

NCSX Project Work Breakdown Structure (WBS) Dictionary
Diagnostic Systems (WBS 3)
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**Work Breakdown Structure (WBS) Dictionary
Diagnostic Systems (WBS 3)**

Record of Revisions

Revision	Date	Author	Description
0	9/8/2003	Simmons	Initial issue
1	1/21/2004	Simmons	Updated WBS dictionary to delete technical requirements and reflect CD-2 milestone scope.
2	6/21/2007	Simmons	Updated WBS to Reflect Scope for 2007 Rebaseline.

Work Breakdown Structure (WBS) Dictionary

Diagnostic Systems (WBS 3)

WBS Element: 3	WBS Level: 2
WBS Title:	Diagnostic Systems
Description:	<p>The diagnostic systems provide the detailed measurements of the plasma parameters that are critical to the research goals of NCSX. The diagnostic systems will be installed as needed to support the research program. Diagnostic Systems are:</p> <ul style="list-style-type: none"> • Magnetic Diagnostics (WBS 31); • Fast Particle Diagnostics (WBS 32); • Impurity Diagnostics (WBS 33); • MHD Diagnostics (WBS 34); • Profile Diagnostics (WBS 35); • Edge and Divertor Diagnostics (WBS 36); • Turbulence Diagnostics (WBS 37); • EB Mapping Diagnostics (WBS 38); and • Diagnostics Integration (WBS 39). <p>Typical diagnostic equipment include sensors, vacuum interface, shutters, collection systems and associated support structures, sensor cables, and signal conditioning hardware and racks. The typical diagnostic work scope includes design, R&D to support the design effort, component fabrication, assembly, installation, system level commissioning and testing, and diagnostic alignments and calibrations.</p> <p>MIE Project Scope: The NCSX Major Item of Equipment project includes only Diagnostics work needed to meet CD-4 objectives, or to install trapped sensors that cannot be added later. The following lower level elements are included in the MIE Project:</p> <ul style="list-style-type: none"> • Magnetic Diagnostics (WBS 31); • Edge and Divertor Diagnostics (WBS 36) – only the Fast visible TV camera system (based on existing equipment); • Electron Beam Mapping (WBS 38); and • Diagnostic Systems Integration (WBS 39). <p>All other WBS elements are excluded from the MIE Project, but may be considered for future upgrades.</p>

Work Breakdown Structure (WBS) Dictionary Diagnostic Systems (WBS 3)

WBS Element: 31		WBS Level: 3
WBS Title:	Magnetic Diagnostics	
Description:	<p>Magnetic sensors include diamagnetic loops, flux loops, saddle loops, Rogowski coils and local B-field probes, and loops co-wound with coils. In-vessel and ex-vessel magnetic sensors will be used to measure plasma position and shape, plasma current, and total plasma stored energy. It also includes sensors to measure edge magnetic field variations due to internal MHD activity (Mirnov coils).</p> <p>For a typical group of magnetics channels, there are the sensors, sensor mounts, sensor lead cables, a vacuum electrical feed-thrus (if in-vessel sensors), junction boxes near the machine, field cables, racks, rack cross-connects, interconnect rack cabling, integrators, data acquisition, AC power and isolation and grounding digitizers.</p> <p>MIE Project Scope: The NCSX MIE project includes only that which is needed to meet CD-4 objectives, or to install trapped sensors that can not be added later. The following magnetic diagnostics are included:</p> <ul style="list-style-type: none"> • Co-wound loops to be installed on the modular coils, toroidal field coils, and poloidal field coils. • Saddle loops to be installed on the vacuum vessel. • Rogowski loops. • Integrator, digitizer, and data acquisition for one Rogowski loop. 	

WBS Element: 32		WBS Level: 3
WBS Title:	Fast Particle Diagnostics	
Description:	<p>This WBS element consists of diagnostics required for evaluation of fast particle behavior, including confined and escaping beam ions and fusion products, as well as escaping fast neutrals.</p> <p>MIE Project Scope: None</p>	

WBS Element: 33		WBS Level: 3
WBS Title:	Impurity Diagnostics	
Description:	<p>This WBS element consists of spectroscopic diagnostics required for measurement of the types and concentrations of impurities in the NCSX plasmas.</p> <p>MIE Project Scope: None</p>	

WBS Element: 34		WBS Level: 3
WBS Title:	MHD Diagnostics	
Description:	<p>This WBS element consists of all MHD diagnostics (excluding low frequency Mirnov coils which are part of WBS 31) required to characterize MHD activity, magnetic island locations and widths, and disruptions.</p> <p>MIE Project Scope: None</p>	

Work Breakdown Structure (WBS) Dictionary Diagnostic Systems (WBS 3)

WBS Element: 35		WBS Level: 3
WBS Title:	Profile Diagnostics	
Description:	<p>This WBS element covers diagnostics required to provide spatial profile information as a function of time for electron density and electron and ion temperature, for the magnetic field direction, and for the toroidal and poloidal rotation. These kinetic profiles provide information needed to characterize and understand local transport and stability issues.</p> <p>MIE Project Scope: None</p>	

WBS Element: 36		WBS Level: 3
WBS Title:	Edge and Divertor Diagnostics	
Description:	<p>This WBS element consists of diagnostics required to characterize the plasma edge and divertor regions. Quantities measured include the hydrogen recycling, the edge neutral pressure, the edge temperature and density profiles, the divertor radiated power, the divertor target temperature, and edge and divertor flows. This information is important in the understanding of edge transport and plasma wall interactions.</p> <p>MIE Project Scope: The current MIE Project scope is limited to only the Fast visible TV camera system (based on existing equipment).</p>	

WBS Element: 37		WBS Level: 3
WBS Title:	Turbulence Diagnostics	
Description:	<p>This WBS element consists of diagnostics required to measure plasma turbulence in both the plasma core and edge regions, which can significantly influence plasma performance. Data from these diagnostics will be critical in the understanding of the details of plasma loss mechanisms.</p> <p>MIE Project Scope: None</p>	

WBS Element: 38		WBS Level: 3
WBS Title:	Electron Beam (EB) Mapping	
Description:	<p>This WBS element consists of electron-beam mapping equipment used to measure properties of the magnetic surfaces including shape and topology.</p> <p>MIE Project Scope: The following equipment will be installed, making use of existing components to the extent possible:</p> <ul style="list-style-type: none"> • Probe drive with an electron gun at its tip. • Fluorescent detector which intercepts the electron beam. • High resolution CCD camera to detect the light from the detector. 	

WBS Element: 39		WBS Level: 3
WBS Title:	Diagnostics Integration	
Description:	MIE Project Scope: Planning and interface definition for diagnostics.	