

NCSX

Work Breakdown Structure (WBS) Dictionary

Electrical Power Systems (WBS 4)

NCSX-WBS4-03

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Work Breakdown Structure (WBS) Dictionary
Electrical Power Systems (WBS 4)
Record of Revisions

Revision	Date	Author	Description
0	8/27/2003	Simmons	Initial issue
1	1/21/2004	Simmons	Updated WBS dictionary to delete technical requirements, and updated to PBR scope.
2	03/29/06	Ramakrishnan	Updated WBS Dictionary to reflect the most recent Project scope.
3	04/12/07	Ramakrishnan	<p>Updated to reflect current scope:</p> <ul style="list-style-type: none"> • Deleted all references to D-Site (WBS 4 Overview, WBS 43, WBS 432 & WBS 433, WBS 441, and WBS 46). • WBS 4 Overview – simplified description to that defined by GRD, • WBS 421 –clarified scope. • WBS 444 – deleted scope to include optically isolated shunts for each circuit. • WBS 453 – clarified that testing of TF and Trim Coils will be accomplished using temporarily configured power supplies.

Work Breakdown Structure (WBS) Dictionary

Electrical Power Systems (WBS 4)

WBS Element: 4		WBS Level: 2
WBS Title:	Electrical Power Systems	
Description:	<p>The Electrical Power Systems WBS Element covers the supply and delivery of all AC and DC electrical power to all equipment associated with the NCSX experiment. The NCSX Project includes all Electrical Power System capabilities required for initial operation as defined in the GRD.</p> <p>Included in the NCSX Project are design, component fabrication, assembly, and installation activities, system level commissioning, and testing. Electrical Power Systems (WBS 4) includes the power delivery work up to the bus stubs in the floor.</p> <p>Electrical Power Systems (WBS 4) includes the following elements:</p> <ul style="list-style-type: none"> • AC Power Systems (WBS 41); • DC Systems (WBS 43); • Control and Protection Systems (WBS 44); • Power System Design and Integration (WBS 45) 	

WBS Element: 41		WBS Level: 3
WBS Title:	AC Power Systems	
Description:	<p>This WBS element consists of the following subsystems:</p> <ul style="list-style-type: none"> • Auxiliary AC Power Systems (WBS 411); and • Experimental AC Power Systems (WBS 412). 	

WBS Element: 411		WBS Level: 4
WBS Title:	Auxiliary AC Power Systems	
Description:	<p>This WBS element consists of the effort to design and reconfigure existing auxiliary AC power systems. The existing AC power infrastructure at C-site will be re-used to the maximum practical extent. A new AC distribution system, up to and including power panels, is provided in the NCSX test cell. Activities associated with the reactivation of AC power systems at C-site are included. Grounding in the NCSX test cell is provided.</p>	

WBS Element: 412		WBS Level: 4
WBS Title:	Experimental AC Power Systems	
Description:	<p>This WBS element consists of the effort to design and reconfigure existing experimental AC power systems. For initial operation, the C-Site Rectifiers will be used to power the NCSX PF and modular coils.</p>	

WBS Element: 42		WBS Level: 3
WBS Title:	AC/DC Convertors	
Description:	<p>This WBS element provides the AC/DC Convertors required for initial operation.</p>	

WBS Element: 421		WBS Level: 4
WBS Title:	C-Site AC/DC Convertors	
Description:	<p>The C-Site AC/DC convertors will be used for initial operation. Six existing Robicon Rectifiers and the PEI Rectifier will be used.</p> <p>MIE Project scope: none.</p>	

WBS Element: 422		WBS Level: 4
WBS Title:	D-Site AC/DC Convertors	
Description:	<p>MIE Project scope: none</p>	

Work Breakdown Structure (WBS) Dictionary

Electrical Power Systems (WBS 4)

WBS Element: 43		WBS Level: 3
WBS Title:	DC Systems	
Description:	This WBS element consists of refurbishment, as needed, of cabling and other DC components required to feed the NCSX machine from the existing C-Site rectifiers	
WBS Element: 431		WBS Level: 4
WBS Title:	C-Site DC Systems	
Description:	<p>The NCSX coils will be fed from the C-Site Rectifiers located in the ESAT Building. This will include reuse and refurbishment, as needed of the following existing C-Site components:</p> <ul style="list-style-type: none"> • Cabling from the ESAT Building to the Test Cell Basement • Circuit Disconnect Switches • Bus stubs with the associated Disconnect switches coming into the Test Cell 	
WBS Element: 44		WBS Level: 3
WBS Title:	Control and Protection Systems	
Description:	<p>This WBS element consists of the following subsystems:</p> <ul style="list-style-type: none"> • Electrical Interlocks (WBS 441); • Kirk Key Interlocks (WBS 442); • Real Time Control Systems (WBS 443); • Instrumentation Systems (WBS 444); • Coil Protection Systems (WBS 445). 	
WBS Element: 441		WBS Level: 4
WBS Title:	Electrical Interlock System	
Description:	<p>This WBS element consists of the effort to design, fabricate, and install an electrical interlock system for NCSX. An electrical interlock system is designed and installed which ensures the proper configuration of the power system in accordance with the commanded state from the NCSX control room and access control systems, and which provides coordinated fast fault response of the power supplies when faults are detected. The system is implemented by Programmable Logic Controllers (PLCs) at various C-site locations interconnected through a fiber optic network.</p>	
WBS Element: 442		WBS Level: 4
WBS Title:	Kirk Key Interlocks	
Description:	<p>This WBS element consists of the effort to design, procure, fabricate, and install kirk key interlocks for NCSX.</p>	
WBS Element: 443		WBS Level: 4
WBS Title:	Real Time Control Systems	
Description:	<p>This WBS element consists of the effort to develop the specification of the hardware requirements and software algorithms to be provided by WBS 5 (Central I&C) for the real time digital feedback control of the power supply system, including the high-speed digital input and output links.</p>	
WBS Element: 444		WBS Level: 4
WBS Title:	Instrumentation Systems	
Description:	<p>This WBS element consists of the effort to design, specify, procure, install, and implement current and voltage measurements for the NCSX coil systems. Existing shunts in the C-Site Rectifiers will be used. Voltage measurements will also be provided using voltage transducers. Included in this WBS element will be the capability to signal condition using devices that are capable to receive the current measurements and buffer, filter, and fan out each signal to multiple destinations.</p>	
WBS Element: 445		WBS Level: 4
WBS Title:	Coil Protection Systems	
Description:	<p>This WBS element consists of the effort to design, specify, procure, and implement hardware as required to protect the NCSX coils based on current levels.</p>	

Work Breakdown Structure (WBS) Dictionary

Electrical Power Systems (WBS 4)

WBS Element: 45		WBS Level: 3
WBS Title:	Power System Design and Integration	
Description:	This WBS element consists of the following subsystems: <ul style="list-style-type: none"> • System Design and Interfaces (WBS 451); • Electrical Systems Support (WBS 452); and • System Testing/PTPs (WBS 453). 	
WBS Element: 451		WBS Level: 4
WBS Title:	System Design and Interfaces	
Description:	This WBS element consists of the electrical system engineering and design/drafting, which includes the design and analysis of the overall electrical system, its documentation, and the conduct of design reviews.	
WBS Element: 452		WBS Level: 4
WBS Title:	Electrical Systems Support	
Description:	This WBS element consists of the effort to ensure overall project coordination of electrical systems by providing electrical systems support to other systems, including diagnostics, which provides the engineering, design/drafting, and installation of diagnostic cabling.	
WBS Element: 453		WBS Level: 4
WBS Title:	Systems Testing (PTPs)	
Description:	This WBS element consists of the effort to conduct all systems-related preoperational testing, including: <ul style="list-style-type: none"> • DC circuit hipots and impedance measurements • Electrical interlocks • Overall systems testing, including: <ul style="list-style-type: none"> ○ kirk key interlock testing, ○ instrumentation test & calibration, ○ real time control system testing, ○ coil protection system testing, ○ ground fault monitor testing, and ○ coil power supply dummy load testing. • Testing TF Coils and Trim Coils by injecting currents at the required levels using temporarily configured power supplies. 	