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**FIRE Remote Handling Status and  
Update**

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**FIRE Engineering Meeting**

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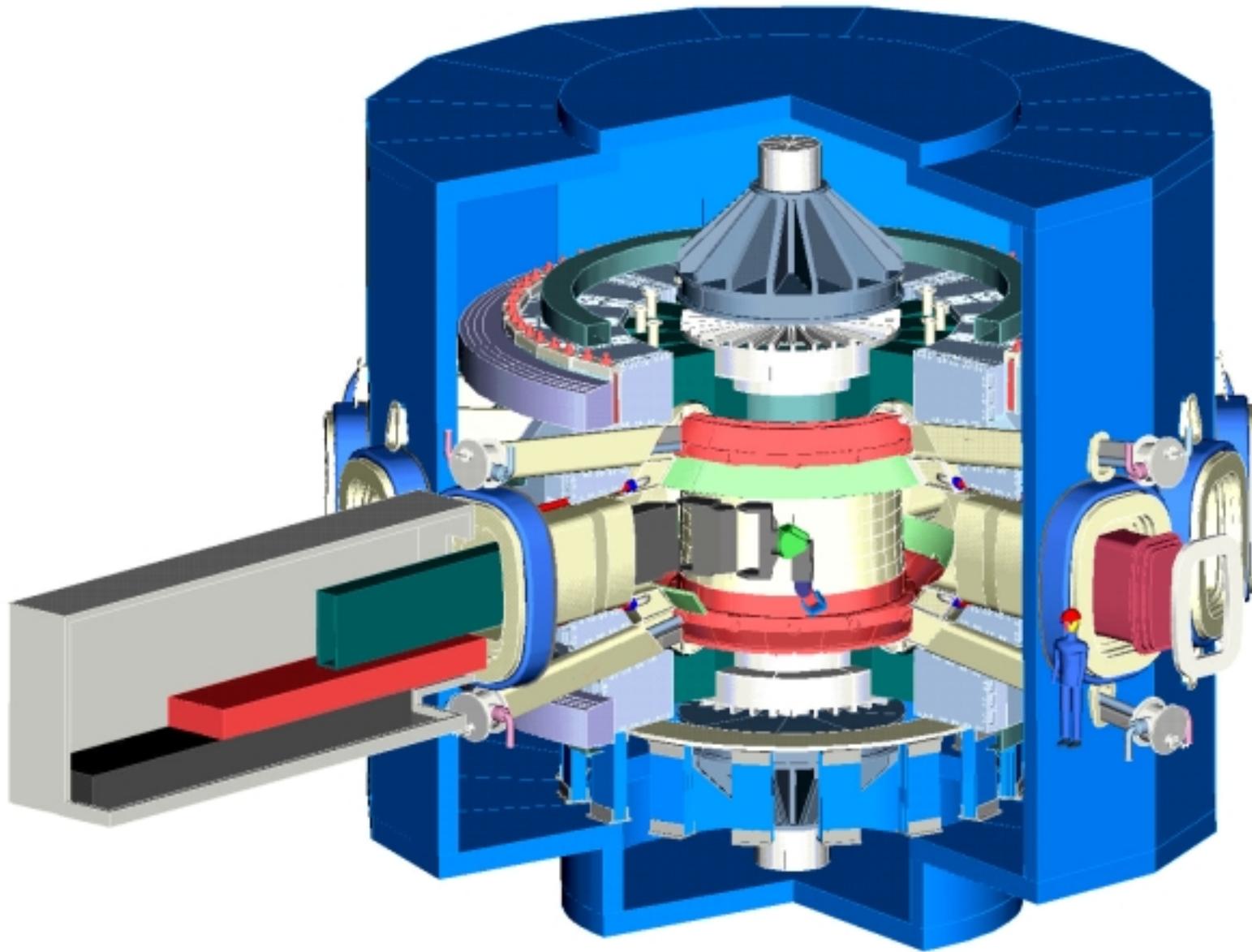
**PPPL**

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## Remote Handling Systems (WBS 7.5) Expected Changes for FIRE Engineering Report

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- Update the IVT boom and end-effector for the combined divertor
  - In progress
- Minor changes expected to engineering section text and figure (IVT) required
  - Recommend updating maintenance time estimates and table for combined divertor and include with other maintenance time estimates in appendix along with other back-up information (e.g., component classifications, equipment list)



In-vessel remote handling transporter deployed through a midplane port

## **Hot Cell Remote Handling Systems (WBS 7.6) for FIRE Engineering Report**

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- Hot Cell RH System Equipment to be defined
  - In progress (Burgess/Dilling)
- Costs for the Hot Cell RH Systems to be generated
- FIRE Engineering Report section to be prepared/updated??

## Hot Cell Remote Handling Equipment (WBS 7.6)

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### Min. Cask Docking Interfaces (already costed under WBS 7.5):

#### Hot Cell:

- 1 Midplane port in-wall port assembly
- 1 Auxiliary port in-wall port assembly
- 1 IVT midplane cask for divertor and midplane port transfer into hot cell
- 1 Auxiliary port for transfer of aux. port assemblies into hot cell

#### RH Equipment Storage Area:

- 1 midplane port cask
- 1 auxiliary port cask

### Example Hot Cell RH Equipment (to be costed under WBS 7.6):

- 1 bridge crane (sized for largest port assembly? ~50 tons)
- 1 manipulator transport bridge with a dual-arm dexterous manipulator for working on in-wall port assemblies and other misc. tasks in cell
- 1 MSM (manipulator/window) workstation at waste processing area of cell
- 1 MSM workstation at divertor processing area of cell
- 1 MSM workstation at component storage, inspection area of cell
- 12 in-cell cameras with pan/tilt (4 wall, 2 crane, 5 manip. bridge, 1 portable)
- 1 divertor processing station for PFC replacement TBD
- TBD component handling/transport devices?? (port assemblies probably most difficult to transfer into cell from cask)
- TBD Tools and lift fixtures

## Remote Handling Systems (WBS 7.5) Cost Estimate

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Level 4 Element	Cost	Contingency	Total Cost
7.5.1 In-Vessel Transporter	\$ 13,608 k	28%	\$ 17,418 k
7.5.2 In-Vessel Inspection Systems	\$ 2,649 k	12%	\$ 2,967 k
7.5.3 Port Assembly Handling Systems	\$ 16,130 k	28%	\$ 20,647 k
7.5.4 Remote Handling Tools	\$ 6,300 k	28%	\$ 8,064 k
7.5.5 Containment and Transport Systems	\$ 9,420 k	28%	\$ 12,058 k
7.5.6 Remote Handling Control Room and Test Stand	\$ 4,320 k	12%	\$ 4,838 k
<b>Total</b>	<b>\$ 52,427 k</b>	<b>26 %</b>	<b>\$ 65,992 k</b>

- Level 5 estimate that assumes complete hands-on access to ex-vessel region
- Extensive prototypes and mock-ups required for design development and verification
  - Prototype equipment becomes FIRE Site RH Mock-Up
  - WBS 7.5 provides RH prototypes, component WBS to provide VV, divertor and FW component mock-ups
- Remote handling systems designed by ORNL with possible exception of cutting/welding tools (Boeing) and air cushion vehicle (AeroGo)
- Equipment fabricated and procured from vendors
- Integrated systems testing of final RH equipment performed at FIRE Site by RH Group costed for 2 years of construction phase
  - Group leader, 4 engineers, 4 technicians

## Remote Handling Systems (WBS 7.5) Cost Estimate

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### WBS 7.5 Summary of Combined Total Costs

Level 4 Element	Cost	Contingency	Total Cost
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Hourly rates vary from \$90/hr to \$124/hr, Avg. ~ \$110/hr

### WBS 7.5 Summary per PPPL Cost Estimate Forms

Cost Category	WBS 7.5 Remote Handling Systems		
PACE:			
Engineering	62,992 hrs		
Hardware	\$ 18,978 k		
Procurement Support	6800 hrs		
Installation	11,300 hrs		
Integrated Testing	36,000 hrs		
OPEX:			
R&D / Mock-up tests	\$ 16,778 k	+	39,700 hrs
Subtotal	\$ 35,756 k	+	156,792 hrs