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A PERSPECTIVE ON EQUIPMENT DESIGN FOR FUSION REMOTE HANDLING (P2-G-159)

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For 8 years, JET remote operations have become more capable and confident. Many tasks have been successfully completed, even those never intended to be remote maintenance activities.

The general approach to the provision of remote handling equipment at JET has been the preferred use of commercially-off-the-shelf equipment. In the areas of electrical, electronic, software and control this approach has been generally achievable. However, in the area of mechanical equipment it has been more difficult. In particular the RH tooling has been almost entirely bespoke as its requirements are highly sensitive to the design of the JET component being handled and there are many design variations. Hence, JET has required the design and manufacture of over 700 types of bespoke RH equipment.

This paper will discuss the experience of introducing and developing remote handling mechanical equipment for JET. The paper will cover the relationship between the remote handling equipment and the JET component design and the potential for improving the design function.

A major lesson from the introduction of remote handling to JET has been demonstration of the very close interdependency of the design of JET components with design of remote handling tooling. The JET remote handling manual was originally introduced as the vehicle to ensure remote handling compatibility by the introduction of standards. Experience has shown that in general the remote handling manual approach has been insufficient. Future fusion machines will be much more complex than JET and will demand even greater remote handling compatibility. This paper will discuss possible methods for improving this process.

Equipment operating in a high radiation environment must be dependable It may spend part of its time in areas that would be extremely difficult to recover from in the case of failure. The equipment may also have a high duty cycle to minimise shutdown times and probably cannot be manually inspected on a frequent basis. To foresee and therefore prevent equipment failure technologies such as online condition monitoring and self-diagnosis will be essential.

The economics of future fusion projects will demand that commercial off-the-shelf equipment be used in the remote handling system wherever possible and that the integration and support of the systems are as simple as possible. The modularisation and standardisation of components and software is therefore essential.

The paper will discuss possible methods for addressing these needs of the preparation, maintenance and support of remote operations. If ignored, this aspect has significant potential to inflate costs and reduce operational effectiveness.

The paper will also discuss innovations and developments which have the potential for improving some of the key technologies required for fusion machines such as in pipe joining techniques and actuator developments