



Closeout Report on the DOE/SC CD-4 Review of the

National Spherical Torus Experiment (NSTX) Upgrade Project

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Committee Chair

Office of Science, U.S. Department of Energy

<http://www.science.doe.gov/opa/>



2. Technical

A. Kellman, General Atomics / Tom
McManamy/ Subcommittee 1

1. Has the NSTX-U project met all CD-4 requirements, which includes: completing the technical scope and achieving the Key Performance Parameters as defined in the Project Execution Plan?
Yes, all elements of the technical scope and Key Performance Parameters as defined in the Project Execution plan were completed.

2. Is the transition to operations plan adequate to transition the NSTX-U project to research operations? *All key elements of the transition planing appear to have been well developed, although they have not been integrated into a single, formal document.*

4. Is the NSTX-U project ready for approval of CD-4, Project Completion? *Yes.*
 - Findings
 - Comments
 - Recommendations



Findings

- All elements of the technical scope as defined in the Project Execution Plan and the Key Performance Parameters required for satisfaction of CD-4 have been accomplished, including plasma current operation above 50 kA (140 kA achieved) and NB operation at 40 kV for 50 msec (45 kV, 100 msec achieved)
- CAMs have signed off the completion of all technical WBS elements.
- With one exception, all action items from all reviews have been completed.
- Both major technical upsets (Aquapour and OH arc) were reviewed by both internal and external panels and recommendations followed.



Comments

- The project has done an excellent job of addressing the full range of technical challenges and has addressed problems in a professional manner.
- Key elements of transition planning appear to be well developed, although they have not been integrated into a single, formal document.
- Analysis of the Operational plan to mitigate the remaining Aquapour indicates there will not be a significant impact on machine performance.
- There is an on-going effort to commission key sensors and validate key engineering analysis as NSTX-U moves towards full parameters. This effort should continue and be managed with higher visibility and reviewed periodically to maintain focus.
- Firm up development of inspection and maintenance plan (e.g. critical welds, bolt torques, joint resistance, etc) with defined intervals and integrate into rollover schedule.
- Additional discussion should be included in Lessons Learned concerning the large use of contingency on the Centerstack assembly and fabrication.
- The process of Operations group review of XP's should be formalized.



Recommendations

- Address D₂ explosion hazard in vessel in the SAD. Evaluate whether it needs to be added to the Safety Envelope and the Summary on Maximum Credible Incidents (after CD-4)
- Implement Item #6 in Aquapour Operational Impact Review - Modify PLC to handle failure of TF cooling (after CD-4)



3. Is the draft project closeout report adequate and have the lessons learned from the project been identified and captured in a draft document?

Yes. However, the Lessons Learned document needs to be updated to include additional items (see comments), which can be completed Post CD-4.

4. Is the NSTX-U project ready for approval of CD-4, Project Completion?

Yes



Findings

- The EAC of \$93.6M includes \$100k estimate for August and September costs.
- Cost contingency at CD-2 of \$17.0M was comprised of three elements:
 - task-by-task activity assessment for unknowns and uncertainties
 - weighted assessment of tabulated risk events
 - standing army costs related to project schedule contingency
- Of the \$17M in contingency at CD-2,
 - \$17.1M was needed for cost overruns,
 - \$0.5M for post OH arc failure mitigation
 - \$3.5M returned to contingency as a result of over estimates,
 - Allowing for \$2.3 million scope enhancement
 - Resulting in \$0.6M in contingency available for use by the FES program
- Nearly all the 12 months of schedule contingency was used in addition to the early start
- Center stack fabrication cost twice the original estimate
- ~80% of the project scope was accomplished in-house
- The project considers the majority of the cost and schedule overruns were related to activities classified as unknowns. ~\$10M of the \$17M cost contingency was used for work classified as unknowns



3. Cost and Schedule

D. Arakawa, DOE- ORSO & T. Maier,
DOE-OPA. Subcommittee 2

Findings

- The project has processed 136 Engineering Change Proposals
- The CD-4 early finish date was September 2014.



Comments

- The NSTX machine failure at the beginning of the project proved to be beneficial for project success
- Significant under estimating of cost and schedule led to the use of nearly all the contingency.
- The CAMs oversight of procurements was less than adequate
- Although the lessons learned matrix does identify the under estimating of cost and schedule for the overall project, the project has not identified this as one of the major lessons learned. In particular the center stack fabrication cost twice as much as the original estimate.
- Consider adding or enhancing a lessons learned regarding vendor management of Everson Tesla.



Comments

- While EVMS performance reporting was good, it did not necessarily accurately convey the project status at the summary level. In particular, the early start of the project gave the project additional schedule.
- All costs associated with the project appear to have been captured, including the costs associated with the OH arc event, and a justification document was developed and signed by PPPL and review by BHSO.
- It was stated that the August costs were less than \$100K and September costs were going to be about \$20K.
- There are no concerns for additional vendor claims, in part because most of the scope was conducted in-house, and therefore the remaining \$0.6M is available to the FES program.



Recommendations

- Update the Lessons Learned after CD-4
- The project is ready to proceed to CD-4 approval



3. Cost and Schedule

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OPA. Subcommittee 2

PROJECT STATUS:		
Project Type	MIE	
CD-1	Planned: Dec 09	Actual: Apr 10
CD-2	Planned: Jan 11	Actual: Dec 10
CD-3	Planned: Jan 12	Actual: Dec 11
CD-4	Planned: Sep 15	Actual: Sep 15 (F)
TPC Percent Complete	Planned: 100 %	Actual: 99.9 %
TPC Cost to Date	\$93.6M	
TPC Committed to Date	\$93.6M	
TPC	\$94.3M	
TEC	\$80.2M	
Contingency Cost (w/Mgmt Reserve)	\$ 600K	
Contingency Schedule on CD-4	0.5 months	100 %
CPI Cumulative	0.95	
SPI Cumulative	1.00	



3. Is the draft project closeout report adequate and have the lessons learned from the project been identified and captured in a draft document? **Yes, draft is adequate, but can (should) be improved by adding a comprehensive, yet succinct project narrative as the executive summary, and a strong technical edit of the entire report.**

4. Is the NSTX-U project ready for approval of CD-4, Project Completion? **Yes, after the Committee's recommendations are addressed.**



Findings

- **Documentation demonstrating satisfaction of CD-4 prerequisite requirements was provided/presented**
 - CD-4 completion demonstrated by combination of machine performance measurements demonstrating achievement of KPPs
 - Formal declarations by each CAM that assigned WBS scope is complete
- **Draft Project Completion Report prepared**
- **Final project safety statistics documented**
- **Planning for transition to operations/research presented**



Comments

- **Committee recognizes the entire project team for their very high quality work delivered over the course of the project, and resilience in overcoming expected and unexpected obstacles**
- **CAM validation of completed project scope following the NSLS II completion documentation process is a good process/practice**
- **Safety performance very good given scope and nature of work, duration of project, and work environment**
- **Lessons learned should be revisited to incorporate all key lessons and to make them more reader-friendly**
- **Translate existing transition to operations planning into a formal Project Transition to Operations Plan**
- **Ensure all project documents and supporting information required for CD-4 are appropriately integrated and updated**



Recommendations

1. **Prepare a formal Transition to Operations Plan (Prior to CD-4 ESAAB)**
2. **Ensure all CD-4 prerequisite documents are appropriately integrated and updated (Prior to CD-4 ESAAB)**
3. **Continue to make the project's lessons learned documentation more complete and reader-friendly (Final Project Closeout Report)**
4. **Request approval of CD-4 when committee recommendations are complete**