Report

of the

NSLS-II Project Advisory Committee

At

Brookhaven National Laboratory

March 29 - 30, 2012

Executive Summary

A meeting of the NSLS-II Project Advisory Committee (PAC) was held at Brookhaven National Laboratory (BNL) on March 29-30, 2012, to review the progress of the NSLS-II Project and make recommendations on matters related to project planning, execution, management, and safety.

The project is now 72% complete and is making excellent progress. It is currently on schedule and on budget and has had excellent technical, cost and schedule performance to date. The current baseline cost estimate is $828M, an increase of $43M since February 2011. The Total Project Cost remains $912M. The current Estimate at Completion is $848M. The contingency on the EAC (25% of remaining work or 36% of uncommitted work to go) is adequate to complete the currently approved baseline scope within the available TPC. Some contingency budget is likely to be available to support additional capabilities for the facility; a prioritized list has been prepared for this eventuality. The project should continue to plan for the possibility of making such enhancements but hold each decision for release of contingency as long as is practicable without putting the CD-4 milestone at risk. At present there are 14 months of float in the schedule relative to the CD-4 date of June 15, 2015. The CD-4 schedule milestone is achievable with high probability. NSLS-II hardware production is well underway in all areas. Linac commissioning began on schedule during the last week of March 2012. The major issue with magnet fabrication from one year ago seems to have been overcome by working closely with the vendors and by revising requirements on magnet errors. Good technical progress has been made and there are no major technical issues remaining. The safety program which faced early challenges has improved greatly; recent reportable and DART incidents are at a level of less than one per year. Conventional construction made excellent progress this past year. Ring building construction remained ahead of schedule and is expected to be complete this month. Laboratory Office Building construction is also ahead of schedule. Overall, the project has had an outstanding year of accomplishment.

1) Introduction

The NSLS-II Project Advisory Committee (PAC) is appointed by and reports to Dr. Sam Aronson, the Brookhaven National Laboratory (BNL) Director. It is intended that the PAC will provide continuity of oversight for the project until its completion. A meeting was held at Brookhaven National Laboratory (BNL) on March 29 - 30, 2012, to review the progress of the NSLS-II Project and make recommendations on matters related to project planning, execution, management, and safety. The charge included a list of topics and specific questions to be addressed as part of the review. The PAC heard presentations from project leaders on subjects related to its charge. In addition, the PAC considered the reports of other technical advisory committees and the reports of review panels assessing the health of the project. The assessment of the Project Advisory Committee is documented in the body of this report.

The sections in this report are organized by Findings, Comments and Recommendations, which are defined as follows:

i) Findings are statements of fact that summarize noteworthy information presented during the review.

ii) The Comments are judgment statements about the facts presented during the review and are based on committee experience and expertise. The comments should be evaluated by the project team and actions taken as deemed appropriate.

iii) Recommendations are statements of actions that should be addressed by the project team.

Reference materials for this review are contained in the Appendices. The Charge for this review is shown in Appendix A. The review was conducted following the agenda shown in Appendix B. Committee members and their contact information are listed in Appendix C.

2) Technical Progress: Review the overall technical progress for meeting performance, cost, and schedule goals.

a) Findings

i) The project is on budget and on schedule and is now 72% complete.

ii) Contingency is managed for the mitigation of major risks and performance enhancement for which a priority list has been established.

iii) An early completion of the project is envisaged for June 2014 (the current projection is April 2014).

iv) All large contracts for the accelerator have been placed.

v) Linac:

(1) The Accelerator Readiness Review for the Linac was concluded without any problems.

(2) Commissioning of the Linac started this week, on schedule. The first beam could be extracted from the gun on Wednesday this week.

vi) Booster:

(1) This machine is a semi-turnkey device from BINP.

(2) Installation of Booster has been started.

(3) Production of components at BINP is making good progress.

(4) Booster magnet girders at BINP are ready for shipment.

vii) Storage Ring:

(1) Production of SR components is over 50% complete.

viii) Magnets:

(1) Difficulties seem to have been overcome.

(2) The production is well advanced (80% complete).

ix) Girder:

(1) Girders are stored in the experimental area and are ready for installation.

(2) 25 girders with magnets have been installed.

(3) One full cell has been installed.

x) Power supplies:

(1) They are about 55% completed

xi) Vacuum:

(1) Vacuum chambers are 90% complete.

xii) RF system:

(1) The RF power system is ready (klystron, IOT installed, 100% complete).

(2) Design of SC cavity has been completed and construction started.

(3) The cryogenic plant design has been completed.

(4) Low level RF control has been tested at CLS.

xiii) Diagnostics:

(1) BPM electronics has been tested at ALS.

xiv) Beamlines:

(1) Components are in the heavy procurement phase (27% completed).

(2) Final designs for all project beamlines have been completed.

(3) Engineering designs for long-lead-time beamline components have been completed.

(4) The front ends had some design iterations to meet the requirements, but production of components has been started now.

(5) A state of the art ID measurement facility has been completed.

(6) All contracts for the IDs have been concluded; DW and EPU are in production.

(7) Damping wiggler construction has started.

xv) Utilities:

(1) Utilities are 70% complete.

(2) 60% of electrical utilities are installed and 40% fully functional.

(3) Mechanical utilities are ready for start-up and commissioning

b) Comments

i) Linac:

(1) We congratulate the team on the start of Linac commissioning.

(2) No problems are expected; the design is conservative and proven.

ii) Booster:

(1) BO progress is satisfactory.

(2) Full responsibility for installation and commissioning should remain with the supplier.

iii) Magnets:

(1) Problems with magnet fabrication seem to have been overcome partly by relaxing the requirements on the magnet errors. It was stated that performance is not affected and that no reduction in flexibility is expected.

(2) The team is congratulated on their practical solution to this problem.

iv) Girder:

(1) Achievement in positioning accuracy is excellent (30 μm).

(2) The adoption of an economical concept for the adjustment system is appreciated.

(3) Assembly is well under way with 30 girders having been equipped with magnets thus far; the ambitious goal is to complete all girders before the end of the year.

v) Power supplies:

(1) Production is well on track. The strategy is endorsed since it reduces risk by making use of expertise at BNL.

(2) A modular structure is used with off-the-shelf parts and parts developed in house; these are then assembled into full systems in house.

vi) Vacuum:

(1) The vacuum system is very advanced and does not manifest any problem.

(2) All vacuum chambers for dipoles and multipoles needed for girder assembly are ready.

(3) The procurement and fabrication of pumps, gate valves, absorbers, etc. is progressing very well.

vii) Radio Frequency (SC-Cavity):

(1) There seems to be an intrinsic conceptual problem which makes assembly very critical. Since the vendor does not have the expertise the project should obtain this expertise where it is available (Cornell).

(2) Explore carefully the potential consequences of the proposed fall-back solution, the preliminary installation of a Petra 7-cell cavity. This might be cumbersome because of all the additional equipment which would have to be constructed. It is also questionable if the benefit would be that large since the current would be limited to 25 mA.

(3) With all the HLS in preparation a first characterization of the machine might be very fast.

(4) The early test of the LLRF at CLS and its excellent performance is appreciated.

viii) Diagnostics:

(1) The digital BPM program is a great success.

(2) The achieved resolution of 200 nm is extraordinary.

(3) The strategy of an early test at ALS is endorsed.

ix) Beamlines:

(1) Project beamlines are progressing very well.

(2) The early completion of construction and installation (by June 2014) remains a challenge.

x) Summary:

(1) No major technical issues remain.

(2) The main remaining challenge is the (advanced) schedule.

(3) The project is progressing under budget and ahead of schedule.

(4) No major problems are expected to meet the cost and schedule performance project goals.

c) **Recommendations:**

i) To further explore the effect of the increased error content of the magnets, investigate the possibility of alleviating effects by sorting of the elements, as far as possible (sorting within smaller batches).

ii) Major recommendation: Proceed in the same way as you have so far!

3) Safety Management: Review adequacy of the safety program and whether it is being fully integrated and effectively managed.

a) Findings

i) The safety program in the construction activities has improved greatly after a shaky start. Recent reportable and DART incidents are at a level of one or less than one per year. The rates for the NSLS-II staff are and have been excellent.

ii) A process for conducting both Accelerator Readiness Reviews and Instrument Readiness Reviews has been established, and worked well for the Linac commissioning.

iii) The conventional construction activities are rapidly winding down, activity is transitioning to installation, and the program has moved to respond to this change.

b) Comments

i) We recognize that the project has identified a potential problem connected with the change from construction to installation, and commend them for it. We also encourage extra effort to maintain the present excellent performance and prevent any potential relaxation on the part of the staff and contractors.

ii) The safety program is being fully integrated and effectively managed.

c) Recommendations: None.

4) Completion Plan for Conventional Construction: Assess the progress on conventional construction and its plans for construction completion phase.

a) Findings:

i) Conventional construction progress has been excellent during the past year.

ii) Ring building construction has been ahead of schedule all year.

iii) Field changes are running at 2.6% not including scope changes.

iv) The remaining work is minor and the contract will complete during April 2012.

v) LOB construction is ahead of the original baseline by one year.

vi) Cost and schedule performance is slightly ahead of schedule and under budget.

vii) Safety performance is good and continuing to improve.

viii) Integration of contractors is working well.

b) Comments:

i) Conventional construction is being managed very well and the cooperation between the technical team and the procurement team is excellent.

ii) Integration of construction contracts has worked very well with very few issues.

c) Recommendations: None

5) Production, Installation, Start-up and Commissioning: Assess the progress for production, assembly, and installation of the accelerator systems and 6 project beamlines and their plans for startup and commissioning.

a) Findings

i) Hardware production is well under way in all areas.

ii) Ring magnet production is close to completion except for the dipoles.

iii) Insertion devices contracts have been placed.

iv) Accelerator systems are ~3 ½ months behind schedule and will likely remain that way.

v) Girder integration has validated the mechanical design and achieved technical specifications.

vi) The first girders have been installed in the tunnel and the initial systems test has started.

vii) Initial installation of many other systems in the tunnel has started.

viii) First Linac beam was achieved this week. Well done!

ix) Booster components are starting to arrive from BINP.

x) Beamline design is complete and many major technical procurements have been placed.

xi) Beamline schedule slippage is a concern.

b) Comments

i) The major issue of magnet production from last year has improved dramatically. Well done. The only remaining concern is dipole delivery. The magnet quality meets (or is close to) the demanding design specifications. Likewise, the girder integration has also demonstrated that it can meet the difficult mechanical tolerances.

ii) Girder installation in the tunnel is ~ 8 months behind the original baseline but the production line is now set to double the nominal production rate to 2 per week. It is reasonable to expect that this variance with diminish over the remainder of the year. Dipole delivery and acceptance will remain a challenge to the schedule.

iii) SRF systems can be notoriously unforgiving. Continue to work closely with the vendor. Regarding Plan B, is an incremental approach feasible? If the risk is only the gradient, then do you need a plan B?

iv) It is gratifying to see the Booster components start to arrive. Employing BNL installation labor with BINP supervision a very good idea. With a turnkey operation such as this the main concern (now) is the interfaces; ensure that nothing falls through the cracks.

v) Installation is a traditional “black-hole” for labor. This issue has been addressed in a timely fashion to this point. We suspect that this topic has not completely vanished. Continue to access lab resources (survey, design) where possible. This is crunch time for the project.

vi) Linac beam was achieved on schedule no less! These are the green shoots of the commissioning process. This is an excellent test of not only the Linac components, controls, interlocks, etc. but also the ARR process.

vii) Beamline design is in good shape. Converting design to procurement packages has taken (worryingly?) longer than anticipated. Hopefully the experienced vendors will hold the line on the schedule. It is difficult to get too concerned about the schedule which currently has a 14 month float relative to CD-4. However, delays may cost money due to the standing army.

viii) In-house optics R&D has gone well. Beyond state-of-the-art beamline capabilities can be expected.

ix) The project should ensure that beamline effort is not diluted by the other non-project ones. This situation can also work in a positive fashion by providing additional “ballast” if necessary.

x) Start-up and commissioning hasn’t really begun yet aside from the Linac. What can be said is that the commissioning planning is mature for this point in the project.

c) Recommendations: None

6) Risks and contingency spend plan: Are the Project's risks being managed effectively and the contingency adequate for the remaining risks?

a) Findings

i) The NSLS-II project Total Project Cost is $912M and the current Baseline Cost Estimate is $828M. Very good progress has been made since our last meeting (February 2011) and the project is approximately 72% complete as of February 2012.

ii) The current Estimate at Completion is $848M. The remaining contingency on the EAC is $63.6M which is 25% of remaining work or 36% of uncommitted work to go.

iii) The Early Project finish milestone (Level 1) is June 2014 and the Project Completion milestone (CD-4) is June 2015 with 12 months of float between the two.

iv) The current forecast for project completion is April 2014.

v) Seven (7) weeks of schedule float has been lost over the past 33 months.

vi) The project has a Risk Management program that is used to identify and manage technical, cost and schedule risks. Risks are documented in a Risk Register.

vii) The Risk Register is routinely reviewed and reflects the most current project information available including the decision making history affecting each item in the register. There are now 21 active risks in the register which are estimated to have a potential cost impact of $28M; 29 major risks (technical, cost and schedule) have been retired.

viii) The contingency plan reflects the Project's projection of funding that will be required for identified risks.

ix) The contingency spend plan provides for contingency usage for additional scope items (5 prioritized categories of candidate scope additions totaling $33.7M have been identified). This approach will be discussed in the response to the following charge question 6.

b) Comments

i) The current contingency on the EAC (25% of remaining work or 36% of uncommitted work to go) is adequate to complete the currently approved baseline scope within the available TPC.

ii) The CD-4 schedule milestone of June 2015 is achievable with high probability.

iii) The early completion Level 1 milestone of June 2014, for which there is currently only 2 months of float, is considered to be a very aggressive schedule.

iv) The Project has done an excellent job in identifying a prioritized list of possible scope increase items for inclusion in the project if future contingency utilization is favorable. We

strongly support the Project's goal of optimizing the science potential of the NSLS-II project by including these items which are primarily experimental equipment enhancements.

v) The PAC considers it to be unlikely that the use of contingency while delivering the currently approved baseline scope will be sufficiently favorable to allow the addition of all items within the 5 categories on the prioritized list of potential scope increase items.

c) Recommendations: See recommendation in next section.

7) Contingency Spend Plan: Assess the appropriateness of the contingency spend plan in order to ensure the maximum and timely scientific productivity upon project completion.

a) Findings

i) Up to this point, in recognition of good cost experience, the NSLS-II Project has added about $36M in scope enhancements, such as the wider ring building and more LOB capacity.

ii) Based on the judgment that project costs will continue to be favorable, a contingency spend plan was presented that calls for allocating approximately $34M of the remaining $64M contingency (based on the current EAC) for additional scope items to enhance the scientific capability of NSLS-II.

iii) Key elements of this plan are features that would optimize the productivity of the current NSLS-II beamlines, provide additional insertion devices and front ends to facilitate the addition of future beam lines, and an additional satellite endstation building.

iv) This would leave approximately $30M to deal with risks or new problems that may arise within the project. Depending on the timing for each decision, the remaining contingency on work to go could be a concern.

b) Comments

i) We agree that some contingency budget is likely to be available to support additional capabilities for the NSLS 2 facility.

ii) We also agree that actions that would enhance the science productivity should be the highest priority for additional funding.

iii) We agree with the order of priority of the additional items presented by the Project.

iv) However, we are not yet convinced that the commitments can be made as early as proposed and still have enough reserve to assure that NSLS-II can be completed within budget.

v) We note that there is 1 year float between the June 2014 early finish date and the June 2015 “official” CD-4 date, and that there is time for more informed decision-making and still complete the Project on schedule.

c) Recommendation

i) Continue to plan for scope enhancement for NSLS-II, but hold each decision for the release of contingency as long as practicable without putting the CD-4 milestone at risk.

Appendix A

Charge to the NSLS-II Project Advisory Committee
March 29-30, 2012

Since the last PAC meeting on February 2011, the NSLS-II project made an excellent progress on construction of the Conventional Facilities, production of components for the Accelerator Systems and completion of the final design of the six project beamlines while ramping up the installation of the Accelerator Systems and procurement of the beamline components.

By February 2012, the Project will be over 74% complete while maintaining the baseline parameters with reasonable cost and schedule contingencies available. The project has continued to analyze remaining risks and update plans to add scope beyond the baseline to maximize the scientific productivity of the facility.

The primary goals for 2012 are to continue to keep the Project on schedule and on budget while ensuring safety, to execute assembly and installation of the accelerator systems, and to finalize plans to successfully transition from construction to operations. In this context, the PAC is kindly requested to evaluate and make recommendations on the following topics:

a. Technical Progress: Review the overall technical progress for meeting performance, cost, and schedule goals.
b. Safety Management: Review adequacy of the safety program and whether it is being fully integrated and effectively managed.
c. Completion Plan for Conventional Construction: Assess the progress on conventional construction and its plans for construction completion phase.
d. Production, Installation, Start-up and Commissioning: Assess the progress on production, assembly, and installation of the accelerator systems and 6 project beamlines and their plans for startup and commissioning.
e. Risks: Are the Project's risks being managed effectively and the contingency adequate for the remaining risks?
f. Contingency Spend Plan: Assess the appropriateness of the contingency spend plan in order to ensure the maximum and timely scientific productivity upon project completion.

A review report is requested to be sent to the BNL Laboratory Director by April 27, 2012.

Appendix B

NSLS-II Project Advisory Committee Meeting

AGENDA

Bldg. 817, Room 4

Thursday, March 29, 2012

08:00 - 08:30 Committee Executive Session
08:30 - 08:40 Welcome ..... S. Aronson
08:40 - 09:30 NSLS-II Overview ..... S. Dierker
09:30 - 10:00 Project Performance and Risk Management ..... A. Byon
10:00 - 10:10 Break .....
10:10 - 10:30 ESH ..... S. Hoey
10:30 - 11:00 Conventional Facilities ..... M. Fallier
11:00 - 11:45 Accelerator Systems..... F. Willeke
11:45 - 12:15 NSLS-II Project Beamlines..... Q. Shen
12:15 - 01:00 Lunch
01:00 - 01:30 NEXT and ABBIX Beamlines ..... S. Hulbert
01:30 - 02:00 Contingency Spend Plan and Early Science Program ..... S. Dierker
02:00 - 03:30 Committee Executive Session
03:30 - 05:00 Tour
05:00 - 06:00 Committee Executive Session
06:00 Adjourn

Friday, March 30, 2012

08:00 – 12:00 Committee Executive Session
12:00 – 01:00 Lunch
01:00 – 02:00 Closeout
02:00 Adjourn

Appendix C

Project Advisory Committee Membership:

Ken Stanfield, Chair, FNAL (retired)	kenstanfield@comcast.net
Gene Desaulniers (retired)	desaulgene@aol.com
Michael Harrison, BNL	harrison@bnl.gov
Suzanne Herron, ORNL (unable to attend)	herronsa@ornl.gov
Michael Rowe, NIST Center for Neutron Research (retired)	jmrowe@erols.com
Les Price, DOE Oak Ridge (retired)	lasprice@tds.net
Albin Wrulich, Paul Scherrer Institute (PSI)	albin.wrulich.psi.ch