

**NSTX-U RECOVERY PROJECT
Risk Management Plan**

NSTX-U-PLAN-12-05

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SIGNATURE PAGE

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CHANGE LOG

Rev. #	Date	Change Description
0	January 2018	Initial Issue
1	December 2018	Reformatted risk register
2	January 2019	Changed Risk Management Board Membership and mitigation plan
3	February 2019	Added note for Monte Carlo analysis treatment of Level 3 risks, provided attachment with copy of risk entry worksheet, deleted Attachment 1
4	June 2019	Changed references to Deputy Project Manager to Risk Management Coordinator. Ensured consistency between RMP, RR and Acumen Risk with regards to Tables 4.1, 4.2, and 4.3 (Probability and Consequence Tables). Added section 4.9 for Uncertainty. Added typical confidence level that MC analysis is run at. Minor formatting changes. Added definitions and additional accountabilities for RACI.
5	August 2019	Updated Table 4.4 (one of the two 32's was colored red – changed to yellow).

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1.0 INTRODUCTION

The purpose of this document is to describe the Risk Management Plan for the NSTX-U Recovery Project. A disciplined risk management process will allow the Project team to forecast and manage risks before they become serious issues. When established, risk mitigation plans will support the Project team in performing informed decision-making, optimizing resource allocation and use, and coordinating trade studies against cost, schedule, and technical performance goals.

This plan provides a brief description of the risk management processes [risk (threat or opportunity) identification, risk analysis, risk handling, risk monitoring, and risk documentation] to be used in carrying out this important effort.

2.0 DEFINITIONS

Risk Events are the potential threat to (or opportunity of) achieving overall project objectives within defined cost, schedule, and technical constraints. Risk events have two components: the probability/likelihood of failing to achieve a particular outcome, and the consequences/impacts that results from failing to achieve that outcome.

Quantitative Risk Analysis is the process of simulating thousands of executions of the project, subject to the elicited risks, to draw conclusions about the project performance and risk severity based on the distribution of simulated project outcomes.

Uncertainty associated with the project is a condition of insufficient knowledge which may impact project objectives. Uncertainty strategies are employed to contain uncertainty and eliminate it when prudent.

Risk Management is the act or practice of dealing with risk. It includes planning for risk, assessing (identifying and analyzing) risk areas, developing risk-handling options, monitoring risks to determine how they have changed, and documenting the overall risk management program.

Risk Planning is the process of developing and documenting an organized, comprehensive, and interactive strategy and method for managing project risk. This includes identifying and tracking risk areas, developing risk handling plans, performing continuous risk assessments to determine how risks have changed, and assigning adequate resources. The result is the project Risk

Management Plan.

Risk Identification is the process of examining the project areas and each critical technical process to identify and document the potential risk events.

Risk Analysis is the process of examining each identified risk area or process to refine the description of the risk, isolate the cause, and determine the effects. It includes risk rating and prioritization in which risk events are defined in terms of their probability/likelihood of occurrence, severity of consequence/impact, and relationship to other risk areas or processes. Additionally, risk simulation is used to support contingency estimates.

Risk Mitigation Plan is the process that describes the actions taken to control an identified risk event by risk reduction (avoid/mitigate), transfer, or elimination. This includes the specifics on what should be done, when it should be accomplished, who is responsible, and the associated cost and schedule.

Risk Monitoring is the process that systematically tracks and evaluates the performance of risk-handling actions against established metrics throughout the acquisition process and develops further risk-handling options, as appropriate.

Risk Documentation is the process of recording, maintaining, and reporting the results of risk assessment, handling, and monitoring processes.

3.0 RESPONSIBILITY

The following RACI (Responsible, Accountable, Consulted and Informed) diagram depicts the risk management responsibilities throughout the organization.

Figure 3.1 NSTX-U Project RACI Diagram

	Project Management Team			Risk Mgmt Coordinator	Risk Owners	
	Project Director	Project Manager	Project Controls Mgr	Risk Mgmt Coordinator	APMs	COGS
Plan, organize, direct, and control the risk management process	I	I	A	R/A		
Authorize expenditure of resources to support approved risk handling plans	I	R				
Approves the Risk Management Plan and any future revisions	R/A	R/A				
Administer the risk management process		I		R/A	R	A
Serve as the overall Risk Management Coordinator		I		R/A		
Develop and maintain the Risk Management Plan		I	A	R/A		
Evaluate risk assessments, risk handling plans and risk monitoring results	I	I	A	A	R	
Develop and maintain the risk documentation			A	A		
Plan, organize, and direct monthly review process for project risk with Project Management Team and Risk Owners				A		
Assure that risk analyses results are appropriately handled, monitored, and documented	I	I	A	A	R	R
Perform risk assessment for their cognizant area of the project					A	R
Develop risk register documentation and mitigation strategies				A	A	R
Identify new risks, estimate probability of occurrence and determine impacts to the project	A	A	A	A	A	R
Implement risk mitigation plans		A			A	R
Conducts / Participate in monthly risk reviews	I	I	R	R	R	R
Regularly monitor and update risk registry		A		A	A	R

Legend

- A = Accountable - Individual ultimately answering for correctness/completeness
- R = Responsible – Individual responsible for completing the task
- R/A = Responsible/Accountable – Combination of both A and R
- I = Informed – Individual(s) updated on the status
- COGs = Cognizant Individual responsible for a work scope
- APMs = Associate Project Managers responsible for project management of assigned work scope

3.1 NSTX-U Recovery Project Management Team

- Composed of NSTX-U Recovery Project Director, Project Manager, Risk Management Coordinator, and Project Controls Manager.
- Review risk register on a monthly basis.

3.2 NSTX-U Recovery Project Risk Management Team

- Composed of NSTX-U Recovery Project Risk Management Coordinator, Project Control Manager, APMs, COGs, and others as assigned.
- Conduct formal risk reviews on a monthly basis.

4.0 RISK MANAGEMENT PROCESS

The Risk Management Process is a structured, formal, and disciplined approach focused on identifying, analyzing, making risk-informed decisions, integrating, tracking, reporting, and closing threats and opportunities. It includes maximizing the results of positive events and minimizing the consequences of adverse events. This process enhances the probability of project success by increasing the likelihood of improved project performance, thereby decreasing the likelihood of unanticipated cost overruns, schedule delays, and compromises in quality and safety.

4.1 Risk Planning

Risk Planning is the documentation of the formal program through the development of this RMP and associated procedures. The objective of this RMP is to present the program and methods necessary to identify, communicate, and handle both threats and opportunities, thus allowing program stakeholders to make informed decisions, and allocating resources accordingly.

4.2 Risk Identification

Risk Identification begins by compiling the risk events for the NSTX-U project. The Project Team should examine and identify project events by reducing them to a level of detail that permits an evaluator to understand the significance of any risk and identify its causes, i.e., risk drivers. This is a practical way of addressing the large and diverse

number of potential risks that often occur in projects. Risk events are best identified by examining each WBS product and process element in terms of the sources or areas of risk.

4.3 Risk Analysis

4.3.1 Risk Analysis is a systematic evaluation of identified risk events by determining the probability of occurrence and consequences, assigning a risk rating based on the established criteria, and prioritizing the risks.

4.3.2 The first step in the risk analysis process is to determine for each risk event the probability that the event will occur.

Table 4.1 Risk Probability Categories

LIKELIHOOD CATEGORY	DESCRIPTION	RANGE
VH	Very High	91 - 100%
H	High	76 - 90%
MH	Mod High	61- 75%
M	Moderate	51-60%
ML	Med Low	26-50%
L	Low	12 - 25%
VL	Very Low	3 - 11%
VVL	Very Very Low	1-2%
N	Null	≤1%

4.3.3 The next step in the risk analysis process is to determine for each risk event the magnitude of the consequence should the event occur. For the NSTX-U Recovery Project, consequences will be determined for both cost and schedule. The following tables provide a summary of cost and schedule consequence values used in this process.

Table 4.2 Cost Consequence Categories

COST CONSEQUENCE CATEGORY	DESCRIPTION	RANGE
VH	Very High	≥\$3M
H	High	<\$3M
MH	Mod High	<\$1.5M
M	Moderate	<\$1M
MM	Mod Mod	<\$750K
ML	Mod Low	<\$250K
L	Low	<\$100K
VL	Very Low	<\$10K
N	Null	\$0

Table 4.3 Schedule Consequence Categories

SCHEDULE CONSEQUENCE CATEGORY	DESCRIPTION	RANGE
VH	Very High	≥12 months
H	High	<12 months
MH	Mod High	<11 months
M	Moderate	<9 months
MM	Mod Mod	<6 months
ML	Mod Low	<3 months
L	Low	<1 month
VL	Very Low	<0.5 months
N	Null	0

4.3.4 Once the level of likelihood and the consequences of a risk event have been determined, a risk rating can be assigned to the risk event. This rating is a reflection of the severity of the risk and provides a starting point for the development of options to handle the risk. The vertical index represents the risk probability category while the horizontal index represents the highest value between the cost and schedule consequence.

Table 4.4 Risk Assessment Matrix (Risk Probability vs. Cost or Schedule Consequence)

Index	Null	Very Low	Low	Mod Low	Mod Mod	Mod	Mod High	High	Very High
Very High	9	18	27	36	45	54	63	72	81
High	8	16	24	32	40	48	56	64	72
Mod High	7	14	21	28	35	42	49	56	63
Moderate	6	12	18	24	30	36	42	48	54
Med Low	5	10	15	20	25	30	35	40	45
Low	4	8	12	16	20	24	28	32	36
Very Low	3	6	9	12	15	18	21	24	27
Very Very	2	4	6	8	10	12	14	16	18
Negligible	1	2	3	4	5	6	7	8	9

4.3.5 At this stage in the risk analysis, a risk rating has been established for each risk. Risks will be categorized using a three-level differentiation as follows:

- Level I will consist of the highest priority scores (greater than 32).
- Level II will consist of the second level of priority scores (16 to 32).
- Level III risks will consist of all remaining risks (less than 16)

4.4 Risk Handling

Risk handling plans and the allocation of risk management resources will be dictated by the ranking of the risk events.

4.4.1 There are four approaches to handling risk:

- **Accept:** An acknowledgment of the existence of a particular risk situation and a conscious decision to accept the associated level of risk without engaging in any special efforts to control it. This approach is most suited for those situations that have been classified as low risk.
- **Avoid:** A change in the concept, requirements, specifications, and/or practices that reduce risk to an acceptable level. Simply stated, it eliminates the sources of high or possibly moderate risk and replaces them with a lower risk solution and may be supported by a cost/benefit analysis.
- **Control (Mitigate):** Not an attempt to eliminate the source of the risk, but a plan to reduce or mitigate the risk event. It monitors and manages the risk in a manner that reduces the probability and/or impact of its occurrence or minimizes the effect of the risk on the project.
- **Transfer:** A risk response strategy that transfers the consequences of a risk to another party. Obtaining insurance is an example of transferring risk.

4.4.2 For all risk events, various handling techniques will be evaluated in terms of feasibility, expected effectiveness, cost and schedule implications, and the effect on the system's technical performance.

4.4.3 Risk mitigation plans identify the activities to reduce the probability of the occurrence of a particular risk and/or to minimize the adverse impact of the occurrence of a particular risk event. Each risk mitigation plan should consider:

- Assessment of risk/problem
- Consequence of risk occurrence
- Performance level (attribute) loss
- Schedule effect
- Cost effect
- Identification if other risk areas or handling plans may be impacted
- Alternatives considered with risk and cost of each as applicable
- Post-mitigation assessment of risk probability, cost and schedule after mitigation plan is in effect
- Criteria for closure of risk event/milestone

The risk mitigation plan will be loaded into the risk register.

4.5 Risk Monitoring

Risk Monitoring is the systematic tracking and evaluation of the progress and effectiveness of risk handling actions. By comparing the predicted results of planned actions with the results actually achieved, the need for any change in risk handling plans can be determined. All identified risks will be reassessed monthly with higher frequency, if required, for those rated Level I and Level II. Monitoring results may also provide a basis for developing additional risk handling options and identifying new risks.

- Level I and II risks will be monitored by executive project team in monthly meetings.
- Level III monitored by risk owners and reported upon quarterly.
- Typical Agenda for a monthly Risk Management Review:
 1. Overview of Current Level I and II risks and current status
 2. New risks added in last month and mitigation plan status
 3. Risks retired in last month
 4. Upcoming risk retirement in next month
 5. Net change in Risk contingency since last month

4.6 Quantitative Risk Analysis

Quantitative Risk Analysis is the process of simulating thousands of executions of the project, subject to the elicited risks, to draw conclusions about project performance and risk severity based on the distribution of simulated project outcomes. Quantitative risk assessments provide a more detailed, schedule-informed ranking of risks, relative to the qualitative risk assessment. Quantitative risk analysis consists of two sources of variance: estimation uncertainty and identified risks.

Inputs to quantitative risk analysis include the information collected during the risk identification process, estimation uncertainties, and the resource-loaded schedule. The inputs are analyzed using Deltek Acumen Risk, a Monte Carlo simulation tool that allows thousands of iterations of the project risk to be performed. During each iteration, the cost and schedule values for each risk are sampled from the elicited distributions. The Monte Carlo simulation is performed at an 80% confidence level. The outputs of the analysis are used to develop a listing of the project's top risks and a recommendation for project minimum contingency levels.

4.7 Risk Registry Document

The NSTX-U Recovery Risk Registry is a risk management tool for tracking project risks. It will be maintained to update status of currently identified risks and to provide status of newly identified risks. New risk items will be added to the Risk Registry after review with the Risk Management team. The Risk Registry is a dynamic document throughout the life of the Project and will be updated as required based on the addition or elimination of moderate and high risks.

4.8 Risk Entry Worksheet

The NSTX-U Risk Entry Worksheet is a tool used by the project to define a risk, quantify the potential impact to the program, suggest risk mitigation activities, and track the risk through closure. All of the inputs required to assess and manage a specific risk (threat or opportunity) are captured using this form. This form can be found in Attachment 1, and is required for all Level I risks, and preferred for Level II risks.

4.9 Control Account Uncertainty

Uncertainty ranges for each Control Account have been developed using two factors: (1) design maturity and (2) design complexity classification. These uncertainty ranges have been incorporated into the risk analysis (Acumen Risk software) and are included in the determination of contingency reserve minimum requirements. The uncertainty ranges for each Control Account are shown as a tab in the Risk Register.

Table 4.5: Control Account Design Maturity and Complexity

		Design Complexity					
Design Maturity		Low		Medium		High	
	Low	-15%	+25%	-20%	+40%	-30%	+60%
	Medium	-10%	+15%	-15%	+25%	-20%	+40%
	High	-5%	+10%	-10%	+15%	-15%	+25%

Design Maturity Definition

High Final design available. All design features/requirements well known. No further design development or evolution expected that will impact estimate.

Medium Preliminary design available. Some additional design evolution likely. Further developments can be somewhat expected or anticipated and reflected in estimate.

Low No better than conceptual design basis currently available. Design details, procedures, etc. still need much development and evolution of requirements beyond estimate basis is likely and expected.

Design Complexity Definition

Low Work is fairly-well understood - either standard construction or repetition of activities performed in past. Little likelihood of estimate not being well understood and requirements not being well-defined.

Medium More complex work requirements that have potential to impact cost and schedule estimates. Limited experience performing similar tasks, so ability to estimate accurately is somewhat suspect.

High Extremely challenging tasks and/or requirements. Unique or first of- a-kind assembly or work tasks. No good basis for estimating work exists so there is a high degree of estimate uncertainty. Based on standard industry and DOE estimate classifications (per AACE Recommendations).

ATTACHMENT 1

Risk Entry Worksheet used to capture inputs to Risk Process

NSTX-U Recovery Project Risk Entry Worksheet

Risk ID	WBS	Type	Status	Risk Owner

Risk Description		
At this time	...then there will be this technical consequence	...which impacts the Project in this way

Other Risk Areas Impacted	Impact

Pre-Mitigation				
Probability of Occurrence	Basis			
Cost Impact (\$M)				
Schedule Impact (Months)				
Mitigation Plan				
Other Alternatives Considered	Prob	Cost	Sch	Reason Not Selected
Risk Handling Approach				

Post-Mitigation					
Probability of Occurrence	Basis				
Cost Impact (\$M)					
Schedule Impact (Months)					

Retirement Date/Milestone	Criteria for Closure