

**Heavy Flavor Tracker  
(HFT)  
Draft Risk Management Plan  
Version 0.4**

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**HFT**  
**Project Risk Management Plan**

**Approved :**

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Flemming Videbaek  
Contractor Project Manager

Date: \_\_\_\_\_



## HFT RISK MANAGEMENT PLAN

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## **1. INTRODUCTION**

This document describes the Risk Management Plan for the HFT project and provides a structured and integrated process for identifying, evaluating, tracking, abating, and managing project risks in terms of three risk categories: cost, schedule, and technical performance. The management and mitigation of Environment, Safety, and Health (ES&H) risks are also very important and are identified in the HFT Preliminary Hazard Analysis Document, and are managed through Integrated Safety Management. Therefore this document does not focus on assurance of safety and environmental protection.

The key to successful risk management is awareness of potential risks and a deliberate approach to accepting, preventing, mitigating, or avoiding them. The HFT project becomes aware of potential risks in many ways, notably during work planning, meetings, reviews, and via lessons learned from experience. Routine meetings, such as weekly Project Management meetings, weekly WBS Level 2 system meetings, and monthly progress meetings provide important forums for identifying, discussing, and resolving key risk areas and developing and adopting mitigation plans. Risk is managed during the planning and design phase by implementing appropriate actions, such as ensuring adequate contingency and schedule float, pursuing multiple parallel approaches, and/or developing backup options. The Pixel, Intermediate Silicon Tracker (IST) and Silicon Strip Detector (SSD) design and construction subprojects of the HFT project are well within the experience and expertise of the Brookhaven, Lawrence Berkley and MIT technical staff and physicists who are participating. Every effort has been made to specify these projects in a manner that reduces the risk to an acceptably low level.

The technical risks facing the HFT Project that are identified will be managed as early as possible to assure that they do not derail the timely completion of the project or stress its budget in unexpected ways.

Because contingency is one of the major resources available to deal with problems arising during project execution, the management of cost, schedule and technical risks and the management of contingency are closely linked. Proactive risk identification and mitigation can therefore reduce pressure on contingency, by reducing the probability of unexpected events that could require contingency to resolve. Risk management of HFT project will implement maximizing the probabilities and consequences of positive events and minimizing the probabilities and consequences of adverse effects to project objectives.

## **2. RESPONSIBILITIES**

The Contractor Project Manager has responsibility for overall project risk management and managing contingency, consistent with the change control process and thresholds

described in the Project Execution Plan (PEP). The objectives are to maintain level 3 contingency conservatively commensurate with project risks through project completion, to ensure that the full project scope is achieved on schedule.

The Contractor Project Manager is responsible for:

- Developing the HFT Risk Management approach
- Performing a project (WBS Level 1) risk analysis of the potential risks identified by the WBS managers in their WBS Level 2 risk analysis
- Developing and executing risk mitigation strategies for the Project Level 1 risks
- Scheduling periodic reviews of project risks
- Assuring that the risk analyses results are appropriately documented, tracked, and closed in the HFT Project Risk registry
- Participating in the project's risk management process, including risk determinations and mitigations
- Approving, modifying, or assisting in HFT risk abatement strategies
- Chairing the HFT Risk Management Board

The HFT WBS Level 2 managers are responsible for:

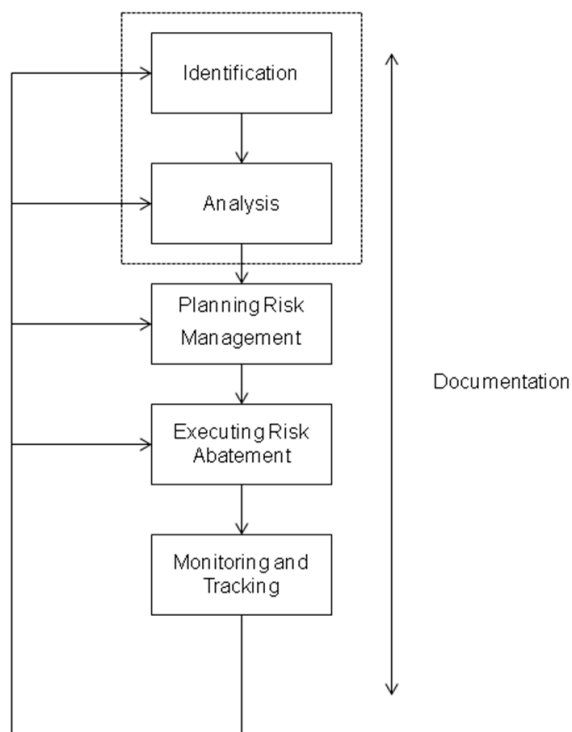
- Performing a risk analysis including identification of potential risks to the technical, cost, and schedule success of their WBS system, determining their likelihood of occurring, and estimating their potential impact on the project. This analysis is performed down to WBS level 3
- Developing and executing risk mitigation strategies for their Level 2 system
- Informing the Contractor Project Manager about the significant risks and the status of risk mitigation strategies in their WBS system
- Serving as a member of the HFT Risk Management Board

The HFT Risk Management Board (RMB) (Consisting of the Contractor Project Manager, Contractor Deputy Project Manager, Project Engineer, Level 2 Managers and experts from the collaboration as needed) is responsible for:

- Reviewing and recommending approval or modification of risk analyses and risk mitigation strategies, as requested by the Contractor Project Manager
- Assisting in the development of risk abatement strategies as needed

### **3. THE HFT RISK MANAGEMENT PROCESS**

The HFT Risk Management approach at both Level 1 and 2 consists of a five step process: (1) identifying potential project risk, (2) analyzing project risk (3) planning risk abatement strategies (4) executing risk abatement strategies and (5) monitoring and tracking the results and revising risk abatement strategies.



### 3.1 STEP 1: IDENTIFYING PROJECT RISK.

The HFT Risk Management process includes both bottoms-up and top-down risk identification. Level 2 managers evaluate potential subproject risks for each technical equipment item and subsystem that exceeds \$100K, is on or near the critical path, or poses a particular technical challenge. The Project Manager identifies Level 1 project risks that may not have been identified in any of the Level 2 risk analyses. A table of common risk areas has been included in Appendix A as a tool to assist HFT managers in identifying areas of project risk.

### 3.2 STEP 2: ANALYZING PROJECT RISK.

HFT project risks are analyzed by considering their likelihood or probability of occurring together with the impact to the project's technical performance, cost, and/or schedule baselines. Probability is assessed qualitatively in Table 2 as **Low, Moderate, and High**.

Impact relates to the potential consequence of the threat on cost, schedule, and/or the technical baselines. Each impact will be evaluated on these three aspects using the criteria and thresholds in Table 1. The highest (worst) impact determines the overall impact rating for the threat.

Based on the combination of probability and impact, risks are classified as high, moderate or low in accordance with the categorization provided in Table 2. Probability percentages in Table 2 are meant as qualitative guides, not as absolute thresholds.

**Table 1: Impact Assessment Matrix**

<b>Consequence</b> <b>Risk Area</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>
Cost:	≤ \$100K	≤\$250K	>\$250K
Schedule:	Delays Level 2 milestone or Project critical path by < 1 month	Delays Level 2 milestone or Project critical path by <4 months	Delays Level 2 milestone or Project critical path by >4 months
Technical:	Negligible, if any, degradation.	Significant technical/scope degradation.	Baseline scope or performance requirements will not be achieved.

**Table 2: Risk Classification Matrix**

	<b>Impact</b>		
<b>Probability</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>
<b>High (p &gt; 75%)</b>	Low	Moderate	High
<b>Moderate (25% p &lt; 75%)</b>	Low	Moderate	High
<b>Low (p &lt; 25%)</b>	Low	Low	Moderate

### 3.3 STEP 3: PLANNING RISK ABATEMENT STRATEGIES.

HFT WBS managers are responsible for developing appropriate risk abatement strategies to accept or mitigate Level 2 project risk. Note that some risks might be recognized too late for mitigation, or that time may run out for risk mitigation. Tables of common risk area and abatement strategies have been included in Appendix A as a tool to assist in addressing Level 1 and Level 2 project risks.

If a Level 2 manager identifies any risk item that is classified as moderate or high risk, then the risk analysis must be reported to the HFT Project Manager in documented form.



Low-risk items may be documented at the discretion of the WBS manager. The risk report should describe how the risk was classified, and include the analysis of risk level described in section 3.2, along with the risk abatement strategy preferred by the WBS manager. The strategy could propose simply to accept the risk and deal with it, if it materializes.

Upon receiving the documented risk notice, the HFT Project Manager will be responsible for accepting or rejecting the risk level and mitigation strategy being reported by the WBS manager and for deciding if the risk would benefit from additional review by the HFT Risk Management Board. The Risk Management Board will provide an objective and independent review of risk analyses and risk abatement strategies reported by HFT Level 2 manager, and recommend approval or modification of risk analyses and/or abatement strategies. The HFT Project Manager serves as the chairman of the Risk Management Board and is responsible for scheduling the review.

#### **3.4 STEP 4: EXECUTING RISK ABATEMENT STRATEGIES.**

The Level 2 manager is responsible for performing the work consistent with the plan for mitigating risk, and for keeping the HFT Project Manager informed of the status of the work, including its risk status. The status of all Moderate and High risk items will be maintained in the HFT Risk Registry, Document number 1112, and updated as appropriate.

#### **3.5 STEP 5: MONITORING AND REVISING RISK ABATEMENT STRATEGIES.**

Level 2 managers and HFT project management will monitor the performance of work vis-à-vis risk, evaluate the success of risk mitigation strategies, and address project risk issues on a continuing basis. Work plans and mitigation strategies will be adjusted continuously to take advantage of lessons learned and maximize the probability for successful project completion.

### **4. RISK ABATEMENT STRATEGIES FOR DIFFERENT RISK TYPES**

The three identified Risk types, Cost, Schedule, and Technical, all have different mitigation strategies that can be used to reduce or eliminate their consequences or probability of occurrence. In the following sections, the general outline for each case is discussed.

## 4.1 TECHNICAL RISK

Preparation of clear and concise specifications, judicious determination of subcontractor responsibility and approval of proposed lower tier sub-subcontractors, and implementation of QA provisions will minimize technical risk. Projects have been designed to further minimize technical risk by exploiting previous experience to the greatest extent possible, and minimizing exposure to single vendor failures.

Making deliberately conservative design choices, making use of proven designs, and carrying out extensive R&D, prototyping, and testing where new technologies are involved will be minimized technical risk throughout the Project. Moreover, institutional commitments will be carefully crafted within the subprojects in order to help ensure timely and successful completion of the Project.

## 4.2 COST RISK

Use of fixed-price subcontracts and competition will be maximized to reduce cost risk. Basis of Estimate (BOE) documentation will be generated to validate the quality of the project cost estimate. Cost performance will be tracked by Project Controls, with the use of contingency carefully monitored and approved through a change control process defined in the HFT Project Execution Plan.

## 4.3 SCHEDULE RISK

It is incumbent upon HFT to deliver hardware on a schedule compatible with the long term plans and goals for RHIC research, with the ongoing work at the STAR detector as well as planned RHIC Runs and Shutdown periods. For this reason, considering schedule risks is a top priority.

In general, schedule risk will be minimized via:

- Thorough testing, and prototype development
- Realistic planning based on actual data from producing similar components,
- Verification of subcontractor's credit and capacity during evaluation,
- Close surveillance of subcontractor performance,
- Advance expediting, and
- Incremental awards to multiple subcontractors when necessary to assure total quantity or required delivery.

Incentive subcontracts, such as fixed-price with incentive, will be considered when a reasonably firm basis for pricing does not exist or the nature of the requirement is such that the subcontractor's assumption of a degree of cost risk will provide a positive profit incentive for effective cost and/or schedule control and performance.

In addition, a resource loaded schedule will be generated and the Project will be tracked, with schedule changes carefully monitored and approved through a change control process defined in the HFT Project Execution Plan.

#### **4.4 CONTINGENCY ALLOWANCE AND SCHEDULE FLOAT**

The risk quantitative analysis will identify risk with both contingency allowance and schedule float. The effect on project contingency and float will be assessed after the mitigation strategies are in place.

### **5. RISK MANAGEMENT TOOLS AND PRACTICES**

#### **5.1 RISK MANAGEMENT REPOSITORY**

Risk assignments are associated to specific WBS entries down to Level 3. The WBS number will also serve as the Risk Index. This serves to emphasize the role of the Level 2 WBS manager in risk management. Risk information, including the probability and impact assessments and brief summaries of mitigation strategies, are stored in the HFT document repository.

#### **5.2 RISK “WATCHLIST”**

The Project Management Group will maintain a list of all activities assigned a risk severity of high or moderate in the Risk Registry. The list will include the status of the WBS activity, key risk-related dates, and the status of the various risk mitigation strategies. It will be used to identify the most important and/or timely risk items.

#### **5.3 INTEGRATION OF RISK MANAGEMENT WITH OTHER HFT ACTIVITIES**

Risk management is a line activity in HFT and, as such, will be a normal part of many activities and meetings. HFT management meetings will regularly include reports from Level 2 managers that will address risk-related issues.

## **APPENDIX A: RISK MANAGEMENT TOOLS**

**Table A-1: Common Risk Areas**

<b>Project Risk Areas</b>	<b>Significant risks</b>
<b>Facilities and Equipment</b>	Major equipment development Inadequate planning for long lead items and vendor support.
<b>Design</b>	Design relies on immature technologies or “exotic” materials to achieve performance objectives. Design not cost effective.
<b>Requirements</b>	Operational requirements not properly established or vaguely stated. Requirements are not stable. Requirements are too restrictive— cost risk.
<b>Testing/Evaluation/Simulation</b>	Test planning not initiated early in program (Initiation Phase). Testing does not address the ultimate operating environment. Test procedures don’t address all major performance and suitability specifications Facilities not available to accomplish specific tests, especially system-level tests. Insufficient time to test thoroughly. Project lacks proper tools and modeling and simulation capability to assess alternatives.
<b>Schedule</b>	Funding profile not stable from budget cycle to budget cycle. Schedule does not reflect realistic acquisition planning. Schedule objectives not realistic and attainable. Resources not available to meet schedule.
<b>Supplier Capabilities</b>	Inadequate supportability late in development, resulting in need for engineering changes, increased costs, and/or schedule delays. Restricted number of available vendors Restricted production capacity
<b>Cost</b>	Realistic cost objectives not established early. Funding profile does not match acquisition strategy.
<b>Technology</b>	Project depends on unproven technology for success with no alternatives. Project success depends on achieving advances in state-of-the-art technology. Potential advances in technology will result in less than optimal cost-effective system or make system components obsolete. Technology has not been demonstrated in required operating environment. Technology relies on complex hardware, software, or integration design.
<b>Management</b>	Acquisition strategy does not give adequate consideration to various essential elements, e.g., mission need, test and evaluation, technology, etc. Subordinate strategies and plans are not developed in a timely manner or based on the acquisition strategy. Proper mix (experience, skills, stability) of people not assigned to the project. Effective risk assessments not performed or results not understood and acted upon.

**Table A-2: Common Risk Abatement Strategies**

<b>HFT Project Risk Category</b>			
<b>Project Impact</b>	<b>High</b>	<b>Moderate</b>	<b>Low</b>
<b>Cost</b>	Closely monitor cost and spending Consider implementing phased procurements Obtain Multiple bottoms-up independent cost estimates Perform Value Engineering Visit Vendor Apply aggressive cost control	Closely monitor cost and spending Obtain at least two bottoms-up independent cost estimates	Quality controls applied as defined in the BNL Quality Management Plan
<b>Schedule</b>	Increase lead time substantially by initiating procurements 6-8 weeks early Visit Vendor Evaluate in-house procurement Contract incentives/penalties Maintain vendor oversight	Increase lead time by initiating procurements 2-4 weeks early Visit Vendor Evaluate in-house procurement Contract incentives/penalties Maintain vendor oversight Add additional vendors	Quality controls applied as defined in the BNL Quality Management Plan.
<b>Performance</b>	Perform major redesign Increase prototype cycles Evaluate alternate technology Request additional process control steps during fabrication Define extensive QA/acceptance testing Increase lead time/increase testing cycles	Moderate redesign as required Define QA/acceptance testing Increase prototype acceptance tests	Quality controls applied as defined in the BNL Quality Management Plan.

**APPENDIX B: RISK MANAGEMENT FORM**

	<b>HFT RISK FORM</b>	<b>WBS Number:</b>
		<b>Identified By:</b>
		<b>Date: Rev. Date:</b>
<b>Statement of Risk (with context):</b>		
<b>Risk Type (Cost, Schedule, Technical):</b>		
<b>Risk Impact (Low, Moderate, High):</b>		
<b>Probability of Occurrence (% , Low, Moderate, High – from Table 2 of HFT Risk Management Plan:</b>		
<b>Severity of Risk (Low, Moderate, High – from Table 2 of HFT Risk Management Plan):</b>		
<b>Other WBS items impacted by this risk item:</b>		
<b>Mitigation Strategy (consider different strategies to mitigate the risk and the required schedule for implementation):</b>		