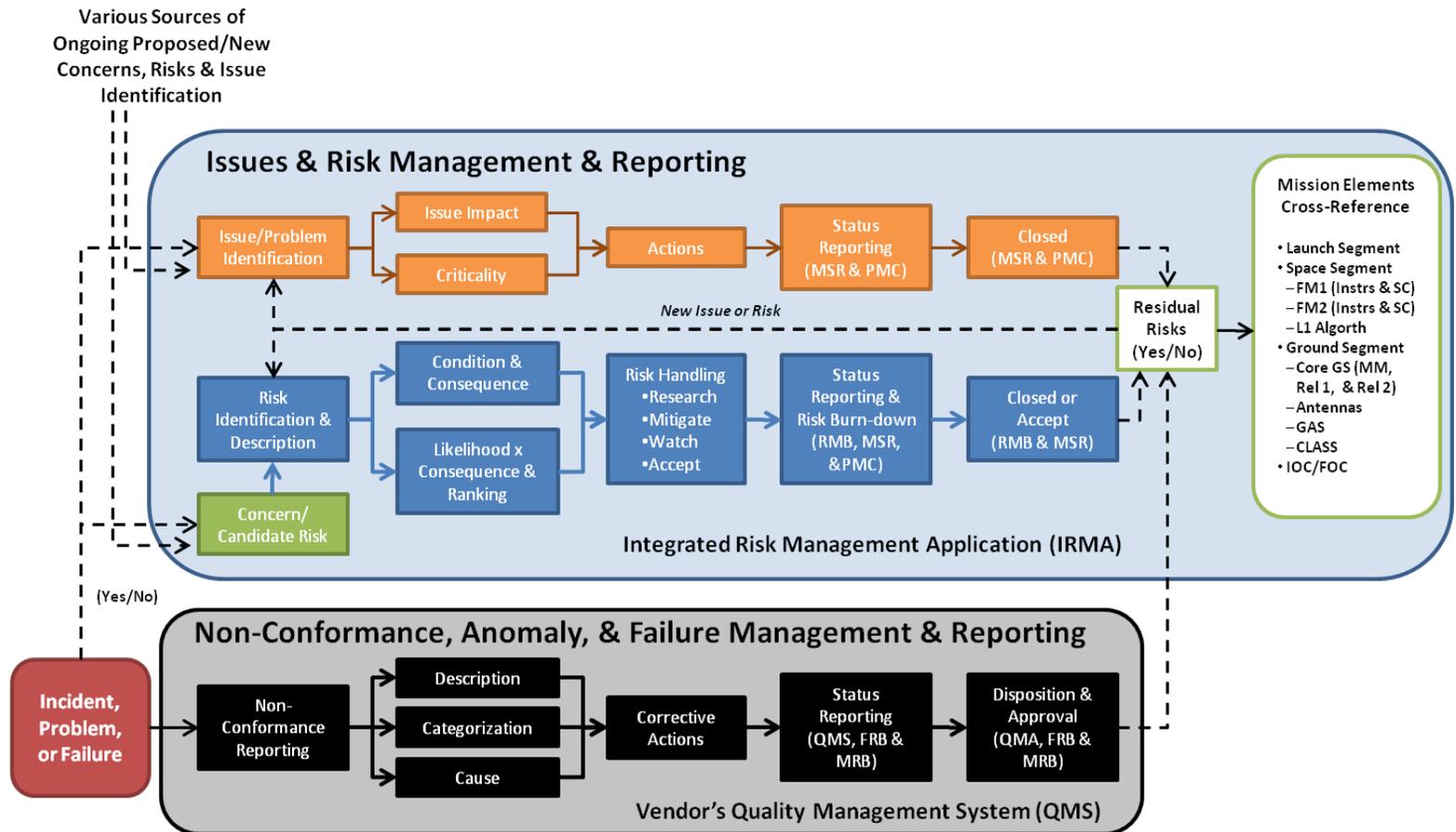


Figure 4 - 6 Residual Risk Information Flow
 (CCR 1796)

Check the VSDE at <https://goessp.ndc.nasa.gov> to verify correct version prior to use.

5 Resources and Schedule of Risk Management Milestones

Incompliance with NPR 7120.5 and NPR 8000.4, resources for the management of risks are divided into two categories:

- Overhead costs associated with the risk management process
- Resources associated with mitigation plans, specifically those with risk handling/action plans.

Budget allocation for mitigation plan development and execution is included as part of the overall program management reserves. Contingency funding will be managed at the Program Management level. In general, funding reserves shall be maintained and allocated commensurate with the level of risk exposure determined and based on the expected values (EVs) reported for each risk handling/action approach.

Milestones

- Monthly program meetings shall include status of risks.
- Top Significant Risks for the Overall Program and Project risk status shall be summarized and reported to the SPD on a monthly basis.
- Once a risk has been assigned, the initial set of risks shall be reviewed on a regular basis.

6 De-scope/Scope Reduction Strategy and Cost/Budget and Schedule Allowances (CCR 2428A)

6.1 De-scope/Scope Reduction Strategy

In compliance with NPR 7120.5 details of the GOES-R Series Program re-scope/scope reduction options are documented in the GOES-R Series program/project management documentation. Should program de-scope be required, the SPD will assemble a team comprised of project managers and technical leads to review options and proposed de-scope in mission performance, operations, or science. The ongoing RM process will be applied to the new scope.

The GOES-R Series Program shall pursue scope reduction and performance/capability reduction only as a last resort to mitigate risks. The GOES-R Series Program shall include potential scope reduction options and alternatives along with implementation time frames and projected cost-savings, as part of the program acquisition and review process. If other methods of cost containment are not practical, the reductions identified may be exercised; however, any reduction in performance or capability will be implemented only after GOES-R Series SPD approval.

6.2 Cost/Budget and Schedule Allowances

In compliance with NPR 7120.5 and NPR 8000.5, the GOES-R Series Program has implemented a process to ensure that sufficient budget and schedule contingencies are provided and maintained throughout the GOES-R Series Program life cycle. Due consideration shall be given to the use of budget contingency and planned schedule contingency to mitigate program risks.

The cost and other budget information for the GOES-R Series Program is available to the team for design, development, operations, data distribution and launch studies. Additional reserves and allowance funding will be held for mission re-scope/scope reduction options. De-scope options and re-planning are linked to maintaining minimum program requirements. An EVM system as defined by EIA-748-A is being implemented on the program with standard WBS-level performance measurement reporting. Consistent with the continuous cost-risk management guidelines, a risk-based Lifecycle Cost (LCC) estimate is prepared that also includes performance measurement and risk factors for WBS elements.

6.3 Impact of Liens, Threats, and Encumbrances on Budget Contingency (CCR 2428A)

In compliance with NASA GSFC Flight Projects Directorate guidance, the GOES-R Series Program has implemented a process that establishes the method for determining the potential

cost impact associated with risks. It needs to be reiterated that situations or circumstances that have either already occurred or are inevitable regardless of risk management strategy are identified as issues, not as risks. Due consideration shall be given to the use of budget contingency and planned schedule contingency to mitigate program risks.

Risks are a key element in understanding the potential cost liabilities that a program or project may incur. The following method will be used for determining the potential cost impact associated with risks. Definitions are provided for terms to be used to categorize the real and potential reductions to budget contingency. Additionally, requirements for calculating, budgeting, and reporting liens, threats, and encumbrances are established. The intent is to provide a more realistic reflection of potential project cost growth.

Threat, Lien, and Encumbrance Definitions:

- 1) Threats are ALL risks (red, yellow, and green) with a likelihood (L) of 2 or higher, that have potential cost impacts.
- 2) Liens are ALL risks with a likelihood, L=5, or issues, that have potential cost impacts (liens are usually realized, at least in part).
- 3) Encumbrances are issues/risks that are fully realized and have a final cost impact.

There may be unusual circumstances where a lien or threat is not associated with a risk, but in general all threats and liens should result from risks.

Threat, Lien, and Encumbrance Calculations:

- 1) Threats are calculated and book kept based on the projects assessment of likelihood consistent with placement on the risk matrix according to the following:

Expected Value of the Threat = Probability (P) x Estimated Cost Impact.

P = 20% for L of 2 (low)

P = 40% for L of 3 (moderate)

P = 60% for L of 4 (high)

Lien for L of 5 (very high)

- 2) Liens are calculated and book kept at 100% of the estimated cost impact.
- 3) Encumbrances are book kept at 100% of the final cost impact.

Encumbrances, liens and threats will be reported as part of budget submissions and Monthly Status Reports. Threats will be grouped into three categories, red, yellow and green in accordance with the placement of the associated risk on the 5x5 risk matrix, with a detailed listing of all threats available in backup documentation.

(CCR 2428A)

7 Risk Information Systems

The RMIS stores and allows retrieval of risk-related data. The GOES-R Program has implemented the Integrated Risk Management Application (IRMA) as the RM database. It provides data for creating reports and serves as the repository for all current and historical information related to risk. Data are entered into the RMIS directly or can be forwarded to Risk Management using the Risk Information Sheet (RIS). (CCR 1796)

7.1 Risk Information Sheet (Generic)

A generic Risk Information Sheet (RIS) is provided in Figures 7-1 and 7-2.

ID	<i>GOES-R Series Program Risk Information Sheet</i>		Date Identified:
Priority/RAC	Risk Statement (Condition; Consequence)		
Probability			
Impact			
Timeframe	Area/WBS:	Assigned to (Risk Owner):	Date:
Risk Identifier/Originator:		Date Identified:	
Context			
Approach:			
Handling/Action Strategy			
Action Plan and Trigger(s)/Fallback Plan and Trigger(s)			
Status:		Status Date:	
Lessons Learned			
Closing Approval: Signature and Date SPD		Closing Rationale	
Risk Owner			
Identifier			

Figure 7 - 1 Risk Information Sheet (Sheet 1 of 2)

Check the VSDE at <https://goessp.ndc.nasa.gov> to verify correct version prior to use.

Risk Response Estimating Form										
<i>Original Estimate</i>					<i>Technical</i>	<i>Cost</i>	<i>Schedule</i>			
WBS	Task									
<i>Risk Identification/Analysis Results (Qualitative/Quantitative):</i>										
Risk		Probability	Impact			EV			EU	
Condition	Consequences		Technical	Cost	Schedule	(TPM)	(Days)	(\$)		
Expected Value/Expected Utility of Risk										
Estimate for Work to be Performed (Original Estimate – Expected Value of Risk)										
Total Expected Value/Expected Utility Before Risk Response										
<i>Risk Action Planning (Qualitative/Quantitative)</i>										
<i>Risk Response Estimate</i>					<i>Technical</i>	<i>Cost</i>	<i>Schedule</i>			
WBS	Task (Add/Remove)									
Risk Action		Probability	Impact			EV			EU	
Condition	Consequences		Technical	Cost	Schedule	(TPM)	(Days)	(\$)		
Expected Value/Expected Utility of Risk After Risk Response										
Estimate for Work to be Performed (Original Estimate – Expected Value of Risk)										
Total Expected Value/Expected Utility After Risk Response										
Notes:										

Figure 7 - 2 Risk Information Sheet (Sheet 2 of 2)

Check the VSDE at <https://goessp.ndc.nasa.gov> to verify correct version prior to use.

GOES-R Series Program RIS Definitions

- ID - sequential number prefaced by Organizational code, i.e., NOAA, GOES-R Program, etc.
- Identified by - name of person who identified the risk.
- Priority - number assigned by GOES-R Series SPD
- Probability, Impact, Timeframe – defined in Risk Plan
- Statement – single phrase condition/consequence of a risk
- Area/WBS: Area or Work Breakdown Structure element assigned by the Program
- Assigned to and Date: Person who has been assigned to manage the risk and the date the assignment was given
- Context – provide additional information about the risk to ensure that the risk is properly understood
- Handling/Action Strategy – describe realistic, measurable goals for mitigating the risk
- Action/Fallback Plan and Trigger – describe the action plan for mitigating the risk/ if a fallback plan is necessary, describe fallback plan and what trigger (realistic and measurable) should be used should the action plan not be effective.
- Status and Status Date – used to describe a change in status of an identified risk with explanation.
- Approval – signature of person authorizing the acceptance of a risk statement
- Closing Rational and Date: Description of how the risk was mitigated and the date it was removed from active tracking

7.2 Risk Information System Web Site

The RMIS is designed to communicate risk information to Program team members. Access to the RMIS is obtained through the current NOAA GOES-R Series Program's portal (<https://goessp.ndc.nasa.gov>). (CCR 1796) (CCR 2428A)

All GOES-R Series Program team members may submit a risk information using the web-based form. Upon completion of all the required data, the Risk Originator will submit the risk to the RMIS. The Risk Management Coordinator will review each submittal for consistency and completeness. If the data provided is complete and format is consistent, the RMIS will generate a report of each risk submittal that will establish the Risks/Concerns List for RMB meeting. For configuration control, the RMIS automatically assigns each new concern a unique number. If the risk is considered valid, management, with input from the RMB, will assign an owner to the risk. The RMIS automatically assigns each new risk a sequential Risk Id number. The Risk Owner is responsible for implementing the approach to respond to the risk. (CCR 1796)

Various reports can be accessed via the RMIS, including the Risk Summary and the Top Risk List. (CCR 1796)

7.3 Risk Identification Form/Instructions

The risk information form is to be completed as soon as possible after a risk has been identified. This form is initiated by completing the:

- Date Identified - When the risk was identified
- Risk Title – Originator develop the risk title
- Risk Statement - Statement of the risk consisting of condition and consequence(s)
- Originator - Person or organization that identified the risk
- Context - Associated information supporting the risk. If the originator is aware of any additional risk information at the time of submittal, it is to be made known in order to thoroughly evaluate and process the risk information sheet.
- Probability - The likelihood of risk occurrence
- Impact - The severity if risk should materialize
- Timeframe - Time to start action or mitigation
- Classification - Technical, programmatic, Schedule, or Cost
- Area - Area impacted by the risk (Mission, Program Office, Spacecraft, etc.)

7.4 RMIS Maintenance

The RMIS will contain records for all RMB activity. The Risk Management Coordinator, or designee, will review all concern submittals for completeness and clarity. If the candidate submittal is not elevated to a risk, the originator will be notified with an explanation. The Risk

Management Coordinator will enter the maintenance screen of the RMIS, to complete the following fields (*CCR 1796*):

- Board Action – Review, Reject, Action Item, Close
- Approach – Avoidance, control/mitigation, transfer, or accept
- Risk Assessment Code/Risk Exposure – Product of Impact times Probability
- Assigned Owner – Person responsible for the risk action
- Owner E-mail Address – E-mail address for risk owner
- Assigned Lead – Organization lead for owner
- Assigned Lead E-Mail – E-mail address for assigned lead
- Accept/Acceptance Rational – RMIS records the rational for accepting a risk
- Research/Due Date – RMIS records a description of the research to be performed and the date due
- Watch/Trigger – RMIS records the trigger (event and/or date) that could cause a change in status for the risk or concern (*CCR 1796*)
- Mitigate/Action Due/Mitigation Plan Source File – RMIS records a description of the mitigation approach and a due date for the action plan. Additional planning data will be recorded in the form of an attachment. The cognizant Program or Project Manager is responsible for approving mitigation plans
- Risk Management Coordinator Notes (Current Status)/Notes as of – The RMIS records the status and status date.
- Closure Approved by - SPD signature or designee
- Date Signed – Date risk closed by SPD
- Candidate for Lessons Learned –SPD to note if candidate for lessons learned

7.5 Risk Management Summary Card

The Risk Management Summary Card is the compilation of data acquired through the Likelihood and Consequence fields. The inputs into the Likelihood and Consequence fields will be shown in the RMIS on the Risk Matrix via a small dot, which will automatically be placed by GOES-R IRMA.

The Risk Matrix provides three separately colored areas that the Likelihood Consequence result could fall in:

- Red indicates the highest
- Yellow indicates medium
- Green indicates lowest

The overall classification reflects the total risk when the Likelihood and Consequence factors are used to determine the location on the Risk Matrix.

When determining the overall consequence level for the record the highest score on any of the consequences is represented on the Risk Matrix as a single score value. For example if the consequences

are: Technical (4); Schedule (3); Cost (None); Safety (4); then the Risk Matrix would show a consequence rating of 4. For more information regarding the Risk Matrix and its relationship with the Likelihood and Consequence fields refer the GOES-R Risk Summary Card shown in Figure 7 – 3 and Figure 7 - 4.

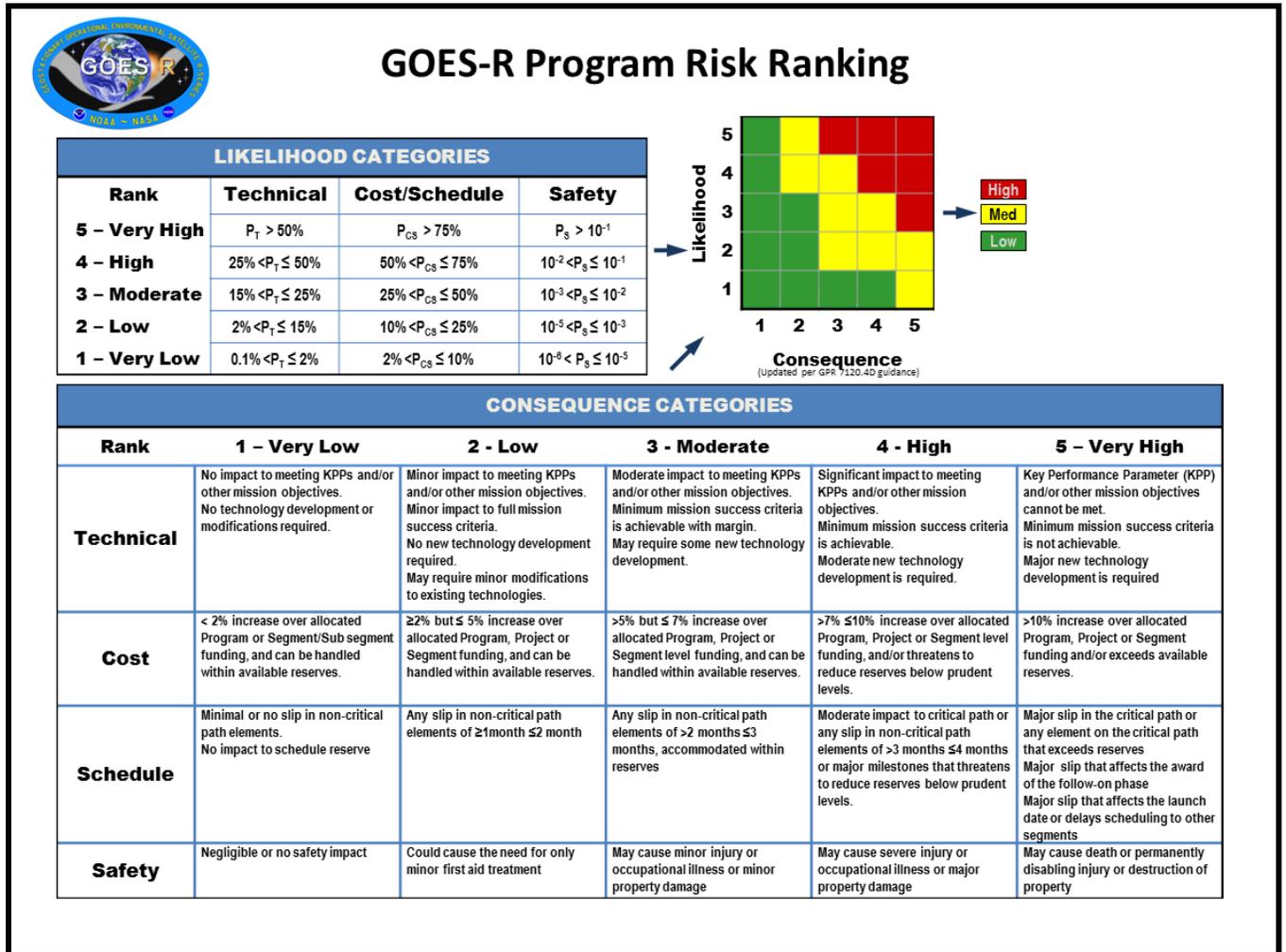


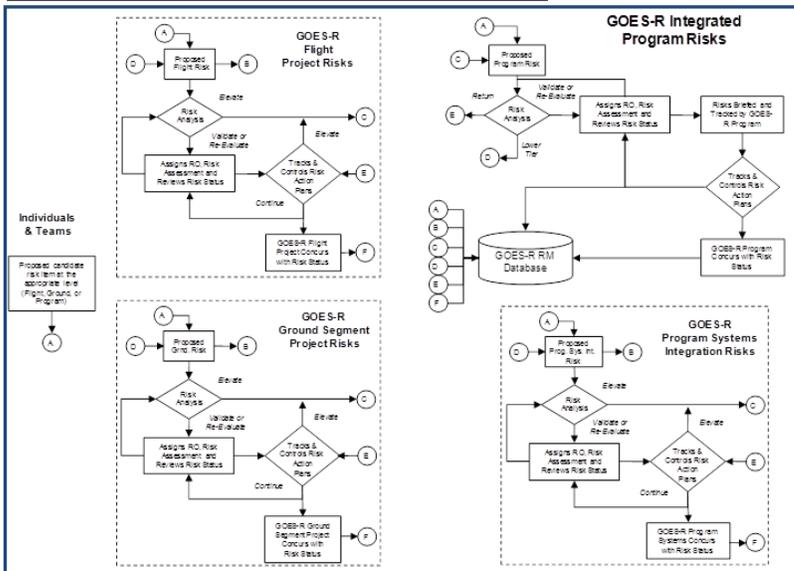
Figure 7 - 3 Risk Matrix Summary Card (Side 1)
 (CCR 1796)(CCR 2428)

Check the VSDE at <https://goessp.ndc.nasa.gov> to verify correct version prior to use.



TIMEFRAME CATEGORIES	
Rank	Description
5 – Imminent	Mitigation action to start immediately, within 1 month
4 – Near Term	Mitigation action to start in 1 to 2 months
3 – Mid Term	Mitigation action to start in 2 to 4 months
2 – Far Term	Mitigation action to start in 4 to 6 months
1 – Long Term	Mitigation action to start in 6 and beyond

RISK ATTRIBUTES
 GOES-R Series Program risk management process utilizes rating scales for several risk attributes.
 The impact of a risk event can be to cost, schedule and/or technical performance simultaneously.
 For any risk, it is the impact with the most severe rating that is used to determine the risk exposure.
 The 5-Level method shall be used for evaluating attributes. Risk attributes of likelihood, consequence, and timeframe are initially estimated and entered at the same time the risk is identified and documented.



RISK ASSESSMENT	
Step	Action
1	Evaluate to determine if there is a valid risk related to issue, concern, or problem identified. A risk is deemed valid if it truly represents a credible condition with some level of uncertainty having an impact on the program.
2	Risk attributes (impact, probability, timeframe, and Expected Value) are assigned using qualitative assessment
3	Risk attributes are entered into the risk database.
4	Risk attributes are reviewed and corrected periodically by the Risk Management Coordinator and the RMB.
5	Candidate or Proposed Risks are validated, assigned a Risk id, and prioritized in their respective areas by the GOES-R Series SPD, Project Manager, and the RMB.
6	Top significant risks are further evaluated using quantitative analysis, as needed

Figure 7 - 4 Risk Matrix Summary Card (Side 2)
 (CCR 1796)(CCR 2428A)

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8 Abbreviations and Acronyms

A&O	Acquisition and Operations
ANSI	American National Standards Institute
CIL	Critical Items List
CM	Configuration Management
CMC	Center Management Council
CONOPS	Concept of Operations
CSO	Chief Safety and Mission Assurance Officer
DOC	Department of Commerce
DSPD	Deputy System Program Director
EIA	Electronic Industries Alliance
EU	Expected Utility
EV	Expected Value
EVM	Earned Value Management
FMEA	Failure Modes and Effects Analysis
FTA	Fault Tree Analysis
GOES-R	Geostationary Operational Environmental Satellite - R
GSFC	Goddard Space Flight Center
IDT	Integrated Development Team
IPT	Integrated Product Team
IRMA	Integrated Risk Management Application
IRT	Independent Review Team
ISO	International Standards Organization
ISSO	Information Systems Security Officer (ISSO)
ITAR	International Traffic in Arms Regulation
KDP	Key Decision Point
KPP	Key Performance Parameter
LCC	Life Cycle Cost
MAP	Mission Assurance Plan
MAR	Mission Assurance Requirements
MCDM	Multi-Criteria Decision Making
MRD	Mission Requirements Document
NASA	National Aeronautics and Space Administration
NAO	NOAA Administrative Order
NESDIS	NOAA National Environmental Satellite, Data, and Information Service
NOAA	National Oceanic and Atmospheric Administration
NPR	NASA Procedural Requirement
OSD	Office of Satellite Development
PDL	Product Development Lead
PDRR	Program Definition and Risk Reduction
PM	Project Manager

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410-R-PLN-0081
Version: 2.0

PMC	Program Management Council
POC	Point of Contact
PR	Project Risk
PRA	Probabilistic Risk Assessment
PSE	Program Systems Engineer
RAC	Risk Assessment Classification
RF	Radio Frequency
RIDM	Risk Informed Decision Making
RIS	Risk Information Sheet
RM	Risk Management
RMB	Risk Management Board
RMIS	Risk Management Information System
RMP	Risk Management Plan
RO	Risk Owner
RTL	Risk Tracking Log
SEMP	System Engineering Management Plan
SPD	System Program Director
TPM	Technical Performance Measurement
VSDE	Virtual System Design Environment
WBS	Work Breakdown Structure
WG	Working Group
WI	Watch Item

(CCR 1204) (CCR 1796) (CCR 2428A)

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9 Change History Log

VERSION	DATE	CCR #	SECT. AFFECTED	DESCRIPTION
Baseline	02/22/07	376	All	Baseline the Risk Management Plan
1.1	08/08/08	1204	TOC, 1.1, 1.2, 1.4.2, 1.4.3, 1.5, 1.6, 2.2, 3.1, 3.2, 3.3, 3.6, 3.8, 3.9, 3.10, 3.11, 3.12, 4.2, 4.3, 4.4, 4.6, 4.6.2, 8; Figures 2-2, 3.1, 3-2, 3-3, 3-4, 4-1, 4-2, 4-3; Tables 4-3, 4-4	Replace Operations Project with Ground Segment Project. Updated wording to reflect current A&O Phase. Modified risk attributes to reflect most current guidelines.
1.2	06/25/10	1796	TOC, 1.1, 1.4.1, 1.4.3, 1.6, 2.2, 3.1, Figure 3-1, Figure 3-2, Figure 3-3, Table 3-1, 3.2, 3.7, 3.9, 3.10, 3.11, 3.14, 3.15, 4.1, 4.2, Figure 4-1, Table 4-1, 4.3, Table 4-2, Figure 4-2, 4.6, 4.6.1, 4.6.2, Figure 4-3, Figure 4-4, Figure 4-5, 4.6.3, Figure 4-6, 7.2, 7.4, 7.5, Figure 7-3, Figure 7-4	Correct typographical and grammatical errors and correct formats. Update concern, risk, & issues nomenclature and modify wording to reflect this change. Refine & expand definition of Candidate, Concern, Issue and Residual Risk. Update RM Functional structures for Program & Projects. Correct use of terms Instrument Manager(s) and Instrument Systems Engineer(s). Expand description of Risk Management process flow to address concerns, risks, and issues. Update Risk Matrix. Update Example Risk Chart and Issue Chart. Add description of Non-Conformance/Failure Reporting & Residual Risk tracking. Update RMIS information.

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Effective Date: Date of last signature
Expiration Date: Five years from date of last signature
Responsible Organization: GOES-R/Code 410

410-R-PLN-0081
Version: 2.0

VERSION	DATE	CCR #	SECT. AFFECTED	DESCRIPTION
2.0	07/22/13	2428A	Signature Page, TOC, 1.4.2, 1.6, 2.3, 3.14, 4.1, 4.2, 4.3, 4.6.1, 6, 6.1, 6.2, 6.3, 8, Figure 2-1, Figure 4-2, Figure 4-3, Figure 4-5, Figure 7-3	Correct typographical/grammatical errors and correct formats. Update use of the terms elevate and escalate. Clarify the use of the term Watch and Watch Item as relates to GOES-R RM process. Clarify definition and use of terms Concern and Candidate. Refine and update GOES-R RM process and paradigm to be consistent with latest version of NASA GSFC Procedural Requirements, GPR 7120.4D, Risk Management to include: Risk-Informed Decision Making (RIDM); links to reliability analyses Failure Modes and Effects Analysis (FMEA)/Critical Items List (CIL), Fault Tree Analysis (FTA), and Probabilistic Risk Assessment (PRA); impact of liens, threats, and encumbrances; and, modification to the risk categories assigned to two of the boxes in the 5x5 risk matrix. Update Risk Matrix. Update Example Risk Chart. Update cover page and headers to reflect the GOES Program as Code 410.

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