

NCSX Vacuum Vessel Sub- Assembly and Modular Coil Winding Form Procurements

P. Heitzenroeder, NCSX Deputy Project Manager for Engineering

SC Project Review
DOE Office of Science, Germantown, MD
December 7, 2004

Contains Procurement Sensitive
Information

OUTLINE

 NCSX

This presentation will be made in two parts:

- Part I will cover the Vacuum Vessel Sub-Assembly (VVSA)
- Part II will cover the Modular Coil Winding Form (MCWF)

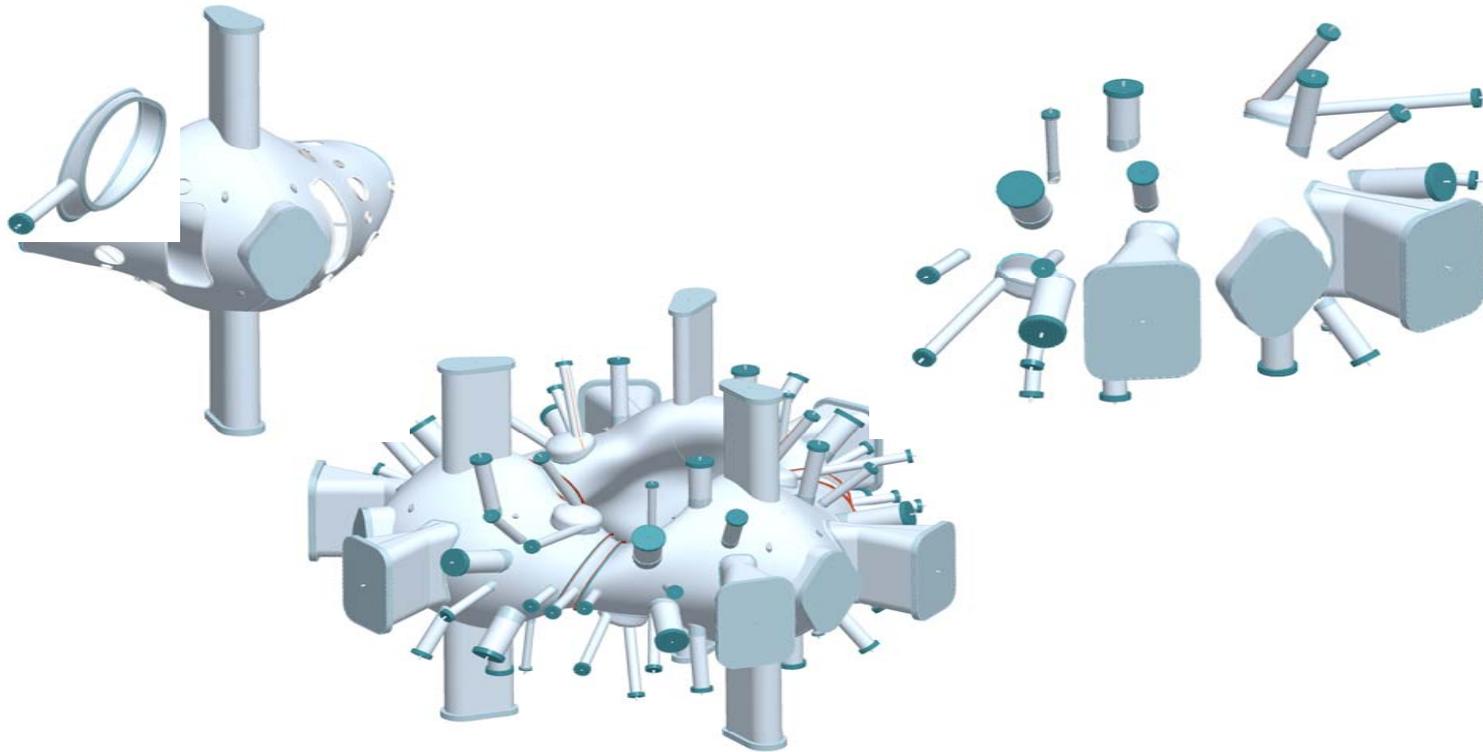
Topics:

1. Accomplishments since CD-3
2. Schedule forecasts relative to milestones.
3. Progress to date relative to schedules.
4. Mechanisms for managing issues and changes.
5. Adequacy of budget & contingency.
6. Plans for the next 6 months (December-May)

NCSX

Part I. The Vacuum Vessel Sub-Assembly

Subcontractor: Major Tool and Machine, Inc.

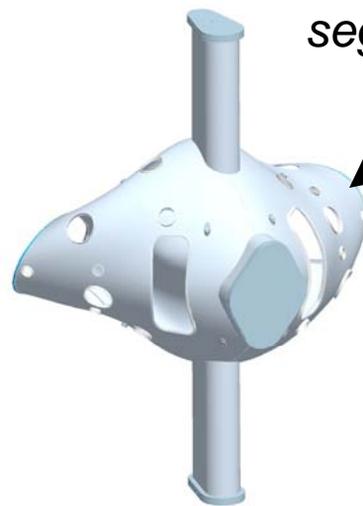
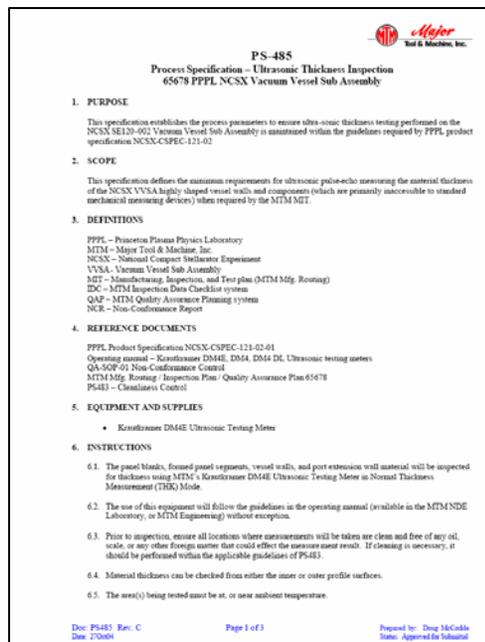


Contains Procurement Sensitive
Information

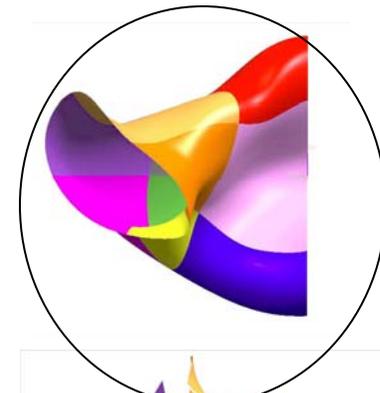
MTM's Work Is Proceeding on Schedule

NCSX

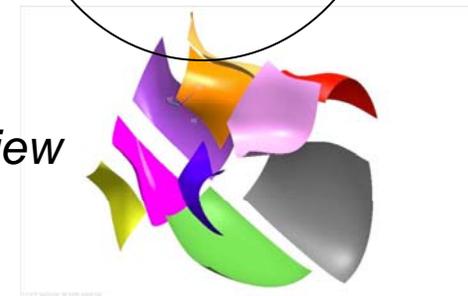
- Manufacturing Inspection Test (MIT) / QA Plans and work planning documents have been prepared and are nearing completion.
- An optimized vessel panel segmentation scheme has been developed.
- Die designs are underway.
- Materials have been ordered (albeit with longer delivery times).



View looking into vv segment end.



Exploded view of panels



Contains Procurement Sensitive Information

The VVSA Will Be Fabricated Using the Methods Successfully Developed for the Prototype

NCSX



A Die Set



Press-Forming a Panel



Weld Fixture



Welded Prototype Segment



Vessel Prototype

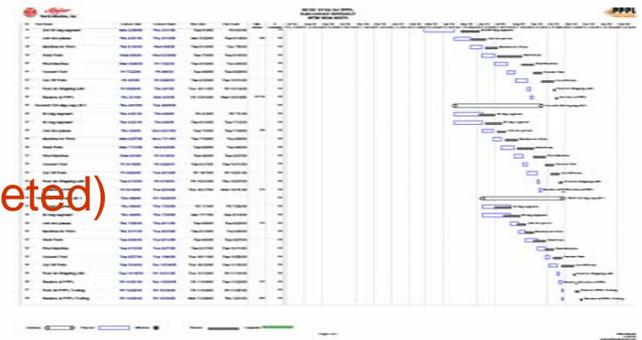
Contains Procurement Sensitive Information

MTM Modified Detailed Schedules – Still Meets NCSX's Requirements

NCSX

MTM had to adjust schedules to adjust for Inconel delivery stretch-out that occurred during contract finalization. The resulting schedule, in black, is compared to the proposal dates in red:

- Contract signed 24 Sept. 04 (**03 Sept 04**)
- Finalize segmentation scheme 19 Nov. 04 (**Completed**)
- Procure die material 7 Jan 05. (**22 Oct. 04**)
- Machine dies; inspect 11 Feb. 05. (**20 Dec. 04**)
- Complete fabrication of 60° fixture 18 Feb 05.
- Complete fabrication of 120° fixture: 4 March 05.
- Procure Vessel Material: 29 October 04-25 Feb 05.
- 1st VVSA received at PPPL: **19 October 05** (28 Sept. 05)
- 2nd VVSA received at PPPL: **31 October 05** (28 Oct. 05)
- 3rd VVSA received at PPPL: **22 November 05**. (28 Oct. 05)



MTM added more parallel tasks to permit the delivery dates to be held within 3 weeks of the baseline dates.

3 months of free float remain.

Contains Procurement Sensitive Information

Mechanisms for Managing Issues and Changes Are In Place

NCSX

- MTM has been in frequent e-mail and telephone contact for clarifications to the Spec and SOW.
 - MTM requested that some tolerances be relaxed, and made suggestions to improve manufacturability.
 - Accepted changes were made in accordance with PPPL's ECN / ECP Procedures.
- PPPL has instituted a "rapid response" system to accommodate minor drawing, spec, and SOW revisions to better (and more quickly) accommodate changes such as those described above.
 - Formal guidance will be given by the Tech. Rep. (Mike Viola) after clearing it with the VV Work Package Manager (Paul Goranson) and Responsible Line Manager (Brad Nelson) via the Procurement Representative (Larry Sutton).
 - Larry Sutton will issue the guidance with a ref. tracking number.
 - Accumulated actions will be acted upon periodically (not to exceed 90 days) to bring the contract documentation (SOW, spec, drawings, contract documents) up to date via PPPL's ECN / ECP Procedures.

Contains Procurement Sensitive
Information

Extensive Technical Oversight is Planned As Production Begins

NCSX

- A PPPL on-site visit is planned in February prior to the start of fabrication to review and / or discuss:
 - MIT / QA Plans and DCMA on-site inspections.
 - Forming Dies.
 - Fixtures and tooling.
 - Answer questions.
 - Develop tentative dates for future
- Future on-site visits will be scheduled for significant activities.
 - Examples: assembly of first 60° segment; joining of two 60° segments; port alignment and welding; pumpdown (strain measurements) and leak checking.
- The PPPL visits will be supplemented by DCMA monitoring of welds, dimensional inspections, etc.

VVSA Budget and Contingency Are Adequate

NCSX

- The Project has \$459.3K of budget contingency (10%) on the remaining VVSA work.
- All work on the VVSA is now being performed under a fixed price and schedule subcontract.
 - As previously noted, some drawing, SOW, and Spec updates have been made, but no cost impact is anticipated.
 - *Only 1 project directed design change has been made, (and that was simply to change the orientation of the vessel hanger). Minor change; no price adjustment is anticipated.*

6 Month Look-Ahead for the VV

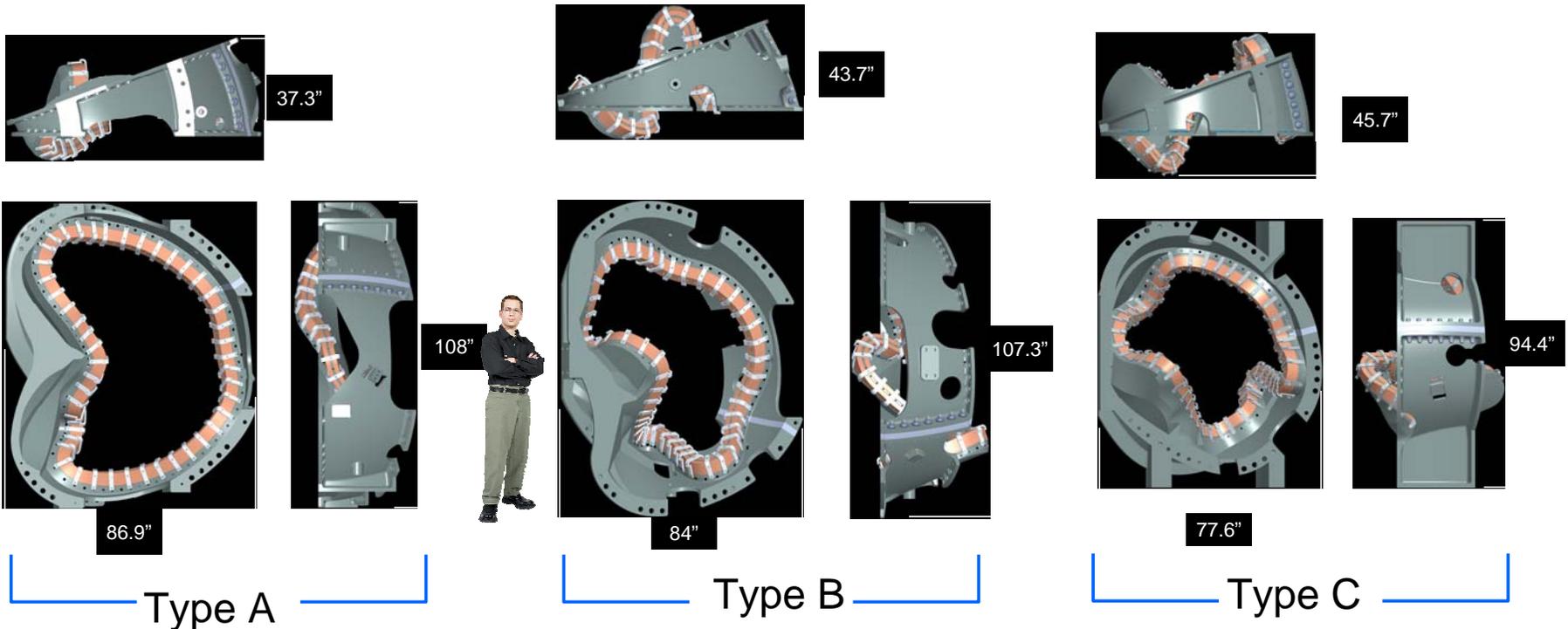
(December – May)

 NCSX

- All prerequisites for the start of production will be completed in the next 6 months and production will be underway:
 - MIT / QA Plans and supporting procedures will be finalized.
 - Materials will be delivered.
 - The dies will be completed.
 - The fixtures will be completed.
 - Trial panels will be formed to verify the dies.
 - Forming of the production panels will underway.
 - The first 60⁰ segment will be completed and the second will be underway.

Part II. The Modular Coil Winding Forms (MCWF)

Subcontractor: Energy Industries of Ohio with team members Lawton, MetalTek and Major Tool.



Contains Procurement Sensitive Information

The EIO Team's Work is Proceeding On Schedule

NCSX

- MIT / QA Plans needed for start of fabrication activities were prepared.
 - Approval of all by mid-December expected.
- Detailed project schedules were developed and incorporated into the Project baseline.
- The Type C hard wood pattern was completed and dimensionally inspected.
- Stainless steel alloy for near-term needs were ordered.
- MetalTek is preparing to pour the C1 casting on December 21st.
- MTM is fabricating the machining fixtures.
- Lawton has started on the Type A pattern.

A Schedule Has Been Developed Which Supports Project Milestones

NCSX

- **Delivery dates for first & last casting are the same as in proposal.**
 - A 1 month delay before the casting of C2 has been incorporated in the schedule to permit the C1 results to be verified.
 - Reduces risk: verifies flow/solidification analysis & dimensions before proceeding with other castings.
- **EIO agreed modified winding form delivery sequence that we mentioned in the last review. (C-C-A-C-B...)**
 - This is a “Win-win” situation. It helps EIO with pattern verification and helps us to have an earlier start on the machine assembly process development.
 - The EIO schedule is reflected in NCSX’s current baseline schedule.

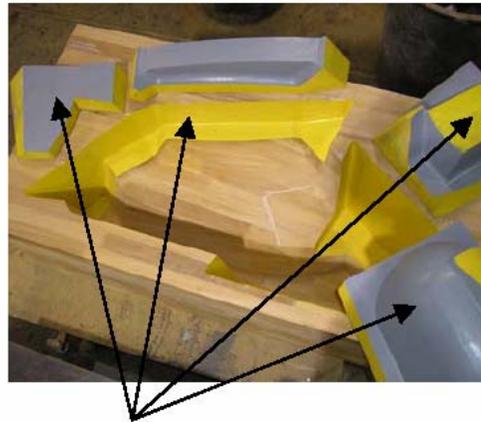
The MCWF’s are on the critical path, and consequently we are closely monitoring schedules.

The Type C Pattern Is Scheduled for Delivery At MetalTek Today (7 December)

NCSX



Side Core Box



Loose Pieces



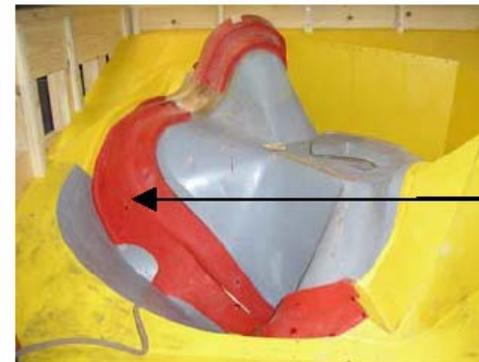
Cope Core Box Loose Top



Cope Core Box



Cope Pattern



Urethane plug

Contains Procurement Sensitive Information

State-of-the Art Laser Optical Scanning Is Being Used for Dimensional Verification of the Pattern Components

NCSX

SUMMARY

3D CAD

CORE 1

CORE 2

CORE 3

CORE 4

DRAG 1

CORE4

DRAG 5

CORE 5

CORE 6

CORE 7

CORE 8

CORE 9

CORE 10

CORE 11

CORE 12

CORE 13

CORE 14

COPE

DRAG

CASTING 1

CASTING 5



Fusion Chamber Castings
Phase 1
C Pattern Dimensional Inspection



Status

ID	READY FOR SCANNING	SCANNED	INSPECTE
CORE 1			
CORE 2			
CORE 3			
CORE 4 D1	x	x	
CORE 4 D5			
CORE 5	x	x	x
CORE 6	x	x	x
CORE 7	x	x	
CORE 8			
CORE 9	x	x	
CORE 10	x		
CORE 11	x		
CORE 12	x		
CORE 13	x		
CORE 14	x		
COPE			
DRAG			
CASTING 1			
CASTING 5			

Note: This report will automatically request to install the E-Drawings plug in required to view models in 3d.

[View of SCANCO NCSX Pattern Inspection web page](http://www.3dscanco.com)

<http://www.3dscanco.com>

Contains Procurement Sensitive Information

Processes for Managing Issues and Change Are In Place

NCSX

- There have been just a few requests for clarifications.
 - So far, no changes have been necessary or requested in the drawings, SOW, or Spec.
- EIO identified schedule issues with the patterns in early November and quickly resolved them.
 - They promptly notified us while in parallel they worked with Lawton to develop a work-around.
 - Lawton subcontracted some of the non-critical work to another pattern shop that they previously worked.
 - This, along with extended work hours by their staff, permitted the schedule to be met.
 - They have also successfully managed issues associated with materials and dimensional control (i.e. use of Laser scanning to speed up this process)..
- As production activities get underway, requests for clarification, tolerance reviews, and design changes to improve manufacturability are expected to increase.
 - Our plan is to handle them in the same way as being used for the vacuum vessel (i.e., the “rapid response” system and PPPL’s ECN / ECP Procedures).

Contains Procurement Sensitive
Information

The MCWF Budget & Contingency Are Adequate

NCSX

- The Project holds \$809.7K contingency (10%) for the remaining work on the winding forms.
- The Type C pattern, and C1 casting is being produced on a cost reimbursement basis.
 - The initial estimate has grown by \$72K (approx. 20%).
 - Increased pattern complexity resulted in the number of parts doubling from 125 to 250.
 - Lawton assures that there will be no further increases associated with the pattern.
 - Lessons learned will improve efficiency on the A and B Patterns.
 - No cost increases are foreseen with the C1 casting operations since this a repeat of the process performed for the prototype.
- The remainder of the winding forms are produced under a fixed price and schedule subcontract.
 - *To date, no project-directed changes are foreseen which will increase costs.*

Extensive Technical Oversight is Planned As Production Begins

NCSX

- A PPPL on-site visit is planned in January to :
 - Inspect the C1 casting after it is de-molded.
 - Discuss casting “upgrading” and Quality inspections (in particular, X-ray inspections).
 - Discuss MIT / QA Plans and plans for DCMA on-site inspections.
 - Discuss the Type A and B patterns and molds.
 - Discuss schedules.
 - Answer questions.
 - Develop tentative dates for future visits.
- Future on-site visits will be scheduled for significant activities.
 - Examples: Inspection of the first Type B and first Type A castings; final machining and dimensional inspections.
- PPPL visits will be supplemented by DCMA monitoring of upgrading operations, inspections, machining, dimensional inspections, etc.

Contains Procurement Sensitive
Information

6 Month Look-Ahead for the MCWFs

(December – May)

 NCSX

- 6 December: Lawton - ship C1 Pattern to MTK
- 21 December: MTK pours C1 casting.
 - MetalTek has work scheduled through the Holidays.
- 15 February: C1 Casting received at MTM.
- 1 March: Rough machining of C1 completed.
- ~15 February: C2 casting poured; Type A Pattern Complete
- 15 April: Finish machining of C1 completed.
- 12 May: C1 inspections completed; Type B Pattern completion expected.
- 16 May: C1 winding form received at PPPL.

Summary

NCSX

- Both the VVSA and MCWF teams have ramped up extremely rapidly, responded effectively to issues, and have accomplished much.
 - MTM responded to material supply schedule issues and developed plans which minimize NCSX schedule impact.
 - EIO and Lawton have responded to the increased complexity of the patterns by subcontracting some of the non-critical components.
 - Both teams are proceeding on schedule.
- All work except the type C pattern and C1 casting are being produced under fixed price subcontracts.
 - We do not foresee any Project-initiated (ie, cost bearing) changes in either effort.
 - There has been \$72 K of cost growth in the cost reimbursement subcontract for the Type C pattern, due to unforeseen complexity as they transitioned from a foam to a hard wood pattern. This is now “retired risk”.
 - Budget and cost contingency for both are adequate.
 - VV schedule contingency is adequate.
 - MCWF schedule is the critical path – schedule has not changed.

Both subcontracts are off to a good start!