

## A PERSPECTIVE ON REMOTE HANDLING OPERATIONS AND HUMAN MACHINE INTERFACE FOR REMOTE HANDLING IN FUSION (P2-G-174)

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A large-scale fusion device presents many challenges to the remote handling operations team. This paper is based on unique operational experience at JET and gives a perspective on remote handling task development, logistics and resource management, as well as command, control and human-machine interface systems.

Remote operations require an accurate perception of a dynamic environment, ideally providing the operators with the same unrestricted knowledge of the task scene as would be available if they were actually at the remote work location. Traditional camera based systems suffer from a limited number of viewpoints and also degrade quickly when exposed to high radiation. Virtual Reality and Augmented Reality software offer great assistance.

The remote handling system required to maintain a tokamak requires a large number of different and complex pieces of equipment co-ordinating to perform a large array of tasks. The demands on the operator's skill in performing the tasks can escalate to a point where the efficiency and safety of operations are compromised. An operations guidance system designed to facilitate the planning, development, validation and execution of remote handling procedures is essential.

Automatic planning of motion trajectories of remote handling equipment and the remote transfer of heavy loads will be routine and need to be reliable.

This paper discusses the solutions developed at JET in these areas and also the trends in management and presentation of operational data as well as command, control and HMI technology development offering the potential to greatly assist remote handling in future fusion machines.