

## NCSX Work Breakdown Structure (WBS)

| WBS      | Description   | Responsibility | Comment            |
|----------|---|----------------|--------------------|
| <b>1</b> | <b>Stellarator Core Systems</b>                           | Nelson         |                    |
| 11       | <b><i>In-Vessel Components</i></b>                        | Goranson       |                    |
|          | 111 Limiters  |                |                    |
|          | 112 Internal Liner  |                | Not in MIE Project |
|          | 113 Internal Trim Coils                                   |                | Not in MIE Project |
|          | 114 Local I&C   |                |                    |
| 12       | <b><i>Vacuum Vessel Systems</i></b>                       | Goranson       |                    |
|          | 121 Assembly  |                |                    |
|          | 122 Thermal Insulation                                    |                |                    |
|          | 123 Heating and Cooling Distribution System               |                |                    |
|          | 124 Supports  |                |                    |
|          | 125 Local I&C   |                |                    |
| 13       | <b><i>Conventional Coils</i></b>                          | Williamson     |                    |
|          | 131 TF Coils  |                |                    |
|          | 132 PF Central Solenoid Coils                             |                |                    |
|          | 133 PF Ring Coils   |                |                    |
|          | 134 External Trim Coils                                   |                |                    |
|          | 135 Local I&C   |                |                    |
| 14       | <b><i>Modular Coils</i></b>                               | Williamson     |                    |
|          | 141 Winding Forms   |                |                    |
|          | 142 Windings and Assembly                                 |                |                    |
|          | 143 Local I&C   |                |                    |
|          | 144 Modular Coil Winding Facility and Fixtures            |                |                    |
| 15       | <b><i>Coil Support Structures</i></b>                     | Williamson     |                    |
| 16       | <b><i>Coil Services</i></b>                               | Williamson     |                    |
|          | 161 LN2 Distribution System                               |                |                    |
|          | 162 Electrical Leads                                      |                |                    |
|          | 163 Coil Protection System                                |                |                    |
| 17       | <b><i>Cryostat and Base Support Structure</i></b>         |                |                    |
|          | 171 Cryostat  | Gettelfinger   |                    |
|          | 172 Base Support Structure                                | Kalish         |                    |
| 18       | <b><i>Field Period Assembly</i></b>                       | Chrzanowski    |                    |
|          | 181 Planning and Oversight                                |                |                    |
|          | 182 Preparation of the TFTR Test Cell                     |                |                    |
|          | 183 Receipt, Inspection, and Testing of Coils             |                |                    |
|          | 184 Receipt, Inspection, and Testing of Vacuum Vessel     |                |                    |
|          | 185 Field Period Assembly                                 |                |                    |
|          | 186 Tooling Design and Fabrication                        |                |                    |
|          | 187 Measurement Systems                                   |                |                    |
| 19       | <b><i>Stellarator Core Management and Integration</i></b> |                |                    |
| <b>2</b> | <b>Auxiliary Systems</b>                                  | Dudek          |                    |
| 21       | <b><i>Fueling Systems</i></b>                             | Blanchard      |                    |
|          | 211 Gas Fueling Systems                                   |                |                    |
|          | 212 Pellet Injection Fueling Systems                      |                |                    |
| 22       | <b><i>Torus Vacuum Pumping System</i></b>                 | Blanchard      |                    |
| 23       | <b><i>Wall Conditioning Systems</i></b>                   | Blanchard      |                    |
|          | 231 Glow Discharge Cleaning System                        |                |                    |
|          | 232 Boranization System                                   |                | Not in MIE Project |
|          | 233 Lithiumization System                                 |                | Not in MIE Project |
| 24       | <b><i>ICH System</i></b>                                  | NA             | Not in MIE Project |
| 25       | <b><i>Neutral Beam Injection System</i></b>               | Stevenson      |                    |
| 26       | <b><i>ECH System</i></b>                                  | NA             | Not in MIE Project |
| <b>3</b> | <b>Diagnostics</b>  | Johnson        |                    |
| 31       | <b><i>Magnetic Diagnostics</i></b>                        |                |                    |
| 32       | <b><i>Fast Particle Diagnostics</i></b>                   |                | Not in MIE Project |
| 33       | <b><i>Impurity Diagnostics</i></b>                        |                | Not in MIE Project |
| 34       | <b><i>MHD Diagnostics</i></b>                             |                | Not in MIE Project |
| 35       | <b><i>Profile Diagnostics</i></b>                         |                | Not in MIE Project |
| 36       | <b><i>Edge and Divertor Diagnostics</i></b>               |                |                    |
| 37       | <b><i>Turbulence Diagnostics</i></b>                      |                | Not in MIE Project |
| 38       | <b><i>Electron Beam (EB) Mapping</i></b>                  |                |                    |
| 39       | <b><i>Diagnostics Integration</i></b>                     |                |                    |

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| <b>4</b> | <b>Electrical Power Systems</b>                          | Ramakrishnan      |                                   |
| 41       | <b>AC Power</b>  |                   |                                   |
|          | 411 Auxiliary AC Power Systems                           |                   |                                   |
|          | 412 Experimental AC Power Systems                        |                   |                                   |
| 42       | <b>AC/DC Converters</b>                                  |                   |                                   |
|          | 421 C-Site AC/DC Converters                              |                   |                                   |
|          | 422 D-Site AC/DC Converters                              |                   |                                   |
| 43       | <b>DC Systems</b>  |                   |                                   |
|          | 431 C-Site DC Systems                                    |                   |                                   |
|          | 432 D-to-C Site DC Systems                               |                   |                                   |
|          | 433 D Site DC Systems                                    |                   |                                   |
| 44       | <b>Control and Protection Systems</b>                    |                   |                                   |
|          | 441 Electrical Interlock Systems                         |                   |                                   |
|          | 442 Kirk Key Interlocks                                  |                   |                                   |
|          | 443 Real Time Control Systems                            |                   |                                   |
|          | 444 Instrumentation Systems                              |                   |                                   |
|          | 445 Coil Protection Systems                              |                   |                                   |
|          | 446 Ground Fault Monitoring Systems                      |                   |                                   |
| 45       | <b>Power System Design and Integration</b>               |                   |                                   |
|          | 451 System Design and Interfaces                         |                   |                                   |
|          | 452 Electrical Systems Support                           |                   |                                   |
|          | 453 System Testing (PTPs)                                |                   |                                   |
| 46       | <b>FCPC Building Modifications</b>                       |                   |                                   |
| <b>5</b> | <b>Central I&amp;C Systems</b>                           | Oliaro            |                                   |
| 51       | <b>TCP/IP Infrastructure Systems</b>                     |                   |                                   |
| 52       | <b>Central Instrumentation and Control Systems</b>       |                   |                                   |
| 53       | <b>Data Acquisition &amp; Facility Computing Systems</b> |                   |                                   |
| 54       | <b>Facility Timing and Synchronization Systems</b>       |                   |                                   |
| 55       | <b>Real Time Plasma and Power Supply Control Systems</b> |                   |                                   |
| 56       | <b>Central Safety Interlock Systems</b>                  |                   |                                   |
| 57       | <b>Control Room Facility</b>                             |                   |                                   |
| <b>6</b> | <b>Facility Systems</b>                                  | Dudek             |                                   |
| 61       | <b>Water Cooling Systems</b>                             | Dudek             |                                   |
|          | 611 C-Site Cooling Systems                               |                   |                                   |
|          | 612 Neutral Beam Water Cooling System                    |                   |                                   |
|          | 613 Vacuum Pumping Water Cooling System                  |                   |                                   |
|          | 614 Bakeout Water System                                 |                   |                                   |
|          | 615 Diagnostic Water Cooling System                      |                   |                                   |
| 62       | <b>Cryogenic Systems</b>                                 | Gettelfinger      | Not in MIE Project                |
| 63       | <b>Utility Systems</b>                                   | Dudek             |                                   |
| 64       | <b>Helium Bakeout System</b>                             | Kalish            | Not in MIE Project                |
| 65       | <b>Facility Systems Integration</b>                      | NA                | No Longer in Project - was in CDR |
| <b>7</b> | <b>Test Cell Preparation and Machine Assembly</b>        | Perry             |                                   |
| 71       | <b>Shield Wall Reconfiguration</b>                       | Perry             |                                   |
| 72       | <b>Control Room Refurbishment</b>                        | Perry             |                                   |
| 73       | <b>Platform Design and Fabrication</b>                   | Perry             |                                   |
| 74       | <b>Machine Assembly Planning and Oversight</b>           | Perry             |                                   |
| 75       | <b>Test Cell and Basement Assembly Operations</b>        | Perry             |                                   |
| 76       | <b>Tooling Design and Fabrication</b>                    | Perry             |                                   |
| 77       | <b>Measurement Systems</b>                               | Perry             | Will use 187 Measuring Systems    |
| <b>8</b> | <b>Project Oversight and Support</b>                     | Neilson           |                                   |
| 81       | <b>Project Management and Control</b>                    | Neilson           |                                   |
| 82       | <b>Project Engineering</b>                               | Reiersen          |                                   |
| 83       | <b>Environmental and Safety/QA Management</b>            | Levine & Malsbury |                                   |
| 84       | <b>Project Physics</b>                                   | Zarnstorff        |                                   |
| 85       | <b>Integrated Systems Testing</b>                        | Gentile           |                                   |

**Record of Revisions:**

|        |       |   |
|--------|-------|---|
| Rev. 0 | 8-Sep | Deleted NCSX from the title of WBS 73<br>Changed WBS 71 to Shield Wall Reconfiguration<br>Collapsed WBS 15 => Central Solenoid Support Structures moved to WBS 132<br>Added WBS 144 - Modular Coil Winding Facility<br>Moved Integrated Systems Testing from WBS 76 to WBS 85<br>Revised WBS 13 - Split PF Coils into Central Solenoid & Ring Coils => renumbered remaining items |
|--------|-------|---|

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