PART I - DESCRIPTION

WBS Number: 1.2.1	**Title: Vacuum Vessel Shell**
Originator: B. Nelson	

Description

General Description of Work to be Performed:

The vacuum vessel is a complex, three period structure with a geometry that repeats every 120 degrees toroidally. The geometry is also mirrored every 60 degrees so that the top and bottom sections of the first (0 to 60 degree) segment can be flipped over and serve as the corresponding sections of the adjacent (60 to 120 degree) segment. Table 1 lists the main vacuum vessel parameters.

Table 1 vacuum vessel parameters

Material	Inconel 625
Thickness	0.95 cm (3/8 in)
Time constant	<10 ms
Inside surface area (without ports)	27.6 m^2
Inside surface area (with ports)	57.6
Enclosed volume (without ports)	8.69 m^3
Enclosed volume (with ports)	11.0 m^3
Weight with ports (without pfc's)	5375 kg

The vessel will be fabricated in three subassemblies that are bolted together, complete with modular coils and ports. The preliminary port configuration may be seen in Figure 1. Most of the ports must be welded onto the three liner sub-assemblies after installation of the modular coils and prior to final assembly. Port stubs are provided on the vessel to permit the modular coils to slip on first, followed by automatic welding of the port extensions from the outside, that is, by a pipe welder inserted down into the port extensions.

The vessel shell may be formed by pressing, explosive forming, or possibly casting sections of the vessel and welding them together to form the finished shape. Segmentation of the vessel is driven by assembly requirements and inherent fabrication limitations. Fabrication by pressing requires the panel sections to be removable from the tooling dies. This requirement must mesh with the desire for half-period segments. The result is that the number and geometry of poloidal segments is dictated by the die contour. A first cut at the segmentation indicates that the half period can be formed with as few as three poloidal sections, four are used for the cost estimate, as shown in Figure 2.

The torus sections are provided with internal, machined end flanges that provide a double o-ring, bolted assembly. To provide a precise fit during final assembly, the welding of the field period sections to their respective end flanges is done with the components all pre-assembled on a fixture into a complete torus.

WBS Number: 1.2.1 (Continued)	Title: Vacuum Vessel Shell
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Description

Design
All drawings and analysis required for the full vacuum vessel shell are provided, including design drawings for the press tooling.

R&D
Sufficient R&D funds are provided to cover a full scale partial prototype (1/2 field period) vessel, typical port extensions, cooling lines and other features.

Materials and Subcontracts
All fabrication work is assumed to be performed by one or more industrial subcontractors via a fixed price or cost plus award fee contract.

Fabrication and Assembly
No in-house fabrication or assembly is required

Installation and Testing
All installation and testing is included in WBS 7

Description of Existing Equipment/Facilities to be Reused:

None

Description of Major Modifications Required to Existing Equipment/Facilities:

None

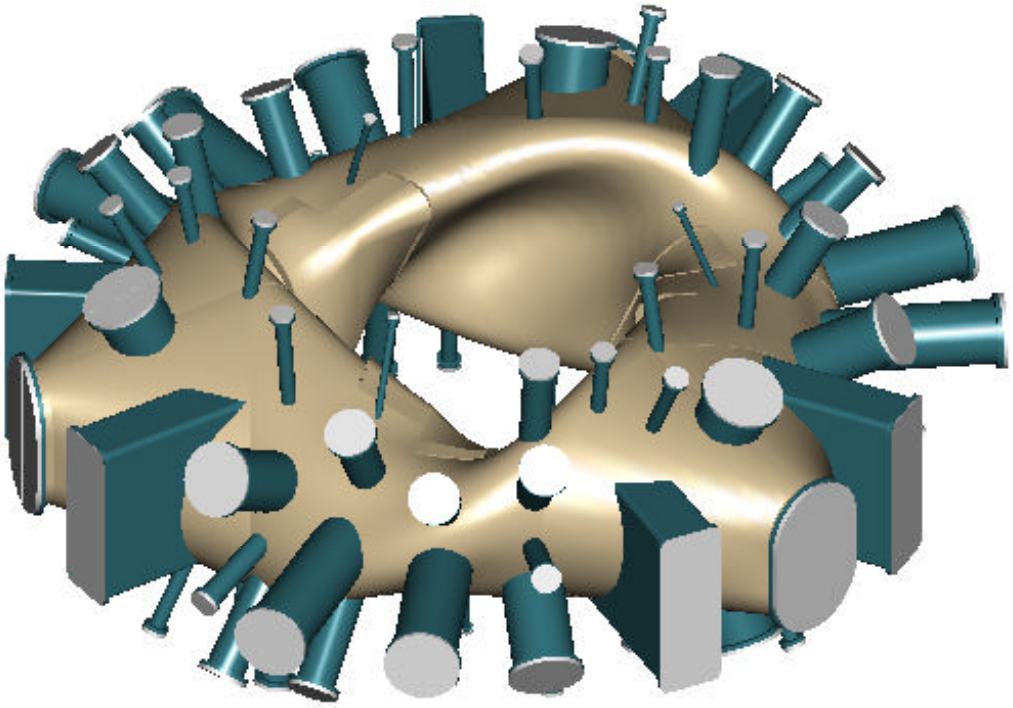

Figure 1 Vacuum vessel with port extensions

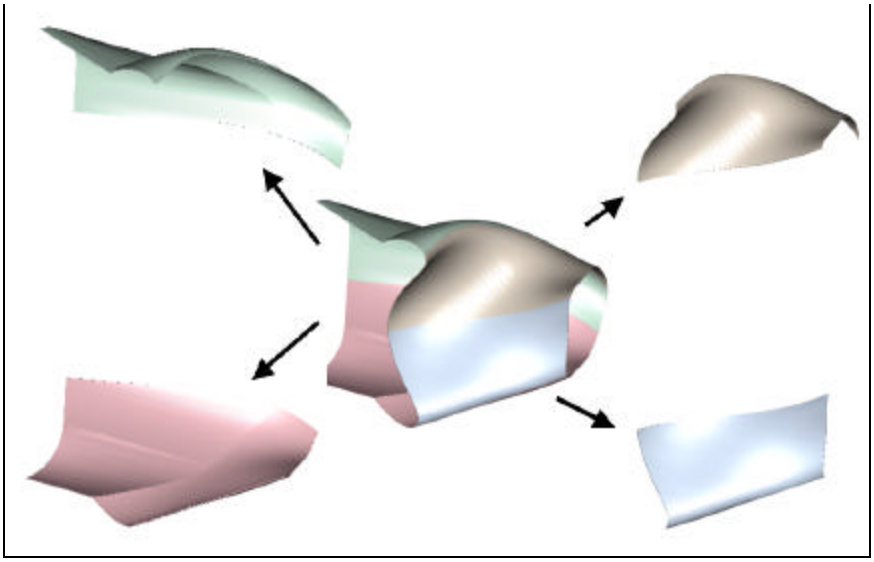

Figure 2 Vacuum vessel shell segmentation