Case Study: MASCOT

The Robotic System

*What hardware does it have?*

* bilateral master / slave telerobotic manipulator system with haptic feedback
* attached to an articulated boom for positioning

*What level of autonomy does it have?*

* remotely controlled by an operator via control software (computer assisted tele-operation)
* software constraints on where arms can move, virtual forces / force scaling
* some semi-autonomous/ automatic moves (eg. arms move to “home position”)

*What sort of software implements any autonomous functions?*

* C++ on VX Works

*Does the level of autonomy require hand-over between the system and a human operator*

* yes

The Task and Environment

*What does the robotic system have to do?*

* carry out inspection, maintenance, repair, removal and replacement of components inside the torus vessel during a shutdown
* wide range of in-vessel tasks including welding, cutting, bolting, handling and inspection

*What materials is the robot handling/manipulating?*

* tools required to carry out the above tasks
* activated metal components, beryllium tiles (20kg handling capacity)

*Will the robot become activated (so, can we remove it from its environment for maintenance or replacement)?*

* potentially contaminated with tritium and beryllium
* has to be bagged for movement to a contained facility after operation

*Are there any other environmental constraints?*

* only used in-vessel during a shutdown periods – vessel has become activated (gamma-rays) and is contaminated with tritium and beryllium dust
* do not want to contaminate torus vessel with fluids, polymers, or leave any debris, dropped materials

Key Hazards

*Hazards caused by and mitigated by the robotic system*

* breach of vessel due to impact (eg. silica window)
* during combined manual and remote handling work in-vessel, potential for injury to operator and/or damage to pressurised suit

*Hazards of the task*

* personnel injury hazards on the master end

*Hazards or challenges caused by the environment*

* space constraints
* control systems remote due to radiation, large amount of wiring in the boom
* unknown conditions in the torus (erosion, deposition, movement of components)