9 Industry

9.1 OVERVIEW

The UKAEA Fusion and Industry Liaison programme has two aims:

- to increase the number of UK companies bidding for fusion contracts, especially from the ITER programme;
- to identify and promote areas of technology transfer between fusion and industry.

The construction of ITER has now commenced in Cadarache, France and there are many contract opportunities for UK companies. The first aim is therefore now the primary focus for the Fusion and Industry programme. ITER contracts are placed by both the central ITER International Organisation (ITER-IO), and the Domestic Agencies of the seven partners – including Fusion for Energy (F4E), the European Agency in Barcelona, which as well as its own contracts advertises those from ITER-IO on its website http://eidi.f4e.europa.eu/index.php.

9.2 WORK WITH FUSION FOR ENERGY AND THE ITER ORGANISATION

9.2.1 EUROPE'S INDUSTRY LIAISON OFFICER NETWORK

During 2008, F4E encouraged each of its members to nominate an Industry Liaison Officer (ILO). The UKAEA Fusion and Industry Manager, Dan Mistry, is the UK's ILO. The aims of the ILOs are to:

- raise awareness and transmit information to potential contractors about forthcoming calls to be launched by F4E or ITER;
- assist potential contractors in their understanding of the requirements of F4E within the frame of the above-mentioned calls;
- advise the potential contractors, upon request on technical, contractual and financial aspects of F4E;
- foster the registration of potential contractors in the databases of F4E;
- act as a forum to exchange information on matters related to F4E industrial policy and related subjects;
- encourage long-term participation of industry in fusion in view of realising DEMO.

F4E's engineering and procurement team, the ILOs and industry representatives from over 17 European countries met in Barcelona in December 2008 to discuss how they can work together to help deliver Europe's in-kind contribution to the ITER programme. The UK's ILO was accompanied by representatives from UK industry including engineering company Cosworth Ltd, professional engineering services supplier Frazer Nash Consultancy, and human factors consultancy CCD Design & Ergonomics Ltd. The meeting was arranged by F4E to brief the ILOs and industry representatives on the technical, political and management complexity associated with ITER. It allowed ILOs to express their commitment to working with industry and F4E to provide 'best value' when supplying goods/services to ITER. The ILOs also aired some of industry's concerns to assist F4E in developing a commercial framework which is acceptable to the European industry.

F4E organised the second meeting in February 2009 to brief the ILOs on the Work Programme for 2009 and to bring to their attention the procurement plans for the largest ITER components (i.e. the vacuum vessel and toroidal field magnets). These are on the critical path and will require a wide-range of expertise including further R&D.

UKAEA is focusing its efforts on identifying and encouraging appropriate companies, in the hope that they will bid for these work packages, either on their own, or as consortia (see below). The ILOs are also working to together to introduce companies to help form pan-European consortia.

9.2.2 WORKING WITH ITER-IO

In July 2008 we organised a two-day trade mission to ITER for UK companies Atkins Global, Halcrow Group, AMEC Nuclear and Lloyds Register. The visit was timely as ITER was looking for suppliers for its Engineering Services Contracts covering building design, specification, planning and civil engineering.

In March 2009, several of the ILOs met with the ITER-IO's Senior Advisor for Industrial Matters to understand the organisation's particular requirements and also to offer their services. Regular meetings are planned and, at the request of ITER-IO, the UK ILO is planning to take trade missions to introduce appropriate companies whose skills are currently needed.

9.3 CONSORTIA TO RESPOND TO ITER CHALLENGES

During 2008, F4E released Calls for Expression of Interest for the ITER Vacuum Vessel and TF Magnet Winding Packs, both of which are very large and complex systems. The following UK companies have responded to these opportunities.

9.3.1 ITER VACUUM VESSEL CONSORTIUM VISITS F4E

UK companies have formed a consortium to bid for construction of the ITER vacuum vessel, the central part of the ITER machine. Made up of nine sectors, the Vacuum Vessel is a significant engineering challenge that no one company is able to supply. Davy Markham has formed the consortium with fabrication specialist Metalcraft. Two other companies are providing support services to the consortium: AMEC is supplying design and programme management services and The Welding Institute technical support. The breadth of skills and experience in the consortium will enable it to present a solid technical and commercial case to F4E to be the supplier of the majority of ITER vacuum vessel sectors.

The consortium has pre-qualified and attended the 'Technical Information Meeting for Qualified Companies' at F4E's offices in Barcelona in December 2008. Further meetings are planned for 2009.

9.3.2 UK CONSORTIUM ATTRACTED TO ITER MAGNETS

In July 2008, UKAEA held a briefing for companies interested in the manufacture, testing and delivery of components of the ITER magnet system. The half day briefing brought together F4E's leading expert on magnets and engineers from over ten UK companies.

Figure 9.1: *Site visit during magnets briefing*

Following this, a UK ITER Magnet consortium was formed, led by Cosworth, better known for its integration of mechanical and electronics technologies in the world of high-performance motorsport. The company has diversified in recent years to add aerospace and energy generation to its business activities.

The consortium is called *UK FusionTech*, and comprises Cosworth; Scientific Magnetics – a manufacturer of superconducting magnet systems; the Science and Technology Facilities Council – a key player in other large superconducting magnet projects, with expertise in materials in radiation environments, and successful vacuum impregnation of large superconducting magnet structures; the Hyde Group, an engineering manufacturing company made up of three divisions: Tooling, Hyde Aero Products and Engineering; and International Business Wales, which will play an important role in helping to facilitate infrastructure development.

Cosworth is the consortium's primary representative and has attended technical discussions on the magnets at F4E in Barcelona and met with members of the ITER Magnet team.

9.4 UK COMPANIES WINNING KEY FUSION CONTRACTS

A number of UK companies have won contracts for ITER and JET, including the following.

9.4.1 ITER

In spring 2008, **Jacobs Engineering UK** won a contract to provide preliminary architectural and engineering services to the ITER International Organisation. The 12-month contract was worth over 6.5 million Euros and at that time was the largest contracts placed by ITER-IO. Jacobs Engineering UK was responsible for bringing together and developing, as required, all of the relevant data and user and system requirements for the different buildings and technical groups within the ITER Organisation. It prepared the technical attachments for the procurement arrangement documents that will be issued to F4E by the ITER Organisation.

Oxford Technologies Ltd was contracted to create a guide for specification, organisation and management of the future ITER remote handling facilities. A further, recently completed, contract was for UKAEA which was undertaking an EFDA-funded study of the remote handling requirements of the ITER neutral beam facility.

CCD Design and Ergonomics Ltd won a contract to prepare a human factors integration plan for the ITER project. The plan will consider the ways in which the

working environment for engineers, scientists and support staff work can be optimised to create a safe working environment at the fusion experiment.

The **West Midlands Manufacturing Measurement Centre** has undertaken a study into the manufacturing and metrology issues surrounding the vacuum vessel's inner wall blanket modules and their fixings/locations, and run pilot training courses on metrology and tolerance issues for ITER engineers.

9.4.2 JET

Babcock Marine (previously Devonport Management Ltd) has supplied a remote control articulating arm / boom for JET in preparation for installation of the new ITER-like Wall (ILW) starting in 2009. Using aluminium and stainless steel elements, and precision fabrication, the company has developed a lightweight articulated arm, called the Octant 1 Boom, that will be used to reduce the time needed for the disassembly and rebuild of the JET torus internal components.

Castings Technology International is supplying 1,800 superalloy castings for the ILW project, in an EU public procurement contract worth about €2.5 m under the European Fusion Development Agreement. The ILW will be used to evaluate different torus configurations and operational scenarios for the ITER first wall.

Centronic Ltd, a specialist in manufacture of electronic and electro-mechanical components for high performance applications, is supplying an Ultra High Vacuum electrical feed-through assembly for interfacing of the diagnostics related to the JET ITER-like Wall project.

Figure 9.2: *JET Octant 1 Boom supplied by Babcock Marine*

9.5 TECHNOLOGY TRANSFER AT CULHAM INNOVATION CENTRE

Culham Innovation Centre is part of a network of business incubators managed by Oxford Innovation and is home to a wide range of pioneering technology focused companies. The Centre provides start-up companies with a professional infrastructure and image to grow their business, along with a range of business support services needed during the first vital years of operation. Eighteen

companies currently occupy office space or have taken advantage of Oxford Innovation's 'OxiFlex' virtual office service. They work in a wide range of sectors from electronics engineering to marketing.

Our Technical Support Package (TSP) continues to assist suitably qualified start-up companies that are located in the Culham Innovation Centre. Via the TSP, fusion expertise is transferred to start-up companies working in other markets. Depending on their needs, the TSP can include technical advice or access to engineering, scientific and computing skills and technologies. Over the years, several companies have benefited from the TSP in areas like product development and problem solving, usually via the assistance of UKAEA's Special Techniques Group.

Five companies currently benefit from the TSP. They work in a range of markets including plasma devices, aeronautics and nuclear magnetic resonance imaging. One, Reaction Engines Ltd, has been awarded a 1 million Euro contract by the European Space Agency to demonstrate the core technologies for the SABRE air-breathing rocket engine that will eventually power SKYLON – a reusable space-plane that can take off from a conventional aircraft runway, carry over twelve tonnes to orbit, and then return to land on the same runway. The company will build on its knowledge acquired through UKAEA's Technical Support Package to develop the engine's pre-cooler.

Figure 9.3: *SABRE engine model*

9.6 PROMOTIONAL ACTIVITIES

9.6.1 FUSION AND INDUSTRY WEBSITE AND DATABASE

The Fusion and Industry website http://www.fusion.org.uk/industry is kept under review to reflect ITER developments. Many changes are designed to make the site easier to use for visitors. Database registration (http://www.fusion-industry.org.uk/register.asp) has been made more comprehensive allowing us to improve our assistance to UK industry; we now have well over 1,000 companies registered. The relatively recent 'E-News' systems is proving to be very successful enabling these companies to be kept informed of contract opportunities from fusion and developments on the ITER project.

9.6.2 FUSION BUSINESS EZINE NEWSLETTER

Issues 5 to 13 of the electronic *Fusion Business* 'e-zine' were published during the year with the primary focus on opportunities to win ITER business, and features on UK companies who have successfully won ITER, JET and MAST contracts. Also covered are the activities of the Fusion and Industry team,

progress on technology transfer, and Culham Innovation Centre activities including the Technical Support Package. Details of industry exhibitions that have taken place at Culham, and exhibitors' feedback on their experiences, are featured in separate issues on Exhibitions. Current and back issues of the Fusion Business e-zine can be found on our website: http://www.fusion-industry.org.uk/newsletter.asp

9.6.3 EXHIBITIONS AND EVENTS

Over 50 companies exhibited at Culham during the year and demand remains high with companies booking up to six to 12 months ahead. For most companies a tabletop exhibition in the Culham main reception area will suffice, but mobile trailers can also be accommodated. Joint exhibitions by non-competing companies remain very popular, especially for the many companies who request a return visit every year.

Exhibitors come from a wide cross-section of industries including power supplies, electronics, vacuum equipment, data acquisition, photonics components, and test and measurement equipment. Exhibitors are able to present their products to both fusion scientists and engineers, and staff from the many technology companies located at the Culham Science Centre.

The Technology & Innovation Exhibition promotes 'Engineering Equipment and Associated Services' to the UK nuclear industry around the country. It came to Culham for the eighth time in May 2008. The exhibition brought together 32 engineering and high technology companies in a single venue. Over 250 visitors attended the exhibition, which included seven companies new to Culham.

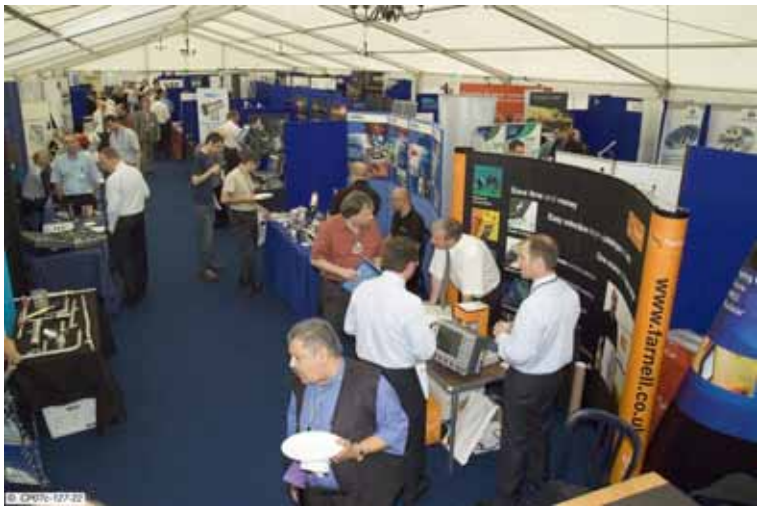

Figure 9.4: *Exhibitors and visitors at the Technology & Innovation Exhibition*

9.6.4 WORKING WITH GOVERNMENT AGENCIES AND TRADE ASSOCIATIONS

The Fusion and Industry team continues to work in partnership with UK Trade and Investment (UKTI), the Regional Development Agencies and Devolved Assemblies, Trade Associations and Research Councils to raise awareness among UK companies of opportunities from 'big science' including fusion and ITER.

In September 2008, Science & Technology Facilities Council, the Sensors & Instrumentation Knowledge Transfer Network and UKTI, organised a packed 'Meet the Buyer' event in London. This mixture of conference, trade show and speed dating event attracted around 370 delegates from industry, academia and

research institutions. 'Buyers' present included the heads of procurement for both the central ITER organisation and Fusion for Energy, as well as representatives from many other international and UK research facilities such as CERN, ESO, ISIS and Diamond. There were talks from the major facilities and case studies from companies that do business with them, opportunities for one-to-one meetings with facilities, and 135 stands and displays showcasing the facilities and companies.

Both ITER-IO and UKAEA had stands at the event which had a steady stream of visitors throughout the day ranging from familiar faces from companies who already work for fusion, to companies new to UKAEA many of which clearly have skills to offer fusion. A popular feature of the Meet the Buyer event was the 'one-to-one' meetings, which were booked throughout the day. UKAEA arranged some of the meetings between UK companies and the senior procurement officers from the central ITER organisation and Fusion for Energy.

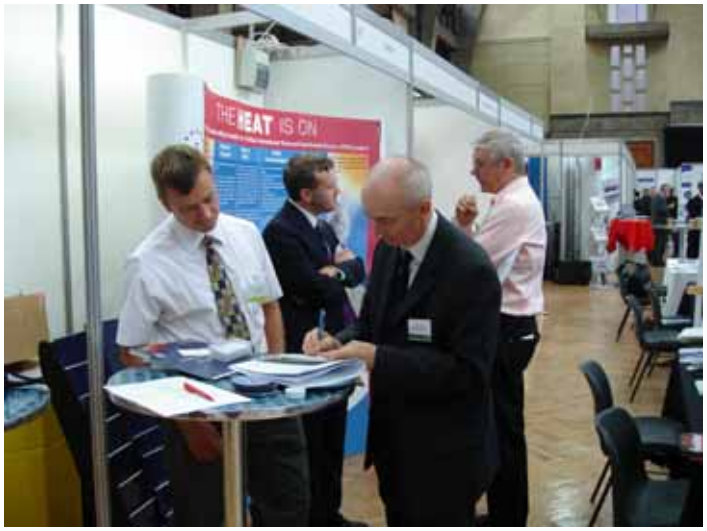

Figure 9.5: *UKAEA stand at the Meet the Buyer event*

9.7 FUTURE PLANS

The Fusion and Industry team will continue to encourage UK industry to ensure that they benefit from the European fusion research programmes and ITER construction. In addition the Fusion and Industry team will:

- encourage UK companies wanting to supply to fusion to register their details on the appropriate databases;
- identify and encourage appropriate companies to respond to the forthcoming tenders;
- identify appropriate companies in advance of forthcoming ITER work packages and where possible facilitate the formation of consortia;
- organise workshops on specific components in conjunction with ITER-IO and F4E engineers. A workshop on power supplies in fusion (including MAST's needs) will also be arranged;
- work with Industry Liaison Officers in fusion programmes around Europe, to help form pan-European consortia;
- work with government agencies to connect with appropriate companies that are located around the country;
- continue to arrange technical support to companies at Culham, to facilitate technology transfer from fusion.