

ITER Central Solenoid Module Fabrication

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General Atomics (GA) was awarded the first phase of the ITER Central Solenoid (CS) Module Fabrication (CSMF) contract by US ITER in July 2011. The ITER CSMF is managed by the US ITER Project Office (USIPO) at Oak Ridge National Laboratory, under the sponsorship of the Department of Energy Office of Science. Goals of the base contract include definition and qualification of manufacturing processes and tooling necessary to fabricate seven CS modules (6 + 1 spare) that constitute the ITER CS. Qualification is completed at each manufacturing station with the production of a mockup coil using dummy conductor. A subsequent, second phase manufacturing effort produces the CS Modules which will be delivered to the ITER site in Cadarache, France during 2016–2018.

GA is developing an integrated manufacturing process along with specialized tooling based on the USIPO requirements. An integrated management system utilizes proven risk management, configuration management, quality assurance, and earned value management tools to identify and manage program efforts. Regular interaction between the USIPO and GA teams is maintained to review and address program issues. Formal Tooling Requirements Reviews (TRR), Preliminary Design Reviews (PDR), Final Design Reviews (FDR) and Manufacturing Readiness Reviews (MRR) for eleven (11) manufacturing stations are the key milestones in the tooling development phase of the program. Seven (7) CS Module deliveries are the primary milestones in the manufacturing phase of the program. The critical path items for the tooling development phase are the Winding System design and fabrication, and the qualification of processes on a mockup of the CS Module. The manufacturing schedule is driven by the delivery of the production conductor.

GA has established a fabrication facility that combines 1,500 m² of offices with 6,000 m² of fabrication space. Extensive building modifications are complete with the first manufacturing tooling arriving in late 2013. The facility utilizes several cranes with up to 35T capacity to handle and move delivered conductor and wound hex and quad pancakes during the winding, joint and lead fabrication, and stacking operations. Once the CS Module is stacked onto a support base, the assembly is moved on a high capacity floor between manufacturing stations utilizing an air bearing moving tool. At this point the CS module, support base and moving tool is nearly 200 metric tons. The manufacturing process flow uses primarily one set of tools per station, except for the critical Winding and Turn Insulation Stations which require two sets of tools to meet delivery requirements and to minimize program schedule risk. Most tools are unique to the ITER CSMF and are designed and built by GA and tooling suppliers. GA is performing manufacturing development tasks to reduce program risks and to support the generation of process and tooling requirements.

GA has placed contracts for the design and fabrication of time critical systems. Tauring S.p.A is designing and fabricating the Winding Station and Ridgway Machines LTD has been selected for the insulation wrapping heads used in the Turn Insulation Stations. The Reaction Heat Treatment Furnace contract has been issued to Seco Warwick.

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