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Office of the Chief Financial Officer (OCFO)
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SOPI 6.0
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STANDARD OPERATING PROCEDURE INSTRUCTION

SOPI 6.0

SRB PROGRAMMATIC ASSESSMENT PROCESS

This document is an update to the Standing Review Board (SRB) programmatic Standard Operational Procedure Instruction (SOPI) document. This update reflects specific guidance in the implementation of the new NASA Independent Assessment (IA) Model.

The IA model was initially outline in the NASA Associate Administrator Memorandum "Independent Assessment of the NASA Program and Projects," dated October 25 2015. Further details on the new approach are included in the white paper titled "NASA Independent Assessment Principles and Approach", approved at the May 18, 2016 Agency Program Management Council. The SRB Handbook was updated December 2016 to reflect new model.

This document follows the guidance of the above documents and serves as direction to best practices for conducting an independent programmatic assessment within the SRB construct.

Andrew Hunter

Acting Chief Financial Officer

Office of Chief Financial Officer

5/23/2017

Date

Cristina Guidi

Director, Strategic Investments Division

Office of Chief Financial Officer

19 MAY 2017

Date

Prepared by:

Charles Hunt

Strategic Investments Division

Office of Chief Financial Officer

5/15/2017

Date

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1.0 PURPOSE

NASA's Office of the Chief Financial Officers (OCFO) is responsible for the functional oversight of the independent programmatic assessments and this Standard Operating Procedure Instruction (SOPI) for Standing Review Board (SRB) Independent Programmatic Assessment Processes. This SOPI documents OCFO best practices for conducting an independent programmatic assessment within the SRB construct.

The SOPI's purpose is to document the SRB Programmatic Team processes for supporting the completion of an independent assessment of a project throughout the program/project life cycle, per NASA Procedural Requirement (NPR) 7120.5E. It is the expectation that the following processes will be followed as part of any programmatic support to an SRB[1].

Note that this instruction uses the word "independence" in broad terms, and it encompasses the term "independent" that is used extensively in NASA policy and requirements documents.

1.1 Prerequisites

Qualified programmatic analysts on a SRB should possess knowledge and/or prior experience in one or more of the following subject areas[2]:

- NASA cost estimating
- NASA schedule management
- Risk management
- Joint confidence level (JCL) and schedule analysis
- Resource management
- Earned value management (EVM)
- Standing Review Board
- Program Planning and Control (PP&C)

2.0 REFERENCES

NPR 7120.5E, NASA Space Flight Program and Project Management Requirements

NPR 7123.1B, NASA Systems Engineering Processes and Requirements

NPR 8000.4A, Agency Risk Management Procedural Requirements

NASA Cost Estimating Handbook, Version 4.0

NASA/SP-2010-3403, NASA Schedule Management Handbook

NASA Project Planning and Control Handbook

NASA/SP-2014-3706, NASA Standing Review Board Handbook

[1] See section 8.0 for guidance on tailoring the review programmatic review process.

[2] It is recognized that many programmatic analysts will have expertise and experience in a subset of the areas listed here. It is also recognized that the importance of each area with respect to the review is subject which life-cycle is being reviewed and the scope of that review. As such, the OCFO will work with programmatic analysts, Mission Directorates, and SRB's to ensure that the SRB Programmatic Team is has a collection of requisite skill sets.

NASA/SP-2011-3422, NASA Risk Management Handbook

NASA Policy Directive (NPD) 1000.5B, Policy for NASA Acquisition

3.0 SCOPE

This SOPI applies to all Independent programmatic assessment activities conducted by the SRB Programmatic Team. The Independent programmatic assessment consists of three phases: Life Cycle Review (LCR) Planning; LCR Analysis & Feedback; and Final LCR, Report Presentations, and Closeout. These phases cover the independent programmatic assessment from planning the review through the LCR which culminates with the final report and presentation of materials to the governing Program Management Council (PMC). It is the SRB Programmatic Team lead analyst's responsibility to ensure that government and contractor personnel supporting the independent programmatic assessment adhere to all the SOPI requirements.

The independent programmatic assessment includes a review of strategic goal alignment, development of project control plans, requirements management, scheduling, workforce planning, resource management, budgeting, cost estimating, acquisition strategy planning, contract management, risk management, performance tracking, and performing the project programmatic functions: planning, execution, tracking, assessment, and reporting out. The Agency does not have a required standard organizational structure that dictates where these programmatic functions reside. They could reside in the Business Management Division, Program Planning and Control Office, a technical organization like Systems Engineering and Integration, or the Office of the Chief Engineer. Wherever they reside, their processes and products are related and should be using the same requirements, work breakdown structure (WBS), and planning assumptions, while adhering to NASA policies and directives.

The SRB Programmatic Team is not only assessing how each functional area performs, but also how the project coordinates and interacts across each programmatic function to ensure that, for example, both the budget and scheduling products are using consistent assumptions for planning and analysis purposes.

The SRB Programmatic Team should coordinate with both the project and the SRB to conduct the independent LCR process through a parallel approach. The parallel approach is for the SRB Programmatic Team to maximize the use of a project's existing products and to engage within the project LCR meetings, boards, and/or products development cycle to minimize the impact to the project while balancing the requirements of the SRB LCR. All products and information requested by the SRB Programmatic Team are in accordance with NPR 7120.5E requirements and therefore should be readily available.

The SRB Programmatic Team will develop an Independent Programmatic Assessment Plan (IPAP) to conduct the independent LCR. The IPAP contains what programmatic assessments will be conducted, project life cycle product delivery dates, and reporting out requirements for the SRB Programmatic Team assessment.

The LCRs are essential elements of conducting, managing, evaluating, and approving spaceflight programs and projects. The program manager is responsible for planning and supporting the LCRs. The SOPI focuses on the unique programmatic requirements that are defined in NPR 7120.5E, however it should be recognized that the purpose of reviewing those products is to support the Standing Review Board's

assessment of the following six criteria (as identified in NPR 7120.5E). Results of any assessment should focus on the information that senior management needs to make forward decisions.

- Alignment with, and contribution to, Agency strategic goals and the adequacy of requirements flow down from those strategic goals.
    - The scope of this criterion includes alignment of program/project requirements and designs with Agency strategic goals, constraints, mission needs, and success criteria; allocation of program requirements to projects; and proactive management of changes in program and project scope and shortfalls.
- Adequacy of management approach.
    - The scope of this criterion includes program and project authorization, management framework and plans, acquisition strategies, and internal and external agreements.
- Adequacy of technical approach, as defined by NPR 7123.1B entrance and success criteria.
    - The scope of this criterion includes flow down of project requirements to systems/subsystems; architecture and design; and operations concepts that respond to and satisfy imposed requirements and mission needs.
- Adequacy of the cost and schedule estimates and funding strategy in accordance with NPD 1000.5B.
    - The scope of this criterion includes cost and schedule control plans; cost and schedule baselines that are consistent with the program and project requirements, assumptions, risks, and margins; Basis of Estimate (BOE); Range Estimate and Joint Confidence Level (JCL) (when required); and alignment with planned budgets.
- Adequacy and availability of resources other than budget.
    - The scope of this criterion includes planning, availability, competency and stability of staffing, infrastructure, and the industrial base/supplier chain requirements, for example, thermal vacuum chamber availability.
- Adequacy of the risk management approach and risk identification and mitigation per NPR 8000.4A.
    - The scope of this criterion includes risk management control plans, open, and accepted risks, risk assessments, risk mitigation plans, and resources for managing or mitigating risks.

4.0 SRB Programmatic Team Structure

The SRB Programmatic Team consists of a Lead, a Schedule Analyst, and a Cost Analyst. The Lead serves as a full voting member of the SRB, while the Schedule and Cost Analysts are considered consultants to the SRB. The Lead, Cost, and Schedule Analysts are not limited to these specific roles and can support all programmatic assessment areas during the review. The SRB Programmatic Team members report to the SRB Chair and will coordinate with the Review Manager, who administers the independent reviews required per the NASA governance model, through the LCR process. The SRB Chair may assign SRB Programmatic Team members additional tasks, analysis, and reports, in addition to the SOPI requirements. For more details on the roles of the SRB Chair and Review Manager, refer to the NASA Standing Review Board Handbook.

Depending on milestone and category of mission and life cycle the size and make-up of the SRB Programmatic Team is tailorable and may be less than three analysts, with the assessment responsibilities distributed appropriately. Regardless of the size of the SRB Programmatic team, the underlying function of lead, cost, and schedule are still required. As reference, ***Table 1: SRB Programmatic Team Size provides guidance for team size.***

Table 1: SRB Programmatic Team Size

	SRR	PDR	CDR	SIR/ORR
Category I Mission	3 analysts	3 analysts	2-3 analysts	2 analysts
Category II Mission	2-3 analysts	2-3 analysts	2 analysts	1-2 analysts
Category III Mission	1-2 analysts	1-2 analysts	1-2 analysts	1 analyst

4.1 SRB Programmatic Team Lead

The SRB Programmatic Team Lead is responsible for the planning and execution of the independent programmatic assessment, identifying the team's roles and responsibilities, and is the primary contact between the SRB Programmatic Team, SRB Chair, and Review Manager.

In addition to leading the programmatic analyst team, the SRB Programmatic Team Lead tailors the IPAP, serves as the primary point of contact for interfacing with the project's programmatic points of contact, develops the SRB planning schedule for the independent programmatic assessment, tracks the SRB Programmatic Team assessment progress, ensures completion of the final report or briefings, and archives assessment information at the end of the review. The Lead should work closely with the SRB Chair and the RM throughout the assessment.

The Lead is also responsible for coordinating with the OCFO if additional resources are required to adequately assess the project life cycle products and to conduct the review. OCFO will coordinate with Mission Directorate if additional resources are required.

4.2 Schedule Analyst

The Schedule Analyst is the focal point for assessing the Integrated Master Schedule (IMS) health and schedule BOEs, providing expert opinion of the schedule performance, conducting Schedule Risk Analysis (SRA), Joint Confidence Level (JCL) analysis, and identifying schedule findings to the SRB. The Schedule Analyst will work closely with the Cost analyst throughout the entire SRB evaluation period to ensure that schedule and cost analysis results are consistent and complementary.

4.3 Cost Analyst

The Cost Analyst is the focal point for assessing the cost BOEs, analyzing the cost estimate and budget, conducting cost estimating, providing expert opinion of the cost performance, conducting cost risk analysis, supporting JCL analysis and identifying cost findings to the SRB. The Cost Analyst will work closely with the schedule analyst throughout the entire SRB evaluation period to ensure that cost and schedule analysis results are consistent and complementary.

5.0 SRB PROGRAMMATIC TEAM ROLE

The SRB Programmatic Team provides programmatic expertise to conduct an independent programmatic analysis that supports the overall SRB assessment of the project at the various LCRs. The SRB Programmatic Team assesses the health of the project programmatic products through independent assessment. The SRB Programmatic Team will focus on, in coordination with the SRB, the identification, assessment, and analysis of the potential of significant risks affecting project-planned execution, to increase the likelihood of the project being successful within cost and schedule objectives. The IPAP is an SRB assessment plan for the project life cycle programmatic requirements, products, and processes. Therefore, the SRB Programmatic Team should work closely with the SRB Chair, Review Manager, and the other SRB members when planning for and developing the IPAP. Please refer to ***Appendix A: SRB Programmatic Team Aids and Product Templates*** for Independent Programmatic Assessment (IPA) templates that can be tailored and links to the OCFO Max site for other SRB programmatic aides and past review document repository.

The IPAP should consider the following different life cycle groups for the independent assessment approach:

- Pre-Phase A and Phase A: LCRs for projects in the formulation phase, such as standing up a project, developing requirements, governance control plans, and preliminary cost and schedule estimates (e.g., System Requirements Review [SRR], System Definition Review [SDR], Key Decision Point B [KDP-B])
- Phase B: LCR that approve a project baseline for cost and schedule (e.g., Preliminary Design Review [PDR], Key Decision Point C [KDP-C], Rebaseline Review)
- Phase C/D/E: LCRs for projects in the implementation phase and can be measured by performance to baseline (e.g., Critical Design Review [CDR], System Integration Review [SIR], Key Decision Point D [KDP-D], Operational Readiness Review [ORR])

The SRB Programmatic Team is officially released from its independent programmatic assessment review duties once the appropriate PMC closes with no further documented actions for the SRB Programmatic Team to support.

6.0 INDEPENDENT PROGRAMMATIC ASSESSMENT LCR WORKFLOW

NASA projects are unique and often tailor LCR criteria to meet the success of the mission. The RM will, with input from the SPT, coordinate with the project to develop a review plan for the Terms of Reference (ToR) and conduct the LCR per the agreements in the ToR. The ToR is the agreement among the SRB, Convening Authorities (CA), and program or project that specifies the nature, scope, schedule, and ground rules for the conduct of the LCR by the SRB.[3]

The SRB Programmatic Team should develop a planning schedule for completing the independent LCR, beginning with the planning stages and extending from SRB's presentation to the governing PMC to the close out of the LCR. Section 6.1 Life Cycle Review (LCR) Planning provides guidance steps for SRB Programmatic Team members conducting the independent programmatic assessment. These are best

[3] For more information on the ToR refer to the NASA Standing Review Board Handbook, Appendix H.

practices to complete the LCR process and are tailorable to conduct the independent programmatic assessment. The Review Manager is responsible for the schedule of the SRB, and the guidance below may need to be adjusted to align with the SRB planning schedule. These steps do not include additional analysis or actions the SRB Chair or Review Manager may request the SRB Programmatic Team to perform.

The independent programmatic assessment process contains three phases during the LCR and is detailed in the NASA Standing Review Board Handbook:

- **LCR Planning:** For a new SRB Programmatic Team and/or SRB, the early planning stage includes standing up the SRB, complete training, begin communication with the project, begin developing an IPAP, and formulate a life cycle review plan for the ToR. For a SRB Programmatic Team already assigned to an existing SRB in a follow-on review, the scope of the early planning includes interfacing with the project to develop/adjust a review plan for the next milestone review as well as developing the IPAP and starting the IPA.
- **LCR Analysis & Feedback:** This phase begins after project's first LCR data drop and the SRB Programmatic Team begins assessing the project products and provides feedback to the project. The SRB Programmatic Team integrates the programmatic assessment in preparation for the SRB discussions for identifying the project strengths and weaknesses. The goal of this phase is open and continuous communication with the SRB and project to have a successful LCR.
- **Final LCR Report, Presentations, & Closeout:** This final phase is the process for the SRB to develop the final out briefs to the project and governing PMCs in preparation of the KDP. The Agency collects the SRB assessment information for archiving and lessons learned from the LCR.

6.1 Life Cycle Review (LCR) Planning

Below are the planning steps to stand up the SRB, complete training, begin communication with the project, and formulate an independent LCR plan.

6.1.1 Complete SRB Programmatic Team Training

SRB Programmatic Team participants are required to complete the SRB programmatic independent assessment training provided by the OCFO and the mission directorate. The training focuses on the role of the SRB Programmatic Team and independent programmatic assessment expectations. Training must be completed within two weeks after being selected for the SRB. For training information, contact the Strategic Investments Division within the OCFO.

6.1.2 SRB Programmatic Team Coordination with the SRB Chair and Review Manager

The purpose of this formal meeting between SRB Programmatic Team, SRB Chair, and Review Manager is to discuss the team's role and the required SRB technical team inputs to complete the independent programmatic assessment. The goal is to ensure roles and responsibilities are defined at the beginning the independent assessment and that the independent assessment aligns with the expectations of the Agency and SRB Chair. The OCFO is available to facilitate communication.

6.1.3 Develop Preliminary IPAP

The SRB Programmatic Team Lead should develop an IPAP that defines the team's roles, programmatic assessment plans, project data drop delivery dates, and the team's independent assessment planning schedule to complete the LCR. **Appendix B: SRB Programmatic Team Planning Schedule for Independent Programmatic Assessment** contains an example LCR schedule.

6.1.4 Initial Communication and Data Access with the Project

Continuous communication ensures both the project and the SRB are transparent on LCR planning and execution. The SRB Programmatic Team Lead should establish a project contact, preferably a Program, Planning, and Control representative or Business Manager, for developing and/or delivering programmatic products for the LCR. The best practice is to plan for recurring telecom meetings, either weekly or biweekly, throughout the LCR process. Refer to Section 7.0 Data Drops for more information.

Coordinate with the project and RM on how the SRB Programmatic Team will access the project LCR data.[4] Data access should include, but not be limited to, products that assist the team in understanding the project, including the project plan, WBS, and latest monthly project status briefing.

6.1.5 Coordinate with the Project on Data Drops, LCR Timeline Flow, and Feedback Loop

The discussion meetings between the SRB and project establish the framework for the LCR to determine when the project will have the appropriate LCR products available and how the team will conduct the independent programmatic assessment. The meeting can be face-to-face, telecom, or via email. The SRB Programmatic Team should discuss the data drops, review timeline with the project, and make changes as needed.

These meetings create a basis with the project for determining LCR data drops (refer to 6.2.1 Data Drop 1) to finalize the IPAP, planned SRB Programmatic Team independent assessment schedule, and work out any disconnects between the SRB and the project. **Appendix B: SRB Programmatic Team Planning Schedule** contains an example of a team planning schedule for independent programmatic assessment. If a JCL is required for the LCR, then a JCL agreement may be developed to detail the type of JCL model, data to be included in the model, and planned delivery or revision dates. These agreements will facilitate writing the ToR.

6.1.6 Coordinate with the Review Manager on Life Cycle IPAP for ToR

The SRB Programmatic Team should discuss the results of the meetings between the team and project with the SRB Chair and Review Manager. This should include:

- The SRB Programmatic Team and project agreed plan for programmatic LCR data drops products and delivery dates
- Continuous communication plan with project (e.g., weekly or bi-weekly meetings)
- IPAP tailoring of the programmatic LCR data drop products or the SRB Programmatic Team independent programmatic assessments conducted that need to be reflected in the ToR
- The Review Manager inputs (e.g., SRB caucus, travel, schedule conflicts) into the SRB Program Team independent assessment planning schedule
- Communication of the IPAP with the OCFO. Per NPR 7120.5E, ToR concurrence includes the OCFO.

6.1.7 Brief SRB on required Programmatic Inputs

Life cycle requirements vary per life cycle milestone and it is necessary to brief the SRB during this phase on required programmatic inputs to complete the IPA. Inform the SRB of any technical assessments or

[4] Please note that consultant contractors supporting the SRB may need additional time to set up data access because some repositories may require a NASA email (.gov) account.

inputs needed to complete the IPA, such as technical risk identification and assessment, or uncertainty boundary analysis. This will ensure the Review Manager has scheduled SRB technical members to provide the appropriate assessments and feedback to the SRB Programmatic Team to complete the IPA. The Best practice is to conduct a preliminary risk assessment meeting with the SRB prior to the life cycle review site review.

6.2 LCR Analysis and Feedback

This phase begins after the first project LCR data drop and the SRB Programmatic Team begins the independent assessment of the project products and providing feedback to the project. The SRB Programmatic Team integrates the programmatic assessment in preparation of the SRB discussions for identifying the projects strengths and weaknesses. The goal is for open and continuous communication to have a successful LCR. The following sections concerning data drops are consistent with guidance in the NASA Standing Review Board Handbook.

6.2.1 Data Drop 1

The first project data drop provides the SRB Programmatic Team with initial data to begin assessing the project. Anything missing from the SRB's initial data request shall be noted and communicated back to the project. If the first set of data is not delivered in reasonable time per the schedule agreed upon in the ToR, then it should be reported to the SRB Chair and the Review Manager. Refer to Section 7.0 Data Drops for more information.

6.2.2 Review Data Drop 1

6.2.2.1 Perform sufficiency review on Data Drop 1 to meet LCR requirements

It is important that the SRB programmatic analysts review the data drop products as soon as they become available, and provide comments and feedback to the project. This review consists of the SRB Programmatic Team evaluating the project products and processes for reasonableness, completeness, and consistency to meet the intent of the LCR requirement. The SRB Programmatic Team can seek clarification, as needed. It is important that communication be continuous and the team is flexible for the project to revise products to meet the intent of the LCR.

6.2.2.2 Provide Data Drop 1 sufficiency review feedback to project

Inform project on sufficiency review results.

6.2.2.3 Perform Preliminary assessment on Data Drop 1 products

Perform Data Drop 1 independent assessment as defined in the IPAP and the SRB Programmatic Team independent assessment planning schedule.

6.2.2.4 Provide preliminary assessment feedback on Data Drop1 to project

Discuss preliminary assessment feedback with the project. Feedback should be continuous throughout the independent assessment of life cycle review. The goal is to communicate concerns or issues to the project to facilitate discussions and mitigate disconnects between SRB and project assessment perspectives.

6.2.2.5 Status SRB Chair on Data Drop 1 preliminary assessment

The SRB Programmatic Team should provide the project and SRB Chair a status of products for Data Drop 1, independent programmatic assessments to date and discuss concerns and issues.

6.2.3 Review Data Drop 2

This is the final data drop and all products should be available for the SRB Programmatic Team to review. Data Drop 2 should include updated Data Drop 1 products and include technical content, cost data, integrated master schedule, BOEs, risks, and if applicable, confidence level statistical model (JCL or range estimates) delivery. Any new schedule performance data and/or programmatic data should also be provided. If the project is developing a JCL, the final model should be delivered. The project should present their JCL model, key assumptions, and provide supporting JCL data to the SRB Programmatic Team. This is the snapshot in time that the IPA will be based on. If the data is not delivered in reasonable time per the schedule agreed upon in the ToR, then it should be reported to the SRB Chair and the Review Manager. Refer to Section 7.0 Data Drops for more information.

6.2.3.1 Perform sufficiency review on Data Drop 2 to meet LCR requirements

It is important that the SRB programmatic analysts review the data drop products as soon as they become available, and provide comments and feedback to the project. This review consists of the SRB Programmatic Team evaluating the project products and processes for reasonableness, completeness, and consistency to meet the intent of the LCR requirement. The SRB Programmatic Team can seek clarification, as needed. It is important that communication be continuous and the team is flexible for the project to revise products to meet the intent of the LCR.

6.2.3.2 Provide Data Drop 2 sufficiency review feedback to the project

Inform project on sufficiency review results.

6.2.3.3 Perform Preliminary assessment on Data Drop 2 products

Perform Data Drop 2 independent assessment as defined in the IPAP and the SRB Programmatic Team independent assessment schedule.

6.2.3.4 Provide preliminary assessment feedback on Data Drop 2 to the project

Discuss preliminary assessment feedback with the project. Feedback should be continuous throughout independent assessment of life cycle review. The goal is to communicate concerns or issues to the project to facilitate discussions and to mitigate disconnects between SRB and project assessment perspectives for the final SRB findings presentations to the governing program management councils.

6.2.3.5 Status SRB Chair on Data Drop 2 preliminary assessment

The SRB Programmatic Team should provide the project and SRB Chair a status of products for Data Drop 2, independent programmatic assessments completed to date and discuss concerns and issues.

6.2.4 Integrated Assessment

The SRB Programmatic Team Lead should integrate the cost and schedule assessments into the IPA and develop life cycle review charts for the SRB. The cost and schedule analysts should provide the SRB Programmatic Team Lead with updated charts (such as schedule health check, critical path analysis, and quantitative risk assessment) of the independent programmatic assessment to date, including the independent assessment of cost and schedule plans to date, and JCL model (if applicable) or S-curves (if applicable) concerning technical content and risks. The draft LCR charts should be available to brief the SRB.

6.2.5 Complete Initial SRB Risk and Uncertainty Assessment

The SRB Programmatic Team should brief the SRB of the draft programmatic LCR charts, facilitate the SRB risk assessment discussion with the whole SRB and work with the appropriate technical SME SRB members to analyze each risk as well as identify new risks. The SRB should deliver their subject matter expert assessment of the project risks (e.g., identify new risks or adjust existing risk likelihood and consequence distribution) and uncertainty boundaries (if applicable). The SRB Programmatic Team uses the SRB risk and uncertainty assessment to update the IPA. It is important that the SRB Programmatic Team and SRB communicate to ensure all parties understand the risk assessment clearly concerning potential cost and schedule impacts. For KDP-B and KDP-C milestones, the SRB should provide SRB uncertainty boundaries (cost and schedule), risk ratings (likelihood and consequence) for each project and SRB proposed additional risks. This is required for KDP-B range estimates and JCL analysis.

6.2.6 Develop Final JCL or Cost/Schedule Risk Analysis Model Updates with SRB Inputs (If Applicable)

Update the IPA for any new risks or changes to independent risk assessment or cost and schedule uncertainty boundaries. If applicable, the SRB Programmatic Team should adjust the JCL or cost/schedule risk analysis models and provide model output reports to SRB for review. Prepare the IPA for the OCFO Checkpoint Review. Please refer to 14.0 Confidence Level Requirements Review Process for range estimates and JCL assessment details.

6.2.7 Conduct OCFO Checkpoint

The goal of the OCFO checkpoint is to ensure that the independent programmatic assessment is well documented and consistent with Agency programmatic assessment expectations. The specific checkpoint timing will be coordinated by the SRB Programmatic Team Lead and the OCFO SID Advanced Programmatic Analysis and Research Capability (APARC) representative. Information reviewed at the checkpoint include project programmatic data delivered to date, project data quality assessment, additional SRB analysis, and timeline through KDP.

6.3 Final Review Report, Presentations, & Closeout

This is the beginning of the process for the SRB to develop the final out-brief packages to the program and governing Program Management Councils for KDP, and for the Agency to collect the SRB assessment and lessons learned from the LCR process. SRB Programmatic Team develop the programmatic content for the SRB final out-brief.

6.3.1 Support SRB Caucus Plan

The Review Manager facilitates the caucus meetings for all SRB members to capture risks, issues, concerns, observations, and identified requests for action to integrate into SRB findings report. The SRB programmatic analysts are responsible for providing the SRB Chair the programmatic Requests for Action (RFA) if a significant SRB programmatic finding requires a mitigation plan. RFA's are submitted to the project as they are generated and coordinated by the Review Manager. SRB caucuses are typically scheduled in the evenings during the life cycle site review, the full day after the life cycle site review or the following week. The SRB Programmatic Team Lead should coordinate with the Review Manager to ensure time is available for the team to discuss and finalize any inputs needed from SRB members to finalize the IPA. Additional or delayed caucuses can be conducted later, depending on the availability of the SRB Chair and members.

6.3.2 Support Life Cycle Site Review

The SRB Programmatic Team should attend the project LCR as members of the SRB. This is the projects review to demonstrate meeting the LCR success criteria.

6.3.3 Support Development of Management Council Snapshot Report

The SRB is required to report out a one-page summary of preliminary LCR findings within 48 hours of the LCR site review. This report includes independent programmatic findings and if a Range Estimate or JCL is required, then the SRB results for the confidence level for Range Estimates and the 70 percent joint cost and schedule confidence level, respectively.

6.3.4 Receive Final Inputs from SRB

Receive any new SRB additions or revisions to existing risks and uncertainty boundary to update the IPA. The SRB Programmatic Team should be completing the final adjustments to the IPA, SRB presentation briefings to the project and governing program management councils.

6.3.5 Finalize Independent Assessment

Incorporate any new SRB revisions into the IPA. The SRB Programmatic Team cost and schedule analysts should inform the SRB Programmatic Team Lead of any updates to the IPA.

6.3.6 Final Independent Assessment Findings to SRB Chair and the SRB

The SRB Programmatic Team briefs the results of the IPA and associated presentations to the SRB Chair and the SRB. These products typically form the programmatic assessment findings portion of the of SRB presentation materials.

6.3.7 Independent Programmatic Assessment Report Completed

The final IPA report is finished and archived by the MD and OCFO. The report is the IPA presentation or document capturing the assessment activities completed during the review and results. Links to example templates of IPA reports and presentations can be found in ***Appendix A: SRB Programmatic Team Aids and Product Templates.***

6.3.8 LCR or KDP Management Council

This step includes the SRB presentation out-brief to the governing management council and is generally conducted by the SRB Chair. The goal is for the governing program management council to occur no later than 30 days after the Snapshot Report. The SRB Programmatic Team may be required to present programmatic assessment sections or answer questions during the governing program management council.

6.3.9 Closeout & Knowledge Management Capture

The SRB Programmatic Lead should provide the OCFO SID APARC and the mission directorate contact with the final life cycle SRB report briefing package, IPA report (if developed), IPAP, supporting analysis materials, and lessons learned. These products will be archived in the SRB repository site maintained by OCFO SID. [5] The intent of the archive is not to include every iteration of analysis or model run, rather the final iteration or run leading to the final SRB findings. All supporting data for the results should be archived. Supporting data includes project and SRB programmatic information. This information can

[5] Strategic Investments Division SRB website (https://community.max.gov/display/NASA/Standing+Review+Board+%28SRB%29+Repository).

include, but is not limited to, BOEs, uncertainty, risks, parametric models, model assumptions, cost and schedule benchmarks, and review plans.

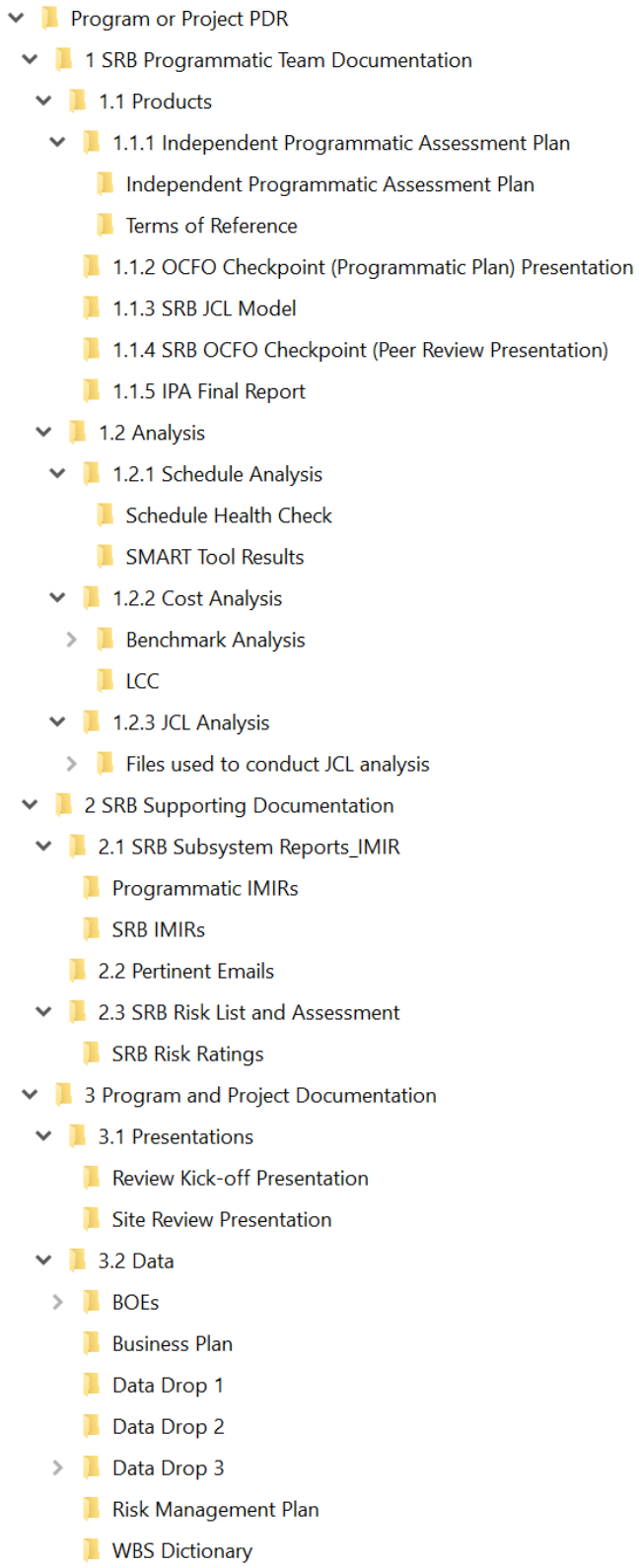
6.3.10 OCFO Closeout Checkpoint

The SRB Programmatic Team should coordinate with the OCFO SID APARC group to conduct a meeting with the specific goals of capturing review lessons learned and mitigate product archiving risks.

Refer to **Appendix B: SRB Programmatic Team Planning Schedule for Independent Programmatic Assessment** for the detailed timeline of the team LCR process mapped to appropriate workflow processes.

Analysts should use the file naming and archiving file structure listed is below. For each folder and individual file name, it is recommended to include the mission directorate, program or project, and review type as the standard prefix during the execution of the LCR. This is important for archiving for follow on LCRs and analogous missions research of future programs and projects SRB assessments and analysis. For each LCR, the OCFO establish a secure website to allow collaboration and file storage for the assigned SRB Programmatic Team. ***Figure 1: SRB Programmatic Analysis Archive File Structure*** shows example of file structure.

Figure 1: SRB Programmatic Analysis Archive File Structure (with example files)



7.0 DATA DROPS

Data drops are the project LCR programmatic products that are available at the appropriate time to provide the SRB Programmatic Team sufficient time to perform an independent programmatic assessment prior to the project LCR milestone to proceed to the governing program management council. The ToR defines scheduling and content for the data drops and is negotiated between the Project, Program Office and SRB prior to the 100 day delivery.

To ensure adequate time for the SRB Programmatic Team to assess the project, the data drops are required to occur before the project life cycle board/site review to proceed to the governing program management council. Three programmatic data drop milestones ensure the SRB Programmatic Team has sufficient time to perform the independent programmatic assessment:

- **Data Access:** Project provides access to required repositories for the LCR and overview documentation (e.g., project plan, WBS dictionary, latest monthly status briefing) to assist the SRB Programmatic Team in understanding the project prior to the beginning of the LCR
- **Data Drop 1:** Project provides preliminary required programmatic LCR products
- **Data Drop 2:** Project provides final required programmatic LCR products

NPR 7120.5 defines project data drop deliverables. Data drop deliverables dates should be included in the IPAP and programmatic section of the ToR. The NASA Standing Review Board Handbook provides recommendation for timelines for data drops[6].

[6] All timelines should be documented in the ToR and agreed to between the SRB and the project. Timelines are often negotiated to accommodate project and Center processes.

Table 2: LCR Data Deliveries

Item	Content*	Timeline
Data Access	Existing program and project management documentation (ref. NPR 7120.5E, Tables I-(2-7)), including working technical baseline description; project risk list, matrix, and mitigation plans; WBS, WBS dictionary; master equipment (MEL) list; equipment power consumption list; software lines of code, integrated master schedule; cost estimate and planning budget by year and phase; staffing requirements and plans; and infrastructure requirements.	100 calendar days prior to LCR**
Data Drop 1	Preliminary delivery of data formally required for the review, including BOEs for cost and schedule, a cost and schedule range estimate or functional JCL model and analysis schedule (if required for LCR) and supporting data (as applicable), and/or any updates that have been made to the risk list, matrix, cost estimate, budget, and schedule.	60 calendar days prior to LCR**
Data Drop 2	Final range estimate or JCL model and analysis schedule (if range or JCL required) and/or any updates to the risk list, matrix, cost estimate, budget, schedule, and project documents.	20 calendar days prior to LCR**

Single project programs, loosely coupled projects, uncoupled projects, or tightly coupled programs
* The list of programmatic cost and schedule data for each independent LCR is found in the NASA Standing Review Board Handbook.
**For two-step LCR. The timeline is with respect to the second step of the independent LCR.

8.0 TAILORING

The criteria documented in NPR 7120.5E provides the emphasis and depth of analysis required. Whenever possible the general review process for each LCR should be followed. However, in certain cases, the amount of programmatic data for review and depth of analysis may be less or more than standard project or tightly coupled programs and, thus, the analysis and reporting can be tailored appropriately. Tailoring should be captured by the ToR.

9.0 LCR TOR

The LCR Deliverables to the SRB section of the ToR captures the required programmatic LCR products and planned delivery dates for the data drops. The ToR should identify any project tailored programmatic requirements and any tailoring to the IPAP. The OCFO Strategic Investments Division should be informed of any programmatic tailoring. See ***Appendix A: SRB Programmatic Team Aides and Product Templates*** for links to a ToR template.

10.0 DISSENTING OPINIONS

Dissenting Opinion is a disagreement with a decision or action that is based on a sound rationale (not on unyielding opposition) that an individual judges is of sufficient importance that it warrants a specific

review and decision by higher level management, and the individual specifically requests that the dissent be recorded and resolved by the Dissenting Opinion process. For details regarding the dissenting opinion process, please refer to NASA Governance and Strategic Management Handbook[7], NASA Space Flight and Project Management Requirements[8], Section 3.4 Process for Handling Dissenting Options, and the NASA Standing Review Board Handbook[9].

11.0 REQUIREMENTS TAILORING

There are three mechanisms for tailoring the requirements in 7120.5E. Requests for tailoring may be submitted in the form of the Compliance Matrix[10], by using a waiver request (see the NASA Space Flight Program and Project Management Handbook) individually or in groups, or via the Program Project Management Board (PPMB).

11.1 Program Project Management Board (PPMB)

The Program and Project Management Board, run by the Office of the Chief Engineer, can assist Program and Project Managers with tailoring guidance. It serves as a forum for adjudicating issues (e.g., SRB project LCR planning issues) as Program and Project Managers work through the Agency process for tailoring waivers, and deviations for program and project management policy. The Program and Project Management Board also serves as a recommendation board to the APMC for project tailoring guidance.

The Office of the Chief Engineering chairs the Program and Project Management Board with members from the mission directorates, the OCFO, Centers, and the Jet Propulsion Laboratory (JPL).

11.2 Compliance Matrix

The Compliance Matrix is provided to streamline the waiver and deviation process described in paragraph 3.5 in NPR 7120.5E. If the Compliance Matrix is completed in accordance with NPR 7120.5E Appendix C instructions, it meets the requirements for requesting tailoring and serves as a group submittal for waivers to NPR 7120.5E. If the compliance Matrix changes or if compliance is phased for existing programs or projects, updated version of the Compliance Matrix are incorporated into an approved Formulation Agreement or Program or Project Plan revision. For a complete conversation on the NPR 7120.5E Compliance Matrix please refer to Appendix C within NPR 7120.5E.

12.0 COST ASSESSMENT

Cost assessments are performed as part of the SRB's IPA. This section is intended to provide guidance to SRB programmatic analysis team members and consultants, as well as providing some things to consider during a SRB LCR.

While some steps of the cost assessment process are mechanistic, often assessment and especially estimation is a predictive process for which judgment and experience add value. Effective assessment and

[7] NPD 1000.0B
[8] NPR 7120.5E
[9] NASA/SP-2016-3706 RevB
[10] NPR 7120.5E, Appendix C. Compliance Matrix

estimation requires an understanding of the technical work to be performed. Please note that programmatic analysts are intended to perform an assessment of the project programmatic processes and products, including life cycle cost estimates. An independent cost estimate (ICE)[11] is not required. However, there may be instances where benchmark[12] estimates are required as part of the LCR by the SRB Programmatic Team, see ***Section 12.2.2 Assessment of Reasonableness.*** For guidance on the process and methodologies for developing benchmark estimates, please refer to the NASA Cost Estimating Handbook.

The intent of the cost assessment is to show the level of confidence that the Agency can commit to externally to accomplish its technical goals while executing its plan on schedule and within budget.

12.1 Cost Requirements Review Process

This section is intended to provide guidance to the SRB programmatic analysis members and consultants concerning the cost estimate requirement within NPR 7120.5E. Specifically, this section provides guidance to following requirement:

Table 3: NPR 7120.5E Cost Requirements

Paragraph Reference	Requirement Statement	General Taxonomy
2.4.2	All programs and projects develop cost estimates and planned schedules for the work to be performed in the current and following life cycle phases (see 7120.5 Appendix I tables). As part of developing these estimates, the program or project shall document the basis of estimate (BOE in retrievable program or project records).	Cost/Schedule

This section only addresses the cost portion of the above requirement. The schedule section is in 13.0 Schedule Assessment.

12.1.1 Scope

The scope of cost assessment should include the entire life cycle of the project, or as defined in the ToR. This typically includes Phase A through E. The SRB assesses the Agency's commitment to the project, so there could be items that the project manager is not actively managing that still need to be part of assessment.[13] Cost contributions to the mission (e.g., foreign contributions) do not need to be directly assessed for JCL purposes; however, costs associated with contribution risks such as fallback options and delivery schedule risk and uncertainties that could affect the project should be noted in the analysis.

[11] Independent Cost Estimate: A quantitative assessment and estimate, performed independently from the SRB Programmatic Assessment, resulting in an independent cost estimate of project's lifecycle cost.

[12] Benchmarking: Comparative analysis of the project's cost and schedule plan to determine reasonableness used to inform the SRB Programmatic Assessment. Benchmarking can be performed using any of the methodologies specified in the NASA Cost Estimating Handbook (including historical, analogy and parametric estimating).

[13] Launch vehicle procurement is an example for Science Mission Directorate missions. Typically launch vehicle procurement is managed by Launch Services Program and the mission directorate.

12.1.2 Basis of Estimate

The cost assessment should start with the documentation, this includes BOE capture and review, estimate summary and detail information. The purpose is to ensure that the estimate is presented in an understandable manner that it is clear, complete, consistent, repeatable, traceable, and defendable.

BOEs should include the scope, technical description, cost phasing, estimating methodology, ground rules and assumptions, exclusions, and risks.

The SRB Programmatic Team should be addressing the following attributes for each BOE:

- Task(s) Description
  - Is there a detailed explanation of how the work will be accomplished?
  - Does the BOE have any unique ground rules and assumptions to consider?
- Rationale and Methodology
  - Is the estimating methodology (e.g., parametric, analogous, grassroots, cost estimating relationships [CERs]) appropriate for the given milestone?
  - Are adjustments and assumptions (e.g., complexity factors, learning curve) adequately explained?
- Source Data
  - Does the data come from a credible source and is it representative of the work being estimated?
  - Can the assessor verify and/or access the data upon request?
  - Is the supporting data current, accurate, and complete?
- Accurate
  - Are any supporting equations documented (e.g.., CERs, rates, factors, etc.)?
  - Are the BOE calculations correct (i.e., has a check been done to ensure it is free of errors)?

12.1.2.1 Ground Rules and Assumptions

BOEs typically provide a detailed description of the ground rules and assumptions used to develop estimates. The ground rules and assumptions help provide insight into what is included, and often, more importantly, excluded from the estimate and scope. It is critical that all assumptions are clearly documented. Any costs excluded from the estimate must be clearly documented. Examples are items covered by other programs or projects, costs covered by the Center, other government agencies, or sunk costs. Indicate any primary trades included in the estimate. The SRB Programmatic Team should review the ground rules and assumptions and assess validity.

12.1.2.2 Basis of Estimate Assessment Criteria

Please refer to ***Appendix A: SRB Programmatic Team Aids and Product Templates*** for example BOE assessment criteria.

12.2 Cost Assessment Process

The cost assessment has six main steps: compile data, review, analyze/validate, document assessment, discuss/brief results; and perform any required iterations.

- Compile Data
  - Request project data
  - Compile historical data

- Review
    - Read and comprehend the project scope, assumptions, liens, threats, risks, or any exclusions.
    - Determine if the estimates add up or contain errors.
- Analysis/Validation
    - Determine if the estimates make sense, and if any of the excluded items are required.
    - Ascertain if the project is within family of comparable historical projects
- Document
    - Write up any questions and or concerns.
    - Notate which comparable historical project information was used in assessment.
- Discuss/Brief
    - Talk to the project frequently; ask questions; share concerns.
    - Talk to SRB about findings, especially issues, concerns, and observations.
- Iterate
    - If/as required

Compiling data is discussed in Section

Figure 1: SRB Programmatic Analysis Archive File Structure (with example files)

- Program or Project PDR
  - 1 SRB Programmatic Team Documentation
    - 1.1 Products
      - 1.1.1 Independent Programmatic Assessment Plan
        - Independent Programmatic Assessment Plan
        - Terms of Reference
      - 1.1.2 OCFO Checkpoint (Programmatic Plan) Presentation
      - 1.1.3 SRB JCL Model
      - 1.1.4 SRB OCFO Checkpoint (Peer Review Presentation)
      - 1.1.5 IPA Final Report
    - 1.2 Analysis
      - 1.2.1 Schedule Analysis
        - Schedule Health Check
        - SMART Tool Results
      - 1.2.2 Cost Analysis
        - Benchmark Analysis
        - LCC
      - 1.2.3 JCL Analysis
        - Files used to conduct JCL analysis
  - 2 SRB Supporting Documentation
    - 2.1 SRB Subsystem Reports_IMIR
      - Programmatic IMIRs
      - SRB IMIRs
    - 2.2 Pertinent Emails
    - 2.3 SRB Risk List and Assessment
      - SRB Risk Ratings
  - 3 Program and Project Documentation
    - 3.1 Presentations
      - Review Kick-off Presentation
      - Site Review Presentation
    - 3.2 Data
      - BOEs
      - Business Plan
      - Data Drop 1
      - Data Drop 2
      - Data Drop 3
      - Risk Management Plan
      - WBS Dictionary

7.0 Data Drops**.** Reviewing estimates is largely covered above in Section **12.1 Cost Requirements Review Process.** The estimate "review" is typically qualitative in nature, focused on ensuring the estimate meets requirements and best practices.[14] This section will specifically cover the Analysis/Validation step discussed above. The Analysis/Validation step is broken into two sections:

- Project Cost Plan Assessment
- Assessment of Reasonableness

12.2.1 Project Cost Plan Assessment

The SRB Programmatic Team will assess the project's cost estimates to validate that they support the project plan.

The SRB Programmatic Team should review all major elements of cost and schedule in the WBS, such as spacecraft, payload systems and instruments, integration and test, level of effort management and oversight, ground systems development and test, and mission control and operations. The team assessment should be able to:

- Explain how the estimate for each element was determined (e.g., grassroots and bottom up, parametric, analogy, fixed-price vendor quote, pass-through from another organization).
- Explain why that estimating methodology was chosen and how the estimate was developed.
    - For grassroots estimates, identify the data sources used that provide an accurate estimate of the schedule and cost required to complete the project.
    - For parametric estimates, identify the model(s) used, the major assumptions that went into the models, and the rationale for those assumptions.
    - For analogy-based estimates, identify the missions/systems used and explain why each is an applicable analog. If the project estimate is out-of-family, explain why.

For fixed-price quotes, the SRB Programmatic Team should assess the level of maturity of the hardware to be delivered as well as the vendors' history in delivering that type of hardware on time and for the promised cost. Analysts should work with the projects to obtain the required information to perform this type of vendor assessment.

The SRB Programmatic Team should examine how workforce estimates were created (e.g., by cost or resource-loading the schedule or by some other method), and assess the assumptions behind the workforce ramp-up and ramp-down and the outcome of workforce sensitivity analysis.

To independently assess this information, the programmatic analyst(s) should determine if the project's estimate is documented, traceable, complete, reasonable, and consistent with analogous missions or systems. The estimate should follow the project lead Center guidance (e.g., GSFC Gold Rules) and any other requirements (e.g., Announcement of Opportunity). The SRB Programmatic Team should consider the experience level of the project team and identify areas where the project and reviewers agree and disagree.

[14] Best practices include those covered in the NASA Cost Estimating Handbook and by JPL, the Goddard Space Flight Center (GSFC), and Johns Hopkins Applied Physics Laboratory (APL) guidance principles.

When assessing grassroots estimates, assessors should consider the following questions as part of the assessment:

- Have the project personnel provided sufficient information about the planned work, their experience in doing or managing similar work, and how they developed their cost and schedule estimates to provide high confidence in the accuracy of those estimates?
- Is the entire mission content covered in the project's estimate? If not, what is missing and what is the rationale for excluding it?
- Are the technical requirements stable?
    - Are there potential changes to requirements, whether within a single project element or handed across an interface from one element to another, that have not been accounted for in the estimate but could drive cost and schedule changes and cause the grassroots estimate to be inaccurate?
- Are the hardware/software requirements and designs mature enough to enable an accurate estimate of the resources required to do the planned work? How mature are the technologies and/or technical approaches the project plans to use?
    - Is there any hardware or software that has not been built and/or flown in space over the past five years? If so, have viable alternatives been identified?
    - Is there a plan regarding how and when a decision to use alternative designs or technologies will be made?
    - Does the project's estimate fund this plan, including the cost of carrying both alternatives until the decision is made?

When assessing parametric estimates, assessors should consider the following questions as part of the assessment:

- Is the modeling approach appropriate to the project's point in the life cycle?
- Is the model's database sufficiently analogous to the project or to the individual project element being estimated that the model can produce a reliable estimate?
- Has the estimator identified all the model inputs (i.e., assumptions and parameters)? Are these assumptions and parameters reasonable?
- Does the model include the entire project's content?
- Does the project have external dependencies (e.g., international partners)?
- What assumptions or inputs had the greatest impact on the model's output?
- Did the estimator do a sensitivity analysis by varying model inputs or using multiple models? If so, what were the results of the sensitivity analysis?

When assessing analogy-based estimates, assessors should consider the following questions as part of assessment:

- Which analogs were used? Was sufficient information on each chosen analog provided to determine that it is an appropriate analog?
    - Is the analog applicable at the top level or at the detailed subsystem level? How might that change the estimate?
    - Are any of the analogs a poor choice for developing the project's estimate? Are there more appropriate analogs that should have been used?

- If information on the chosen analogs was not provided, did the estimator provide a rationale for analog selection?
- Where does this project fit within the overall envelope of costs and schedule durations, in total and at lower levels?
- Does the project have external dependencies (e.g., international partners)?
- Is the project at or near an edge of the envelope in key areas of the project (e.g., where there are known issues and risks)?

When assessing performance-based estimates, assessors should consider the following questions (often used for later LCRs, CDRs, Systems Integration Reviews [SIRs] and Operations Readiness Review [ORRs]):

- Has the technical baseline changed since the last LCR or major planning milestone (e.g., as the result of the annual planning, programming, budgeting, and execution (PPBE) cycle)?
- Does the project track earned value management (EVM)?
    - How is the project EVM performance?
- Does the project have external dependencies (e.g., international partners)?
- Is there a launch window that could drive resource allocation?
- What is the nature of the prime contracts (e.g., firm-fixed-price, cost-plus-fixed-fee)?
- If performance is not to plan, what are the causes (e.g., realized risks, incorrect estimates)?
- What are the project risks, threats, and opportunities? Are they captured in the plan?
- Are the project's sensitivity analyses appropriate based on past performance?

The SRB Programmatic Team should assess whether the planned funding profile adequately supports the project. The goal of the assessment is to determine if the project's funding is available when needed. Including unallocated future expenses (UFE).

One specific area the SRB Programmatic Team should analyze is the annual cost phasing and budget/ New Obligation Authority (NOA) by fiscal year. This should show how it supports the project's proposed schedule and deliverables. The SRB Programmatic Team should also assess how the phasing plan was developed, including the assumptions and strategies used, particularly as they relate to the BOE, historical analogs, the project's proposed schedule and deliverables and the SRB's assessment. The SRB Programmatic Team should address whether the proposed phasing matches the project ability to support the project. Lastly, the SRB Programmatic Team should address how much cost carryover is assumed each year of the project, both in absolute dollars and weeks or months of work.

12.2.2 Assessment of Reasonableness

NASA policy does not require an independent cost estimate (ICE) be performed at any SRB milestone. NASA's independent programmatic function is required to support the SRB by providing an independent cost (and schedule) assessment of the project's provided products.

Though a traditional ICE is not required, it is recognized that performing an adequate assessment may require the analyst to do benchmarking activities to make sure estimates are reasonable and to help facilitate conversation about assessing the project's programmatic products. The term benchmarking will be used throughout this document to represent the practice of performing separate analysis, as required, to help inform the SRB of a project's programmatic product input realisms.

Benchmarking is a cost or schedule analysis conducted to determine the reasonableness of the project's submitted estimate (cost or schedule) or to assess a specific input from of the estimate. Benchmarking can be performed using any of the cost methodologies specified in the NASA Cost Estimating Handbook, Appendix C.

When and where benchmarking is required is left to the SRB Programmatic Team discretion. However, it is recommended that some benchmarking is done for the following project product attributes:

- High risk subsystems/elements that are significant drivers of cost and schedule
- Elements of the project's BOE which do not pass BOE assessment criteria
- Elements of the project where the SRB requests further analysis to fully understand estimate and/or risk posture
- Elements of work for which only preliminary or ROM cost and schedule estimates exist (i.e., Phase E/F estimates at early review gates)

If all, or a majority, of a project's estimate have incomplete BOEs or perceived unrealistic optimism, benchmarking of all activities may be warranted. Further, if an element within a project has a very defendable and traceable BOE, a benchmarking activity may not be warranted.

Benchmarking rationale and results should be communicated to the SRB and the project.

Table 4: Cost summarizes expectations and responsibilities, by phase, with regards to cost for the SRB Programmatic Team.

Table 4: Cost Review Expectation

Cost Review Expectation		Source or Responsibility	Concept &Technology Development (SRR)	Preliminary Design & Technology Completion (PDR)	Final Design & Fabrication (CDR)
Compile	**Project Estimates & BOE**[15]	Project	Exist	Exist, Detailed Estimate for the phase the Project is entering in to, derivation of out phases will be at a higher level	Exist, contract award data & detailed estimates for self-performed work
	Project Summary Schedule	Project	Exist	Exist, aligned with integrated master schedule	Exist, aligned with integrated master schedule
	Historical Data	ONCE	Project & SRB Programmatic Team compile	Project & SRB Programmatic Team compile	Project & SRB Programmatic Team compile
Review	**Project Estimates & BOE**	SRB Programmatic Team	Understand scope, content, & layout		
	Project Summary Schedule	SRB Programmatic Team			
	Historical Data	SRB Programmatic Team	What is the range of timelines & budgets, which mission or missions are most like the project?		
Analyze & Validate	**Project Estimates**	SRB Programmatic Team	Entire scope covered & documented	Entire scope covered & documented & performance to date. Are any corrections realistic?	Entire scope covered & documented & performance to date. Are any corrections realistic?
	Project Summary Schedule	SRB Programmatic Team	Major tasks aligned to funding	Major tasks aligned to funding, performance to date	Major tasks aligned to funding, performance to date
	Historical Data	SRB Programmatic Team	Timelines & budgets, phasing within family?	Timelines & budgets, phasing within Family?	Timelines & budgets, phasing within Family?
Document	**Questions**	SRB Programmatic Team	If SRB Programmatic Team doesn't understand, IG/GAO, etc., probably won't either. Ask questions to help project tell story.		
	Findings	SRB Programmatic Team	Identify any apparent disconnects. Explained to project so they can validate/understand them.		
	Historical Comparisons	SRB Programmatic Team	Show comparisons to all similar missions, any outliers, and identify which mission(s) are most like current project		
Discuss & Brief	**Project Team**	SRB Programmatic Team, & project	Talk to project team first, ask questions, determine if disconnects are disconnects or just lack of clarity		
	SRB Programmatic Team & SRB	SRB Programmatic Team & SRB	Talk to SRB, see if they have any technical concerns that may drive costs. If so, add to findings, and identify to project team.		
	Management	SRB, SRB Programmatic Team, & project	Identify any unresolved disconnects & show historical comparisons		

[15] BOE maturity may not be homogeneous in detail. For example, at SRR BOE detail for phase B should have more detail than BOE's in phase D.

13.0 SCHEDULE ASSESSMENT

Schedule assessments are performed as part of the SRB's IPA. This section is intended to provide guidance to SRB programmatic analysis team members and consultant, as well as providing some things to consider during a SRB LCR.

The schedule assessment helps to determine whether the project has implemented scheduling best practices and is in accordance with Agency requirements. The schedule assessment should validate that:

- The schedule control plan aligns with stakeholder objectives, and best practices are being used to manage the project schedule
- The schedule is aligned with the technical goals of the project
- The schedule has been integrated with the budgeting/funding strategy
- The availability of resources other than budget has been considered and appropriate resources have been incorporated,
- Risks have been identified and are being actively managed, consistently risk informing the schedule so that the project can make informed management decisions.

Another intent of the schedule assessment is to quantify the level of confidence that the Agency can commit to externally for date of project completion, and that the project will be able to accomplish its technical goals while executing its schedule.

13.1 Schedule Requirements Review Process

This section is intended to provide guidance to the SRB programmatic analysis members and consultants with regards to the planned schedule requirement within NPR 7120.5E. Specifically, this section provides guidance to following requirement:

Table 5: NPR 7120.5E Schedule Requirements

Paragraph Reference	Requirement Statement	General Taxonomy
2.4.2	All programs and projects develop cost estimates and planned schedules for the work to be performed in the current and following life cycle phases (see 7120.5 Appendix I tables). As part of developing these estimates, the program or project shall document the basis of estimate (BOE in retrievable program or project records).	Cost/Schedule

This section only addresses the schedule portion of the abovementioned requirement. The cost section is covered in Section *12.0 Cost Assessment*.

13.1.1 Scope

Scope of schedule assessment should include entire life cycle of project or as defined in the ToR. This typically includes phases A through E. The foundation of schedule assessment is the IMS.

13.1.2 Basis of Estimates

The schedule assessment should start with the documentation, this includes a review of the project's integrated master schedule and the schedule BOE, schedule summary, and lower level detailed information. The purpose of this review is to ensure that the schedule was developed and is presented in an understandable manner that is clear, complete, consistent, repeatable, traceable, and defendable.

Schedule BOEs should include documented rationale for project task durations. They may take on a variety of forms and may not be fully contained in one data product. The SRB Programmatic Team should verify that all project constraints and assumptions along with other supporting historical/analogous data sources, and mappings to cost BOE of the same WBS element are identified within the schedule BOE.

The SRB Programmatic Team should be addressing the following attributes for each BOE:

- Task(s) Description
  - Are the project schedule BOEs formally documented?
  - Does the BOE have any unique ground rules and assumptions to consider?
  - Is there a clear trace from the schedule to the costs?
- Rationale/Methodology
  - Are the sources for deriving estimates identified: established standards, expert judgment, analogous comparisons, time estimates based upon historical data from past/related projects, parametric analysis, team brainstorming, and extrapolations from known data and trends?
  - Is the estimating methodology appropriate for the given milestone?
  - Are adjustments and assumptions adequately explained?
  - Are changes from previous estimates tracked?
- Source Data
  - Is the schedule basis sound, realistic, and executable, such that activity durations are based upon normal work schedules and calendars and do not contain padding or buffer?
  - Are judgments or rationale well justified, analogies appropriate, and schedule estimating relationships applied?
- Accurate
  - Is there any evidence of bias?
  - Are activity durations based upon the effort required, available resources, and resource efficiency?
  - Are duration time units (i.e., work days) consistent throughout the schedule?

13.1.2.1 Ground Rules and Assumptions

The BOEs typically provide a detailed description of the ground rules and assumptions used to develop schedules. Estimated durations and schedule logic support the deliverables within the schedule.

13.1.2.2 Basis of Estimate Assessment Criteria

Please refer to **Appendix A: SRB Programmatic Team Aids and Product Templates** for an example BOE assessment criteria.

13.2 Schedule Assessment Process

Like the cost assessment process, the schedule assessment has five main steps: compile data, review, analysis/validate; document, discuss/brief, and any required iterations. The steps and example high-level questions to answer during each process:

- Compile
  - Request project data
  - Compile historical data
- Review
  - Read and comprehend the project scope, assumptions, liens, threats, risks, and any exclusions
- Analysis/Validation
  - Check if schedule captures project scope
  - Check for schedule reasonableness
  - Ensure that project duration is within family of analogous projects
  - Understand how level of effort activities are captured in the schedule and treated by project analysis
- Document
  - Document questions and concerns
  - Compare to historical project information
- Discuss/Brief
  - Talk to project frequently; ask questions; share concerns
  - Talk to SRB about findings, specially issues, concerns, and observations

Compiling data is discussed in

Figure ***1: SRB*** Programmatic Analysis Archive File Structure (with example files)

- Program or Project PDR
  - 1 SRB Programmatic Team Documentation
    - 1.1 Products
      - 1.1.1 Independent Programmatic Assessment Plan
        - Independent Programmatic Assessment Plan
        - Terms of Reference
      - 1.1.2 OCFO Checkpoint (Programmatic Plan) Presentation
      - 1.1.3 SRB JCL Model
      - 1.1.4 SRB OCFO Checkpoint (Peer Review Presentation)
      - 1.1.5 IPA Final Report
    - 1.2 Analysis
      - 1.2.1 Schedule Analysis
        - Schedule Health Check
        - SMART Tool Results
      - 1.2.2 Cost Analysis
        - Benchmark Analysis
        - LCC
      - 1.2.3 JCL Analysis
        - Files used to conduct JCL analysis
  - 2 SRB Supporting Documentation
    - 2.1 SRB Subsystem Reports_IMIR
      - Programmatic IMIRs
      - SRB IMIRs
    - 2.2 Pertinent Emails
    - 2.3 SRB Risk List and Assessment
      - SRB Risk Ratings
  - 3 Program and Project Documentation
    - 3.1 Presentations
      - Review Kick-off Presentation
      - Site Review Presentation
    - 3.2 Data
      - BOEs
      - Business Plan
      - Data Drop 1
      - Data Drop 2
      - Data Drop 3
      - Risk Management Plan
      - WBS Dictionary

7.0 Data Drops**.** Reviewing the schedule estimating methodology is covered in ***13.1.2 Basis of Estimates***. The schedule review focuses on ensuring estimate meets requirements and best practices[16]. This section will specifically cover the Analysis/Validation step discussed above. The Analysis/Validation step is covered in two sections:

- ***13.2.1 Project Schedule Assessment***
- ***13.2.2 Schedule Assessment of Reasonableness***

The SRB Programmatic Team should verify that objective-driven requirements clearly flow down through the WBS, as the WBS provides the project structure and serves as a framework for the schedule development (and financial management). For projects, the integrated master schedule provides the management vehicle, which enables integration of the approved project work scope reflected in the WBS, budget, and certain project risks. The integrated master schedule will reflect both the project approved time-phased baseline plan, including all subsequent approved changes, and the time-phased plan with its current task progress, sequence, and forecasts. the SRB Programmatic Team should be able trace that the project schedule reflects the total scope of the program and the baseline mission design with the status of schedule data. 13.2.1 Project Schedule Assessment

When assessing project schedules, the SRB Programmatic Team should consider the following areas and questions as part of the assessment:

The SRB Programmatic Team should review the project plan.

- Is the project plan complete and consistent with other project documents and supported by the project's scheduling approach?

The SRB Programmatic Team should assess whether a stand-alone plan or part of either the project Plan or combined Technical, Schedule, Cost Control Plan, or the Schedule Management Plan captures content per the key areas in the Schedule Management Plan Template (Schedule Management Handbook, Appendix F),[17] as well as for its general alignment with scheduling processes and best practices as detailed in the NASA Schedule Management Handbook. The SRB Programmatic Team should review the documented approach, techniques, and methods the project intends to use in implementing the schedule management process.

- Is schedule management, including tracking and control, being performed in accordance with and integrated with the institutional EVM processes and methodologies on projects?
- Are there any efficiencies or deficiencies in the project's processes or any issues with the project's ability to follow its processes as the project moves through its life cycle?
- Are appropriate analytical tools, reports, and information provided to managers to make informed decisions?

The SRB Programmatic Team should understand the project's major acquisitions in relation to the project WBS and the integrated master schedule.

[16] NASA Schedule Management Handbook, NASA/SP-2010-3403.
[17] NASA Schedule Management Handbook, NASA/SP-2010-3403. Appendix F. March 2011.

- Are major deliverable items accurately included in the integrated master schedule?

For projects in phases C and D that are required to perform EVM,[18] the SRB Programmatic Team should be aware of which contracts require EVM, as these contracts should be delivering Integrated Performance Management Reports (IPMRs), a WBS, and an integrated master schedule that will inform the project. The SRB Programmatic Team should also be familiar with any findings coming out of the Integrated Baseline Review (IBR), which is held in preparation for KDP-C.

It is a NASA best practice for all reporting to trace from a single integrated master schedule dataset and not from separate schedule sources.

- Does the integrated master schedule accurately reflect accomplished work and planned work?
- How is the project performing integrated master schedule updates, analyzing schedule impacts, and resolving issues to provide updated schedule reporting to project management and necessary customers?

The SRB Programmatic Team should review the project schedule reports; these reports are sometimes contained in Monthly or Quarterly Status Reports (Monthly Status Reports [MSRs] or Quarterly Status Reports [QSRs]). Schedule reports may include a management summary schedule, logic reports, critical path reports, total slack reports, schedule risk reports, schedule margin metrics, and performance trends.

- Is the project generating these reports using sound methodologies?
- Is the content of the reports adequate for decision making?
    - For instance, the reports should provide management with a realistic understanding of the status of the project including warning signs of potential problems (i.e., risks), as well as a critical path assessment, plan versus actual status, milestone trends, float/slack utilization, and reserve status?
- Is project schedule reporting being conducted consistent with overall Agency requirements (i.e., 7120.5, 7120.7, 7120.8, etc...)?

The management and reporting requirements for applicable procurements may be contained in the contract Statement of Work, Contract Data Requirements List, and/or Data Requirements Document. To effectively integrate contractor schedule data into the project integrated master schedule it is imperative that a clear understanding exists between the government and contractors about such details as schedule content, level of detail, formats, reporting frequency, tools, thresholds, responsibilities, and controls. While the SRB Programmatic Team is not expected to review these products, the project's process of obtaining and incorporating the schedule information necessary to manage the integrated master schedule and enable informed decision making should be understood.

For partnerships between a project and other NASA Centers, research institutions, international partners, or other business arrangements not involving contracts or procurements, schedule reporting

[18] "Projects in phases C and D with a life cycle cost estimated to be greater than $20 million and Phase E project modifications, enhancements, or upgrades with an estimated development cost greater than $20 million are required to perform earned value management (EVM) with an EVM system that complies with the guidelines in ANSI/EIA-748, Standard for Earned Value Management Systems…. EVM system requirements shall be applied to appropriate suppliers in accordance with the NASA Federal Acquisition Regulation (FAR) Supplement, and to in-house work elements." NPR 7120.5E. Chapter 2. Section 2.2.8.

requirements should be incorporated into a Memorandum of Understanding, Space Act Agreement, Letter of Agreement, Statement of Work, or other appropriate documents. This will enable the integrated master schedule to fulfill its intended function as an effective and efficient integrated project management tool.

- Do these agreements detail the level of reporting information the project expects to receive and ensure that the project is incorporating the appropriate level of detail into the integrated master schedule?

The SRB Programmatic Team should understand the project's UFE posture as it relates to the integrated master schedule, milestones, and schedule risk impacts.

- Is the schedule margin funded through the budget baseline?
    - Is there enough UFE available to accommodate the schedule risk impacts identified by the project and SRB?

The SRB Programmatic Team should verify that the integrated master schedule captures the total scope of work at an appropriate level of detail. The SRB Programmatic Team should also review the technical progress against schedule performance, including meeting technology readiness levels (TRLs).

If the project has experienced any technical performance issues, the SRB Programmatic Team should communicate these with the SRB, as they may indicate additional risk to meeting schedule objectives and may require further analysis.

- Are there changes in scope that were not part of the baseline plan?
    - How are these changes incorporated into the schedule?
    - Are there technical drivers driving schedule performance?

Schedule credibility is determined by monitoring key indicators within the integrated master schedule that reflect both good and poor characteristics of schedule structure and maintenance and support scheduling best practices.

- Examples of key indicators within the logic network that should be monitored include, but are not limited to: missing predecessors and successors, invalid task constraints, omission of task status, improper status on future tasks, logic ties to and from summary tasks, inaccurate logic ties, and improperly reflecting tasks as milestones.

The SRB Programmatic Team should use a health and quality check to determine whether the project schedule has been developed using NASA standard best practices per the NASA Schedule Management Handbook. Typically, these metrics will have defined thresholds that should be considered as guidelines, which serve as trigger points for additional analysis.

- Did the project conduct a schedule health check?
- What are the project's schedule health metrics and associated thresholds?
    - The SRB Programmatic Team should discuss with the project any instances where tasks do not meet the threshold measurements of the selected metrics, and especially if the project has decided not to adhere to these metrics.

- Regardless of whether the project provides the SRB with a health and quality check, the SRB Programmatic Team should perform an independent health/quality check such that all necessary metrics are reviewed[19] (i.e., analysis that focuses on additional metrics may be necessary to reveal deficiencies not uncovered by the project).

Once the health and quality check of the schedule is performed, the SRB Programmatic Team should work with the project to resolve issues within the schedule network. The objective is to resolve as many of the health check issues as possible so that the schedule used for the schedule risk analysis is complete and well vetted. All health check issues may not be resolved so the analysts should understand their impact on future schedule risk analysis.

The SRB Programmatic Team should assess the current critical path as calculated in the integrated master schedule. The analysis should be performed in several ways, first analyzing the critical path in the project's native schedule as it is calculated by the scheduling software. They should examine the critical path for these characteristics:

- Does the schedule critical path(s) start at time of assessment and proceed as a continuous path to project completion?
- Does the scheduling software tool generate the same critical path that the project is reporting?
- Does the schedule consists of tasks and milestones linked together with network logic using appropriate relationship-types in a sequence that is programmatically feasible or otherwise makes sense from a workflow standpoint?
- Does the schedule have any unexplainable lags or leads or constraints that cause unimportant activities to drive a milestone?
- The schedule critical path(s) contains no level-of-effort activities, summary activities, or other unusually long activities.
- The schedule has no gaps in time between tasks that cannot be explained.
- The integrated master schedule is derived from the integration of lower-level detailed schedules, not by preselected activities that management has deemed critical.

Total float is fundamental to the critical path method (CPM) of scheduling. If the task/milestone that represents the completion of the project has a hard constraint date assigned to it, then there would be a possibility that the critical path could have a positive or negative total float value instead of zero. The SRB Programmatic Team should examine the total float calculations for critical path activities and other critical path analysis.

- Does the schedule have hard constraints?
  - Are they justified?

[19] Several of these software tools are available for download. The Schedule Test and Assessment Tool (STAT) software may be requested via the NASA software catalog at https://software.nasa.gov/software/MFS-33362-1. Other software applications are also available via the One NASA Cost Engineering (ONCE) database at https://oncedata.msfc.nasa.gov/%28S%28bma3ciyzi0pxghnmv21igowf%29%29/default.aspx

- Is the logic automatically updating? Are manual entries and constraints misrepresenting the critical path and float calculations? What are the results of the Defense Contract Management Agency critical path test?
- What is the project integrated master schedule critical path length index?

Through each iteration of critical path analysis, the SRB Programmatic Team should monitor the near-critical paths, also referred to as secondary or tertiary paths, to understand the sensitivity of the schedule, as well as where the schedule has flexibility and where it does not. Tasks with total float within a narrow range of the critical path total float are near critical. They should also review past schedule reports, including MSRs and QSRs.

- What has the project identified as the critical path and near-critical paths over the course of project execution and what is the rationale for any changes in these paths over time?
- Does the project IMS critical path match the SRB programmatic team identified IMS critical path?
- If a SRB analysis schedule is created, does the SRB critical path match the project identified critical path?

The SRB Programmatic Team should examine the metrics that the project is tracking and discuss the results of those metrics with the SRB with respect to schedule performance. The team should also assess whether the program or project is tracking performance at least monthly in the LCR window of 120 days prior to the site review.

- Are there issues or past problems that should be incorporated in the threat, lien, or risk lists?

The SRB Programmatic Team should perform margin analysis,[20] determining whether the project has identified enough margin to account for schedule risk impacts and other unknown unknowns (uncertainty) that may threaten the project completion. The results of the schedule risk analysis help determine the adequacy and appropriate placement of the schedule margin in the integrated master schedule.

- Is the margin consistently identifiable within the integrated master schedule? Is it hidden within the duration of other tasks?
- Does the margin meet the Center's margin guidelines?
- Are the schedule margins realistic? Have they been validated (i.e., schedule risk analysis)?
- Are there adequate management reserves to cover unfunded schedule margin?
- Are the schedule margins consistent with similar missions?
- Are margin and slack being tracked synonymously? (Note: Slack/float is not the same as margin)
- Is there methodology to how the margins were derived (e.g., expert judgment, rules of thumb, insight from schedule risk analysis)?
- How does the project manage margin? Is there a burn-down plan? Who controls it?

[20] Further information about margin assessment can be found in the NASA Schedule Management Handbook.

- Is there a process to guide how margin will be used to offset of scope change, schedule growth, and potential risks?
- Is the schedule margin funded?

Workforce planning is heavily dependent on the integrated master schedule for time phasing. The SRB Programmatic Team should examine whether the project has considered potential equipment and facility conflicts.

- Is the appropriate workforce (skillset and number) available with regards to the planned work?
- Do facility conflicts exist (e.g., for testing in thermal vacuum chambers)? Are there mitigations to accommodate potential conflicts?

If the appropriate workforce or facilities are not available at the appropriate time, there may be additional risk to the schedule. Furthermore, augmentation to staffing plans may be needed to cover threats, liens, and/or possible impacts from schedule risks such as late deliveries. The SRB Programmatic Team needs to understand the schedule and cost impacts of such threats, liens, and risks as they may reduce UFE and schedule margin.

13.2.2 Schedule Assessment of Reasonableness

The appropriateness of the schedule should be considered by the SRB Programmatic Team. Is there perceived unrealistic optimism of schedule duration or lack of schedule detail that may indicate lack of understanding of the work and sequence required to develop and mature the project through the life cycle phases?

As with cost estimates, benchmarking is conducted to determine the reasonableness of the project's estimate (cost and schedule) or to assess the specific input to the schedule estimate.

When and how schedule benchmarking is required and performed is left to the programmatic analyst's discretion. An example benchmarking practice is to compare milestone and total development schedule life cycles of analogous missions.

Schedule assessments occur at different points in a project life cycle (i.e., maturity). To assess the level of maturity of schedules at each LCR, refer to the NASA Schedule Management Handbook, Section 5.3.2.[21] ***Table 6: Schedule Assessment*** outlines project schedule expectations, by phase.

Table 6: Schedule Assessment Expectation

Schedule Expectations		**Concept & Technology Completion (SRR, SDR)**	**Preliminary Design & Technology Completion (PDR)**	**Final Design & Fabrication, System Assembly, Integration & Test, Launch & Checkout (CDR, SIR, ORR)**
Scheduling Tool Considerations	Team possesses tool expertise	Intermediate level capable of Schedule Development	Intermediate level capable of complex critical path analysis	Expert level capable of developing what ifs, schedule crashing scenarios, etc.

[21] NASA Schedule Management Handbook, NASA-SP-2010-3402 (https://www.nasa.gov/pdf/420297main_NASA-SP-2010-3403.pdf)

	Tool(s) selected produce adequate summary schedules, status views, and critical path views	•	•	•
	Tool selection appropriate for Project complexity	•	•	•
Schedule Development	WBS and Organizational Breakdown Structure mapped to the integrated master schedule	System Level	Subsystem Level	At lowest level of the WBS
	Schedule Management Plan	Draft	Baseline	Baseline and revisions
	Task / activity definition / duration	Sufficient detail to allow accurate logic	Activity duration should follow GAO best practice of 44 working days or less, with agreed to exceptions	Activity duration should follow GAO best practice of 44 working days or less, with agreed to exceptions
	Schedule margin / reserve	Allocated at program level	Allocated at project level to safeguard critical path tasks	Allocated at project level to safeguard critical path tasks, and tasks with high likelihood / high consequence risks
	Schedule logic	All tasks have predecessors and successors, with exceptions for outside deliveries	All tasks have predecessors and successors, with exceptions for outside deliveries, and all tasks logic eventually leads to project completion milestone	All tasks have predecessors and successors, with exceptions for outside deliveries, and all tasks logic eventually leads to project completion milestone
	Integrated master schedule baseline established		•	•
	Calculated critical path	Single tool created critical path terminating at project completion milestone	Primary, secondary, and tertiary critical path's terminating at project completion milestone	Primary, secondary, and tertiary critical path's terminating at project completion milestone
Schedule Maintenance	Data backup and archive	•	•	•
	Schedule updates and evidence of continuous updates	Daily	Weekly / monthly	Weekly / monthly
	Status update accounting		•	•
Schedule Assessment and Performance Monitoring	Schedule logic measurement	Less than 10% missing logic	Less than 5% missing logic	Less than 5% missing logic
	Schedule logic effectiveness	All tasks lead to a critical program milestone	All tasks lead to the program completion milestone	All tasks lead to the program completion milestone
	Critical path analysis	Zero float path terminating at Critical project milestone	Zero float path terminating at project termination milestone	Zero float path terminating at project termination milestone
	Schedule margin assessment	Sufficient margin exists to cover program risks	Sufficient margin exists to cover program risks, and usage trends support this	Sufficient margin exists to cover program risks, and usage trends support this

	Constraint usage	Minimal hard constraints	Minimal hard constraints, soft constraints only used for external deliveries	Minimal hard constraints, soft constraints only used for external deliveries
Schedule Control	Baseline control process		Baseline control process is robust and adhered to	Baseline control process is robust and adhered to
	Schedule forecast Control		Schedule forecast is managed to safeguard critical program milestones	Schedule forecast is managed to safeguard critical program milestones
	Schedule exceptions reporting		Documented examples of schedule baseline and / or schedule forecast exceptions reporting to management	Documented examples of schedule baseline and / or schedule forecast exceptions reporting to management

14.0 CONFIDENCE LEVEL REQUIREMENTS REVIEW PROCESS

This section is intended to provide guidance to the confidence level requirements within NPR 7120.5E. Specifically, this section provides guidance to following requirements:

Table 7: NPR 7120.5E Confidence Level Requirements

Paragraph Reference	Requirement Statement	General Taxonomy
2.2.4	Each program and project shall perform the LCRs identified in its respective figure in accordance with NPR 7123.1, applicable Center practices, and the requirements of this document. These reviews provide a periodic assessment of the program's or project's technical and programmatic status and health at key points in the life cycle using six criteria: alignment with and contribution to Agency strategic goals, adequacy of management approach, adequacy of technical approach, adequacy of the integrated cost and schedule estimates and funding strategy, adequacy and availability of resources other than budget, and adequacy of the risk management approach. (See NPR 8000.4 Agency Risk Management Procedural Requirements and NASA/SP-2011-3422 NASA Risk Management Handbook for further requirements and guidance on risk management and the NASA Space Flight Program and Project Management Handbook for further guidance on addressing the expected maturity for each of these criteria.) A life-cycle review is complete when the governing Program Management Council (PMC) and Decision Authority (DA) complete their assessment and sign the Decision Memorandum (see paragraph 2.4.1).	Risk
2.4.2	All programs and projects develop cost estimates and planned schedules for the work to be performed in the current and following life-cycle phases (see 7120.5 Appendix I tables). As part of developing these estimates, the program or project shall document the basis of estimate (BOE in retrievable program or project records).	Cost/Schedule
2.4.3	Tightly coupled and single-project programs (regardless of life-cycle cost) and projects (with an estimated life-cycle cost greater than $250 million) shall develop probabilistic analyses of cost and schedule estimates to obtain a	Programmatic Estimating

Paragraph Reference	Requirement Statement	General Taxonomy
	quantitative measure of the likelihood that the estimate will be met in accordance with the following requirements.	
2.4.3.1	Tightly coupled and single-project programs (regardless of life-cycle cost) and projects (with an estimated life-cycle cost greater than $250 million) shall provide a range of cost and a range for schedule at KDP 0/KDP B, each range (with confidence levels identified for the low and high values of the range) established by a probabilistic analysis and based on identified resources and associated uncertainties by fiscal year.	Range Estimate
2.4.3.2	At KDP I/KDP C, tightly coupled and single-project programs (regardless of life-cycle cost) and projects (with an estimated life-cycle cost greater than $250 million) shall develop a resource-loaded schedule and perform a risk-informed probabilistic analysis that produces a JCL.	JCL
2.4.4.3	When a tightly coupled program, single-project program, or project with an estimated life-cycle cost greater than $250M is re-baselined, the JCL should be recalculated and approved as part of the re-baselining approval process.	JCL

This section is divided into two major sections to cover the requirements above. The first section will provide both cost and schedule guidance on performing an assessment on the project's cost and schedule range estimate requirement. The second section will provide guidance on assessing the Agency's JCL requirements.

14.1 Cost and Schedule Range Estimate Assessments (KDP-0/KDP-B)

The KDP-0/KDP-B requirement for range estimates focuses on the project providing a high and low cost and schedule estimate for the project to be successful and meet objectives. The SRB Programmatic Team assessment of cost and schedule range estimate requirements is intended to focus on the reasonableness of the project generated cost and schedule range estimate by analyzing the validity of the range estimate input parameters, assumptions, and overall quality of the product. NASA guidance does not direct how a project generates their range estimates for cost and schedule but a few underlying principles should apply to the products. Range estimates should be based on the project preliminary plan and technical scope; range estimates should encompass project's unique risks and uncertainty. Per the NASA Cost Estimating Handbook and the Schedule Management Handbook, there are several acceptable methodologies for generating a KDP-0/KDP-B cost and schedule range estimate.

The SRB Programmatic Team assessment of the range estimate will include aspects covered in ***12.0 Cost Assessment*** and ***13.0 Schedule Assessment***; but will also include additional factors such as assessing the project uncertainty and risks in the plans are properly accounted for in the project range estimates. The project models used to generate the range estimates will be taken and adjusted with SRB technical subject matter expert inputs and evaluated to identify any significant impacts to the project plan.

Though the general process for evaluation of both products can be similar, the mechanics of evaluating the products can vary depending on how the project generates the range estimates.

14.1.1 Basis of Estimate

For all inputs to support the range estimate there should be a BOE for any risk analyses conducted (e.g., Monte Carlo simulation, identification of risk mitigation strategies) including probability distribution assumptions and how their results were used to create the probabilistic cost and schedule estimates.

14.1.1.1 Scope

Please refer to ***12.1.1 Scope*** and ***13.1.1 Scope*** for a general conversation with regards to scope. The project's range estimates scope should include any risks, opportunities, and uncertainties that the project controls and items that the project doesn't manage but could affect the project's baseline. For example, as specified in the NASA Cost Estimating Handbook, with regards to international/inter-Agency contributions, inter-project/program risks, and launch vehicle selection; the project is tasked to include the programmatic risk of cost and schedule impacts to the project stemming from those systems. The project should coordinate with the international, inter-Agency, inter-project/program, and appropriate launch services entities when available; as well as coordinate with its mission directorate, to determine the adjudication and communication of the risks (ownership). Further work should be performed to determine how those risks will be incorporated and communicated in the range calculations. The SRB Programmatic Team will have the responsibility to evaluate all aspects of the range, including international/inter-Agency and inter-project/program relationships.

14.1.1.2 Ground Rules and Assumptions

The BOE should provide a detailed description of the ground rules and assumptions used to develop the range estimates. The ground rules and assumptions help provide insight into what risks, opportunities, and uncertainties are included and excluded from the estimate and scope. For example, the project could make assumptions that certain risks will not happen, such as a hurricane striking an integration center. These exclusions may be fine but need to be understood

14.1.2 Assessing the Cost and Schedule Range Estimates

The SRB Programmatic Team should evaluate three aspects of the cost and schedule range estimates:

- Credibility of project inputs to the range estimate
- Adequacy of the risk management plan (RMP), process, risk identification, and mitigation plans
- Reasonableness of project cost and schedule estimate

14.1.2.1 Assessment of Project Cost and Schedule Range Estimate Model

The SRB Programmatic Team will assess the project cost and schedule range estimates.

If the range estimates are generated using parametric or analogous data, then the SRB Programmatic Team should assess the following:[22]

- Applicability of the project input data and the model (e.g., tools) being used to support range estimate calculations. Is the basis for the range estimates analogous to the project? If the project is using analogous data to support range estimates than SRB Programmatic Team should obtain inputs from the SRB if the analogies are reasonable. The team should use inputs from the technical

[22] It is important to note that the SRB Programmatic Team analysts may be required to generate SRB range estimates in the event the project does not satisfy range estimate requirements or at the request of the SRB Chair or convening authorities.

SRB subject matter experts (approved by the SRB Chair) to adjust the project range estimates and provide results to the SRB.

- Assessment that the project input data and model (e.g., tools) are being utilized properly. For example, if the project uses parametric tools, are both inputs of uncertainty and CER uncertainty being properly utilized? SRB technical subject matter input can be solicited, but the SRB Programmatic Team will most likely be the SRB subject matter experts on CER best practices.[23]
- Assess the project input data and model (e.g., tools). Are the project inputs to the cost and schedule range estimates reasonable?
- Assess if the project risks are captured in the input data or model.

If the range estimates are generated via a schedule risk analysis, then refer to ***13.0 Schedule Assessment.*** It is important to note that a JCL is *not* required to fulfill a KDP-0/KDP-B range estimate requirement. The assessment of a grassroots input looks at the schedule (schedule risk analysis) and cost range estimates separately.

14.1.2.2 Risk Management Assessment of Cost and Schedule Range Estimate

The SRB Programmatic Team will coordinate with the SRB to assess the project risk management approach beginning with an evaluation of the Risk Management Plan.[24] The SRB Programmatic Team should evaluate if the Risk Management Plan summarizes how the program implements risk-informed decision making (RIDM) and continuous risk management (CRM) in accordance with NPR 8000.4A.

The project risk list provided for the LCR should include all risks and appropriate actions to mitigate each risk. Project's with international or other U.S. Government Agency contributions must plan for, assess, and report on risks due to international or other government partners and plan for contingencies.

The SRB Programmatic Team will conduct an independent risk assessment to determine if the project meets RIDM and CRM processes in accordance with NPR 8000.4A requirements regarding programmatic risk. The SRB technical risk SME will conduct an independent risk assessment to determine if the project meets RIDM and CRM processes regarding safety and mission assurance risk. As examples of areas to assess, the project:

- Documents risk acceptability criteria and thresholds, as well as elevation protocols (the specific conditions under which a risk management decision must be elevated through management to the next higher level).
- Establishes risk communication protocols between management levels, including the frequency and content of reporting, as well as identification of entities that will receive risk-tracking data from the unit's risk management activity.
- Conducts CRM process.
    - **Identify:** Identify contributors to risk.
    - **Analyze:** Estimate the probability and consequence components of the risk through analysis, including uncertainty in the probabilities and consequences and, as appropriate, estimate aggregate risks.

[23] NASA Cost Estimating Handbook, v.4.0, February 2015, 2.3.3; NASA Schedule Management Handbook, NASA/SP-20910-3403, March 2011, 7.9

[24] As identified by NPR 7120.5E; Tables I-1, I-3, I-7 Program Plan Control Plans, and Appendix G section 3.3 for Programs, Table I-5 Project Plan Control Plans and Appendix H for projects.

- **Plan:** Decide on risk disposition and handling, develop and execute mitigation plans, and decide what will be tracked.
- **Track:** Track observables relating to performance measures (e.g., technical performance data, schedule variances), as well as the cumulative effects of risk disposition (handling) decisions.
- **Control:** Control risk by evaluating tracking data to verify effectiveness of mitigation plans, adjusting the plans as necessary, and executing control measures.
- **Communicate and Document:** Communicate and document the above activities throughout the process.

14.1.2.3 Uncertainty Assessment of Cost and Schedule Range Estimates

Like Cost and Schedule BOEs, modeled uncertainty for range estimates need to have a basis of estimate. Refer to 14.2.2.4 Uncertainty Assessment of JCL for additional details.

14.1.2.4 Assessment of Cost and Schedule Range Estimate Reasonableness

NASA's independent assessment model requires the SRB to provide an independent cost and schedule assessment of the project programmatic LCR products. For example, when a project provides a JCL to the SRB to assess, the expectation is not for the SRB programmatic analysts to perform a separate independent JCL analysis but assess the project inputs to the project cost and schedule estimates. This applies to cost and schedule range estimate and for *risk-informed and schedule adjusted baseline* cost estimate updates.

NASA policy does not require a SRB ICE for any LCR milestone.

Though an ICE is not required, it is recognized that performing an adequate independent assessment may require the SRB Programmatic Team to generate a benchmarking analysis (e.g., performing separate analysis, as required, to help inform the SRB of the reasonableness of the project estimates) to ensure cost and schedule estimates are reasonable and to facilitate conversations with regards to assessing the project's programmatic products.

14.1.2.5 Cost and Schedule Range Estimate Confidence Levels

NASA policy does direct what the associated confidence levels for the cost and schedule range should be at KDP-0/KDP-B. The policy states the associated high and low confidence levels need to be documented to support the range estimates and provide a high and low confidence level for both schedule and cost range estimates. The SRB Programmatic Team, with SRB subject matter expert inputs, should assess whether the recommended ranges are reasonable.

14.1.3 Key attributes to a successful Cost and Schedule range estimate SRB assessment

The SRB Programmatic Team supports the SRB to determine if the project has identified and accurately quantified all the known risks and if the uncertainty boundaries in the cost and schedule estimates are appropriate. When assessing the project's risks and confidence level calculation, the SRB should be able to answer the following questions[25]:

[25] It should be noted that answers to these questions provides a solid basis to communicate the results of the SRB programmatic assessment to NASA decision makers.

- Has the SRB identified new risks for the range estimates or adjusted risk likelihoods, consequences or impacts different from the project? The SRB should provide the technical rationale for the differences from the project inputs in the risk assessment.
- Do the SRB's uncertainty boundaries differ from the projects? If so provide the technical rationale for the differences from the project inputs in the risk assessment.
- When the project range estimate models are updated using the SRB SME adjustments to risk and uncertainty distribution, how do the results compare to the project's proposed budget and schedule?
- After evaluating risk and uncertainty drivers, what changes to the risk list and uncertainty distribution have the biggest impact compared to the project's proposed cost and schedule?
- How does the ratio of the assessor-identified risks to uncertainty differ from the project's inputs?
- If appropriate, have the risks and impact of missing a launch window been included in the project's risk list?
- Have risks associated with partner/international contributions been included in the project's risk list? Has the project identified the impact if partner/international contributions are not provided or are provided later than in the project's plan, and have assessed alternatives if needed?

14.2 Joint Confidence Level Assessment

The SRB Programmatic Team should assess the project JCL for KDP-C or a Rebaseline Review. This assessment is to determine the reasonableness of the project's generated cost and schedule range submissions in support of KDP-C and external stakeholder commitments such as the Agency Baseline Commitment (ABC).

The SRB is responsible for analyzing the project JCL to determine the validity of the JCL inputs (e.g., cost, schedule, risk, uncertainty) and the reasonableness of the assumptions. The assessment will include all aspects covered in the cost and schedule estimate sections (see ***12.0 Cost Assessment*** and ***13.0 Schedule Assessment***), but will also include additional factors that are JCL modeling specific. The project JCL model is adjusted with SRB inputs via subject matter expert analysis and evaluated to identify any significant impacts to the project current resource plan.

14.2.1 Basis of Estimate

A JCL is based on the project's current cost and schedule resource plan with probabilistic attributes (e.g., adding risks and uncertainties). Like the expectations in both the cost and schedule sections, all inputs to support the JCL should have a BOE. Specifically, the JCL analysis adds the necessity for BOEs to support a project's risk and uncertainty inputs, as well as on a project's time independent or time dependent assumptions.[26]

14.2.1.1 JCL Scope

The scope of the JCL is typically project formulation through the end of Phase D focusing on the development costs. Please note per NPR 7120.5E this is not the total life cycle costs or operational life of a project.

[26] NASA Cost Estimating Handbook, v.4.0, February 2015, Section 3.1.3.

The content of what is included in the costs and schedule of the JCL to meet this Phase-D requirement is agreed upon between the project and convening authorities as part of the ToR or from the PPMB if the project uses the board to adjudicate differences. As discussed in ***14.1 Cost and Schedule Range Estimate Assessments (KDP-0/KDP-B)***, the JCL should include any risks, opportunities, and uncertainties that the project manages and items that the project does not control (e.g., contributions or other funds lines) that could affect the project's mission.

Refer to the NASA Cost Estimating Handbook, with regards to international/inter-Agency contributions, inter-project/program risks, and launch vehicle selection; the project is tasked to include the programmatic risk of cost and schedule impacts to the project stemming from those systems. The SRB Programmatic Team should evaluate all aspects of the JCL, including international/inter-Agency contributions and inter-project/program relationships.

14.2.1.2 JCL Ground Rules and Assumptions

The project should provide detailed description of the ground rules and assumptions used to develop the JCL. The ground rules and assumptions help provide insight into what risks, opportunities, and uncertainties are included and excluded from the JCL estimate and scope.

14.2.2 Assessing the JCL

Guidance on how to conduct a JCL is documented in the NASA Cost Estimating Handbook. This section will follow this process for JCL generation and discuss how to assess each section: build a JCL schedule/logic network, load cost onto the schedule activities, incorporate a risk list, conduct uncertainty analysis, and analyze results. Generally, the goal of the assessment is to determine if the project adequately captured all the risks and uncertainties with regards to cost and schedule.

14.2.2.1 Schedule Logic Network

The schedule logic network is the backbone to creating a JCL. A project may utilize their integrated master schedule as the JCL analysis schedule (refer to ***13.0 Schedule Assessment*** with regards to how to assess the deterministic integrated master schedule). The project may also develop an analysis, or summary, schedule for the JCL analysis[27] when the integrated master schedule exceeds a manageable number of activities to cost and risk load. If the project provides an analysis schedule, then the SRB Programmatic Team needs to perform schedule health checks, per ***13.2.1 Project Schedule Assessment***, on both schedules (integrated master schedule and analysis) and to ensure the analysis schedule accurately represents the more detailed integrated master schedule (e.g., critical paths are similar). The analysis schedule should have all schedule margin removed and they should evaluate hard constraints within the schedule, as theses hard constraints are not recommended for JCL analysis.

14.2.2.2 JCL Cost Loading

The JCL cost inputs should be evaluated per ***12.0 Cost Assessment***. Additionally, the SRB Programmatic Team needs to evaluate if the project adequately mapped the costs to the schedule. This mapping should be clearly documented in the JCL model and include all cost scope per the ToR.

[27] For pros and cons associated with the integrated master schedule versus analysis schedule for JCL, please refer to NASA Cost Estimating Handbook, Section 3.

The SRB Programmatic Team should assess the adequacy of the project cost inputs to determine if the inputs are reasonable to be Time Dependent or Time Independent. JCL model adjustments by SRB should be communicated to the project. Refer to the NASA Cost Estimating Handbook for more clarification of time dependent and time independent for JCL modeling.

14.2.2.3 Risk Management of Assessment for JCL

The SRB Programmatic Team should assess all risks modeled in the JCL. There are several attributes of the risk list that need to be assessed:

- Did the project identify all the risks that could affect the project? Cross-reference the risks modeled in the JCL to the project risk list to ensure that all risks that could influence cost and schedule are modeled. Furthermore, the SRB Programmatic Team should review the risks with the SRB for subject matter expert inputs to determine if additional risks should be added or adjustments to existing risks.
- Are the risks properly linked to the JCL schedule logic? The SRB Programmatic Team should evaluate and, as appropriate, review with the SRB to verify that the risks are properly linked to the schedule and adjust as appropriate per SRB subject matter expert inputs.
- Are the risks properly quantified with regards to likelihood and impact? The SRB Programmatic Team should review project risk likelihood and impact for all JCL-modeled risks and adjust per SRB subject matter expert inputs as needed.

The JCL model should model each risk against the current cost and schedule plan. Certain risks can be quantified as pre-mitigated or post-mitigated in the JCL model. If a risk in the JCL model is a post-mitigated consequence, then the SRB Programmatic Team should make sure that the mitigation strategy is clearly baselined in the project plan with a funded mitigation strategy. (Refer NASA Cost Estimating Handbook, Section J.4.1.3, for more discussion on pre-and post-mitigation in JCL models).

The SRB Programmatic Team will work with the SRB to assess the risk management approach starting with an evaluation of the project Risk Management Plan.[28]

14.2.2.4 Uncertainty Assessment of JCL

As defined in the NASA Cost Estimating Handbook, Appendix J, uncertainty is the indefiniteness about a projects baseline plan. It represents our fundamental inability to perfectly predict the outcome of a future event. The NASA Cost Estimating Handbook and the NASA Project Planning and Control Handbook provide excellent dialog on how uncertainty and risks are related. NASA does not dictate at what level uncertainty is to be applied but it should be clearly documented within the JCL model. Uncertainty should be applied to activity durations, cost loading (time dependent and time independent), and risk consequences.[29] How to assess uncertainty will be dependent on how the program/project generates and defends their inputs with BOEs, but in general the SRB Programmatic Team should ask the following questions when doing the assessment.

- Data-driven uncertainty:

[28] As identified by NPR 7120.5E; Tables I-1, I-3, I-7 Program Plan Control Plans, and Appendix G section 3.3 for Programs, Table I-5 Project Plan Control Plans and Appendix H for projects.

[29] It's important to note there will be instances where there will not be uncertainty. For each instance of uncertainty, the SRB Programmatic Team should assess the adequacy of input.

  - Was the data normalized? If so, how? If the data was not normalized, some simple normalization may be warranted (e.g., inflation). For normalized data, oftentimes outlier events will be "normalized" out. Efforts to understand what the data constitutes is very important.
  - What level is the data, and is the data compatible with the JCL model? Uncertainty metrics are not always easily transferable from one WBS level to another.
  - Is the data relevant to what the project is estimating? Ensure the data is homogeneous to what is being estimated.
  - Is there enough data to support the analysis? Sample size matters. Small samples could introduce statistical bias in the estimate of population range parameters. This bias should be considered and accounted for.
- Performance-based uncertainty:
  - Is past performance relevant to work forward? For example, financial mutual funds, past performance may not be a good indicator of the future.
  - At what level was the past performance data collected? Level of performance-based metrics collected for BOE should be the same general fidelity as the JCL model.
- Subject matter expert-based uncertainty:
  - Where did the subject matter expert input come from? Ensure the right subject matter expert provided inputs. For example, a person may be quite the expert in a technical field but may not have a good handle on the cost and schedule uncertainties of that field; whereas a recent project manager, or Center cost estimator, may not be as competent in the technical area but have a better feel for cost and schedule impacts.
  - Is there confirmation bias? Confirmation bias is the tendency to search for or interpret information in a way that confirms one's beliefs or hypotheses. For example, a project may underestimate the negative uncertainty because they *want* the project to succeed.
  - Is there framing bias? Framing bias can lead to using a too-narrow approach and description of the situation or issue.
  - Is there hindsight bias? Hindsight bias is the inclination to see past events as being predictable.

14.2.2.5 Analyze JCL Results

All JCL analysis results and inputs for both the project JCL model and SRB-adjusted model should be communicated with the SRB Chair. The SRB Programmatic Team should provide both the 50 and 70 percent joint cost and schedule confidence levels for both the project and SRB model at a minimum. All differences between the project JCL and SRB model should be clearly documented and drivers identified. The team should demonstrate that the cost and schedule deltas between the 50 and 70 percent JCLs are reasonable, based on major risk drivers, uncertainty distributions, and historical analogous data.

If the current project plan differs from the 50 and 70 percentiles (either the project's or SRB-adjusted JCLs), the SRB Programmatic Team should lead a discussion with the SRB on drivers of variation for accuracy and documentation in preparation for the presentation to support the convening authority's project life cycle management councils.

In addition to providing the above results, the following questions should be answered by the SRB Programmatic Team analysis:

- What are the schedule activities and critical paths that may be impacted by risks?
- Has the project identified all probable critical schedule activities? Secondary? Tertiary?
- What is the probability that the schedule milestones dates will be completed on time?
- What are the risk drivers (e.g., risk tornado chart)? Which risks impact the cost and schedule the most?
- What is the impact of uncertainty inputs?
- How much margin and UFE is required to achieve specific confidence levels (e.g., to achieve 70 percent confidence level)?
- How much margin and/or UFE does each risk require for mitigation?
- Is the project carrying sufficient margin and/or UFE in appropriate places within the schedule?
- Does the ratio of time independent costs to time dependent costs seem reasonable?
- Is the project using reasonable correlations values in the JCL analysis?

14.2.3 Key attributes to a successful JCL assessment

The SRB Programmatic Team supports the SRB in determining whether the project has accurately identified and quantified all the known risks to the success of the project. They also advise on whether the generic uncertainty in the cost and schedule estimates is appropriate. When assessing the project's risk list and confidence calculation, the SRB should be able to answer the following questions[30]:

- Does the analysis schedule have a logic network that has minimal constraints and is linked to major milestones?
- Is the schedule cost-loaded? Are the fixed and variable costs within the schedule properly identified?
- Is the project risk list properly linked to the schedule activities with likelihood and cost/schedule impacts quantified? Does the SRB have adjustment to what risks could affect the project, where the risks occur, and the likelihood and impact of each risk?
- Have the SRB members identified different risks than the project or ranked the risks differently? The SRB should provide the technical rationale for the differences in risk assessment and quantified likelihoods, consequences and expected values, and should include a BOE for the likelihoods, consequences and expected values of the added or changed risks.
- Does the SRB's uncertainty distribution(s) differ from the projects? If so, why?
- When the probabilistic estimating models are run using the SRB's risk list and uncertainty distribution, how different are the results compared to the project's proposed budget and schedule?
- What changes to the risk list and uncertainty distribution have the biggest impact compared to the project's proposed cost and schedule?
- How does the ratio of the assessor-identified risks to uncertainty differ from the projects?
- Have the risks and impact of missing a launch window been included in the project's risk list?

[30] It should be noted that answers to these questions provides a solid basis to communicate the results of the SRB programmatic assessment to NASA decision makers.

APPENDIX A: SRB PROGRAMMATIC TEAM AIDES AND PRODUCT TEMPLATES

This appendix contains links to and examples of presentations, tools, reports templates and BOE grading criteria scorecard that can be used by the SRB Programmatic Team to support LCRs. The OCFO SID group has set up the MAX web portal to provide a shared location for IPA templates, an archive SRB document repository of programmatic documents created during earlier LCRs, and a current SRB repository for common file storage of project and SRB products used and developed during a SRB review.

MAX Site Link:

https://community.max.gov/display/NASA/Standing+Review+Board+%28SRB%29+Repository

Table 8: Available Templates

Template Name
IPA Briefing
IPA Report
Review Kickoff
Checkpoint Review
SRB Risk and Uncertainty
SRB Snapshot
Knowledge Management and Capture
ToR Project LCR Programmatic Section

Example BOE Assessment Criteria

Table 9: Example BOE Assessment Criteria

	Criteria	Green	Yellow	Red
Well Documented				
Existence of Formal BOE	Cost / budget / schedule are documented with a formal BOE	Existence of formal BOE that is "current"	No formal BOE but data exists or "outdated" BOE	No formal BOE or data delivered
Estimate Traceable	Cost & schedule estimates trace from BOE to budget.	BOE tracks to budget / estimate within acceptable rounding errors	BOE tracks to budget / estimate within 10%	BOE does not track to budget / estimate
Basis Traceable	Methodology & rationale provided & information is presented in traceable manner containing all supporting source documentation & technical data. Changes from previous estimates are tracked.	Fully traceable–tools, techniques, estimating methodology, and supporting data used to develop estimate is provided	Partially traceable–Methodology provided but lacks supporting details	Not traceable–no basis for calculations provided
Repeatable	Cost / budget / schedule estimates can be replicated by personnel from outside Agency or replacement personnel	Estimate can be replicated within acceptable rounding errors	Part of estimate can be replicated	Not enough information is provided to replicate estimate
Comprehensive				

	Criteria	Green	Yellow	Red
Scope	Well defined scope/baseline	Fully defined technical baseline/scope of effort	Partially defined technical baseline / scope, lacks details such as quantities and specific descriptions that include mass, dimensions, & power requirements as appropriate	Undefined technical baseline / scope
Complete	All ground rules, assumptions, rationale, and exclusions are included	All ground rules, assumptions, rationale, exclusions provided	Partial ground rules, assumptions, rationale, exclusions provided	No ground rules, assumptions, rationale, exclusions provided
Credible				
Error Free	Calculations are error free	Calculations are totally error free	Minor calculation error(s) without impacting outcome / plan	Significant calculation errors exist or not enough information provided to evaluate
Estimating Methodology	Estimating methodology / statistics applied properly	Estimating methodology and/or statistics are applied correctly	Improperly applied estimating methodology / statistics without impacting outcome	Improperly applied statistics / methodology impacting outcome or not enough information provided to evaluate
Cost Phasing	Estimate phasing explained and consistent with integrated master schedule	Estimate is phased, rationale for cost phasing provided, and phasing is consistent with integrated master schedule	Limited rationale for cost phasing and/or inconsistent with integrated master schedule	No rationale for cost phasing
Realism	Sound/realistic/ executable– judgments or rationale well justified. Appropriate analogies, CERs and schedule estimating relationships applied, Realistic assumptions.	Methodology and rationale well justified and source data supports estimate. UFE / reserves are expected to cover all known and unknown risks.	Methodology and rationale are partially justified. Estimating methodology and/or source data lacks applicability. UFE / reserves appear low.	Methodology & rationale not justified and / or not consistent with historical experience. No supporting source data provided. UFE calculations not performed or extremely low.
Discrete Risks	Discrete risk analysis of project's risk list is used to inform level of UFE / contingency/ reserves / margin	Risk list is quantitatively assessed (likelihood x consequence, expected value, or simulation) and linked to level of UFE / reserve / contingency / margin	Portion of risk list is assessed and applied or discrete risks are not linked to level of UFE / reserves	Risk list is not applied or linked to level of UFE / reserves
Estimating Uncertainty	Estimating uncertainty used to inform level of UFE / contingency / reserves / margin	Uncertainty is quantitatively assessed (expected value, simulation, S-curve) and linked to level of UFE / reserve / contingency / margin	Uncertainty is partially applied to some elements and/or not linked to level of UFE	Uncertainty not applied or linked to level of UFE / reserves

APPENDIX B: SRB PROGRAMMATIC TEAM PLANNING SCHEDULE

This appendix contains a typical planning schedule for Independent Programmatic Assessment.

Table 10: Example Planning Schedule

Activity/Schedule	Workflow SOPI	Reference Date	Description
SRB Approval Letter Signed	6.0	SR Start - 125 days	The Review Manager works the chair and team acceptance with the CAs. The approval letter is one vehicle for the official acceptance of the team. The ToR is the other. OCI/PCI clearance is determined prior to the members' approval. No member can work on SRB tasks until this letter is signed.
Complete SRB Independent Programmatic Assessment Training	6.1.1	SR Start – 120 days	The training focuses on the role of the analyst and IPA expectations
SRB Review Plan Signed	6.1.2	SR Start - 120 days	The SRB Review Plan is developed as a joint effort between the Review Manager and cost & schedule analysts. It is an integrated SRB Programmatic Team and Review Manager plan with a common schedule.
Terms of Reference (ToR) Signed	6.1.5-6, 9.0	SR Start - 110 days	The ToR defines the agreement between the Cost Analysts, SRB, and project. It defines the deliverables and evaluation criteria.
IPAP Developed	6.1.3	SR Start – 100 days	The Independent Programmatic Assessment Plan (IPAP) defines the SRB Programmatic Team roles, programmatic assessment plans, data drop delivery dates, and the schedule to complete the LCR.
Data Access	6.1.4-5	SR Start - 100 days	All available data will be collected from the project for preliminary analysis. Anything missing from the SRB's initial data request (Step 2, -115 days) shall be noted and delivered as soon as the Project has the data available. If the first set of data is not delivered on time, it will be reported to the SRB Chair and the SRB Programmatic Team Lead.
Review Project Schedule and Provide Feedback	6.2.2.3	SR Start - 80 days	The Schedule Analyst will provide the Project feedback about the schedule health check. Allow the project one week to fix any errors and provide an updated schedule.

Activity/Schedule	Workflow SOPI	Reference Date	Description
Data Drop (1)–Initial JCL Model Delivery	6.2.1	SR Start - 60 days	This is the second data drop from the project, which should include updated technical, cost, and schedule data drop, BOEs, risks, model delivery. Any new schedule performance data and/or programmatic data should be provided. If the project is doing a JCL, the initial model should be delivered. The project should present their BOE to the SRB, and provide preliminary data package supporting the JCL model.
IPA Overview Presentation to SRB	6.1.7	SR Start - 60 days	IPA overview presentation given to the SRB at SRB kick-off meeting.
Kick-Off Meeting	6.2	SR Start - (30 to 90) days	The SRB Chair gives the SRB team specific directions and task assignments. The schedule for future events and deliverables is presented. The Cost Analysts, Program Executive, mission directorate contact, TA and others provide the team with background information to anchor them in process and project status.
Readiness to Proceed	6.2.3.1	SR Start - (30 to 90) days	The SRB Chair gathers data from the project and compares it to the review's entrance criteria and expected maturity. The Chair makes an individual assessment of the readiness of the project to enter the review.
Touch-base with Project Cost/Schedule/Risk Team	6.2.3.4	SR Start - 60 days	The Programmatic Analysts will meet with the project cost/schedule/risk team to discuss project risks, how they map to both cost and schedule and how they potentially impact both cost and schedule.
SRB Risk Assessment Telecon	6.2.5	SR Start - 40 days	Initial telecom between all SRB members to discuss the project risks and any SRB-identified risks. This is the initial interaction of the SRB to discuss the risks so that each member can appropriately score each risk and provide the Programmatic Analysts with cost and schedule input for the integrated cost and schedule risk assessment.

Activity/Schedule	Workflow SOPI	Reference Date	Description
Initial SRB Risk Assessment	6.2.5	SR Start - 30 days	An initial independent risk assessment by the SRB is due to the Cost and Schedule Analysts. The SRB needs to identify and score (likelihood and consequence distribution) the risks, including SRB-identified risks, as well as project-identified risks. The SRB should also consider areas of cost and schedule uncertainty.
Data Drop (2)–Final JCL Model & Programmatic Updates Delivery	6.2.3	SR Start - 20 days	Final data drop from the project. If the project is doing a JCL, deliver the completed model. The project should present their final BOE to the SRB and provide a complete data package supporting the JCL model.
Updated SRB Risk Assessment	6.2.6	SR Start - 20 days	The SRB needs to identify and score (likelihood and consequence distribution) the risks, including SRB- and Project-identified risks. The SRB should also consider areas of cost and schedule uncertainty.
OCFO Checkpoint–Peer Review	6.2.7	SR Start - 7 days	SRB Programmatic Team will conduct peer review of IPA results to-date with OCFO. Provide SRB analysts suggestions with regards to the assessment (process driven, not product driven) and provide OCFO insight on current best practices, on-going programmatic issues, and programmatic review needs.
SRB Programmatic Team Status Briefing to SRB	6.3	SR Start - 5 days	A status briefing of IPA charts showing results to-date will be provided to the SRB by the SRB Programmatic Team.
Site Review Start	6.3.2	SR Start	The Site Review begins.
Site Review End	6.3.2	SR End	The Site Review is completed.
Present Final Analysis to SRB	6.3.6	SR End	Obtain any new risk information from the SRB learned at the Site Review (last day of the Site Review).
Snapshot Report	6.3.3	SR End + 2 days	The SRB Chair briefs, typically by telecon, the Cost Analysts on the SRB results.
Finalize IPA	6.3.5	SR End + 5 days	Incorporate any new risk information from the SRB learned at the Site Review.
Inform SRB Programmatic Team Lead of Any Updates	6.3.5	SR End + 7 days	Inform the SRB Programmatic Team Lead of any changes to the IPA from the Site Review and SRB assessment.

Activity/Schedule	Workflow SOPI	Reference Date	Description
Final IPA Findings to SRB Chair	6.3.5	SR End + 10 days	Final IPA findings are delivered to the SRB and Chair.
IPA Report Completed	6.3.7	SR End + 30 days	The IPA SRB final report is published.
CMC Briefing	6.3.8	Pre MDPMC	Brief the designated Center on the SRB results.
MDPMC Briefing	6.3.8	Pre APMC	Brief the sponsoring mission directorate on the SRB results.
Final Briefing Package due to APMC Executive	6.3.8	At least 7 days prior to APMC	Deliver the final and fully annotated briefing package, with cover letter, to the APMC Executive.
APMC Briefing	6.3.8	SR End < + 30 days	Brief the Agency PMC on the SRB results.
OCFO Checkpoint– Knowledge Management and Closeout	6.3.9	SR End + 30 days	SRB Programmatic Team document analysis lessons-learned, issues, and successes. Goal is to inform OCFO on how to prioritize programmatic improvement efforts. Lastly, conduct a completeness review on final products for archival purposes.

APPENDIX C: ACRONYMS

ABC	Agency Baseline Commitment
APARC	Advanced Programmatic Analysis and Research Capability
APL	Advanced Physics Laboratory
APMC	Agency Program Management Council
BOE	Basis of Estimate
CA	Convening Authority
CADRe	Cost Analysis Data Requirement
CDR	Critical Design Review
CEH	Cost Estimating Handbook
CMC	Center Management Council
CPM	Critical Path Method
CRM	Continuous Risk Management
DA	Decision Authority
DPMC	Division Program Management Council
EVM	Earned Value Management
FAR	Federal Acquisition Regulation
GSFC	Goddard Space Flight Center
ICE	Independent Cost Estimate
IMIR	Individual Member Independent Report
IMS	Integrated Master Schedule
IPA	Independent Programmatic Assessment
IPAP	Independent Programmatic Assessment Plan
JCL	Joint Confidence Level
JPL	Jet Propulsion Laboratory
KDP	Key Decision Point
LaRC	Langley Research Center

LCC	Life Cycle Cost
LCCE	Life Cycle Cost Estimate
LCR	LCR
MD	Mission Directorate
MDPMC	Mission Directorate Management Council
MDR	Mission Definition Review
MEL	Master Equipment List
MRR	Mission Readiness Review
NASA	National Aeronautics and Space Administration
NPD	NASA Policy Directive
NPR	NASA Procedural Requirement
OCE	Office of the Chief Engineer
OCFO	Office of the Chief Financial Officer
ORR	Operational Readiness Review
PDR	Preliminary Design Review
PE	Program Executive
PEL	Power Estimate List
PIR	Program Implementation Review
PM	Program or Project Manager
PMC	Program Management Council
POC	Point of Contact
PPBE	Planning, Programming, Budgeting, and Execution
PP&C	Program/project Planning and Control
RFA	Request for Action
RIDM	Risk Informed Decision Making
RMP	Risk Management Plan
S&MA	Safety & Mission Assurance
SBU	Sensitive But Unclassified

SDR	System Definition Review
SID	Strategic Investments Division
SIR	System Integration Review
SMH	Schedule Management Handbook
SPT	Standing Review Board (SRB) Programmatic Team
SRA	Schedule Risk Analysis
SRB	Standing Review Board
SRR	System Requirements Review
STAT	Schedule Test and Assessment Tool
ToR	Terms of Reference
TRL	Technology Readiness Level
UFE	Unallocated Future Expenses
WBS	Work Breakdown Structure