

Advanced Photon Source Upgrade (APS-U) Project - Update

*“Summary of the Directors Review of the APS-U
Project”*

Geoff Pile APS-U Project Manager
APS/Users Operations Monthly Meeting
March 30th, 2011

Where We Are Today

- Conceptual Design Review (CDR) Rev2 is almost finalized
- Critical Decision 1 is looming on the horizon (we're almost ready)
- Closing in on a well-defined scope (thanks to SAC, user community, and staff)
- Lab management is engaged and highly supportive
- Cost & schedule is in good shape for this stage of the project

- **There's still serious work to be done**
- **But CD1 is in sight!**

15 APS-U Project Reviews

[APS-U CD1 Review \(DOE Lehman Review\)](#) May 17-19, 2011

[APS-U Front Ends Technical Review](#) April 12-13, 2011

[Director's CD1 Review](#) March 14-16, 2011

[APS SAC Review](#) March 7-9, 2011

[Short Pulse X-ray Review](#) March 3-4, 2011

[Joint ANL/JLab Cavity System Design for APS-U SPX](#) February 9-10, 2011

[Insertion Devices Review](#) January 27-28, 2011

[Ultrafast Beamline Review](#) December 13-14, 2010

[Diffraction Beamline Review](#) November 18-19, 2010

[Imaging Beamline Review](#) November 10, 2010

[Spectroscopy Beamline Review](#) October 26, 2010

[Superconducting Undulator Status Review](#) October 22, 2010

[Short Pulse X-ray Review](#) October 18-19, 2010

[Accelerator Physics Review](#) October 14-15, 2010

[Cost Review](#) October 12-13, 2010



Latest APS-U Project Reviews

- **SAC Review**
 - The recent SAC prioritization of the proposed beamlines aids tremendously in setting the project scope
- **Director's Review**
 - Highly valuable experience as a dry-run for the Lehman Review
 - Constructively critical in all areas
 - We learned a lot from this exercise
- **Lehman Review (ICR)**
 - Independent Cost Review chaired by OECM (Robert Raines)



APS-U Project Director's Review - Committee

- Ed Temple - **Chair**
- Richard M. Boyce SLAC – **Cost & Schedule**
- Dean Chapman UASK
- Tony Chargin Consultant - **Management**
- Brian Chase Fermi – SPX
- David Fritz SLAC - Ultrafast
- Richard Hislop Consultant – **Safety & QA**
- Steve Hulbert BNL - Spectroscopy
- Mike Kelly ANL
- Joanna Livengood DOE
- Steve Milton ANL/Colorado State University
- Graeme Murdoch ORNL
- Cev Noyan Columbia Univ. – Extreme Conditions
- Soren O. Prestemon LBNL – Insertion Devices
- Don Rej Los Alamos
- Jeff Sims ANL
- Eliot Specht ORNL - Interfaces
- Juergen Thieme BNL - Imaging
- Ferdinand Willeke BNL - Accelerator



APS-U Project Director's Review - High Points

- **Management**

- An initial project management team has been put in place.
- Top-level ANL management is clearly supportive of and engaged in APS-U.
- Significant LDRD of general R&D that can impact the APS-U is supported.
- Key APS Programmatic R&D is underway.

- **Funding**

- An “incremented” APS annual funding has been received → actual APS-U funding is negotiated between the APS-U Project Director and the Interim ALD for Photon Sciences

- **Cost**

- A scope with a TPC of just over \$355M has been identified; this includes a 30% contingency.
- Recommend a scope reduction contingency plan if 35% contingency required by Lehman/ICR Committee Review.



APS-U Project Director's Review - High Points cont'd.

■ Technical

- A comprehensive Conceptual Design Report (currently Rev. 1) has been written.
 - **Rev 2 will need to clearly delineate in-scope and contingent scope items.**
- A detailed R&D program is underway to address critical SPX and SCU questions and reduce risk before production will begin.
- We suggest two sets of technical parameters:
 - 1) APS-U KPPs (Key Performance Parameters)** that are straight-forwardly achieved, demonstrate that components of the upgrades are working, signifies CD-4 Ready to Begin Operations, and the end of the project and
 - 2) APS-U Goals** that are planned to be achieved after some significant amount of time, a few to many months of commissioning, refinements, and adjustments.

■ Schedule

- It appears that the schedule for the APS-U is strongly funding limited. This seven-year project could be a four- or five-year project with an adequate funding profile AND appropriate risk management. The current approach may be the best that can be done with strongly limited or even reduced SC funding.
- The committee believes that operations priorities should be
 - 1) Beam quality
 - 2) Availability (operates as and when advertised)
 - 3) 5000 hours per year that is negotiable if and as needed!



APS-U Project Director's Review - High Points cont'd.

Accelerator

- **Scope Technical**
 - Any accelerator **changes that are not part of the project scope but are a prerequisite of the Upgrade and necessary for full exploitation should be clearly identified and distinguished from the project scope.**

- **Interfacing**
 - Interfaces between the diverse parts of the project, but also within accelerator scope, was not given much attention in presentations.

- **Expert Staff Availability**
 - Operational organization is expected to have a certain amount of labor reserve to make high expertise and labor available quickly in order to resolve operational problems. This is the staff to work on upgrade project, development, and improvements.
 - It is important that the management sets clear priorities how these resources are to be used.



APS-U Project Director's Review - High Points cont'd.

- **Accelerator: SCU**

- **The overall design of the various undulators are technically sound given the current knowledge of the various beamlines**, and where needed there is an adequate R&D plan in place.
- **The plan for delivery is well thought out**; the team is planning to leverage external expertise where appropriate.
- **A significant R&D effort is underway to mitigate risk for the SCU.**
- R&D effort should be more clearly defined as a path towards implementation: show design, highlight risk areas=>R&D provides mitigation
- Only 3 beamlines have SCU's in the scope, but the motivation for this technology development is clear and provides APS with a clearly defined path for future flux increases by filling in the tuning gaps.



APS-U Project Director's Review - High Points cont'd.

- **Accelerator: SPX**
 - **Identify areas of cost and schedule contingency. Where there is none, consider revising the R&D plan.**
 - **The conceptual design is technically plausible. However, technical risk is substantial for a project at this stage.**
 - The conceptual design for a pair of SRF cryomodules does address the mission need to provide intense short pulse beams at high repetition rates. The mission critical R&D plan is to be completed by ~Dec. 2013. The intent is to reduce technical risk on more than a dozen issues identified as either medium/high risk.
 - Some good progress on R&D for SPX cavities has been made.



APS-U Project Director's Review - High Points cont'd.

Beamlines - Difficult to summarize because there are five separate reports

- Generally, beamline designs are technically sound and beamlines are likely to meet or exceed performance expectations
- Generally, the projects scope and specifications are sufficiently well defined
 - **It needs to be made clearer which beamline subprojects are in and out of scope**
- The costs are credible, but schedule needs to be defined
- All beamlines will meet the overall goal of “looking into real materials under real conditions in real time”

Lots of constructive & thoughtful comments & recommendations about specific beamline projects

We will incorporate the advice for Lehman Review



From Director's review to CD1

- The CD1 Review is DOE's critical decision point to move the Upgrade forward
 - All prior reviews have been in support of this review
 - Success is crucial
- What we need to do now
 - Refine our cost estimates
 - Provide consistent traceability in our estimates
 - Improve consistency of presentations
 - Provide more time for discussion
 - Clearly define project scope
 - De-emphasize contingent scope but identify & carry ~\$50M



APS-U Scope

▪ Accelerator

- Short Pulse X-ray generation
- Enhanced Beam Stability
- 150 mA Operation
- 4 Long Straight Sections
- 15 Insertion Devices
 - 2 Superconducting Undulators
 - 6 Revolver Undulators (2 existing periods per device)
 - 1 APPLE II (Variable polarizing device)
 - 1 Electromagnetic variable polarizing Undulator
 - 5 existing period planar devices



APS-U Scope

■ Beamlines

– New Beamlines (Total = 6)

- Short Pulse X-ray Beamline 1
- Wide-field Imaging Beamlines (long beamline)
- High-energy Tomography
- Next Generation Nanoprobes Phase 1
- High-energy Diffraction (side branch)
- X-ray Interface Science Phase 1

– Upgraded Beamlines (Total = 8)

- Short Pulse X-ray Beamline 2
- Enhanced Pump/Probe Facility (14-ID): Physical Sciences
- MERIX
- Micro and 3D Diffraction (2)
- Magnetic Spectroscopy (2)
- High Energy Diffraction (main branch)

– Required Moves (Total = 4)

- Fuel Spray Beamline (relocate 7-BM due to SPX)
- Relocation due to WFI
- Liquid Surface Scattering (relocate 9-ID due to MERIX)
- Move 6-ID program due to SPX, Magnetic Spectroscopy



APS-U Scope

■ Enabling Technologies

- Front Ends
 - 8 New Front Ends (HHL, CU, VHHL, ACU)
 - Modify existing Front Ends for 150 mA operation
- Infrastructure for Wide Field Imaging long beamline
 - External Building to house 2 experiment stations
 - Corridor to connect the external building to APS

■ R & D

- Short Pulse X-rays
- Superconducting Undulators
- High Heat Load Optics



Lehman Review(ICR) of the APS-U Project- Committee

Department of Energy (CD-1) Review of the
Advanced Photon Source-Upgrade (APS-U) Project
May 17-19, 2011

Robert Raines, DOE/OECM, Chairperson
Daniel R. Lehman, DOE/SC, Deputy Chairperson

SC1 Accelerator Physics and High Heat Load Engineering

Accelerator Physics, \$30M (WBS ___)

High Heat Load Engineering, \$35M (WBS ___)

Sam Krinsky, BNL
John Arthur, SLAC
Lonny Berman, BNL
Christopher Steier, LBNL

SC2 Superconducting Devices

Short Pulse X-Ray Cavity, \$37M (WBS ___)

Insertion Devices/SCU, \$32M (WBS ___)

* Kem Robinson, LBNL
Mark Champion, FNAL
Tom Peterson, FNAL

SC3 Ultrafast and Spectroscopy Beamlines

Ultrafast Beamline, \$17M (WBS ___)

Spectroscopy Beamline, \$15M (WBS ___)

Chi Chang Kao, SLAC
Phil Heimann, LBNL
Bill White, SLAC
[Lonny Berman, BNL]

SC4 Diffraction Beamlines

Interfaces, \$24M (WBS ___)

Extreme Conditions, \$14M (WBS ___)

* Mark Bourke, LANL
Ken Evans-Lutterodt, BNL
Rich Sheffield, LANL

SC5

Imaging Beamlines, \$29M
(WBS ___)

Tony Warwick, LBNL
Yong Chu, BNL

SC6

Environment
Safety and Health

* Steve Hoey, BNL

SC7

Cost and Schedule

* Thomas Fornek, SLAC
Ethan Merrill, DOE/SC

SC8

Project Management

* John Galayda, SLAC
Kurt Fisher, DOE/SC



Lehman Review of the APS-U Project - Charge to the Committee

1. **Conceptual Design:** Is the conceptual design sound and likely to meet the technical performance requirements in the mission need statement?
2. **Project Scope:** Are the project's scope and specifications sufficiently defined to support the preliminary cost and schedule estimates?
3. **Cost and Schedule:** Are the cost and schedule estimates to include life-cycle costs, credible and realistic for this stage of the project? Do they include adequate scope , cost, and schedule contingency?
4. **Management:** Is the project being properly managed at this stage? Has the management team met all the prerequisite requirements for CD-1 approval? Is the project ready for CD-1?
5. **ES&H:** Is ES&H being properly addressed given the project's current stage of development?



Planning for Lehman Presentations - Dry Runs

- **Define session leads & session protocol**
- **Plenary Session Talks - 3 Dry Runs**
 - for all talks - week of 4/4 and again 4/11
 - Small detail changes over the following 2 weeks
 - Full Dress Rehearsal 4/29
 - Post Presentations 3rd May
- **Breakout Sessions Talks- 3 Dry Runs**
 - 2 dry runs in April
 - Full Dress Rehearsals 5/6
 - Post Presentations 3rd May (minor changes until 3/10)



Summary

- **Directors Review** – Positive outcome with lots of constructive help from committee
- **Scope** – Clear scope for CD1
 - Project Baseline is not until CD2
- **Cost & Schedule** – Good shape
 - Project estimates: \$355M TPC & 4th Quarter FY18 Finish
 - CD-0 range of \$300-400M & 5-7 years
- **Prep for Lehman** – Agendas being finalized with reviewers
 - lots of hard work with clear path to succeed
- **Lehman Review** - 17th to 19th May 2011

The Upgraded Advanced Photon Source will provide revolutionary, unique capabilities to enable continued leadership in ground breaking Science



Comments, etc., re: the APS-U Project

For comments, suggestions, and/or questions about the APS-U Project, contact:

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