Preliminary Project Execution Plan

Core Facility Revitalization (CFR) Project
Brookhaven National Laboratory

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by:
Brookhaven Science Associates

Preliminary Project Execution Plan

Core Facility Revitalization (CFR) Project

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CHANGE LOG

Rev. No.	Date	Change Description	Pages Modified
Rev. 0		Initial issue to support CD-1 approval.	N/A

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ACRONYMS AND ABBREVIATIONS

A/E	Architect/Engineer
ASCR	Advanced Scientific Computing Research
BCCB	Baseline Change Control Board
BCP	Baseline Change Proposal
BES	DOE Office of Basic Energy Sciences
BNL	Brookhaven National Laboratory
BSA	Brookhaven Science Associates
CD	Critical Decision
CFR	Core Facility Revitalization
CM	Construction Manager
CM/GC	Construction Manager/General Contractor
CPD	Contractor Project Director
CPM	Contractor Project Manager
DOE	Department of Energy
DOE HQ	Department of Energy Headquarters
EMS	Environmental Management System
ES&H	Environment, Safety and Health
ESH&Q	Environment, Safety, Health and Quality
EVMS	Earned Value Management System
FPD	Federal Project Director
FPSC	Fixed Price Subcontractor
FY	Fiscal Year
GC	General Contractor
HEP	DOE Office of High Energy Physics
IPR	Independent Project Review
IPT	Integrated Project Team
ISM	Integrated Safety Management
KPPs	Key Performance Parameters
LCCA	Life Cycle Cost Analysis
LEED	Leadership in Energy and Environmental Design
LHC	Large Hadron Collider
M&O	Management and Operating
MPO	Modernization Project Office
NEPA	National Environmental Policy Act
NP	DOE Office of Nuclear Physics
NSLS-II	National Synchrotron Light Source II
OMB	Office of Management and Budget
OMD	BHSO Operations Management Division

OSHA.....Occupational Safety and Health Act
PARS II.....Project Assessment and Reporting System
PED.....Project Engineering and Design
PEP.....Project Execution Plan
PHA.....Project Hazard Analysis
PD .....Project Director
PM.....Project Manager
PV .....Planned Value
QA.....Quality Assurance
RMP .....Risk Management Plan
SBMS.....Standards Based Management System
SC.....Office of Science
TEC.....Total Estimated Cost
TPC .....Total Project Cost
WBS.....Work Breakdown Structure

1.0 INTRODUCTION

This Preliminary Project Execution Plan (PPEP) identifies and summarizes the critical information and processes necessary to successfully manage, perform, control and execute the Core Facility Revitalization (CFR) Project. The PPEP defines the Project scope; describes the organizational framework and overall management systems; identifies roles and responsibilities of the project participants; describes the formal change control process by which the project scope, cost, schedule, and PEP may be revised; and establishes the stage in work progress at which the project shall be considered completed. Revisions will be documented through the configuration control change process.

The CFR project will be implemented in accordance with DOE Order 413.3B, "Program and Project Management for the Acquisition of Capital Assets". CD-0, Approve Mission Need, was approved September 1, 2015. The request for CD-1, Alternative Selection and Cost Range is scheduled for the fourth quarter of FY 2016. An Integrated Project Team (IPT), led by the Federal Project Director, will execute the project.

The Department of Energy (DOE) Office of Science (SC) Associate Deputy Director for Field Operations is the Project Management Executive (PME) for this project. Revisions to the PPEP that are required to incorporate baseline change actions and routine status updates are considered to be approved by virtue of the corresponding baseline change approval and will be issued by the Federal Project Director.

1.1 Project Background

Brookhaven National Laboratory (BNL) is a multi-purpose research institution funded primarily by SC that operates facilities for studies in physics, chemistry, biology, medicine, applied science, and a wide range of advanced technologies. Among BNL's core capabilities are: nuclear physics, particle physics, and large scale user facilities for advanced instrumentation. BNL also has programmatic strengths in data-centric and high-throughput "mid-scale" computational science, principally in support of the Relativistic Heavy Ion Collider (RHIC) and A Toroidal LHC Apparatus (ATLAS) programs. These capabilities and strengths support DOE's Strategic Objective 3 area of concentration with advanced scientific computing to analyze, model, simulate, and predict complex phenomena, including the scientific potential that exascale simulation and data will provide in the future. A significant amount of computation and data storage is currently conducted within the RHIC-ATLAS Computing Facility (RACF) that directly supports RHIC and US-ATLAS research operations. The RACF also provides mid-scale computing support to other research programs funded by SC, research efforts funded by Strategic Partners and computationally-intensive research that indirectly supports the broader SC mission.

The objective of this project is to provide the critical computational facilities and associated power and cooling infrastructure required to support the mission need identified in the approved CFR Mission Need Statement (MNS), September 2015. This MNS details the need to replace the functionally obsolete RHIC/ATLAS computing facility. The project shall also address the energy metering and power efficiency requirements of the OMB Data Center Optimization Initiative (DCOI).

1.2 Justification of Mission Need

A mission need exists to provide mid-range computational and data storage support to current and planned particle physics experiments using RHIC and the ATLAS detector at CERN (*Conseil Européen pour la Recherche Nucléaire*) that are funded by NP and HEP, respectively. Significant infrastructure in terms of space, power and cooling within the existing RACF are projected to degrade over time due to existing conditions and increasingly stringent operating standards for data centers. Capable, reliable and efficient computing facilities are required to support experiments that are expected to generate ever greater amounts of data that must be stored and analyzed. Additionally, the evolution of the technologies employed to deliver computation and data storage capabilities is expected to require higher levels of reliability and demand more robust infrastructure, such as space and utilities. These factors combine to effectively make almost half of the current computing and data storage facility functionally obsolete and unable to accommodate future generations of computation and data storage technologies. Therefore, the projected capability gaps in computing infrastructure are due to a combination of *decreases* due to degrading capacities and *increases* in future requirements of mid-scale computing performed by RACF.

The RACF currently occupies over 15,000 square feet of space in three rooms within Building 515 that was originally constructed in the 1960s and expanded in 2009. The existing RACF facilities and infrastructure have finite capacities in terms of processing (computer cores), storage (petabytes of tape data), server space (racks), and power (kilowatts of electricity). The existing RACF facility also has significant deficiencies due to its age, limited amount of usable area for data center equipment, rigid building configuration and marginally adequate power distribution and cooling systems.

Although the RACF is marginally adequate to meet current demands, the facility will be unable to meet future requirements in terms of capacity and reliability due to the evolution of technology and data center operating standards. The overall computing capacity of the RACF is expected to decrease over the next ten years, beginning in FY 2018 with significantly reduced capability after FY 2020. This overall reduction will be caused primarily by the limitations of Building 515 in terms of space and utilities, despite increases in computation power of new hardware. When server and tape storage equipment will be replaced at the end of their useful lives (approximately four years), the racks to accommodate new equipment will need to be reoriented with increased distances between them to enable the necessary cooling and to account for limitations of the existing floor structure. These adjustments in server rack spacing will result in a reduction of server rack capacity by approximately 50 percent from the current level.

The data volume generated by the RHIC experiments and ATLAS are expected to increase three to six times, which will require proportional increases in storage and compute capacities, over the next ten years. Furthermore, these increases in data storage and compute requirements will drive increased requirements for space, power and cooling of computing facilities. The existing capacity limitations and facility deficiencies will negatively impact the availability and reliability of computational support to NP and HEP funded research, and will result in significant infrastructure capacity gaps over the next five to ten years given projected future requirements. Failure to accommodate these projected increases will significantly impede mission readiness of

the RACF and will impose significant risks on research funded by NP and HEP, as well as other programs that may rely on BNL data storage and computational capabilities in the future.

Filling the programmatic capability gaps and infrastructure capacity gaps is consistent with the SLI program mission to support scientific and technological innovation at the SC laboratories by funding and sustaining mission-ready infrastructure and fostering safe and environmentally responsible operations. The SLI program conducted a Mission Validation Independent Review (MVIR) of the proposed mission need July 21-22, 2015. The MVIR committee consisted of representatives from NP, HEP, ASCR and other SC headquarters offices. The MVIR committee concluded that a mission need exists, and that the programmatic requirements are valid. In addition, the committee noted that uncertainty exists on computation data storage projections, and that reasonable cost and schedule ranges should account for the level of project definition. NP and HEP (as the primary beneficiaries of closing the capability gaps) concurred with this mission need.

2.0 PRELIMINARY PROJECT BASELINE

The preliminary technical scope as identified in this document forms the preliminary baseline for establishing the project's Key Performance Parameters (KPPs). The preliminary baseline will be further developed and evaluated prior to CD-2.

The technical scope at the conceptual design stage is the design and construction of new computing facilities with modern power and cooling capabilities to replace aging, unreliable, and physically inadequate facilities. The conceptual design effort has identified and documented the need for a new 2.4MW (IT Power) facility. The facility design shall include incremental power and cooling expansion capabilities as future needs are realized. The preliminary project baseline has been developed on the current version of the Conceptual Design Report (CDR) and current estimates of the construction cost and schedule.

2.1 Preliminary Scope Baseline

The scope of this project includes the design and construction of a new Computing Facility on the main BNL campus. The key elements of the scope are summarized in **Table 1** and graphically depicted in **Figure 1**. **Table 1** shows the Threshold and Objective values for the Preliminary Key Performance Parameters (KPPs). The Preliminary Threshold KPP comprises the minimum scope included in the project to fulfill the Mission Need. The Preliminary Objective KPP indicates potential project scope enhancements, consistent with the project's Mission Need, which could be executed if the Project experiences favorable cost and schedule performance. Where appropriate, potential scope enhancements (or deductions) will be designed and included in the construction bid packages as options. Any potential scope enhancements added to the project baseline will be incorporated in accordance with **Table 6**.

The planned IT power (available computing power) to be delivered to the new facility under the "day-one "scenario will be 2.4 MW. The new facility will meet or exceed High Performance and Sustainable Buildings (HPSB) Guiding Principles as outlined in DOE O 413.3B and comply with the Data Center Optimization Initiative metering and power usage guidelines. The new facility will be constructed within the core and shell of the recently decommissioned NSLS-I facility

(B725) at the heart of the main BNL campus, which will provide access to the BNL facilities and staff that will support the programs. A rendering of the current schematic floor plan for the CFR project is provided in **Figure 1** and the site plan is provided in Appendix A.

The existing spaces that currently house the RHIC and ATLAS computing programs will be vacated upon relocation into the new facility. BNL is studying the repurposing of these areas for less intensive laboratory support functions. Approximately 20,000 GSF of existing second floor office space at B725 shall be re-furbished and occupied by the research staff. Second floor refurbishment and all move-in activities is not part of this projects scope.

BNL will obtain the desired outcome when this scope is completed in accordance with design and construction subcontracts, the drawings and specifications (as verified and confirmed by inspection and a commissioning process), in a safe manner and within the approved schedule and cost baseline**.**

Table 1 – CFR Preliminary Key Performance Parameters (KPPs)

Description of Scope	Threshold Value	Objective Value
Deliver identified Computing Facility IT power and emergency back-up power/cooling capabilities	2.4 MW IT power, 1.2 MW emergency back-up capabilities	2.4 MW IT power, 2.4 MW emergency back-up capabilities

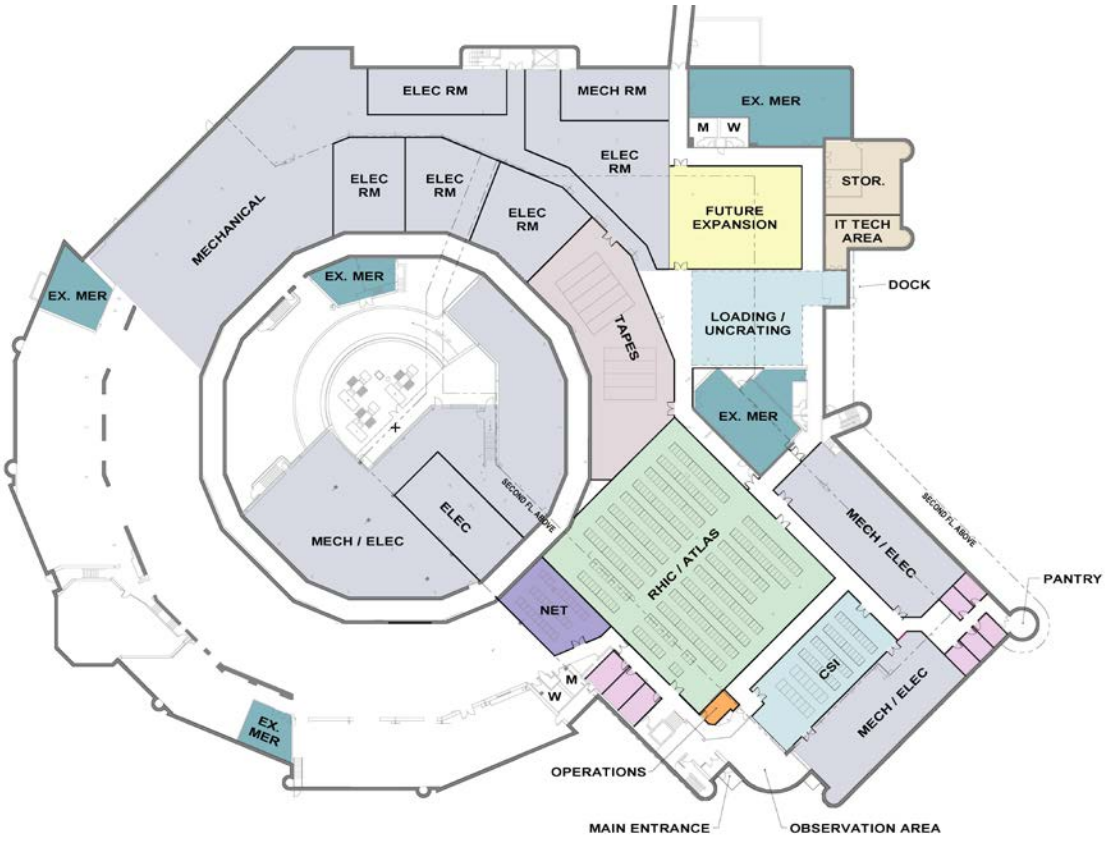


Figure 1 – CFR Preliminary Design Floor Plan

2.2 Preliminary Cost Baseline

The Preliminary Baseline Project Estimate (excluding contingency) for the recommended alternative is $55.85M to provide a scope of 2.4 MW IT power and 2.4 MW of emergency back-up capabilities. The contingency is $11.17M, which is approximately 20% of the current Estimate to Complete (ETC). The Project Estimate shall be updated and refined during Preliminary and Final design. The cost baseline will be established at CD-2. The Preliminary Total Estimated Cost (TEC) range is $63.6M to $76.6M. The estimated Preliminary Total Project Cost (TPC) range is $64.5M to $77.5M. All estimates include cost escalation to mid-point of construction (3 years).

Table 2 – Preliminary Project Cost Summary

Core Facility Revitilization (CFR) Project *Preliminary Cost Estimate - B725 Renovation Point Estimate*							
WBS Level 1	WBS Level 2	WBS Level 3	WBS Level 4	Description	in $K		in $K
1.0	**Core Facility Revitailzation**						
	1.01	**Project Design & Engineering**					**$5,140**
		1.01.01		A/E Preliminary & Final Design	**$4,217**		
		1.01.02		CM Pre-construction Services & ICE	**$220**		
		1.01.03		Project Commissioning - Pre-construction	**$75**		
		1.01.04		Project Management Pre-Construction	**$485**		
		1.01.05		BNL/MPO Engineering Support Pre-Construction Phase	**$143**		
	1.02	**Construction**					**$50,712**
		1.02.01		Site Preparation Activities	**$2,000**		
		1.02.02		CFR Construction - (18 Months)	**$44,034**		
		1.02.03		A/E Construction Administration Services	**$440**		
		1.02.04		Project Commissioning - Construction	**$200**		
		1.02.05		Project Management - Construction	**$1,425**		
		1.02.06		Project Support - Construction			
			1.02.06.01	BNL/MPO Engineering Support - Construction	**$230**		
			1.02.06.02	BNL Field Support - Construction	**$2,129**		
		Escalation - (Inclded in Const Est. @ 3% for 3 yrs.)					
		Subtotal					**$55,853**
		Total Project Contingency (20%)					**$11,171**
		Total Estimated Cost (TEC)					**$67,023**
	1.03	**Other Project Costs (OPC)**					
		1.03.01		Conceptual Design (BSA Cost)	**$850**		**$850**
		Total Line Item Project Cost (TPC)					**$67,873**

2.3 Preliminary Schedule Baseline

The preliminary projected CD-4 date is 4Q FY 2021 and includes approximately 12 months of schedule contingency plus the assumption of a 1 year FY17 Continuing Resolution. **Table 3** shows the key project milestones at Level 1, 2, and 3. The project will be managed with the goal of meeting the early finish schedule. Status, through the monthly EVMS updates from BNL to DOE, will be reported to the baseline milestones with forecasted late finish dates. The preliminary project schedule will be refined during the design stage and final baseline milestone dates will be established at CD-2.

Table 3 – Preliminary Milestones

Level	Milestone Description	Date
1	CD-0 Approve Mission Need	September 2015 (A)
1	CD-1 Approve Alternative Selection and Cost Range	4Q FY16
2	Award A/E Design Contract	1Q FY18
2	Award CM/GC Pre-construction Services – Phase 1	2Q FY18
2	Complete Preliminary Design (30%Documents)	3Q FY18
1	CD-2/3A Approve Performance Baseline / Start Early Site Preparation Activities	3Q FY18
2	Complete Final Design	1Q FY19
3	Start Site Preparation Activities	3Q FY18
1	CD-3 Approve Start of Construction	1Q FY19
3	Award CM/GC Construction Services – Phase 2	1Q FY19
2	Start Construction – Issue NTP	1Q FY19
2	Construction Substantially Complete	3Q FY20
1	CD-4 Approve Project Completion	4Q FY21

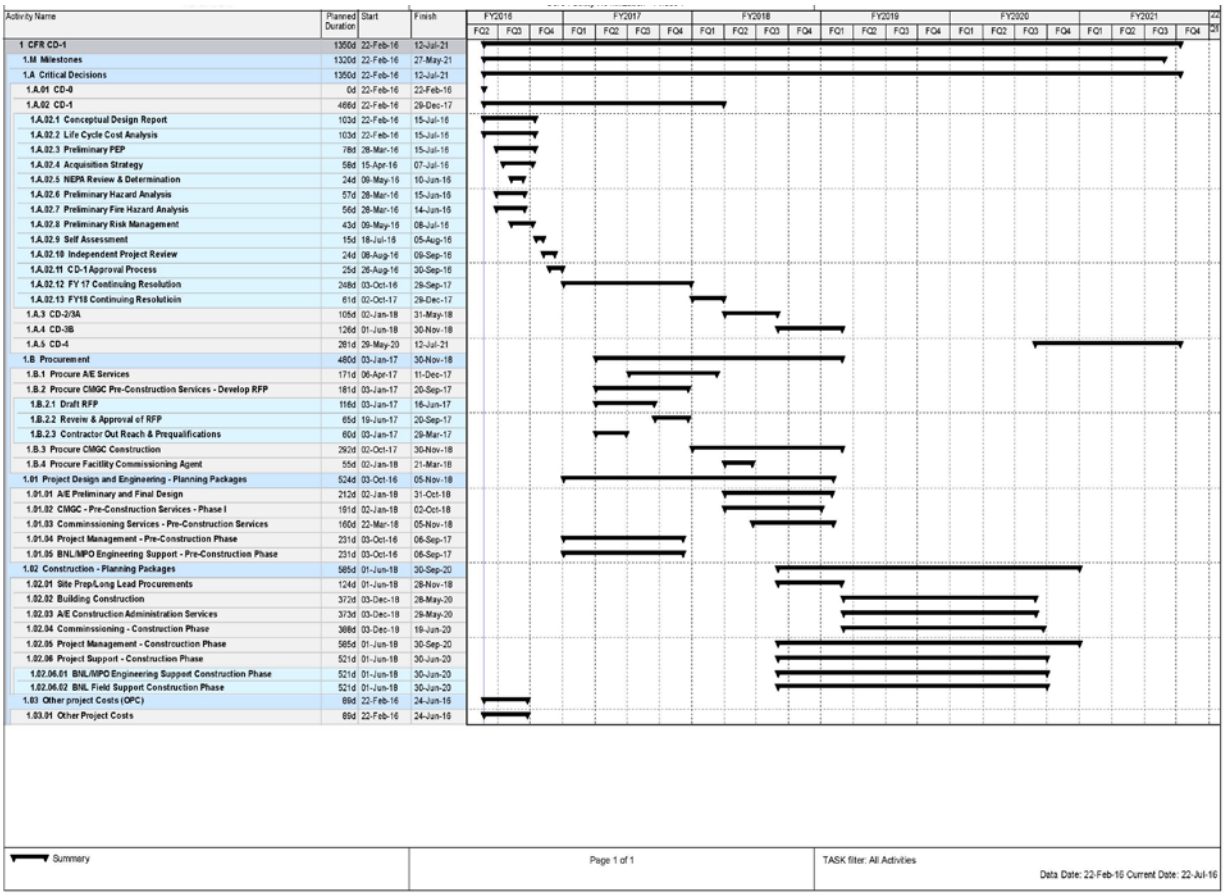


Figure 2 – Project Schedule

2.4 Preliminary Work Breakdown Structure (WBS)

The project has been organized into a Preliminary Work Breakdown Structure (WBS) for purposes of planning, managing, and reporting project activities. The project WBS is shown to Level 4 in **Table 2**. Work elements are defined to be consistent with discrete increments of project work and the planned method of execution.

WBS elements have been defined to Level 4 and are described in a written narrative and collected in a project WBS Dictionary. This denotes anticipated scope composition and intent and serves as a common reference for the project team. The WBS dictionary helps avoid work duplications or omissions.

2.5 Funding Profile

Table 4 shows the funding profile based on the optimum TPC, supported by the projects preliminary point estimate. The project is not baselined and the representative profile is for planning purposes only. The preliminary project schedule and preliminary milestone dates are based on receiving project funds in the Fiscal Years shown in **Table 3**. The preliminary baseline assumes a 12-month Continuing Resolution (CR) at the beginning of Fiscal Year 2017 and a 3 month CR each year after.

Table 4 – Preliminary Funding Profile ($K)

	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	Total
OPC*	***$850***					***$850***
TEC PED		***$1,800***	***$5,200***			***$7,000***
TEC Construction**			***$10,000***	***$30,000***	***$20,023***	***$60,023***
Total Project Cost***	***$850***	***$1,800***	***$15,200***	***$30,000***	***$20,023***	***$67,873***

NOTES:
This is a line item project with the baseline funding profile shown above.
* *Other Project Costs (OPC) includes Conceptual Design.*
** *Total Estimated Cost (TEC) Construction includes Preliminary and Final Designs, construction, project management, and other costs not captured in OPC.*
*** *Total Project Cost (TPC) includes TEC, PED, TEC Construction, and OPC*

3.0 LIFE CYCLE COST

A thorough alternatives analysis is provided in the project Acquisition Strategy and is summarized below. More details on these two alternatives can be found in the Acquisition Strategy.

The total life cycle costs of Alternatives 1, 2, and 3 were calculated and compared for cost effectiveness. The results are summarized below in **Table 5** and are detailed in the separate CFR Analysis of Alternatives and Life Cycle Cost Analysis calculations. The cost of Alternative 5 vs. in-house capabilities was also studied. Those results are also presented in the Analysis of Alternatives. While the cost of Alternative 1 is less than Alternatives 2 and 3, it does not satisfy the mission need or address the capability gaps. Alternative 4 was not considered for further evaluation.

Table 5 – Life Cycle Cost Analysis (LCCA) Results

	Alternative 1 Maintain Status Quo (Base Case)	**Alternative 2 Renovate Existing Facility**	**Alternative 3 Construct New Facility**
`	**$109,328,869**	**$125,182,303**	**$148,144,853**
Net Cost Savings	**N/A**	**-$15,853,434**	**-$38,815,984**
Meets Mission Need?	**No**	**Yes**	**Yes**

In order to test the sensitivity of the analysis to data uncertainty, this evaluation includes six scenario-based sensitivity analyses. The scenarios were defined using the professional judgment of the HDR analyst and are consistent with standard practices for cost-effectiveness analyses. The sensitivity analyses were performed using the financial analysis that was prepared by HDR. The sensitivity analysis compares Alternative 1 Status Quo (Do Nothing) to Alternative 2 Renovate Existing Facilities.

The objectives of the sensitivity analyses were to: (a) account for uncertainty in certain key parameters, and (b) determine a combination of the variables, which would result in the CFR Project being the most cost-effective. The details of the sensitivity analysis can be found in the Life Cycle Cost Analysis Report for the Project.

4.0 ACQUISITION APPROACH

After considering Lessons Learned on recent projects, FAR and DEAR procurement requirements, the technical aspects of the CFR project, project risks, and CFR project team member expertise, BNL is recommending a CM/GC project delivery method with best value procurement approach. Multiple national laboratory project teams have successfully utilized this approach with several recent projects.

The CM/GC project delivery method mitigates cost and schedule risk. Participation by the CM/GC in the design process will allow for consideration of scheduling issues in designing the project. The CM/GC will be involved in developing final cost and schedule estimates, and application of a construction management perspective to develop these estimates has proven to be valuable on previous SLI projects. The CM/GC can also provide input regarding the lead-time and price volatility of construction materials. Early involvement of a qualified CM/GC in the overall planning process assures that a high degree of construction management expertise can be brought to bear on the complex coordination of tasks involved in this Project. Additionally, the partnership environment and information sharing that can be developed among BNL, end users; the A/E, CM/GC and construction trade subcontractors can minimize the risk of delays due to changes and disputes during construction.

Architecture and Engineering Firm

The Architecture and Engineering (A/E) firm shall be selected under a best value source selection and will prepare the preliminary and final design, and construction documentation. The A/E will also provide construction administration support including submittal reviews, prepare responses to Requests for Information (RFIs), and field change resolution.

CM/GC Subcontractor

A CM/GC shall be selected under a best value source selection for a fixed-price CM/GC contract and will perform two major tasks (Phases). Phase 1 is under contract and is for preconstruction CM/GC support services during the design phase. The CM/GC services to be provided during the design phase include constructability reviews, developing an independent cost estimate and schedule, performing feasibility studies and pre-qualification and recommendation for award of construction subcontractors. Phase 2 will be for construction performed by the CM/GC acting as the fixed price General Contractor and for managing and administering all construction activities and subcontracts for the Project.

5.0 TAILORING STRATEGY

DOE Order 413.3B provides options for tailoring of CDs for projects. The CFR Project will propose a CD-2/3A to facilitate the start of early site preparation activities. Activities may include hazardous material remediation, procurement of long lead HVAC and electrical equipment, and/or existing facility roof replacement.

6.0 BASELINE CHANGE CONTROL

The goals of the Baseline Change Control process are to:

- Recognize and predict change
- Evaluate and understand the impacts of each change
- Identify and control consequences of those changes
- Prevent unauthorized or unintended deviations from approved baselines
- Ensure each change is dispositioned at the proper management level

The CFR Project will control changes in the scope, schedule and cost baseline through a baseline change control process. This is the process for identification, evaluation, approval and incorporation of project changes into the approved performance baseline. A Baseline Change Proposal (BCP) identifies the change and will be submitted when a change is identified that will impact the project performance baseline parameters for cost, schedule or scope. Thresholds for determining the BCP approval level that do not modify the Performance Baseline are delineated in **Table 6**.

Any Level 2 and above BCP will be reviewed by the CFR Project Baseline Change Control Board (BCCB) prior to submittal for approval. The BCCB will include the BHSO Federal Project Director (Chairperson), CFR Project Director, CFR Project Manager, and other IPT members as required (e.g., the Conventional Facilities Manager, ESH&Q Manager, or a representative from the A/E firm if appropriate). The Chairperson dispositions (i.e., approves or rejects) Level 2 BCPs and either recommends approval of all deviations and Level 1 BCPs to DOE HQ or rejects them. All approved Level 1 and 2 BCPs will be transmitted to the DOE Program Manager. All BCPs submitted to the BCCB must be recommended for approval by the CFR Project Director. Level 3 BCPs, including use of management reserve, are approved by the CFR Project Director with copies provided to the Federal Project Director.

The FPD will communicate directed changes to the CFR Project Director, who will prepare a BCP. Upon approval, the baselines will be modified to reflect the scope, cost, and schedule impacts of the directed change.

The CFR Project Manager is responsible for the administrative operation and coordination of the overall baseline change control system in support of all CFR Project participants. This responsibility includes initial review and administrative processing of all CFR BCPs and maintenance of the contingency and management reserve log. This begins upon receipt of a draft BCP from the change advocate and continues through the various reviews. The CFR Project Manager is responsible for implementing approved technical, cost/budget, and schedule/milestone baseline changes in the official CFR project baseline documents and files.

Table 6 – Preliminary Change Control Table for Line Item Projects with TPC of Less than $100M

	Deputy Director for Science Programs Level 0	**Project Management Executive Level 1**	**Federal Project Director Level 2**	**M&O Contractor Project Director Level 3**
Scope	Any change in scope and/or performance that affect the ability to satisfy the mission need or meet the Threshold KPP	Any change to the Objective KPPs as defined in PEP Section 2.1, **Table 1**	Any addition to scope as described in PEP Section 2.1 beyond a Threshold KPP or Any major change to Level 3 WBS component in **Table 2**	Any change to Level 3 WBS component in **Table 2**
Cost	Any increase in TPC, TEC, or OPC of the Project in **Table 4**	Any single usage of contingency of ≥$2M or Cumulative contingency usage above $8M	Use of contingency in increments of < $2M, cumulative contingency usage up to $8M	Any increase to budgeted amount of a Level 3 WBS component
Schedule	Any delay in CD-4 (project completion) date in **Table 3**	Any change to a Level 1 milestone in **Table 3** (except CD-4) or any change to a level 2 milestone greater than 3 months	Any change to a Level 2 milestone in **Table 3**	Any change to a Level 3 milestone in **Table 3**
Funding	Any change to the funding profile in **Table 4** that will adversely impact the Performance Baseline	N/A	N/A	N/A

7.0 MANAGEMENT STRUCTURE AND INTEGRATED PROJECT TEAM

This section presents the organizational structure and roles and responsibilities for project participants of the project. **Figure 3** depicts the CFR Project organization.

7.1 Department of Energy, Office of Science Headquarters

Associate Deputy Director for Field Operations

The SC Associate Deputy Director for Field Operations will serve as the Project Management Executive (PME). The key responsibilities of the PME are:

- Approves Critical Decisions.
- Ensures the FPD appointed to a project is qualified and has appropriate communication and leadership skills prior to designation.
- Approves the Acquisition Strategy and PEP, and IPT Charter.
- Conducts monthly or quarterly project reporting/meetings.
- Delegates approval authority for baseline changes.
- Initiates definition of mission need and objectives of the Project.
- Approves PME Level 1 baseline changes.
- Initiates formal periodic reviews of the Project.
- Provide HQ technical guidance and resources to the FPD and Program Manager.
- Provides funding for the construction and operation of the facility.

SLI Program Manager, Office of Operations Program Management

The SLI Program Manager within OPM will report to the PME. The SLI Program Manager serves as the primary interface between the FPD and the PME. The Program Manager's role and responsibilities are:

- Functions as DOE-Headquarters (DOE-HQ) point-of-contact for Project matters.
- Serves as the representative in communicating the interests of the SLI program.
- Coordinates with the FPD, IPT, other SC staff offices, and DOE-HQ program offices, as needed, to execute the Project.
- Assists with budget formulation.
- Reviews formal project documents (MNS, AS, PEPs, IPT Charter, etc.) and recommends changes and/or approval.
- Review project progress reports and deliverables and concurs with FPD monthly assessments in PARSIIe.
- Supports formal periodic reviews of the Project including SC Office of Project Assessment (OPA) Independent Project Reviews (IPRs) and tracks issues to resolution.
- Oversees development of project definition, scope, and budget.
- Prepares, defends, and provides the project budget with support from the field and SC Headquarters organizations.
- Reviews and provides recommendations to the PME consistent with the baseline change control process.
- Develops project performance measures, and monitors and evaluates project performance throughout the life cycle of the Project.

- Ensures that Environment Safety & Health (ES&H) requirements are implemented by the Project.
- Coordinates with other SC offices and the DOE Office of Acquisition and Project Management as needed to execute the Project.

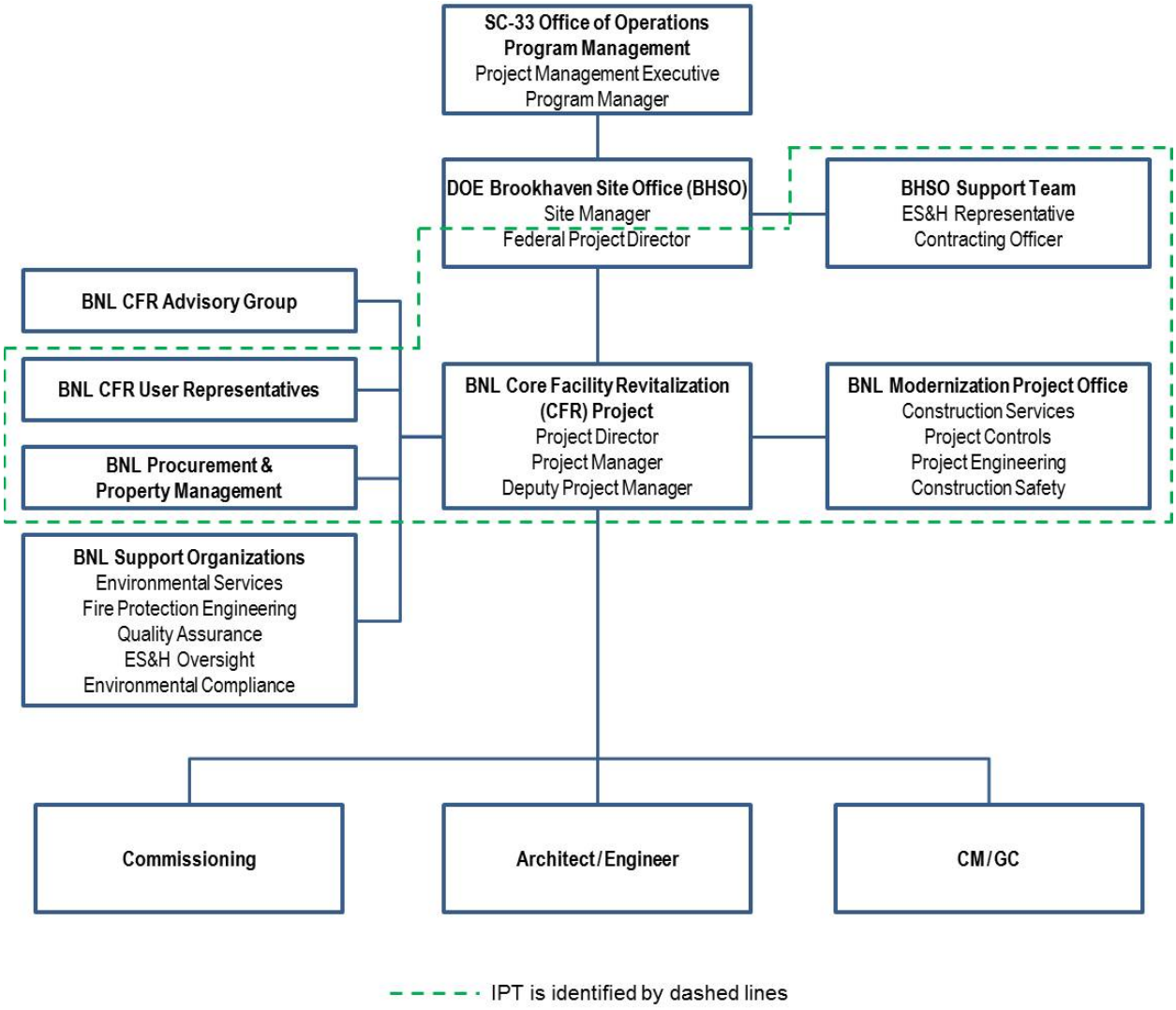


Figure 3 – CFR Project Organization Chart

7.2 Integrated Project Team

The IPT is part of the CFR Project Organization and is indicated by the light blue dotted line in **Figure 3**. Only certain members of the DOE Support Team, the User Representatives and the BNL Project Team are members of the IPT. The IPT Charter in Appendix B outlines the composition of the IPT and the roles and responsibilities of each member. The IPT Charter is a living document and will be updated as necessary.

The FPD will be the primary point of contact with the SLI Program Manager for coordination and submittal of CD documentation. The FPD will also routinely contact the SLI Program

Manager to communicate project status and discuss issues or concerns. The IPT will solicit from the SLI Program Manager on institutional developments that may affect project performance. For CD approvals and project reviews, it may be necessary for the FPD to interface with other DOE Headquarters organizations. However, the SLI Program Manager will be the point of contact for interfaces between the IPT and organizations within SC and external to the IPT.

The DOE Support Team consists of the BHSO staff assigned to the project. Specific roles and responsibilities of the DOE Support Team assigned to the IPT are described in the IPT Charter.

Interface with BNL management and affected personnel will be necessary for coordination with site activities that may impact project performance or where project activities may have broader site impacts. These interfaces will be necessary for planning and implementing a well-organized project. The BNL Project Director will be the primary IPT point of contact for day-to-day interfaces with both the FPD and BNL management, and will also obtain input for coordination of project activities from various stakeholder groups.

7.3 Federal Project Director – DOE Brookhaven Site Office

The BHSO reports to SC Deputy Director for Field Operations and administers the M&O contract and day-to-day oversight of BNL. Overseeing the execution of the CFR Project is the responsibility of the FPD. The FPD will lead the IPT and will be the primary point of contact for communication and coordination with entities external to the IPT. The FPD is responsible, with the assistance of the IPT members, for the following tasks:

- Serves as the single point of contact between Federal and contractor staff for all matters relating to the project and its performance.
- Prepares and maintain the IPT Charter and operating guidance with IPT support and ensure the IPT is properly staffed. Define and oversee the roles and responsibilities of each IPT member.
- Leads the IPT and provide broad program guidance. Delegates appropriate decision-making authority to the IPT members.
- Appointed as the Contracting Officer's Technical Representative, as determined by the Contracting Officer.
- Ensures development and implementation of key project documentation.
- Defines project cost, schedule, performance, and scope baselines.
- Ensures design, construction, environmental, safety, security, health and quality efforts performed comply with the contract, public law, regulations and Executive Orders.
- Submits monthly status reports to DOE-HQ in PARS-IIe.
- Evaluate and verify reported progress; make projections of progress and identify trends.
- Approves (in coordination with the Contracting Officer) changes in compliance with the approved change control process documented or referenced in the PEP.
- Plan, implement, and complete the Project using a systems engineering approach.
- Tailor DOE project management requirements to the Project.
- Oversee development and implementation of the Acquisition Strategy and the Project Execution Plan.
- Ensure timely completion and quality of required project documentation.
- Assess contractor project performance versus contract requirements.

- Proactively identify and resolve critical issues within Federal control.
- Integrate and manage the timely delivery of government reviews, approvals, property, services, and information.

7.4 Project Director – BNL

The CFR Project will be executed by a BNL team that is headed by the BNL Project Director. The BNL Project Director has established a project organization to accomplish the Project which includes the Project Manager, engineering support, ES&H, Quality Assurance (QA), construction oversight and safety, procurement, project controls, and finance personnel. The BNL Project Director provides senior management oversight and approves changes in accordance with the approved change control process. The Project Director is the primary point of contact with all user representatives.

7.5 Project Manager – BNL

The BNL Project Manager is responsible for the design, construction, testing, and turnover to operations of the Project. The BNL Project Manager will:

- Manage day-to-day execution of the Project at BNL.
- Manage and supervise project personnel, the A/E Firm, the CM/GC and various consultants.
- Establish technical and administrative controls to ensure the Project is executed within approved cost, schedule, and technical scope.
- Implement an Earned Value Management System (EVMS) to track performance against the approved Project baseline.
- Ensure ES&H responsibilities and requirements are integrated into the Project.
- Participate in management meetings and communicate the Project status and issues.
- Identify and manage project risks and conduct the risk register review meetings
- Monitor expenditures and review invoices.
- Prepare and provide recommendations for baseline change control proposals.
- Manage project cost and schedule.
- Submits Monthly Reports to the Project FPD.

The BNL Deputy Project Manager is responsible for assisting the Project Manager with the design, construction, testing, and turnover to operations of the Project.

7.6 Procurement Representative – Member of the BNL Project Team

A representative from BNL Procurement provides subcontract administration and contractual support. The procurement representative will:

- Solicit sources and administer subcontracts.
- Assist in source selection.
- Direct preparation of Requests for Proposal.
- Perform price and cost analysis.
- Ensure all contractual provisions are approved and met. Negotiate terms, recommend award of subcontract and prepare necessary justification documentation.

- Prepare subcontract modification changes in scope of work, funding and schedules.
- Recommend resolution of disputes and subcontractor claims.
- Upon completion perform subcontract closeout.

7.7 Environment, Safety, and Health Representative(s) – Member of the BNL Project Team

The ES&H Team Lead will:

- Ensure ES&H resources are available for project activities.

The ES&H Deputy Team Lead will coordinate all ES&H technical aspects including:

- Ensure ES&H programs are fully integrated into the Project
- Work with the IPT and ES&H to identify and document all ES&H requirements and best practices are incorporated into the Project.
- Coordinate the ES&H review and approval of the design documents, involving ES&H staff as needed.
- Participate in the oversight of project activities involving ES&H staff during all phases of the project.
- Provide advice and support to the IPT on continuous improvement of ES&H items throughout the Project.
- Review the CM/GC and construction subcontractor safety plans.
- Provide guidance and support to the project team in the areas of ES&H to include, but not limited to, participation in the review of project documentation, oversight of contractor activities in the ES&H areas including project walkthroughs and assessments.

7.8 Integrated Project Team Members

The IPT members will:

- Support the FPD.
- Develop project contracting strategies.
- Ensure project interfaces are identified, defined, and managed to completion.
- Identify, define, and manage to completion the project environmental, safety, health, security, and quality assurance requirements.
- Identify and define appropriate and adequate project technical scope, schedule, and cost parameters.
- Perform periodic reviews and assessments of project performance and status against established performance parameters, baselines, milestones, and deliverables.
- Plan and participate in project reviews, audits, and appraisals as necessary.
- Assist in preparation of Critical Decision packages.
- Review and comment on project deliverables (e.g., drawings, specifications, procurement, and construction packages).
- Review change requests as appropriate and support Change Control Boards as requested.
- Participate, as required, in Readiness reviews.
- Support preparation, review, and approval of project completion and closeout documentation.

7.9 User Representatives

User Representatives from the RHIC and ATLAS Computing Programs will provide technical guidance on their programming requirements for the Project and will continue to serve as technical advisors through project completion. User Representatives will:

- Represent the interests of all program groups and occupants of the buildings.
- Participate in project meetings and communication planning.
- Participate in project design reviews as well as value engineering sessions.
- Ensure ES&H operational requirements are integrated into the Project.
- Participate in risk assessment meetings.

7.10 BNL Modernization Project Office

- Perform periodic reviews and assessments of the Project to ensure that it is executed within approved cost, schedule, and technical scope.
- Execute Readiness to Operate assessments, including pre-review of all CD submittals and all status reviews by SLI.
- Provide periodic assurance that project earned value management data conforms to BNL's certified EVMS.
- The Project will provide monthly status updates to the MPO.

7.11 CFR Advisory Committee

BNL established an Advisory Committee for the Project consisting of representation from BNL Energy and Utilities, Information and Technology Division, BNL Strategic Site Planning, the User Representatives, the Project Manager, the Project Director, and Integrated Facility Management (IFM) Complex Manager. The Committee provided input to the development and planning for the CFR Project. This committee was and will be called on, as necessary, to review various high level aspects of the CFR Project.

7.12 Commissioning Agent

The third party Commissioning Agent (CxA) will prepare the preliminary and final commissioning plans and required documents. The CA will also provide construction support including submittal reviews, preparing RFI responses, and field change resolution as required. The CA will participate in final inspections and certification of applicable work and prepare the final commissioning report upon completion of all construction activities. They will maintain a log of all work and tasks identified in the commissioning plan.

7.13 BNL Construction Manager/Site Supervisor

A construction manager will be included in the project team prior to construction and will be responsible for interfacing the construction efforts with the BNL processes including coordinating penetration permits, LOTO permits, hot work permits, utility shutdowns, commissioning, and the inspection/testing. The construction manager will also provide safety oversight on the project and will participate in the Project Hazard Analysis (PHA) process, as well as take an active role in the safety plan of the day meeting. The construction manager will maintain daily logs and field notes for the duration of the construction.

7.14 BNL Safety Engineer

A safety engineer will be included in the project team prior to construction and will be responsible for safety oversight of all construction activities. The safety engineer will provide safety inspections and issue safety deficiency notices, as necessary, and work with the construction manager and project manager to proactively plan safe work practices into all construction efforts.

7.15 Architecture and Engineering (A/E) Design Firm

The A/E design firm will prepare the preliminary and final design and construction documents. The A/E will also provide construction administration support including submittal reviews, preparing RFI responses, and field change resolution.

7.16 CM/GC

A Construction Manager/General Contractor (CM/GC) will perform two phases of work for the Project. Phase 1 will consist of pre-construction management support services during the preliminary design, final design and bid phases. Duties during this phase include constructability reviews, developing independent cost and schedules, performing feasibility studies, develop logistics plans, develop an energization plan, perform outreach to the subcontractor community to develop interest in the Project, and to conduct the subcontractor bid process including pre-qualification and recommendation of award of construction subcontractors. Phase 2 will consist of managing the overall construction process, entering into and administering subcontracts with trades, vendors and suppliers to deliver portions of the Project, and may self-perform portions of the work.

8.0 PROJECT MANAGEMENT/OVERSIGHT

8.1 Risk Management

BNL developed a preliminary Risk Management Plan (RMP) to provide a comprehensive overview of how risk will be managed throughout the life of the Project. The RMP will be updated for the CD-2 review. It serves as a guideline and communication tool for management, IPT members, and DOE-SC. The objective of this plan is to identify and manage project related risks such that there is acceptable, minimal impact on the project's cost and schedule as well as on the facility's performance.

The scope of the RMP includes establishing the process for analyzing and managing risk as well as developing and maintaining a Risk Registry. The RMP describes the roles and responsibilities of project personnel and defines reporting and tracking requirements for updates to the Risk Registry.

The IPT has identified the preliminary potential risk areas of all phases of the Project, analyzed the probability and level of each risk, assigned potential costs and schedule impacts and developed a risk handling plan and approach for each credible risk. These risks were analyzed using Monte Carlo techniques to determine the summary cost and schedule impact anticipated on the Project. The results are documented in the Preliminary Risk Registry.

Established design practices and construction materials and methods will be utilized for the Project, thereby making the associated cost and schedule risks manageable. Technical aspects of the Project are generally straightforward. All required equipment and material are readily available. Scope, schedule, and cost baselines will be closely monitored and controlled by the Federal Project Director, the BNL Project Director and the BNL Project Manager.

The major Project risks are listed in a summary form in **Table 7** and potential mitigation strategies are also shown.

Table 7 – Preliminary Risk Planning and Mitigation

Risk	Mitigation Measure
User generated scope changes during construction (cost and Schedule)	Rigorous project controls, value engineering and pre-construction design reviews. Establish scope creep contingency in both schedule and cost. Control changes through change control board. Detailed review and approval of proposed changes.
Increasing construction cost escalation rates (cost)	The project has been estimated using an annual escalation rate of 3% per year to mid-point of construction. The project is also currently carrying a 20% contingency at the low range and 25% at the high range. BNL will continue to monitor local construction market trends as the project progresses to CD-2. CM/GC will provide pre-construction estimating services.
Existing environmental contamination – Dispersible lead dusts (cost and schedule)	BNL has conducted thorough characterization of the existing contamination within the facility. Ongoing review and development of remediation plans is in progress and will be updated at CD-2
Continuing resolution(s) and delay in FY17/18 Funding (schedule)	Funding in FY17/18 is critical for the completion of the construction on the planned schedule. Project has planned for a 12-month CR in FY17 and a 3-month FY18 CR. Will continue to monitor closely with the program.
Limited competition and subcontractor availability (cost and schedule)	CM/GC to provide outreach to stimulate project recognition in the subcontractor community. CM/GC is the preferred procurement methodology to obtain adequate subcontractor participation in the bid process and facilitate early recognition of labor availability issues.

8.2 Project Reporting and Communication Management Plan

A Communications Management Plan has been prepared for the project and is maintained as a living document.

On a monthly basis, the Project Controls personnel will work with the project Control Account Managers (CAMs) to confirm status of the baseline activities, update the estimate at completion, enter cost information into a draft report and submit that report to the Project Management team for review and approval. Project overviews will be prepared and the significant variances analyzed and actions taken to mitigate as necessary. The draft report will be reviewed at the monthly status meetings. The approved report will be published to the team and distributed as appropriate.

The status of the Project will be presented to the BNL Chief Operating Officer and the Project Management Office on a monthly basis. This BNL status review will address the project progress against the Baseline, the key project issues, the financial and EVMS status, the current risks and mitigations, and bring up any issue that the IPT and/or Project Director believes appropriate.

The progress of the Project will be presented to the RHIC/ATLAS Programs at pivotal points, such as key design and construction milestones. The Project Director will also present project status and progress periodically to BNL personnel external to the CFR Project Organization, the CFR Advisory Committee, and other groups as appropriate.

The FPD will formally report project status and progress to the SLI Program Manager monthly through the Monthly Status Sheet, monthly to DOE HQ through PARS-IIe, and quarterly to the PME through the SLI Program Quarterly Project Review (QPR).

8.3 Earned Value Management System

The Project Manager is responsible and accountable for management of the project's scope, schedule and budget. Earned value analysis will be performed and reported on a monthly basis. Details of the BNL certified earned value implementation requirements and processes are outlined in BNL-EVMS SBMS *Earned Value Management System Description*. DOE-funded projects at BNL are executed under the requirements of DOE Order 413.3B, Program and Project Management for the Acquisition of Capital Assets.

The BNL-EVMS complies with the American National Standards Institute (ANSI)/Electronic Industries Alliance (EIA) Standard 748C (2013), Earned Value Management Systems. The ANSI/EIA-748C standard is industry best practice, and DOE's standard for EVMS. The BNL-EVMS meets the requirements of Office of Management and Budget Circular No. A–11 (2003), Part 7, Section 300—Planning, Budgeting, Acquisition, and Management of Capital Assets. The BNL-EVMS is a key component of the organization, methods, and procedures adopted by BNL to ensure that its mission and functions are properly executed

Project status update meetings will be held monthly. A monthly status report will be sent to BNL Management and the FPD. The overall project performance will be documented in the FPD's Monthly Status Sheet to the SLI Program and Quarterly Project Report and presented to the Project Management Executive (PME) in Quarterly Project Reviews. The monthly meetings will concentrate on project details and discuss specific project issues, problems and corrective

actions, while the quarterly review includes a high-level summary of all schedule and cost data for the quarter, which will be used to evaluate current progress compared to scheduled progress. Corrective actions for any variances will be included in the report.

Technical performance will be monitored throughout the Project to assure conformance to approved project requirements. Design reviews, inspections, and performance testing of completed systems will be used to ensure that the facility meets all project requirements. Project controls encompass the activities which support project management and cost and schedule performance management.

The project controls specialist provides the Project Director and the Project Manager with subject matter expertise, maintains the project management system and baseline, assembles cost and schedule performance data from the Control Account Managers, and interfaces with project team control account managers (CAMs) to affect a coordinated effort. Earned Value status will be reported by the project controls specialist using PARS IIe.

The CM/GC will submit a schedule and schedule-of-values (SOV) for approval by the Project Manager. The Construction Schedule will be updated monthly. The CM/GC will submit monthly a draft invoice against the SOV for validation by the BNL Construction Manager based on construction progress verified by BNL inspectors.

At a minimum, the current project schedule will be updated monthly. The Project Controls personnel will collect activity progress data. Actual start dates will be recorded for activities that started since the last update. Likewise, actual finish dates will be recorded for activities that were completed since the last update in addition to any new forecast dates. The CAM will evaluate the progress of the activities they are responsible for, utilizing the earned value technique as approved in the Control Account Plan / Work Authorization.

On a monthly basis, the CAM shall review the Estimate-at-Completion (EAC) for the elements of his or her control account. If, in the judgment of the CAM, the current EAC does not accurately reflect the forecasted total cost for the work in the control account, the CAM will update the estimate and submit it to Project Controls. These updates will be reviewed and approved by the Project Director. CAMs will include in the EAC any cost variances to date as well as estimates for known pending changes and mitigation of known risks.

8.4 Project Reviews

The IPT anticipates having project reviews in accordance with the guidance provided in DOE G 413.3-9. Due to the relative low risk associated with this type of construction, the IPT anticipates that reviews will be primarily confined to event-driven or decision-driven point type reviews, occurring primarily in advance of CD approvals. The following event-driven reviews are anticipated for the Project:

- Independent Project Reviews (IPRs) [Prior to CD-1, CD-2/3A, CD-3B, and CD-4].
- Annual SLI Peer Review(s) [After CD-3].
- BNL internal reviews by the BNL Modernization Project Office (MPO) at a frequency determined by senior BNL Management.
- Independent Design reviews for preliminary, conceptual, and final designs.

Several other types of project reviews may be conducted in order to evaluate various aspects of the Project. Such reviews may include such items as validating project progress, staffing, contracting plans, safety plans and contractor issues.

The scope of this project includes the design and construction using commercially available technologies. No new technologies are required to complete this project. The IPT will assess engineering and technology readiness through independent design reviews, BNL internal reviews, IPRs, and other independent technical reviews.

8.5 Alternatives Analysis and Selection

An analysis of alternatives and the selected alternative is described in the Acquisition Strategy and summarized below. The analysis of alternatives considered the following five (5) alternatives:

Alternative 1 – Maintain the Status Quo or "Do Nothing"

Alternative 2 – Renovate Existing Facilities at BNL

Alternative 3 – Construct a New Building at BNL (Line Item Funding)

Alternative 4 – Construct a New Building at BNL (Alternative Financing)

Alternative 5 – Establish Capability at Another Location/Cloud Computing Services

The total life cycle costs of Alternatives 1, 2, and 3 were calculated and compared for cost effectiveness. The results are summarized in **Table 5** and are detailed in the separate CFR Analysis of Alternatives and Life Cycle Cost Analysis calculations. The cost of Alternative 5 vs. in-house capabilities was also studied. Those results are also presented in the Analysis of Alternatives. While the cost of Alternative 1 is less than Alternatives 2 and 3, it does not satisfy the mission need or address the capability gaps. Alternative 4 was not considered for further evaluation.

Alternative 2, renovate B725 is the preferred and recommended alternative. The recommendation is based on the evaluation of the quantitative data produced by Life Cycle Cost Analysis and other operational factors considered by both BNL Management and the Program Leadership that will populate the new computing facility.

8.6 Environment, Safety and Health

Integrated Safety Management Plan

Proposed project work will be performed in accordance with the BNL operating Contract (DE-AC02-98CH10886) clause I.86, which implements DEAR Clause 970.5223-1 – Integration of Environment, Safety, and Health into Work Planning and Execution (Dec 2000) and 10 CFR 851. BNL utilizes its Standards Based Management System (SBMS), which is an integrated system of Management Systems, Program Descriptions Subject Areas and Manuals, and Facility Use Agreements, to implement Integrated Safety Management (ISM) and its Worker Safety and Health Program required by10 CFR 851. The ISM and Worker Safety and Health Program

Descriptions describes BNL's approach to integrating Environment, Safety, Health, and Quality (ESH&Q) requirements into the processes for planning and conducting work at the Laboratory. Subcontractors will be required to demonstrate both safety philosophy and practices through binding subcontract language.

Each stage of project development, from conceptual design through operational turnover, has and will continue to reiterate the ISM functions: (1) define the work and identify the potential hazards; (2) analyze potential hazards and design the facility or activities to appropriately mitigate those hazards; (3) develop operational controls for hazards that cannot be eliminated through design features; (4) perform the construction and operate the facility in accordance with prescribed limits and procedures; and (5) review the effectiveness of the analyses performed previously and the controls and practices implemented, then provide feedback for improvement.

Safety through design will be a primary driver throughout the design phases of this project. Through management commitment and leadership, safety in the conduct of activities will continue as fundamental drivers through construction and turnover of the completed facility.

Following the transition to operations, the operation and maintenance of the completed facility and installed equipment will become part of the existing BNL line management responsibilities.

Hazards Analysis Report (HAR)

A Preliminary Hazards Analysis Report (PHAR) has been developed for this project and will serve as the basis for design safety criteria, remedial action needs, unique and routine construction ES&H requirements, and facility startup ES&H requirements. As design efforts continue, the Hazard Analysis Report (HAR) will be updated as needed.

Not every ES&H hazard can be addressed through design alone; therefore, hazards must be identified, evaluated, and controlled at every operation and operational sub-task level. Phase Hazard Analysis (PHA) by responsible supervision and crafts will be required of construction personnel. For construction subcontractors, these task- and job-specific hazard analyses are contractual requirements.

Subcontracting and Oversight

BNL's ISM requirements are flowed down to its construction subcontractors. BNL will employ a performance based procurement policy that includes ES&H performance as a critical qualification parameter to assure that subcontractors meet or exceed these requirements. Subcontractors must have a safety record with demonstrated performance in similar construction activities. Their management team must have a strong commitment to the safety program, in particular in applying the principles and core functions of ISM, to assure outstanding worker and ES&H and safety performance. Subcontractor management is held accountable for the safety performance of their workers, and will be responsible for ensuring all work is done safely.

Due to the size and complexity of the Project, the CM/GC will provide ES&H oversight of the construction subcontractors. The CM/GC ES&H professionals will have the authority to assist subcontractor management in the enforcement of subcontract agreement safety requirements.

Environmental Requirements

The project complies with all requirements of the National Environmental Policy Act (NEPA) and its implementing regulations (10 CFR 1021 and 40 CFR 1500–1508). This action has been reviewed and determined to meet the requirements for a Categorical Exclusion (CX) determination and the CX was issued in June 2016. All environmental issues identified will be responsibly and economically addressed. No amendments are expected to be required for the existing site air and ground discharge permits. The facilities are existing and no environmental issues have been identified to date that would significantly impact the execution of this project. The environmental risk is low.

BNL has an Environmental Management System (EMS) certified to ISO 14001. Construction subcontracts flow down requirements from the EMS. Oversight of construction activities will be conducted by BSA to ensure subcontractors are in compliance with EMS requirements. Throughout construction, environmentally sensitive construction practices will be followed to reduce site disturbance, minimize construction waste, and improve indoor air quality. The RSL-II construction will include a construction waste management plan and a construction Indoor Air Quality Management Plan. Waste management requirements will include recycling and waste minimization actions.

Prevention by Design

The AE will incorporate the following features to enhance facility safety:

- Segregation of computational and mechanical space with appropriate fire rated construction
- Deployment of Emergency-Power-Off (EPO) switches
- Locating technician workstations and storage facilities outside the data center floor areas
- Providing visual transparency into the data center areas and a central control room
- Inclusion of the dedicated mechanical spaces with appropriate sound deadening materials for noise control
- Building exits from both floors (Levels 1 and 2) directly to grade
- Separation of personnel access points and service entrance/delivery points

The safety features also include eyewash/safety showers, fire/life safety systems and layouts, electrical design that limits the available arc flash energy, safe access to equipment for operations and maintenance, lightening protection, egress lighting and emergency power for safe egress from the building during a power outage.

8.7 Safeguards and Security

The initial security requirements for this project have been coordinated with BNL Laboratory Protection Division.

Security needs of this project are adequately covered by the existing BNL site security plan. The project scope has been coordinated with the site security office, and there are no additional site wide technical security issues or laboratory safeguards required to be incorporated into the design or construction activities, or changed for operations. The facilities are low-hazard, non-nuclear facilities. Building specific security requirements will be defined during the designed

process. Access to and from the job site for design or construction activities will be controlled by the BSA's security forces and the BNL Contractor/Vendor Training and Processing System, which includes minimum training requirements and a contractor database to monitor contractor egress and debarment status. None of the work that will be performed is deemed classified. Potential requirements due to heightened levels in security and commensurate restrictions on work and access to the site would be mitigated using administrative controls.

BNL access requirements and procedures will be written into project subcontract documents and will be followed by all project personnel accessing the site. The subcontractor will be required to fence the project site for both safety and security considerations. Safeguards and security risks are low for this project.

8.8 Systems Engineering

A System Engineering Approach will be utilized for all phases of the design. A clearly defined mission or problem will be established through the development of a User Requirements Document. The requirements will be reviewed at each stage to ensure the integrity of the requirements is maintained. Risks will be managed through the process defined in the RMP to ensure informed decision-making. A quality assurance process will verify that products and services meet customer needs. The goal of the system engineering approach is to transform user operational requirements into system architecture, performance parameters and design details.

8.9 Value Management

The IPT will follow value management/Engineering principles in accordance with the guidance in OMB Circular A-131 during all phases of the Project.

8.10 Value Engineering

Value Engineering is a continual process. A Value Engineering (VE) assessment was conducted during the conceptual design phase. Additional exercises shall be conducted during the schematic design phase, and on the 30% Design Development deliverable. VE assessments will be performed during the final design phases as required. Alternative design approaches, construction techniques and materials, as well as the flexibility of the design, will be evaluated and incorporated into the project design as appropriate.

8.11 Configuration Management/Document Control

Documents defining the configuration of the project baseline will be maintained through a formal change process, with each issue of the document receiving a revision number and obtaining signature approvals. Documents that will be under configuration management for this Project consist of the following:

- Critical Decision Record Documents
- Project Execution Plan
- Acquisition Strategy
- Approved Baseline Changes (through the BCP process)
- Hazard Analysis Report
- Transition to Operations Plan
- Design Documents

8.12 Quality Assurance and Testing and Evaluation

Quality Assurance (QA) at BNL is implemented through SBMS as outlined in the Quality Management System and Quality Assurance Program Description. SBMS Subject Areas (e.g. Engineering Design) and organizational implementing procedures and manuals (e.g., Facilities and Operations Directorate procedures, Procurement Operations Manual, etc.) will be utilized for project development, design, procurement and construction to ensure that all safety, operational, and subcontract requirements are met.

Design reviews will include the consideration of reliability, maintainability, and operability to ensure that the development of systems that are reliable, safe, easy to operate and are maintainable. The building and systems will be inspected during construction to ensure that the building is constructed accurately based on the approved specifications and drawings. In addition, an independent commissioning agent will test the operation of building systems to ensure accurate operations based on the design.

8.13 Transition to Operations

Final Inspection and Acceptance

Upon completion of work, BSA shall evaluate the Project-related facilities, equipment, and systems via the Beneficial Occupancy Readiness Evaluation (BORE) process outlined in the Readiness Evaluations Subject Area in the BNL SBMS. Beneficial occupancy may occur prior to the completion of all of the commissioning and punch list items provided all building life safety systems are tested and operational.

The following items are accomplished by the Project Team and the A/E, working together:

- Equipment testing and training/operational instruction of BNL personnel.
- Preliminary inspection and list of incomplete work.
- Final inspection walk-through and punch list.
- Inspection of corrective actions and completion work (punch list work).
- Inventory of all operational manuals, instructions, and guarantees/warrantees.

Commissioning

A Third Party Commissioning Agent (CxA) will work with the A/E, Project Manager, Maintenance and Operations staff, the CM/GC, and pertinent subcontractors to coordinate:

- Equipment pre-start check, start up, testing and balancing.
- Fine tuning systems for proper coordination between systems and for efficient operation under all anticipated conditions.
- Operational instruction and assembly of the Operations and Maintenance manuals.

The CxA will be engaged to review design documents to ascertain performance and operational test requirements for all major building systems. A commissioning plan to test and evaluate system performance both individually and collectively against approved design criteria will be prepared. Functional performance tests will be established and all designated systems will be tested against the performance criteria. Results will be recorded, and corrective actions initiated when required.

Construction Completion

Construction completion will be defined initially as Substantial Completion (the work is complete and in accordance with the subcontract except only for completion of minor items which do not impair BNL's ability to occupy and fully utilize the building for its intended purpose, then as Final Completion (the work is fully complete without exception). Internal approval for occupancy will occur when the work is approved by BNL's Beneficial Occupancy Readiness Evaluation (BORE) processes. BORE Team members to include Fire Protection Engineer, ES&H Representative SMEs, Client Representatives, Facility Complex Representatives, and Project Manager. Internal approval for occupancy is required for CD-4. Certain project activities may follow CD-4 such as the final Commissioning Report and final transition to operations activities. Move-in and population of the facility will follow the internal approval for occupancy.

Start of Operations

When inspection, acceptance, and commissioning have been completed and the DOE PME has approved CD-4, the Project will be transferred to the operational phase.

Lessons Learned

In preparation for the CFR project, the IPT has reviewed lessons learned from the RSL-II and ISB-I projects at BNL and will continue to utilize these lessons learned through the design, construction procurement, construction and transition to operations phases.

During the Project, lessons learned will be recorded and a lessons learned report will be submitted into PARS IIe. At the conclusion of the Project, the BNL Project Manager will analyze these lessons learned and review them with the IPT. The results of this review will be distributed through BNL Facilities & Operations and the BNL Modernization Project Office and included in the Project Close-Out Report.

8.14 Project Closeout

- After CD-4, BNL audits all charges to ensure that all costs are in proper accounts.
- BNL sends the cost closing statement to the Federal Project Director for authorization to close.
- BHSO closes the Project authorization and submits to DOE Headquarters.
- A Project Closeout Report will developed and submitted into PARS IIe.

8.15 Freeze the Footprint/Reduce the Footprint

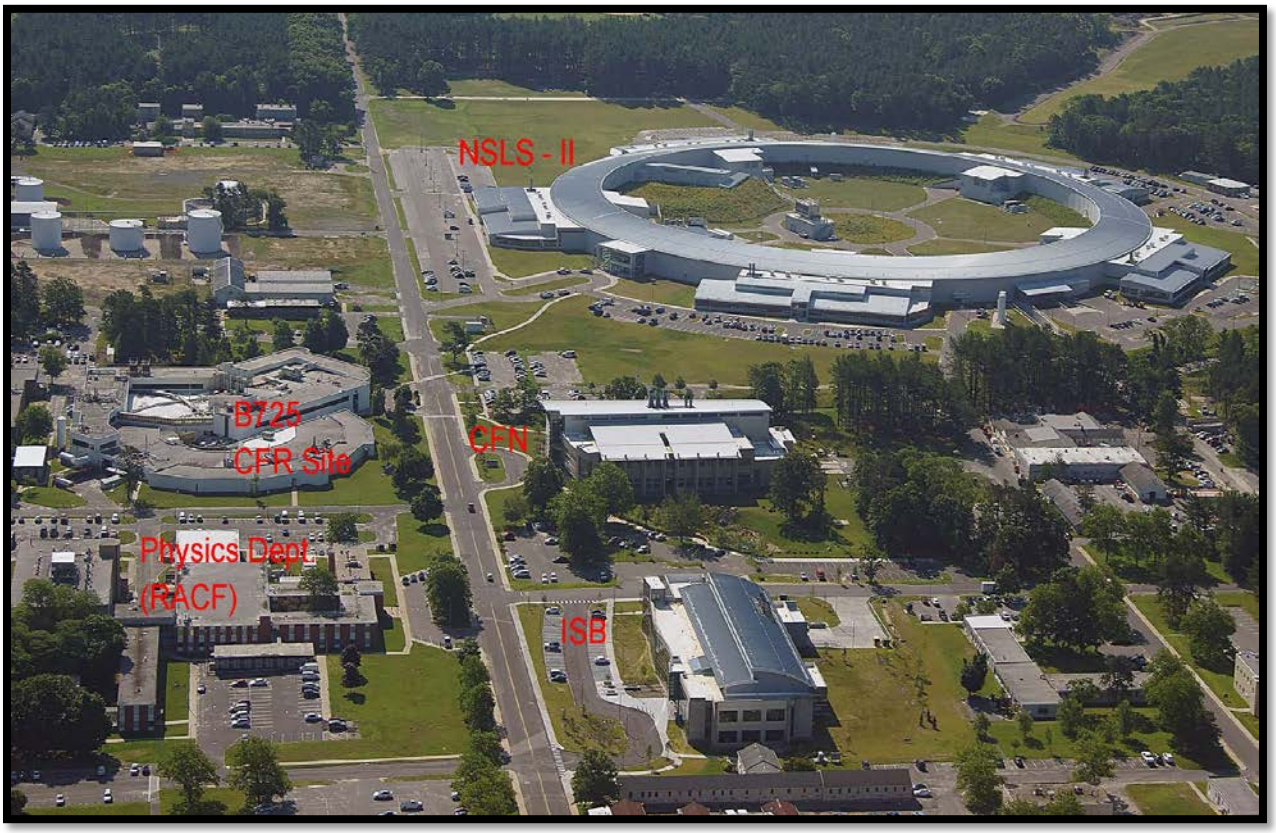
The CFR Project's preferred alternative is consistent with the latest "Freeze the Footprint/Reduce the Footprint legislation in that no additional office space will be constructed. The project capitalizes on existing office space inventory.

8.16 One for One Replacement

The CFR project does not create any additional space and therefor compliance with the one for one replacement requirement is not applicable.

9.0 APPENDICES

Appendix A – CFR Project Site Plan



Appendix B – CFR IPT Charter