SING II MIE DOE Review

Lessons Learned from Beamline Construction

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Managed by UT-Battelle
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Outline

- Lessons Learned from Dec 07
- Lessons Learned from Dec 08
- SING II Implementation

Lessons Learned Session in Dec 2007

SNS Instrument Projects:
Lessons Learned

John Haines
ORNL
Dec 7, 2007

Lessons Learned Session in Dec 2007

- Project Approaches
- Level of Technical Risk
- Lessons Learned:
  - Project Management
  - Technical Requirements
  - Cost
  - Schedule
  - Risk Management
  - Engineering
  - Procurement
  - Installation
  - Project Completion

Design Criteria Document

- Fundamental building block in NScD project management
- Defines technical scope, interface requirements, codes and standards, … for a particular instrument
- Used to satisfy EIR/CD-2 requirement - “EIR Item 6. System Functions and Requirements document”
- Essential for cost and schedule management/control
- This is a living document that is updated as needed by the subproject team – it provides a way of documenting the initial baseline and subsequent changes and evolutions during project execution
  - Change control is defined in the PEP
  - Used to define/confirm project completion

Technical Requirements

- Document all significant technical requirements with the baseline
  - DCD serves this purpose
  - Use disciplined change control process to make changes
- Editorial comment: Use of this process is probably the biggest factor in whether an instrument will meet its cost and schedule goals or not

Schedule

- Sub-project leaders (Instrument Scientist and Lead Engineer) must own the schedule
  - Define logic and durations and assess monthly status
  - Project Controls Staff advise and implement
  - Drives team to make timely decisions
- Purchase high risk items earlier than needed
  - This will obviously give more time for items with schedule uncertainty
  - For cost risk items, it gives the project more time to deal with the problem if an item comes in with a significantly higher cost
    - Negotiate with bidders – cost drivers, reduced performance
    - Reduce non-essential scope elsewhere

Cost Estimating

- Realistic escalation (not required to use OECM guideline)
  - Use ORNL salary planning information for internal labor
  - Use appropriate escalation rates for purchases
- Systematic process for contingency evaluation
- Feedback from recent history
  - Compare estimate to real costs from similar instruments (design, installation, procurement of similar equipment)

Risk Management

- Identify high risks and pay attention to their mitigation strategies
  – Concentrate on the critical few; don't get caught-up in the process and dwell on low risk items
- Bottoms-up input from sub-project leaders and the rest of the team
- Update regularly (quarterly seems to work)

Engineering

- Grouping instrument engineers together increases efficiency, uniformity, and helps share good ideas and practices
  - Shared designs
  - Common equipment minimizes spares inventory and improves maintenance and installation
  - Must create an atmosphere where mistakes and their lessons learned are shared

Procurements

- Economy of scale
- Foreign procurements/exchange rates – try to get in fixed dollars
- Phase funding to optimize BA usage
- Involve all relevant technical staff before awarding contract
- Limited vendors with limited capacities
  - Work closely with vendors
  - Regular weekly conferences from the beginning
- Dedicated procurement staff
- Large vendor base

Engineering/Installation Interface

- Have installation drawings and documents complete before starting installation
  - Complete scope description before starting
  - Avoid verbal orders – RFI process
- Realistic alignment tolerances
- Set liberal tolerances on concrete shield blocks or in equipment that interfaces with concrete structures
  - If needed, fill-in gaps (grout or steel shot in socks) and/or allow for alignment adjustment

Installation

- Local management of installation is essential
  - Allows leveling of resources
  - Prioritization of schedule
  - More efficient use of materials
  - Allows use of construction professionals familiar with local labor rules and market
  - Improves safety – consistent rules and cadre of trained staff and labor force
  - Better engagement by labor force
  - Facilitates feedback to design team

Lessons Learned – Dec 2008

- Why me?
- SING II is largest user of lessons learned, so SING II should gather them
- If SING II gathers them, delivery has occurred

Method

- Log kept through out the year
- Specifically asked for SEQUOIA lessons learned
- Drafted document and sent it to large distribution
- Received comments and additions
- Revised the document and sent to large distribution to "get the word out"
- The effort was well received and considered worthwhile

Project Management

- Schedule Block Diagram greatly aids in understanding the construction/installation sequence
- Advanced Procurement Approvals – plan as part of CD-2 baselining process
- IRR Procedures – start very early. It helps identify needed design features and makes preparation for the IRR more efficient

Construction

- Tolerances – understand what is important and what industry can do
- Construct Cave Equipment At Separate Location – while cave is being built
- Get Installation Group and Survey and Alignment group involved in the design early

Procurement

- Plan early and get procurement involved early
- Use the Advanced Procurement Plan form as a guide

Design

- Shielding –
  – Define and understand requirements well
  – Generate design early
  – Test stack shielding block cans
- Integrate PPS and Non-safety cable pulls into one design package
- Mechanical Interferences – have all designs go through lead engineer and generate “composite” drawing showing equipment locations
- Get the appropriate subject matter experts involved early
- Design equipment (hutches, mezzanines, etc) so that less DB work is needed to install and pull cable
- Documentation – complete and file it as the design progresses (not at the end of the project)

Use Integrated Design Review (IDR) to Drive the Project Forward

- IDR team should represent “stakeholders” – those having to live with the design
- Instrument System Safety Committee (ISSC) should participate in IDR
- IDR should be held early – prior to CD-3
- Nearly all neutronics analysis and all major equipment should be in 3-D model for IDR
- ISSC review of shielding design should occur prior to IDR
- Review of Instrument Operation should be key element of IDR

Improve Shielding Fabrication

- Re-examine stacked shielding gap requirements and fabrication methods
- Have Survey and Alignment determine as built conditions and put data in 3-D model
- Re-examine having vendor fabricate blocks and pour shielding so that stack test can be done at vendor site

System Integration
(Listed in Order they should be generated)

- Process & Instrument Diagram
- Design Criteria Document
- Baseline Debut
  - Address Instrument Operation as well as performance
- Neutronics Analysis Configuration Drawing
- CD-4 Parameters Measurement Drawing
- PPS Sweep Plan

System Integration

- Naming & Numbering – Use only one
- 3-D (Pro-Engineer) Model – show the following early
  - All items on the P&ID
  - Survey and Alignment data showing As-built conditions
  - Shielding (this requires neutronics calculations)
  - All major electrical panels, cable trays, and conduit
  - All major piping
  - Exclusion zones
  - Mezzanines, walkways, etc that determine instrument operation
- Conduct workshops with applicable stakeholders (electrical, survey and alignment, sample environment, detectors, etc)
- Conduct constructability review
- Get ISSC involvement (and approval where possible) early

System Integration – Integrated Design Review (IDR)

- Use it to confirm (and if necessary, drive) that the integration has occurred
- Address instrument operation
- Review team should be stakeholders (those that have to live with the design)
- Review team should include an ISSC member
- Neutronics calculations should be completed and presented

SING II Implementation

SING II Implementation

- Naming – A common equipment list/WBS dictionary has been generated and common names are used where applicable. Consistent naming is stressed daily
- Schedule diagrams exist for VISION, MANDI, and CORELLI
- P&ID's and DCD's exist for VISION, MANDI, and CORELLI – USANS P&ID is in progress
- Baseline Debut has been used for VISION, MANDI, and CORELLI and will be used for USANS
- Neutronics Analysis Configuration Drawings exist for VISION, MANDI, and CORELLI
- CD-4 Parameters Drawing exists for VISION and MANDI
  - They have been used to conduct a workshop with Survey and Alignment to confirm that tolerances are reasonable and can be measured.
- Survey and Alignment As-Built data is in the 3-D model for VISION, MANDI, and CORELLI

SING II Implementation

- Preliminary Design Review (PDR) for MANDI and CORELLI stressed instrument operation
- IDR on VISION checked the System Integration well. Same method (and team where applicable) will be used on remaining instruments
- Workshops with stakeholders and constructability reviews worked well on VISION and will be continued on remaining instruments
- Appropriate early procurement planning has occurred on VISION and will be continued on remaining instruments
- VISION and NOMAD are working with Reuter-Stokes to fabricate detectors – which will ease the strain on SNS staff
- VISION used a functional specification to have Swiss-Neutronics aid in the guide "system" design

SING II Implementation

- Schedules include a 3 month Integrated Systems Testing activity to allow for PPS, motion control and detector testing after construction
- Integration of PPS and Non-safety electrical cable pulls will be pursued in Jan 09
- Development of “composite” drawings will be pursued in Jan 09
- Plans are in place to build VISION cave equipment at location away from Target Building – similar plans will be generated for remaining instruments

Summary

- Lessons learned have been gathered
- Lessons learned have been distributed to those needing them
- Lessons learned are being implemented on SING II