Acquisition Strategy

Core Facility Revitalization (CFR) Project
Brookhaven National Laboratory

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1.0 JUSTIFICATION OF MISSION NEED

Within the Department of Energy (DOE) Office of Science (SC), the mission of the Nuclear Physics (NP) program is to discover, explore, and understand all forms of nuclear matter. NP supports experimental and theoretical research — along with the development and operation of particle accelerators and advanced technologies — to create, detect, and describe the different forms and complexities of nuclear matter that can exist in the universe, including those that are no longer found naturally. The Relativistic Heavy Ion Collider (RHIC) facility, funded by NP, is located at Brookhaven National Laboratory (BNL). RHIC is a collider used for transformative studies of extreme states of nuclear matter and the origin of the proton spin, and has unique capabilities for heavy ion research.

Within SC, the High Energy Physics (HEP) program seeks to understand how the universe works at its most fundamental level by discovering the most elementary constituents of matter and energy, exploring the basic nature of space and time, and probing the interactions among them. HEP supports theoretical and experimental research in both elementary particle physics and fundamental accelerator science and technology. The US-ATLAS (A Toroidal LHC ApparatuS) program is the United States consortium jointly funded by HEP and the National Science Foundation to support research using ATLAS at the Large Hadron Collider (LHC) located in Switzerland. ATLAS and the Compact Muon Solenoid (CMS) are the primary Energy Frontier detectors used to obtain experimental data that provide insight into fundamental forces of nature and the conditions of the early universe. BNL is currently designated as the United States Tier 1 site for ATLAS under an agreement between CERN (*Conseil Européen pour la Recherche Nucléaire*, or European Organization for Nuclear Research) and BNL. As a Tier 1 site, BNL must provide round-the-clock support for the LHC Computing Grid and is responsible for storing a proportional share of raw and reconstructed data, as well as performing large-scale data reprocessing and storing the corresponding output.

In May 2014, the Particle Physics Project Prioritization Panel (P5) issued a report that included a recommendation to "Complete the LHC phase-1 upgrades and continue the strong collaboration in the LHC with the phase-2 (HL-LHC) upgrades of the accelerator and both general-purpose experiments (ATLAS and CMS). The LHC upgrades constitute our highest-priority near-term large project." Implementing this recommendation will require robust, flexible, and reliable computational and data storage capabilities.

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 that are funded by NP and HEP, respectively. Significant infrastructure in terms of space, power and cooling within the existing RHIC-ATLAS Computing Facility (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 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 over the next ten years, requiring proportional increases in storage and compute capacities. 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, Advanced Scientific Computing Research (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 as did ASCR (as subject matter expert).

2.0 PROJECT DESCRIPTION AND PERFORMANCE PARAMETERS TO OBTAIN EXPECTED OUTCOME

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.

In compliance with Office of Management and Budget (OMB) Circular A-94 and consistent with Federal Life Cycle Cost Methodology and Procedures (10 Code of Federal Regulations 436, Subpart A), an alternatives analysis was prepared as part of the Critical Decision-1 (CD-1) process. The preferred alternative has been identified and is the most cost-effective alternative in terms of present value. This Acquisition Strategy (AS) is based on the preferred alternative.

The technical scope at the conceptual design stage is the design and construction of new infrastructure to support computing facilities within the existing Building 725 (B725) facility with modern power and cooling capabilities to replace aging, unreliable, and physically inadequate facilities. The conceptual design has identified the need for a new 2.4 MW (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.

The Preliminary Threshold KPP comprises the minimum scope consistent with meeting the project's Mission Need. The Preliminary Objective KPP includes optimal project scope and potential project scope enhancements 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 project documents as options. The project KPPs will be established at CD-2.

The IT power (available computing power) to be delivered to the new facility at initial occupancy will be 2.4 MW with 2.4 MW back-up power and cooling capabilities. This power availability and back-up capability represents the preliminary Objective KPP. The preliminary threshold KPP includes the same 2.4 MW IT power with a reduced 1.2 MW emergency power and cooling capability. The new facility will meet or exceed High Performance and Sustainable Buildings (HPSB) Guiding Principles as outlined in the DOE O 413.3B and Executive Order 13693 and also comply with the Data Center Optimization Initiative (DCOI) 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 direct access to the BNL facilities and staff that will support the programs. Figure 1 illustrates the proposed location at the core of the BNL site and proximity to mission critical facilities.

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

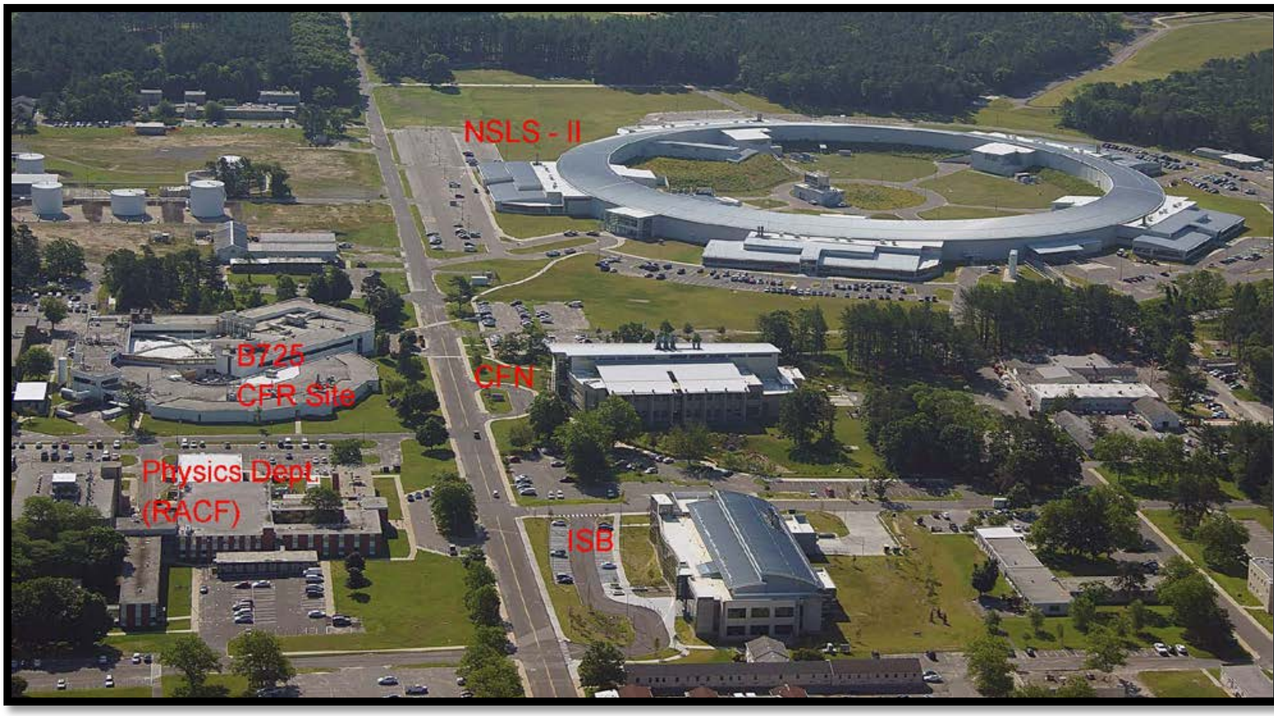

Figure 1 – Proposed CFR Site

3.0 ALTERNATIVES ANALYSIS

Beginning in the spring of 2014, preliminary planning efforts were initiated by BNL to address the growing capability gap at the B515 RHIC/ATLAS Computing Facility. Lists of potential alternatives were identified as well as potential locations. The alternatives considered can generally be organized into five (5) categories. A summary of each approach is presented below. A Life-Cycle-Cost Analysis (LCCA) was prepared by HDR Architects with support from the CFR Integrated Project Team Members including BNL Energy and Utility Professionals (Ref. CFR Analysis of Alternatives).

When the purpose of a life-cycle-cost analysis is to evaluate cost effectiveness, lease purchase, internal government investment, and asset sales rather than to primarily assess energy-related savings, the analysis is subject to OMB Circular A-94. The Building Life-Cycle Cost (BLCC5 5.3-15) software, developed by the National Institute of Standards and Technology (NIST) contains modules designed to perform life-cycle-cost analyses subject to OMB Circular A-94 and was used to perform this analysis.

Alternative 1 – Maintain Status Quo (do nothing)

Under this option, the use of the existing RACF at B515 would be continued to the greatest extent possible. The required deferred maintenance and compliance upgrades would be performed. Substantial productivity loss and programmatic opportunity loss would be realized. The significant risk of catastrophic failure due to the lack of backup chilled water service remains. This alternative does not address the capability gap or contribute to the support of the HEP/NP mission need.

Alternative 2 – Renovate Existing Facilities at BNL

This alternative involves the renovation of existing available facilities on the BNL site. Multiple facilities were considered including the renovation of the existing facility. B725, originally constructed in 1980 with multiple additions and expansion from 1985 through 1995, served as the former home of the NSLS-I program. A sound building of approximately 155,000 GSF, the facility contains adequate space for all of the present and future computing and support space needs. The building is ideally located with respect to available utility infrastructure and proximity to the researchers. The facility contains significant existing quality office space (approx. 38,000 GSF) and other space easily configured for use by other BNL research groups. Re-use and re-purpose of this facility supports federal "Freeze the Footprint" principles with respect to office space. Significant investment in hazardous material remediation and maintenance has been made over the past several years. Renovating this facility would avoid adding significant vacant space to the BNL inventory. The CFR Project would renovate approximately 50% of the first floor gross square footage of this facility to address the capability gaps noted above.

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

This alternative involves the utilization of Line Item funding for the construction of a new building to house the computing facility scope plus future expansion capabilities on the BNL site. Included in the scope is approximately 20,000 SF required to house the required supporting technical and research staff. The new facility would be centrally located on the BNL site. This alternative assumes the B725 facility will remain vacant.

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

This category of alternatives involves the construction of a new building to house the Computing Facility base scope on existing land contiguous to or in close proximity to the BNL site. Also included is the approximately 20,000 GSF required to house the required supporting technical and research staff. In both cases, fixed lease payments would be made to a 3rd-party developer. New funding would be required to service the alternative financed debt. OMB approvals would be required. This option was considered for preliminary study only and will not be considered for further evaluation based on DOE recommendation.

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

This category of alternatives considered two options: Option A – Establish the capability at another national laboratory computing facility; and Option B – Establish the capability via private cloud computing resources.

Option A will not be considered for further evaluation as the RACF computing facility will require significant additional infrastructure, space, and hardware, which is not available at this time at other institutions and would require significant investment at the respective sites. In addition, the necessary expertise to support the mission need resides at BNL. Significant cost and effort would be required to develop this expertise elsewhere and establish the efficient communication/data transfer protocols and communication infrastructure required.

Option B establishes the computing capabilities via cloud computing services. While conventional alternatives lend themselves to objective life-cycle-cost analysis, private cloud computing options remain less defined. They are highly case sensitive, technically problematic relative to software applications, and subject to rapid change in the market due to changing economic pressures. Prior DOE studies have concluded that cloud computing is more expensive than DOE High Performance Computing (HPC) facilities and demonstrated poor performance with communication and I/O intensive scientific applications. These findings are detailed in the Magellan Report on Cloud Computing for Science, Dec 2011. These findings have been validated by recent studies by BNL RACF researchers. The results are presented in the CFR Analysis of Alternatives document.

While progress is evident over the last few years, predicting cost for the next 25 years and making long-term financial decisions based on limited historic data is extremely risky. There has not been adequate data to analyze, nor documented success to validate, the long-term commitment of significant large scientific research program funding, such as that associated with the RHIC/ATLAS mission. These commitments are subject to continuous change brought on by economic factors. Once a program is committed, particularly with respect to data storage, it is costly to move back to any form of institutionally based computing infrastructure. Cloud computing is a long-term commitment with significant risk tied directly to the ability to maintain consistent, long-term funding. It is subject to volatility in the private cloud-services market and does not provide scientific programs the opportunity to economically manage infrastructure to meet changing needs.

3.1 Total Life-Cycle Costs and Benefits

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 1 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 1 – Life-Cycle-Cost Analysis (LCCA) Results

	Alternative 1 Maintain Status Quo (Base Case)	Alternative 2 Renovate Existing Facility	Alternative 3 Construct New Facility
Total Life-Cycle Cost	$109,328,869	$125,068,512	$147,479,171
Net Cost Savings	N/A	-$15,739,643	-$38,150,303
Meets Mission Need?	No	Yes	Yes

4.0 RECOMMENDED ALTERNATIVE

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.

5.0 TOTAL PROJECT COST RANGE

The Preliminary Baseline Project Estimate (excluding contingency) for the recommended alternative is $55.85M to provide a scope of 2.4 MW IT power. 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 – Estimated Project Cost Summary

	Low Range K$	***High Range K$***
Total Estimated Cost (TEC)		
Preliminary and Final Design	*$4,654*	*$6,335*
Construction	*$40,820*	*$50,281*
Project Support	*$4,348*	*$4,701*
Direct TEC	*$49,822*	*$61,317*
Contingency (% TEC)	*$9,964 (20%)*	*$15,329 (25%)*
Scope Contingency (10% Const.)	*$3,837*	
Subtotal TEC	***$63,623***	***$76,646***
Other Project Costs (OPC)		
Conceptual Design - OPC	*$850*	*$850*
Total Project Cost (TPC)	***$64,474***	***$77,496***

6.0 FUNDING PROFILE

Table 3 shows the funding profile based on the optimum TPC, supported by the project's 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 3 – 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***

7.0 KEY MILESTONES AND EVENTS

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 4 shows the key project milestones at Level 1. The project will be managed with the goal of meeting the early finish schedule. The preliminary project schedule will be refined during the design stage and final baseline milestone dates will be established at CD-2.

Table 4 – Key Milestones and Events

Level	Milestone Description	Date
1	CD-0 Approve Mission Need	September 2015 (A)
1	CD-1 Approve Alternative Selection and Cost Range	4Q FY 2016
1	CD-2/3A Approve Performance Baseline / Start Early Site Preparation Activities	3Q FY 2018
1	CD-3B Approve Start of Construction	1Q FY 2019
1	CD-4 Approve Project Completion	4Q FY 2021

8.0 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.

9.0 BUSINESS AND ACQUISTION APPROACH

The DOE Brookhaven Site Office (BHSO) determined that the soundest and most logical approach to procure the delivery of the project is through the Management and Operating (M&O) Contractor.

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, BSA is recommending a Construction Manager/General Contractor (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, the 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 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 (optional) 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. If phase 2 is not exercised, the construction package will be competitively bid.

10.0 MANAGEMENT APPROACH

The FPD will be the primary point of contact with the Science Laboratory Infrastructure (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 Integrated Project Team (IPT) are described in the IPT Charter in the Project Execution Plan.

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. A Preliminary Communications Plan has been established to facilitate this communication and coordination

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's responsibilities are detailed in the Project's IPT Charter.

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. The IPT Charter further details responsibilities.

Project Manager – BNL

The BNL Project Manager is responsible for the design, construction, testing, and turnover to operations of the Project. The IPT Charter further details responsibilities.

Deputy Project Manager – BNL

The BNL Deputy Project Manager will assist the Project Manager and be assigned responsibilities for the design, construction, testing, and turnover to operations of the Project. The IPT Charter further details responsibilities.

Procurement Representative – BNL Project Team

A representative from BNL Procurement provides subcontract administration and contractual support. The IPT Charter further details responsibilities.

Environment, Safety, and Health (ES&H) Representative(s) – BNL Project Team

The ES&H Team Lead will ensure ES&H resources are available for project activities. The ES&H Lead will coordinate all ES&H technical aspects. The IPT Charter further details responsibilities.

Integrated Project Team Members

The IPT members are identified in Figure 2. The IPT Charter further details responsibilities. The IPT will be responsible for implementing elements of work. A current listing of IPT team members is also identified in the IPT Charter. The IPT receives regular input from users by consistently including them in specific meetings and team communications.

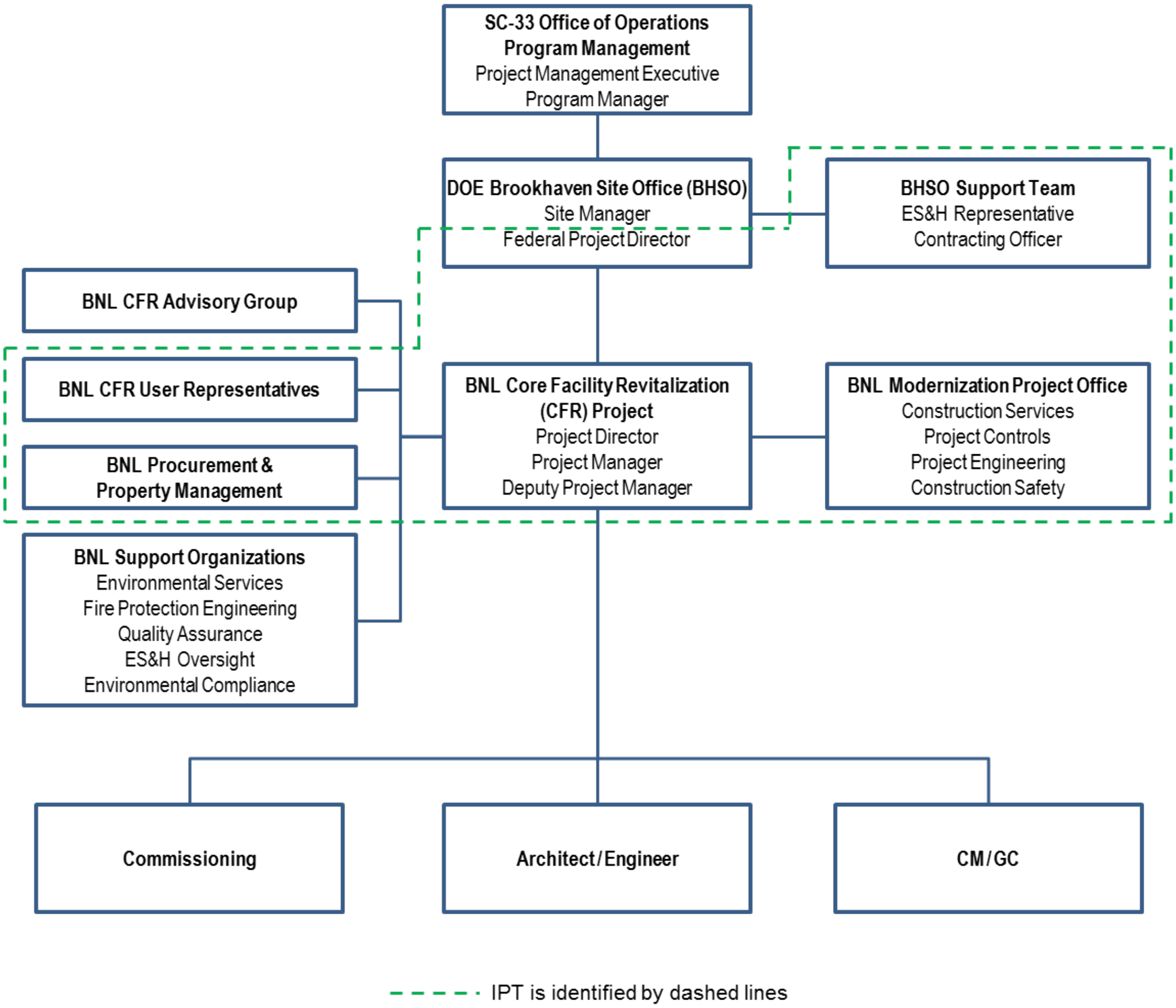

Figure 2 – Integrated Project Team

11.0 RISK ANALYSIS

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, team 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 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 5 and potential mitigation strategies are also shown.

Table 5 – Early Risk/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.

The CM/GC procurement methodology is ideally suited to address and mitigate risks associated with funding, cost escalations, and limited resources. Early involvement of the CM/GC during the pre-construction period will allow for multiple strategies to be developed to address funding profile changes. Early development of estimates by the CM/GC will reflect any unexpected trending with respect to possible cost escalation variances from planned values. Lastly, the CM/GC will have a direct tie to the subcontractor community and will be able to recognize any labor availability issues in a timely fashion, allowing for alternative strategies to be developed. The CM/GC will be required to conduct periodic outreach exercises to monitor subcontractor availability.