07-SC-06, National Synchrotron Light Source II (NSLS-II)
Brookhaven National Laboratory, Upton, New York
Project Data Sheet is for PED/Construction

1. Significant Changes

The most recent DOE O 413.3A approved Critical Decision (CD) is CD-1, Approve Alternative Selection and Cost Range, which was approved on July 12, 2007 with a preliminary cost range of $750,000,000 to $925,000,000 with a project completion of FY 2015. CD-2, Approve Performance Baseline has received a position recommendation from the Energy Systems Acquisition Advisory Board (ESAAB) on December 11, 2007 with a Total Project Cost (TPC) of $912,000,000.

A Federal Project Director has been assigned to this project. The Federal Project Director is pursuing the appropriate certification level.

This Project Data Sheet (PDS) is a continuation of a PED PDS proceeding to construction with modifications to funds allocated to conceptual planning and project engineering and design. This modification addresses FY 2007 and FY 2008 funding constraints as well as the rescission in FY 2008.

2. Design, Construction, and D&D Schedule

	CD-0	CD-1 (Design Start)	(Design/PED Complete)	CD-2	CD-3 (Construction Start)	CD-4[a] (Construction Completion)	Performance Baseline Validation
FY 2007	08/25/2005	1Q FY 2007	4Q FY 2008	TBD	TBD	TBD	—
FY 2008	08/25/2005	2Q FY 2007	2Q FY 2009	TBD	TBD	TBD	—
FY 2009	08/25/2005	07/12/2007	2Q FY 2009	2Q FY 2008[b]	2Q FY 2009	3Q FY 2015	12/11/2007

CD-0 – Approve Mission Need

CD-1 – Approve Alternative Selection and Cost Range

CD-2 – Approve Performance Baseline

CD-3 – Approved Start of Construction

CD-4 – Approve Start of Operations or Project Closeout

3. Baseline and Validation Status

(dollars in thousands)

	TEC, PED	TEC, Construction	TEC, Total	OPC Except D&D	OPC D&D	OPC, Total	TPC
FY 2007	75,000	TBD	TBD	TBD	TBD	TBD	TBD
FY 2008	75,000	TBD	TBD	TBD	TBD	TBD	TBD
FY 2009	60,000	731,200	791,200[c]	120,800	—	120,800	912,000[c]

[a] This column reflects CD-4 (Project Completion), not Construction Completion.

[b] The Energy Systems Acquisition Advisory Board (ESAAB) recommended approval of the performance baseline on December 11, 2007. No construction funds, excluding approval for Long Lead Procurement (LLP) or early actions, will be used until CD-3 has been approved.

[c] The Project Baseline has been validated and confirmed for Critical Decision – 2 (Approve Baseline Performance)

4. Project Description, Justification, and Scope

The NSLS-II project will design, build, and install the accelerator hardware, experimental apparatus, civil construction, and central facilities including offices and laboratories required to produce a new synchrotron light source. It includes a third generation storage ring, full energy injector, experimental areas, an initial suite of scientific instruments, and appropriate support equipment, all housed in a new building.

The National Synchrotron Light Source II (NSLS-II) would be a new synchrotron light source, highly optimized to deliver ultra-high brightness and flux and exceptional beam stability. It would also provide advanced insertion devices, optics, detectors, robotics, and an initial suite of scientific instruments. Together, these can enable the study of material properties and functions with a spatial resolution of about 1 nm, an energy resolution of about 0.1 meV, and the ultra-high sensitivity required to perform spectroscopy on a single atom.

Major advances in energy technologies will require scientific breakthroughs in developing new materials with advanced properties. A broad discussion is given in several recent reports, including the Basic Energy Sciences Advisory Committee reports entitled *Opportunities for Catalysis in the 21st Century* and *Basic Research Needs to Assure a Secure Energy Future*, the Basic Energy Sciences (BES) reports on *Basic Research Needs for the Hydrogen Economy* and *Basic Research Needs for Solar Energy Utilization*, the Report of the Nanoscale Science, Engineering, and Technology Subcommittee of the National Science and Technology Committee entitled *Nanoscience Research for Energy Needs*.

Collectively, these reports underscore the need to develop new tools that will allow the characterization of the atomic and electronic structure, the chemical composition, and the magnetic properties of materials *with nanoscale resolution.* Needed are non-destructive tools to image and characterize buried structures and interfaces, and these tools must operate in a wide range of temperature and harsh environments. The absence of any tool possessing these combined capabilities was identified as a key barrier to progress in the 1999 BES Report *Nanoscale Science, Engineering and Technology Research Directions.*

In order to fill this capability gap and to further the accomplishment of its mission, the Office of Science has determined that its mission requires a synchrotron light source that will enable the study of material properties and functions, particularly materials at the nanoscale, at a level of detail and precision never before possible. NSLS-II will provide these capabilities. Only x-ray methods have the potential of satisfying all of these requirements, but advances both in x-ray optics and in x-ray brightness and flux are required to achieve a spatial resolution of 1 nm and an energy resolution of 0.1 meV.

There are no alternative tools with a spatial resolution of 1 nm and energy resolution of 0.1 meV that also have the required capabilities of being non-destructive and able to image and characterize buried structures and interfaces in a wide range of temperatures and harsh environments. An analysis found that upgrading existing light sources was either impossible or not very cost effective. In the case of NSLS-I, it was found that it would be impossible to upgrade this light source due to numerous technical difficulties, including accelerator physics and infrastructure constraints, such as its small circumference, which limit the feasible in-place upgrade options.

Research and Development activities funded under Other Project Costs will address technical risk in several key areas including energy resolution, spatial resolution, and storage ring magnets.

The Project Engineering and Design (PED) funds requested for NSLS-II will allow the project to complete detailed design. These funds will provide detailed estimates of construction costs based on the

approved design, develop working drawings and specifications, and provide schedules for construction and procurements. Should a decision to proceed with construction be reached, this design effort will ensure that construction could begin on schedule in FY 2009.

The project will be conducted in accordance with the project management requirements in DOE Order 413.3A and DOE Manual 413.3-1, Program and Project Management for the Acquisition of Capital Assets and all appropriate project management requirements have been met.

5. Financial Schedule

(dollars in thousands)

	Appropriations	Obligations	Costs
Total Estimated Cost (TEC)			
PED			
FY 2007	3,000	3,000	2,292
FY 2008	29,727[a]	29,727[a]	30,435
FY 2009	27,273[a]	27,273[a]	25,278
FY 2010	—	—	1,995
Total, PED	60,000	60,000	60,000
Construction			
FY 2009	66,000	66,000	60,951
FY 2010	162,500	162,500	158,686
FY 2011	252,900	252,900	250,508
FY 2012	166,100	166,100	166,343
FY 2013	57,400	57,400	61,969
FY 2014	26,300	26,300	27,255
FY 2015	—	—	5,488
Total, Construction	731,200	731,200	731,200
TEC			
FY 2007	3,000	3,000	2,292
FY 2008	29,727	29,727	30,435
FY 2009	93,273	93,273	86,229
FY 2010	162,500	162,500	160,681
FY 2011	252,900	252,900	250,508
FY 2012	166,100	166,100	166,343
FY 2013	57,400	57,400	61,969
FY 2014	26,300	26,300	27,255
FY 2015	—	—	5,488
Total, TEC	791,200	791,200	791,200

[a] PED funding was reduced by $15,000,000 as a result of the FY 2008 Appropriation and by $273,000 as a result of the FY 2008 rescission. These reductions are restored in FY 2009.

(dollars in thousands)

	Appropriations	Obligations	Costs
Other Project Cost (OPC)			
OPC except D&D			
FY 2005	1,000	1,000	—
FY 2006	4,800	4,800	5,800
FY 2007	22,000	22,000	19,619
FY 2008	20,000	20,000	17,681
FY 2009	10,000	10,000	8,600
FY 2010	2,000	2,000	5,500
FY 2011	1,500	1,500	4,100
FY 2012	7,700	7,700	7,600
FY 2013	24,400	24,400	24,500
FY 2014	22,400	22,400	22,400
FY 2015	5,000	5,000	5,000
Total, OPC except D&D	120,800	120,800	120,800
OPC			
FY 2005	1,000	1,000	—
FY 2006	4,800	4,800	5,800
FY 2007	22,000	22,000	19,619
FY 2008	20,000	20,000	17,681
FY 2009	10,000	10,000	8,600
FY 2010	2,000	2,000	5,500
FY 2011	1,500	1,500	4,100
FY 2012	7,700	7,700	7,600
FY 2013	24,400	24,400	24,500
FY 2014	22,400	22,400	22,400
FY 2015	5,000	5,000	5,000
Total, OPC	120,800	120,800	120,800
Total Project Cost (TPC)			
FY 2005	1,000	1,000	—
FY 2006	4,800	4,800	5,800
FY 2007	25,000	25,000	21,911
FY 2008	49,727	49,727	48,116
FY 2009	103,273	103,273	94,829
FY 2010	164,500	164,500	166,181
FY 2011	254,400	254,400	254,608
FY 2012	173,800	173,800	173,943
FY 2013	81,800	81,800	86,469

(dollars in thousands)

	Appropriations	Obligations	Costs
FY 2014	48,700	48,700	49,655
FY 2015	5,000	5,000	10,488
Total, TPC	912,000	912,000	912,000

6. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate[a]	Previous Total Estimate[b]	Original Validated Baseline
Total Estimated Cost (TEC)			
Design (PED)			
Design	49,000	75,000	49,000
Contingency	11,000	—	11,000
Total, PED	60,000	75,000	60,000
Construction			
Site Preparation	9,243	—	9,243
Equipment	31,579	—	31,579
Other Construction	518,381	—	518,381
Contingency	171,997	—	171,997
Total, Construction	731,200	—	731,200
Total, TEC	791,200	75,000	791,200
Contingency, TEC	182,997	—	182,997
Other Project Cost (OPC)			
Conceptual Planning	24,800	5,800	24,800
Research and Development	35,800	45,000	35,800
Start-Up	50,200	—	50,200
Contingency	10,000	—	10,000
Total, OPC except D&D	120,800	50,800	120,800
Total, OPC	120,800	50,800	120,800
Contingency, OPC	—	—	—
Total, TPC	912,000	125,800	912,000
Total, Contingency	192,997	—	192,997

7. Schedule of Project Costs

For Schedule of project costs, see Section 5, “Financial Schedule.”

[a] Current Total Estimate has been validated and confirmed for Critical Decision - 2 (Approve Baseline Performance).
[b] Previous Total Estimate is based only on Project Engineering and Design funding.

8. Related Operations and Maintenance Funding Requirements

Beneficial Occupancy of the Experimental Floor	4Q FY 2012
Expected Useful Life (number of years)	25
Expected Future start of D&D of this capital asset (fiscal quarter)	N/A

(Related Funding Requirements)

(dollars in thousands)

	Annual Costs		Life cycle costs	
	Current Estimate	Prior Estimate	Current Estimate	Prior Estimate
Operations	119,400	—	4,470,000	—
Maintenance	21,100	—	789,000	—
Total Operations and Maintenance	140,500	—	5,259,000	—

9. Required D&D Information

	Square Feet
Area of new construction	~ 400,000
Area of existing facilities being replaced	N/A
Area of any additional space that will require D&D to meet the "one-for-one" requirement	NA (see below)

The existing facility (NSLS) will be converted to another use. The one-for-one replacement will be met through completed and planned elimination of space at Brookhaven along with "banked" space at the Massachusetts Institute of Technology (MIT) in Middleton, MA and at the East Tennessee Technology Park (ETTP) in Oak Ridge, TN. A waiver from the one-for-one requirement to eliminate excess space at Brookhaven to offset the NSLS-II project was approved by Secretary Bodman on April 20, 2007. The waiver identified approximately 460,000 square feet of banked excess facilities space that were eliminated in FY 2006 at MIT and ETTP.

10. Acquisition Approach (formerly Method of Performance)

The acquisition strategy selected relies on the BNL management and operating (M&O) contractor to directly manage the NSLS-II acquisition. The acquisition of large research facilities is within the scope of the DOE contract for the management and operation of BNL and consistent with the general expectation of the responsibilities of DOE M&O contractors. Some of the design, fabrication, and the assembly of NSLS-II will be carried out by BNL staff.

The design, fabrication, assembly, installation, testing, and commissioning of the NSLS-II Project will be largely performed by the BNL NSLS-II scientific and technical staff. Much of the subcontracted work to be performed for NSLS-II consists of hardware fabrication and conventional facilities construction. Each system or component will be procured using fixed price contracts, unless there is a compelling reason to employ another contract type. Best-value competitive procurements will be employed to the maximum extent possible.

Many major procurements, such as magnets and vacuum chambers, will be "build-to-print" following BNL/NSLS-II drawings and specifications. Many ancillary components are readily available off-the-shelf. Source selection will be carried out in accordance with DOE-approved policies and procedures. Acquisition strategies will be chosen to obtain the best value based on the assessment of technical and cost risks on a case-by-case basis. For standard, build-to-print fabrications and the purchase of off-the-shelf equipment for routine applications, available purchasing techniques include price competition among technically qualified suppliers and use of competitively awarded blanket purchase agreements.

The Architecture-Engineer (AE) contract will be placed on a firm-fixed-price basis for the Final (Title II) Design with an option for construction (Title III) support. The general construction contract will be placed on a firm-fixed-price basis. It is expected that the design specifications will be sufficiently detailed to allow prospective constructors to formulate firm-fixed-price offers without excessive contingency and allowances.

During the design and construction phases, NSLS-II Project management will identify major procurements that represent significant complexity or cost and schedule risk. An advance procurement plan (APP) will be prepared for each major procurement. The APP will include discussion of contract type; special contracting methods; special clauses or deviations required; and lease or purchase decisions. These APPs will identify critical procurement activities and will help to mitigate or avoid schedule conflicts and other procurement-related problems. At appropriate dollar levels, the APPs will be approved by the responsible Division Director, the NSLS-II Procurement Manager, the NSLS-II Deputy Director, and the NSLS-II Project Director.