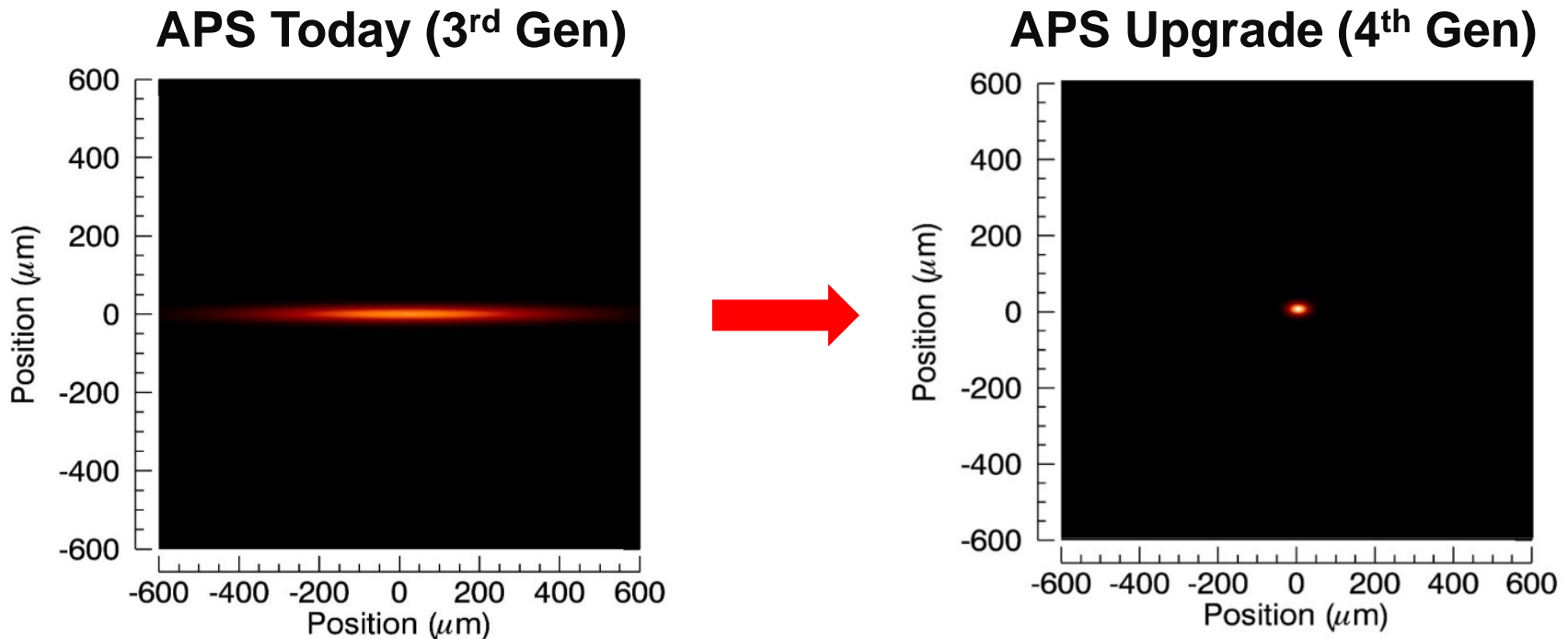


APS Upgrade Progress

Stuart Henderson
APS Upgrade Project Director

March 16, 2016

The APS Upgrade: Building the world's leading high-brightness hard x-ray synchrotron facility



Provides a generational leap in performance

- Build a new storage ring to exceed the capabilities of today's 3rd –gen lightsources by 2 to 3 orders of magnitude in brightness and coherent flux
- Build a set of experimental capabilities that are best in the world

World's brightest storage ring lightsource above 4 keV

Two recent major DOE reviews validated APS-U Project readiness for Critical Decision 1

DOE/SC review of APS-U (Sept. 22-24, 2015)

- *'...the project is ready for CD-1 approval. The conceptual design for the new storage ring is sound...'*
- *'...the project documentation is in good shape for CD-1...the point estimate for the TPC is reasonable...'*
- *'...the APS-U project management team is strong, capable, motivated, and fully engaged.'*
- *The project has met all of the prerequisite requirements, and the project is ready for CD-1.'*



DOE/Office of Project Management Oversight and Assessment review of APS-U – Independent Cost Review (Sept. 21-23, 2015)

- *'The project team cost estimate is high quality and includes detailed backup documentation and good application of models... The ICR team recommends approval of the APS-U for CD-1...'*

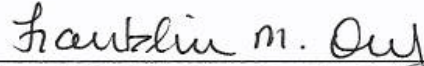
APS-U CD-1 was approved February 4, 2016

News: APS Upgrade Project CD-1 Refresh Approval

Advanced Photon Source Upgrade
At Argonne National Laboratory
CD-1 Refresh ESAAB – Equivalent Review

Approval:

Based on the information presented above and at this review, Critical Decision-1 Refresh, Approve Revised Cost Range is approved and authorized to proceed with the preliminary design and planning, establishing the performance baselines for the Advanced Photon Source Upgrade project.



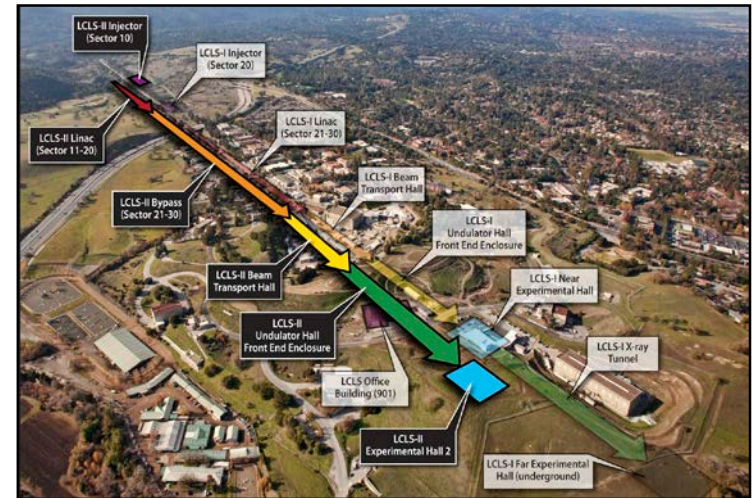
Franklin M. Orr, Jr., Project Management Executive
Under Secretary for Science and Energy

2/4/16
Date

Thanks for all your hard work that led to this success!

Linac Coherent Light Source-II (LCLS-II)

- FY 2016 = \$200,300K; FY 2017 = \$190,000K for R&D, design, prototyping, long lead procurement, and construction of technical systems.
- LCLS-II will provide high-rep-rate, ultra-bright, transform-limited femtosecond x-ray pulses with polarization control and pulse length control to ~ 1 femtosecond. The hard x-ray range will be expanded to 25 keV.
- Added are a 4 GeV superconducting linac; an electron injector; and two undulators to provide x-rays in the 0.2–5 keV energy range.

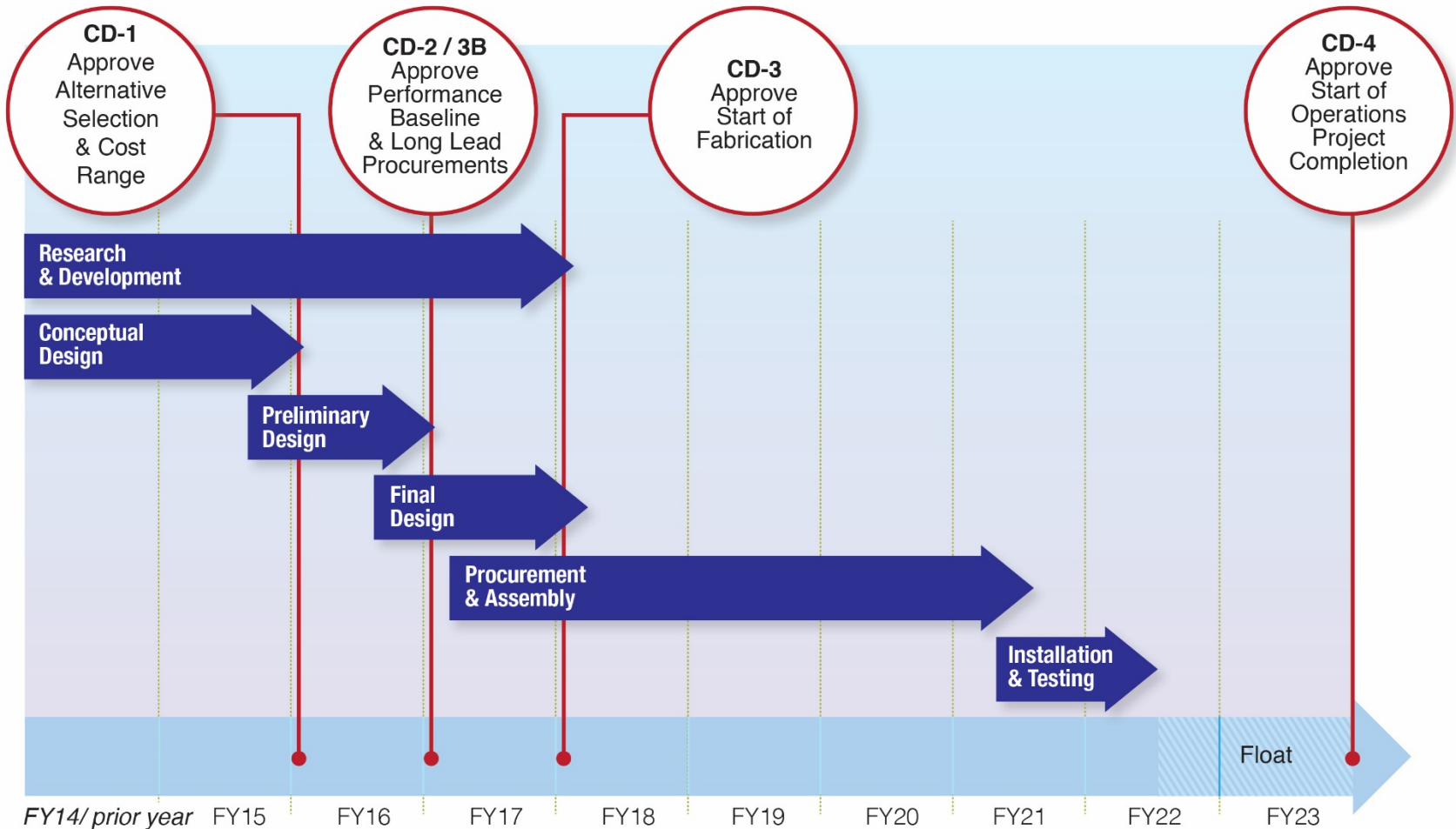


Advanced Photon Source Upgrade (APS-U)

- FY 2016 = \$20,000K; FY 2017 = \$20,000K for R&D, design, and limited prototyping.
- APS-U will provide a multi-bend achromat lattice to provide extreme transverse coherence and brightness.
- Initial conceptual design for the new lattice completed; conducting R&D and key component prototyping in support of the new design. Key performance parameters are being defined for the project and the new storage ring.



APS Upgrade Schedule (presented at CD-1 Review)



Flat funding in FY17 will cause one year delay in project completion and \$30M increase in TPC

BESAC Prioritization

- 2016 Omnibus Appropriations:
 - “...BESAC is directed to update its assessment of the proposed upgrades to x-ray scattering facilities...and to the Spallation Neutron Source using the same criteria that were used in prior studies...”
 - “The assessment shall include a prioritization of the next three to five projects and be submitted to the Committees on Appropriations of both Houses of Congress not later than 1800 days after the enactment of this act.”
- Charge letter from Cherry Murray (Director of DOE/SC) to BESAC
- “Three categories of facilities are to be considered in the prioritization:
 - Free electron laser based x-ray light sources
 1. SLAC LCLS-II High Energy Upgrade (LCLS-II-HE) (i.e. additional cryomodules in existing tunnel)
 - Ring-based x-ray light sources
 1. ANL Advanced Photon Source Upgrade (APS-U)
 2. LBNL Advanced Light Source Upgrade (ALS-U)
 - Spallation based neutron scattering sources
 1. ORNL Spallation Neutron Source Proton Power Upgrade (SNS-PPU)
 2. ORNL Spallation Neutron Source Second Target Station (SNS-STs)
- We are in very good shape going into this prioritization exercise
- We are confident in our story, but remain vigilant
- The first round of presentations (recent BESAC meeting) went very well; next round April 15



Taking stock...

- We have come a long way over the last year to lead the pack of projects vying for priority as “next in line.”
- We’ve been awarded CD-1 in recognition of the maturity of our design, our project plan and ability to deliver APS-U.
- We appreciate the strong and enthusiastic support we get from the community
- We have strong support within DOE/SC
- We intend to cement our leadership position through the BESAC prioritization process
- On the other hand, budgets are very tight, and there are macro-level political priorities in play

Next Steps



Next Steps in Moving the Project Forward

- Beamline planning
 - Continue process for selecting new/upgraded beamlines
 - Complete beamline-by-beamline analysis of needs and capabilities
 - Formulate detailed project scope, cost and schedule
- Accelerator design optimization
 - Evaluate and select amongst lattice alternatives
 - Progress on Preliminary Design of technical systems
 - Progress according to Plan on R&D activities
- Project Planning
 - Adjust/respond to funding profile
 - Prepare for long-lead and advanced procurements
 - Quadrupole doublet assembly
 - Start of “Beamline 1” construction through FOE to serve as optics development platform
- Bring APS-U technical development to the preliminary design level of maturity (~50% design completion)

The Plan: Strategy and Timeline for CD-3b/2/3

- Strategy w.r.t. flat FY17 funding
 - Continue progressing on R&D to reduce/retire as much risk as possible
 - Further advance basis of estimate
 - Keep pushing design toward (and past) preliminary design stage
 - Initiate advanced/long-lead procurements
- We will be aggressive in continuing to move APS-U forward
- In light of all this, we are focusing our attention in the near-term on positioning the Project for CD-3b approval at the next DOE/OPA Review



Status of Beamline planning process

- To baseline the Project, we need to select
 - A set of new beamlines to be constructed (proposed 6 at CD-1)
 - A set of major upgrades to existing beamlines (proposed 2 at CD-1)
 - A package of enhancements for remaining beamlines
- We had a fantastic response to our Call for Beamline Proposals issued 10/30/15
 - 36 Proposals, with 215 unique investigators from > 80 institutions including universities, industries and laboratories
 - These proposals represent a stakeholder community including > 200 institutions

Advanced Photon Source
Office of Science User Facilities



The screenshot shows the APS Beamline Selection website. At the top, there is a navigation bar with links for APS User Info, Machine Status, Beamlines, Divisions, Industry, Science, Media, and Directory. Below this is a secondary navigation bar with links for About, Conferences, Long-Range Schedule, Publications, APS Science 2014, APS Brochure, APS-U, Early Science at the Upgraded APS, and Search the APS. The main content area is titled "Beamline Selection" and contains the following text:

The APS-U Project beamline selection process is a multistage process described by the APS-U Beamline Selection Roadmap. The first step is the submission of a white paper. White papers will be evaluated by the APS-U Project Beamline Review Committee and by APS/APS-U Project Management against criteria described below. Subsequently, developers of white papers will be notified whether they will be asked to submit full proposals. Full proposals will only be accepted based on approved white papers.

The deadline for white paper submission is **January 25, 2016**. Responses to proposers and solicitation for full proposals is expected by **March 15, 2016**. White papers should be submitted (in pdf format) along with a covering e-mail to APSUBeamlines@aps.anl.gov. Submitters will receive a reply to acknowledge receipt of the white paper.

For information on the beamline selection process or for technical information about the APS-U Project please contact either:

- Dean Haeffner, Experimental Facilities Associate Project Manager, APS-U Project, haeffner@aps.anl.gov
- Denny Mills, Deputy Associate Laboratory Director for Photon Sciences, Advanced Photon Source, dmm@aps.anl.gov

The "White Paper Content" section states that white papers should not exceed 10 pages in length and should include the following content:

- Cover page with brief title, developers' names and affiliations, and abstract (150 word limit) that will be made publicly available. A principal developer must be indicated as the point of contact for the white paper, with full contact information provided. (1 page, not included in page count)
- Science case (3-4 pages)
- Beamline description (2-3 page)
- Explicit explanation of the use of APS-U characteristics (1 page)
- Scientific community and stakeholder discussion (2 pages)
- References and CVs of proposers (not included in page count)

While beamline estimated cost information is not expected in the content of the whitepaper, the beamline technical description should be of sufficient detail to allow APS-U Project staff to develop a rough cost estimate.

The "Evaluation Criteria" section states that white papers will be evaluated according to the following criteria:

- Science/technological/industrial impact



Beamline planning timeline

Date(s)	Activity
10/30/15	Call: White Papers
1/25/16	Deadline: White Paper
1/29/15 - 2/15/16	Review by APS-U Beamline Committee
2/16/16 - 2/26/16	APS Management Evaluation
3/15/16*	Call: Full Proposals
6/1/16*	Deadline: Full Proposals
6/2/16 - 6/12/16*	Review by Beamline Cmte and APS Management
6/13/16*	Prioritization/Selection to SAC/ESAC
7/1/16*	Announcement of Selection

← SAC Meeting

* tentative



Beamline Selection Progress

- Beamline Review Committee (Feb. 8-9) assessed 36 white papers according to provided criteria:
 - Scientific/Technological Importance of Program
 - The use of APS-U characteristics and potential for this beamline to be world-leading or world-class
 - Feasibility of design and required R&D activities to mitigate risks
 - Strength of team and expected productivity
- Committee provided very valuable advice
 - Recommended a set to move forward to full proposals
 - Advised on approaches for common proposals
- APS SAC also reviewed proposals and BL Review Committee recommendations
 - Largely endorsed the recommendations from BL Review Committee and APS/APSU management
- Next Steps
 - We will request Full Proposals this week



Beamline enhancements process

- The scope of the Call for Proposals is for newly constructed beamlines or major upgrades to existing beamlines
- APS-U also includes “enhancements” to existing beamlines
- Guiding principles:
 - No beamline should lose ground in the upgrade
 - The project is responsible for making sure all beamlines have usable beams at project completion
 - We strive to provide vastly improved capabilities and performance
- Objectives of the evaluation and selection process:
 - evaluate needs on a beamline-by-beamline basis
 - Self-assessments have been carried out to identify needs along two criteria:
 - Criterion 1: minor upgrades that are essential to be able to utilize beam from APS-U
 - Criterion 2: further upgrades that are desirable to be able to make the most out of APS-U
- Discussions have taken place on a beamline-by-beamline basis.
- Input to the APS-U Project is being assessed and analyzed
- We appreciate the positive, constructive engagement on the part of beamline staff



Finally

- Thanks again for all your hard work that has taken us to this point
- Thanks to the user community for the engagement and support
 - **Your support is essential for our moving ahead!**
- We have a lot of work ahead to move the project forward
- I'm confident that together, we can make APS-U a reality

Thank You!



Questions?



APS-U Beamline Review Committee Membership

Name	Affiliation	Relationship
Gene Ice	ORNL (retired)	ESAC*
Piero Pianetta	SLAC/SSRL	ESAC*
Jean Jordan-Sweet	IBM	SAC**
Janos Kirz	LBNL/ALS (retired)	SAC**
Sine Larsen	U of Copenhagen	SAC**
Mark Daymond	Queens University	User/SME***
Rob McQueeney	Iowa State University	User/SME***
Don Brown	LANL	User/SME***
Qun Shen	BNL/NSLS II	SME***
Sean McSweeney	BNL/NSLS II	SME***
Steve Kevan	LBNL/ALS	SME***
Mike Toney	SLAC/SSRL	SME***
Uwe Bergmann	SLAC	SME***

* APS-U Experimental Systems Advisory Committee

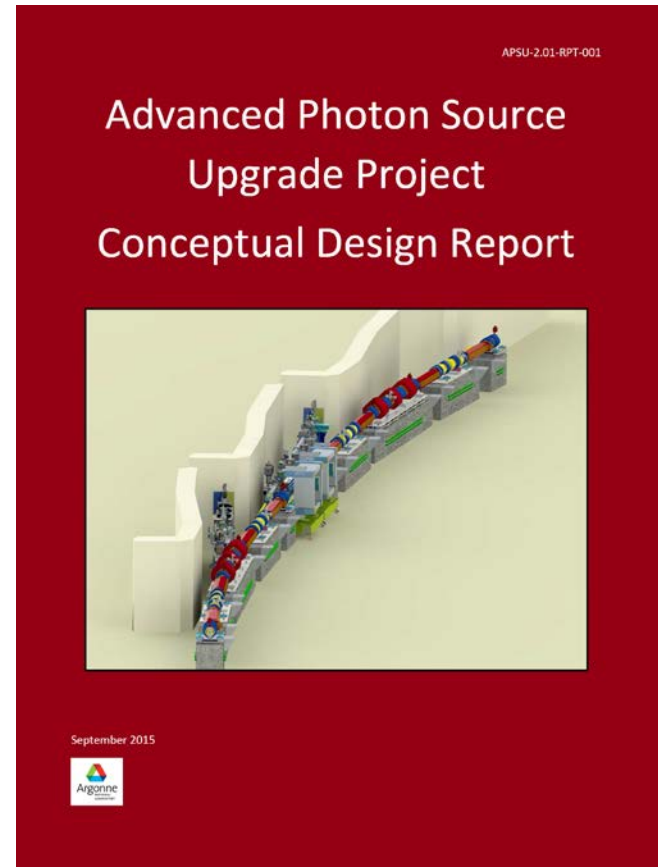
** APS Scientific Advisory Committee

*** Subject matter expert



APS Upgrade design concept and scope

- New storage ring optimized for low emittance and high-brightness
 - 6 GeV MBA lattice (with 2x current) in existing tunnel
- New insertion devices optimized for brightness and flux
 - Superconducting undulators on selected beamlines
 - New and upgraded ID front-ends of common design; higher power and maximum flexibility
- Beamlines
 - Suite of six new and two heavily-upgraded beamlines designed for best-in-class performance with high-brightness source
 - Optics/stability/detector improvements for remaining beamlines, assuring that all beamlines take full advantage of MBA source properties
 - More than 60 operating beamlines at project completion, all with improved performance



The APS Upgrade Concept fulfills the BESAC vision: To build the world's leading high-brightness hard x-ray storage-ring user facility