UPGRADE UPDATE: BOB HETTEL

APS-U Project Status

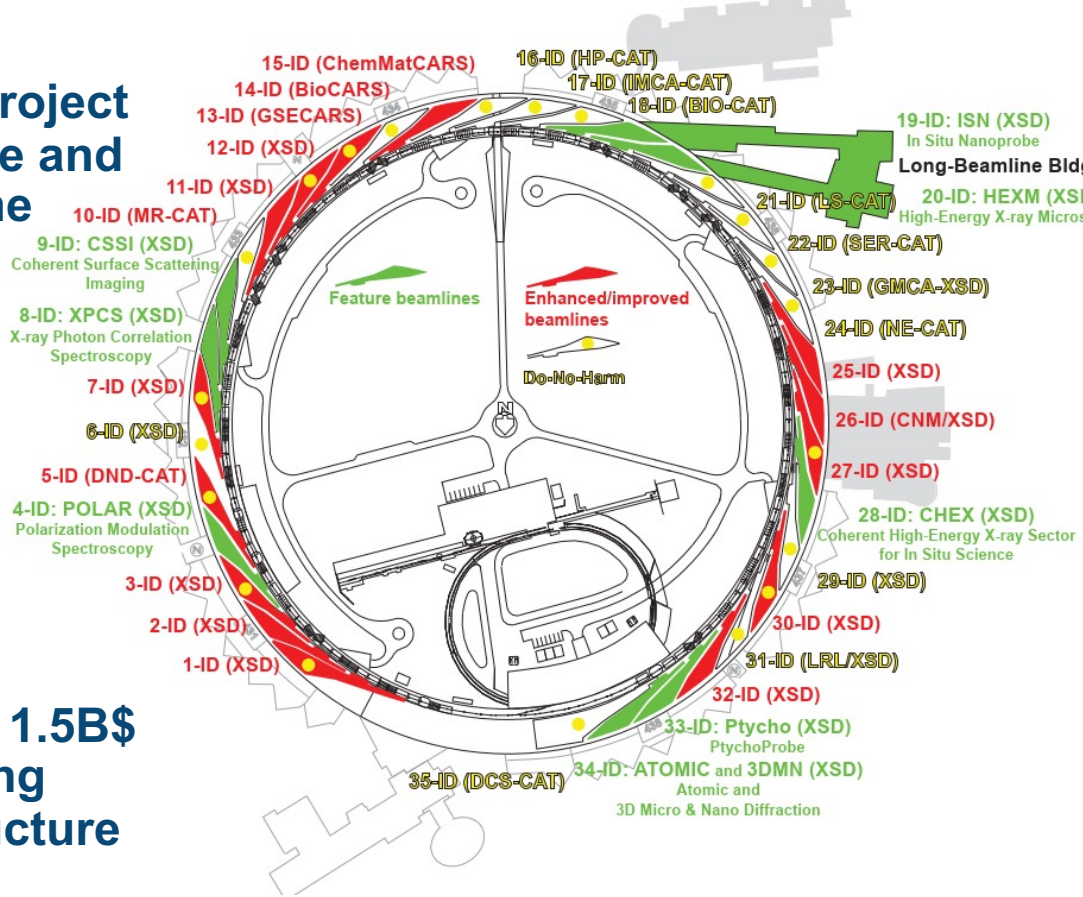
Robert Hettel, APS Upgrade Project Director

PSC All Hands Meeting

November 11, 2021

APS-U Project Scope

815M$ project to update and renew the facility

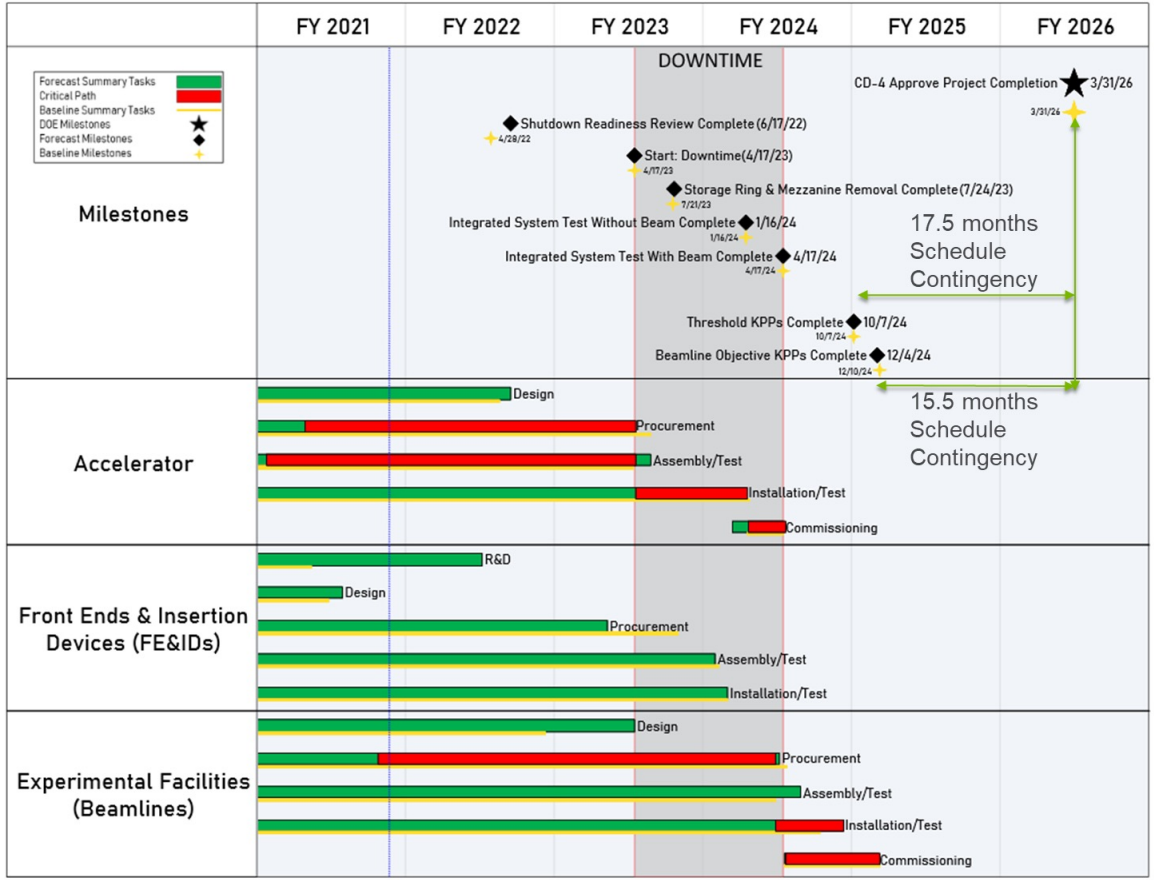


Re-uses 1.5B$ in existing infrastructure

- New storage ring: **42-pm** emittance @ 6 GeV, 200 mA
- New and updated insertion devices, including superconducting undulators
- Combined result in **brightness increases of up to 500x**
- **9 new feature beamlines + Long Beamline Bldg**
- 15 enhanced and improved beamlines
- “Do no harm” beamlines; realign 17 bend magnet lines, updated IDs
- Exploit high-performance computing, AI

APS-U Project Status

- Project is 56% complete; cumulative CPI 0.99, SPI 0.97 (August EVMS).
- APS-U dark time schedule was shifted by 10 months to April 2023 in response to accumulated COVID-19-related component schedule slippages. Many APS Users are happy with this shift and BES is on board.
- 17.5 months schedule contingency; 73.4M$ cost contingency remains (EAC). **Contingency is marginal at this point; draft scope contingency list has been created. Baseline change might be needed.**
- Supply chains ongoing and increasing in complexity based on recent information.



ES&H / QA

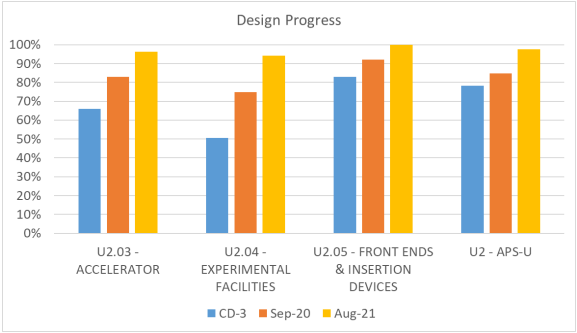
- ES&H and QA are integral to the design, procurement, and installation processes
  - All design reviews and procurement readiness reviews have an ES&H and QA member as part of the committee and specific charge questions are addressed
  - ESH and QA specialists are part of all major procurement bid assessment teams
- APS-U and APS Ops both utilize the same integrated set of review and safety processes
- The Component Database and integrated e-Traveler system are used to track components from receipt to final installation
- All work is planned using the Argonne AWARE system and currently includes COVID controls All work control documents have been revisited and reauthorized with COVID-19 controls in place
- Working with the lab to fill a QA lead position
- Safety performance in FY21: 2 OSHA recordable incidents (1 DART), 2 first aid cases

Operations Interface

- Full success requires the integration of both the Operations and Upgrade efforts
- Working with the divisions and the project, the PMO facilitates the development of a complete overview of needs for success
  - Prioritization of Ops projects based on need
  - Participation and assistance in planning outcomes of Gap Workshop as appropriate
  - Assisting in long-term budget process
  - Assisting PSC in maximizing use of our available resources
  - Beamline workshops, user meetings and Q&A sessions, weekly collaborative access team partner meetings; APS User Organization
- APSU Managing to existing scope – Operations Interface is important for facility success
  - Avoiding scope creep ‘towards the project’ – respecting the defined boundaries
  - Gap workshop engaged personnel from across whole of Directorate
  - DALDs, and DDs, are key in this effort of coordination of all projects in their Divisions
  - J. Kerby serving as interim head of PMO – this has improved understanding and communication with Divisions on Ops Projects

Some of the Significant Progress in FY21

- ~98% overall design completion
- 70+ front end table assemblies completed
- SCU R&D completed; progress in cooling down first unit and preparing for measurement.
- Long lead X-ray optical components placed on order.
- LBB construction continued on schedule and within budget.



Long Beamline Building progress

Front End Tables

Keyhole gaskets

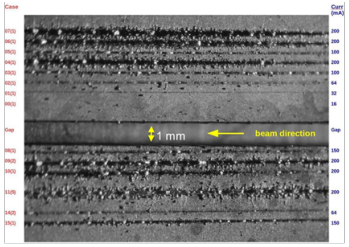
ID vacuum chamber test piece

Cross vacuum chambers

SCU cryostat delivered to ANL

Some of the Significant Progress in FY21 – cont.

- 1095 or more ring magnets received and accepted; magnet plinth assembly commenced.
- Changed injection scheme from vertical with a risky DC septum magnet to horizontal with a much less risky pulsed septum magnet.
- Successfully installed extra shielding for high-charge PAR operation.
- SC bunch lengthening cavity successfully cooled down.
- Significant progress on defining the radiation safety system needed for for swap-out (top-up) injection with open beamline shutters. A review of this system is planned for early of CY22.
- Conducted a multiday **APS-U/APS Operations Gap Workshop** with integrated PSC staff involvement that identified 285 items, grouped in 19 main categories, that need resolution. The issues are being mitigated with project and operations oversight.



Whole beam dump test


First article CAEN power supplies


Superconducting bunch lengthening cavities

Recent DOE Project Status Review

- The Department of Energy conducted and Independent Project Status Review of the APS Upgrade October 26-29
- 22 reviewers, drawn from across the complex, provided feedback on the overall status of the project with regards to technical, schedule, and cost progress
- The charge included specific questions regarding progress and challenges with respect to COVID and related supply chain effects.
- Closeout attended by staff, Laboratory leadership, and program

Committee Members | APS-U Points of Contact

Last Name	Name	Institution	Subcommittee
Ackerman	Andrew	BNL	SC6 Lead
Boyce	Richard	SLAC	SC5
Chao	Kin	DOE/OPA	Chair
Diehl	Joseph	DOE/BHSO	SC7
Fritz	David	SLAC	SC3 Lead
Galambos	John	ORNL	SC8
Hexemer	Alex	LBNL	SC3
Indelicato	Tony	DOE/PSO	SC7
Leemann	Simon	LBNL	SC1
Leftwich-Vann	Robbie	LBNL	SC8 Lead
Leitner	Daniela	LBNL	SC5 Lead
Lung	Allison	TJNAF	SC8
Netto	Andrew	LBNL	SC8
Prestemon	Soren	LBNL	SC4 Lead
Rodgers	Dave	LBNL	SC6
Safranek	James	SLAC	SC1 Lead
Sannibale	Fernando	LBNL	SC2 Lead
Sebek	Jim	SLAC	SC2
Steffey	Wayne	ORNL	SC7 Lead
Temnykh	Sasha	Cornell U	SC4
White	Karen	ORNL	SC2
Zhong	Zhong	BNL	SC3

DOE Project Status Review – Oct. 26-29, 2021 Recommendations

SC1 – Accelerator Physics

- Hold a comprehensive radiation safety review and provide complete requirements for the swap-out radiation safety system by May 2022 to ensure there is time for credited controls to be properly developed and implemented.

SC2 – Accelerator Systems

- Evaluate the impact on the general schedule of a potential further delay in the delivery of vacuum chambers/components. An obvious consequence of such an event is the possibility of jeopardizing the capability of the project to complete the assembly of the modules before the downtime. Evaluate also the effects on other areas and develop a mitigation plan that also considers the assembling of the modules to continue during the downtime. To be completed by Q3 FY22.

SC3 – Experimental Beamlines

- Complete a detailed preliminary mirror metrology schedule in the next 3 months. The schedule should be dynamically updated as fabrication/delivery information evolves.
- Develop a detailed resource loaded plan for installation of U2.04 scope in the next 6 months. This should be logically linked to enclosure completion dates, vendor deliveries, and optics RFI after metrology. Present this plan/tool at the next status review.

DOE Project Status Review – Oct. 26-29, 2021
Recommendations – cont.

SC4 – Front Ends and IDs

- None

SC5 – Accelerator Removal and Installation

- Revisit the R&I risk registry to include additional challenges for R&I by the Installation Readiness Review (Additional harvesting requests, late Integrated Testing requirements.
- Complete the remaining installation designs and firm up detail planning by the next IPR to assess possible additional cost and schedule impacts.
- Complete contractor procurement preparations as soon as possible with the goal to have the majority of the contracts in place by the next IPR. In addition to R&I this task is dependent on completion of installation drawings and subsystem technical packages.

SC6 – ESH/QA

- None

DOE Project Status Review – Oct. 26-29, 2021
Recommendations – cont.

SC7 – Cost and Schedule

- The project should continue to monitor and routinely perform risk analysis to communicate projected cost/schedule contingency shortfalls and potential impacts to the baselined TPC and CD-4 date on a monthly basis.

SC8 – Project Management

- Within 3 months, work with ANL Procurement to determine whether standard language can be included in RFPs that can be used to ascertain known COVID-related delays or shortages that could impact award or delivery.
- Within 3 months, the project and operations develop and implement the process for prioritization, assignment and closure of gaps identified in the Gap Workshop.
- Within 6 months, work with the program office and ANL leadership to analyze the optimum path for the project to increase the likelihood of completion with adequate levels of cost and schedule contingency.

Readiness for APS-U Operations

In Process:

- Definition of requirements to conduct system check-out, based on component designs, interface control documents, system integration processes, etc.
- Preparation for Accelerator Readiness Review that will probe all aspects of the readiness of systems, personnel, policies and procedures in configuration management, QA, safety, etc. Finalize SAD and ASE
- Resolution of major “gaps” in project and APS operations tasks that were identified in the April 2021 APS-U/APS Ops Gap Workshop
- Definition of Transition to Operations plans near the end of the APS-U project and post-project staffing

Summary

- APS-U project is working to the baseline – contingency is a concern
  - Total project scope, cost, and completion (CD-4) unchanged since CD-2
  - The project is 56% complete by cost, 73% by cost + obligations in August
  - Project shifting from design to full receipt and assembly
  - COVID and associated supply chain ripples having continued effects
- Operations and Upgrade working to deliver renewed facility; transition to operations and post-project staffing plans progressing
- Project has remained a priority for the Lab
- Science community engaging on development and preparedness for the new facility

QUESTIONS