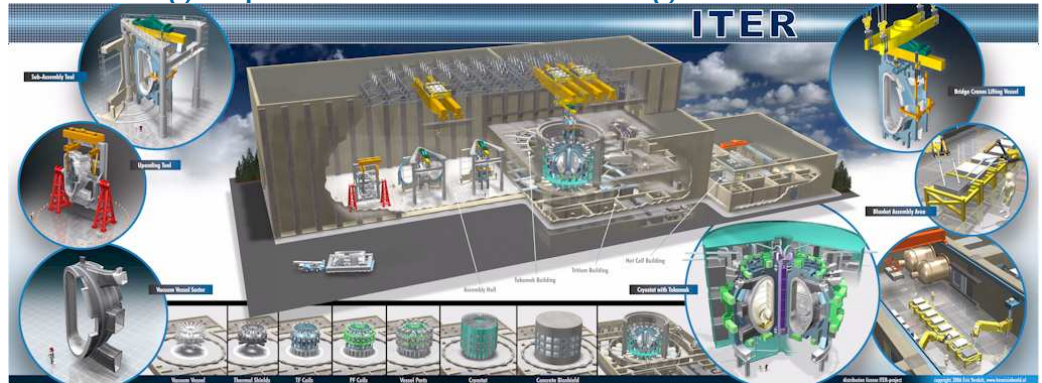


## Newsletter of Oxford Technologies Ltd

### Providing expertise to the ITER Organisation

#### News In Brief

- Oxford Technologies Ltd continues its steady growth. Six new staff have been appointed during the past 3 months and turnover for 2007/8 is on target for continued growth of around 20% per annum.
- TreeC Technology B.V have signed a licence agreement with Oxford Technologies to further develop and market VR4Robots®. TreeC Technology B.V are the suppliers and developers of VR4MAX® which is the core visualisation platform used by VR4Robots®. VR4Robots® offers users of robotic and remote manipulator devices significant benefits for task visualisation, planning, monitoring and implementation in complex remote handling environments.
- Many of the articles in this issue of *Vista* highlight our current involvement with the ITER project both on our own and also in partnership with other industries and National Associations.



The ITER project offers scientists, technologists, project managers and politicians one of the most significant challenges and opportunities yet faced. Oxford Technologies Ltd is proud and honoured to be engaged on a number of the first industry activities awarded by the new ITER Organisation (IO).

Our extensive experience from design and implementation of the remote handling facility at JET over the past 15 years makes us uniquely placed to offer remote handling related competences to ITER.

One of our first contracts is to create a guide for specification, organisation and management of the IO future remote handling facilities. Many of the key systems in ITER will require remote handling techniques for their inspection, maintenance and modifications — in fact the overall availability of ITER and thereby its ability to provide a sound and useful fusion research tool depends directly on its remote handling facility.

The IO management have recognised that its approach to design and implementation of the remote handling system

demands considerable organisation and management to ensure an effective and successful outcome. Oxford Technologies have been contracted to provide two key elements — firstly a document describing the overall methodologies and philosophy for achieving a successful outcome and secondly a definitive 'Remote Handling Code of Practise' which will contain all approved standards and procedures to be used for the remote handling systems and also for the design of ITER components.

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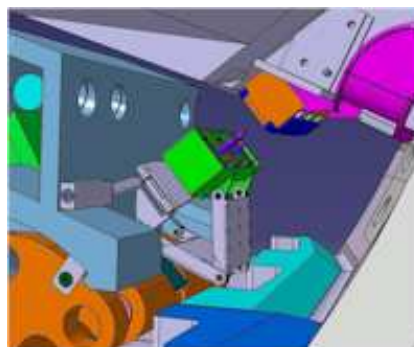
### Working for ITER—Design of the Divertor Electrical Connector

Oxford Technologies has won a contract to study the requirements and produce an engineered design for a remote handling electrical connector that meets the operational needs within the ITER vacuum vessel.

The connector provides electrical power and signals for the instrumented Divertor cassettes which themselves need to be remotely replaced within the ITER torus.

The study draws on over 15 years of experience of producing remote handling electrical connectors for JET.

An optimised design concept of a 180 pin connector has been produced with the recommended conductors comprising twisted pairs of braided glass insulated cable.



The connector plug and socket are located in a difficult access area under the shadow of the blanket modules. The plug is supported on a "Sarrus" straight line mechanism which guides it into the fixed connector socket when actuated by a manipulator using a simple bolt runner.

The supplies to the sockets are designed to be replaced remotely should that be necessary in the event of a cable failure.

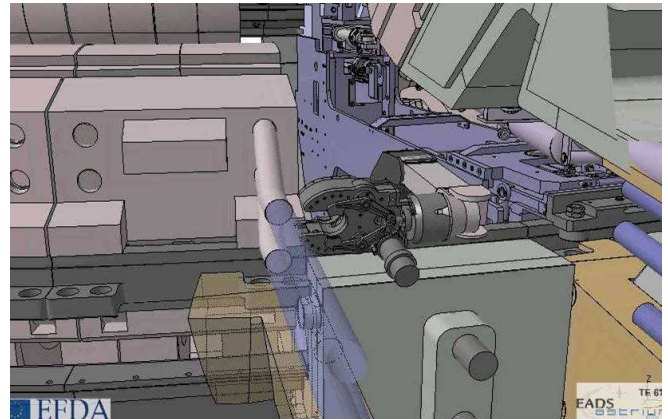
## Working for ITER—with EFDA & EADS ASTRIUM ST

“...to define the requirements and establish a concept solution for a remote manipulator and tooling system ..”

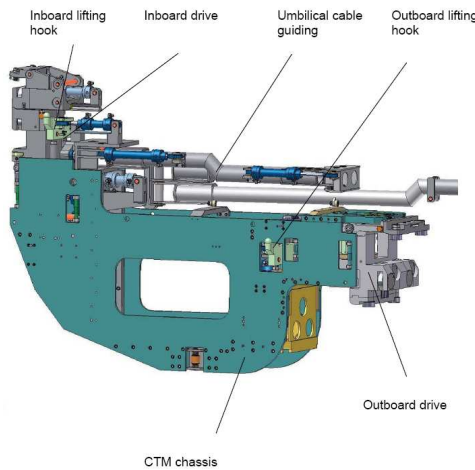
EADS ASTRIUM ST of Bordeaux have requested Oxford Technologies Ltd to participate in a short term work package placed with them by EFDA.

Work performed previously by ASTRIUM ST identified two key areas where the current design of one element of the ITER divertor remote handling equipment requires improvement.

The 12 Tonne ITER divertor cassettes are handled inside



TK environment Digital Mockup provided by AST-ST



the torus using one of two types of so-called 'mover'.

The current design of the mover which lifts and transports divertor cassettes toroidally around the torus (the CTM) is unable to deal with new requirements for handling electrical and pipe connections.

The aim of the study is to define the requirements and to establish a concept solution for a remote manipulator and tooling system to perform the tasks.

The manipulator system must be housed within the CTM and must not require significant changes to an already highly packed umbilical feeding services to the CTM from outside the torus. It must also comply with all of the generic remote handling requirements including failure mode control and recovery from failure.

## Working for ITER—with UKAEA, Culham

“Our expertise in designing and operating remote cutting and welding tooling at JET proved to be invaluable.”

Oxford Technologies, working under contract for the UKAEA, have completed a comprehensive study of the remote handling requirements of the ITER Neutral Beam (NB) facility for EFDA. Due to the diverse nature of remote maintenance requirements a structured approach to task definition through concept design to task verification, including Virtual Reality modelling, was undertaken.

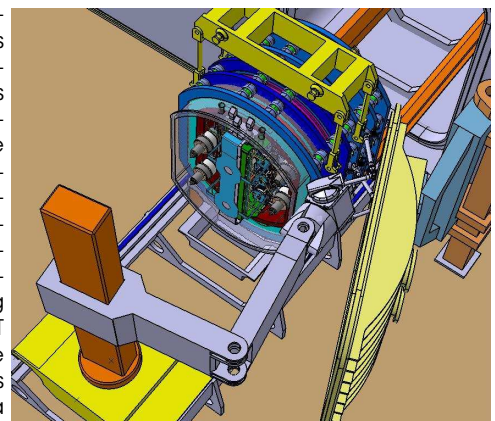
This methodology ensures a consistent set of requirements throughout the design process and provides a framework on which the concept can be developed in the future.

All key features of the NB component and RH design were identified and the critical integration issues addressed. The concept is based

upon standardisation and simplification of RH systems and, where possible, on proven & commercially available technology.

One of the main task requirements was the removal of the NB source from within the beam source vessel. This 36 tonne component requires remote disconnection from its 1MV power supply by remote cutting techniques. Our expertise in designing and operating remote cutting and welding tooling at JET proved to be invaluable. This contrasted with a task to remotely

remove the small (less than 5kg) Caesium oven from deep within the NB system. A detailed strategy for removal followed by production of 3D (Catia) models of the tooling concept were developed in order to substantiate the task.



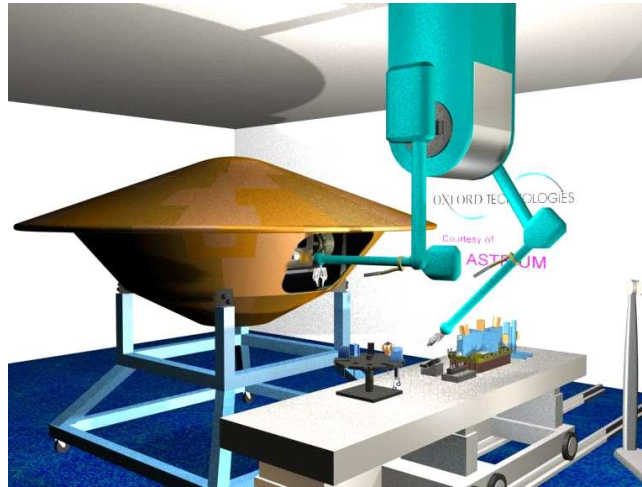
## Robotics AIV Study for EADS ASTRIUM Satellites

Oxford Technologies have been asked by EADS ASTRIUM Satellites of Stevenage, UK to examine the feasibility of using remote handling techniques for the aseptic assembly of interplanetary exploration vehicles (rovers).

Space exploration missions aiming to land and operate a rover on Mars to look for traces of life with a number of scientific instruments is classified as a high priority mission by ESA.

In addition to the scientific package requirements, planetary protection authorities are imposing very stringent requirements on the level of cleanliness of the spacecraft and therefore on the Assembly, Integration and Verification process (AIV).

Experience from previous missions including MER and Beagle2 indicate the value and the opportunity for improved exploration if human operators can be removed from physical contact during the



AIV processes as much as possible.

EADS ASTRIUM Satellites were contracted by the European Space Agency (ESA) to conduct an overall assessment of the potential benefits and technical feasibility for using robotic manipulator devices within the AIV process.

A key element of the evaluation was to understand the feasibility of dexterous remote

manipulation and remote assembly of delicate items such as are used on Mars rovers.

Oxford Technologies staff were able to use their extensive experience in the application of dexterous remote manipulators and Virtual Reality to convince ASTRIUM and ESA of the feasibility to perform the required operations without humans inside the assembly cell.

“A key element of the evaluation was to understand the feasibility of dexterous remote manipulation and remote assembly of delicate items such as are used on Mars rovers.”

## New partnership with ITER-NL

Oxford Technologies have been invited to participate as founder members of a partnership to support the Dutch contribution to ITER.

The Netherlands government have established and funded ITER-NL a new national organisation managed by the research institutes TNO, NRG and FOM.

The long term aim is to strengthen the involvement of Dutch industry and scientific institutions in the ITER project and to foster the development of Dutch industry in fusion related advanced technologies.

The partnership technical lead is from the FOM institute Rijnhuizen based at Nieuwegein. FOM is presently working in partnership with FZK

at Karlsruhe on the design of one of the main RF heating systems for ITER and are leading an industry partnership of Oxford Technologies Ltd, HIT BV and TreeC Technology BV.

The aim of the partnership is to provide FOM with the capability and facilities to be able to design, and also to validate the remote handling compatibility of, ITER components un-

der their responsibility, concentrating on the upper-port launcher plug.

The future plans include setting up a comprehensive Virtual Reality (VR) based remote handling control room at Rijnhuizen to be used for virtual mock-ups.

“The aim of the partnership is to provide FOM with the capability and facilities to be able to design, and also to validate the remote handling compatibility of, ITER components”



## Remote Handling Solutions

7 Nuffield Way  
Abingdon  
Oxon  
OX14 1RJ

tel: +44 (0)1235 522 119  
fax: +44 (0)1235 522 124  
enquiry@oxfordtechnologies.co.uk

[www.oxfordtechnologies.co.uk](http://www.oxfordtechnologies.co.uk)

*“Oxford Technologies Ltd is dedicated to the development of technologies and expertise for the implementation of cost effective solutions to remote handling applications.*

*We operate in the interests of our customers, our staff and our stakeholders and we measure our success by the level of our reputation for operating with the highest of professional and ethical standards.”*

## People & Places

### New Staff Profile - Chris Belcher



Chris joined Oxford Technologies Ltd in June 2007 to work as a Mechanical Design Engineer in the remote handling team at EFDA-JET, Culham. He graduated with a 2:1 Honours degree in Product Design in 2006 and in his final year was awarded a prize in a national student design competition. He brings to Oxford Technologies experience of industrial machine design in the packaging sector.

### New Staff Profile - Ed Robbins



Ed joined Oxford Technologies Ltd in September 2007 to work as a Control Systems Engineer in the remote handling team at EFDA-JET, Culham. Ed gained a 2:1 class Masters Honours degree in Cybernetics from the University of Reading in 2007.

### New Staff Profile - Robin Scott



Robin joined Oxford Technologies Ltd in November 2007 to work as a Remote Handling Engineer in our main offices in Abingdon. Robin has an M.Eng degree with distinction and a PhD in Mechatronics both from the University of Leeds. Since graduating he has worked in R&D activities at RMIT in Melbourne, Australia and the University of Manchester, UK.

### Staff News - Bernhard Haist



It is our pleasure to announce that Bernhard Haist has been appointed as Leader for the Oxford Technologies team working at the EFDA-JET project in Culham, UK. Bernhard has over 15 years experience in remote handling for fusion and has published many papers on the design and implementation of remote handling systems. Most recently, in October 2007, he presented at the 8th International Symposium on Fusion Technology, held in Heidelberg, Germany.