

FUSION TECHNOLOGY TRANSFER ACTION

Project Overview and Reflections

Matthew Edwards
Space Business Incubation
Science & Technology Facilities Council

OVERVIEW

- What was FUTTA?
- Who was involved?
- ESA Space Solutions
- What did we do?
- Metrics for Success
- Thoughts for Future Steps
- STFC Experience



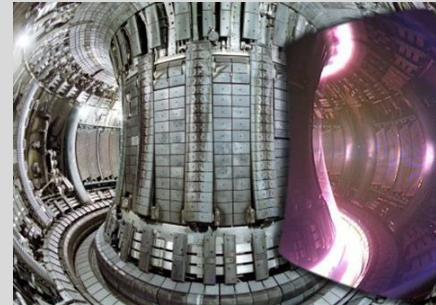
WHAT WAS FUTTA?

Fusion Technology Transfer Action - FUTTA

The initiative had three main goals:

1. Increase TT from fusion (Euratom) to industry & society
2. Capture, record, and promote successful transfers
3. To increase TT between fusion & space

Short term project – 14 months – to assess viability of a larger programme.



Science & Technology
Facilities Council

WHICH ORGANISATIONS WERE INVOLVED?

European Commission
Euratom
EUROFusion

European Space Agency

UK

- Science & Technology Facilities Council – UK Broker
- Culham Centre for Fusion Energy
- JET

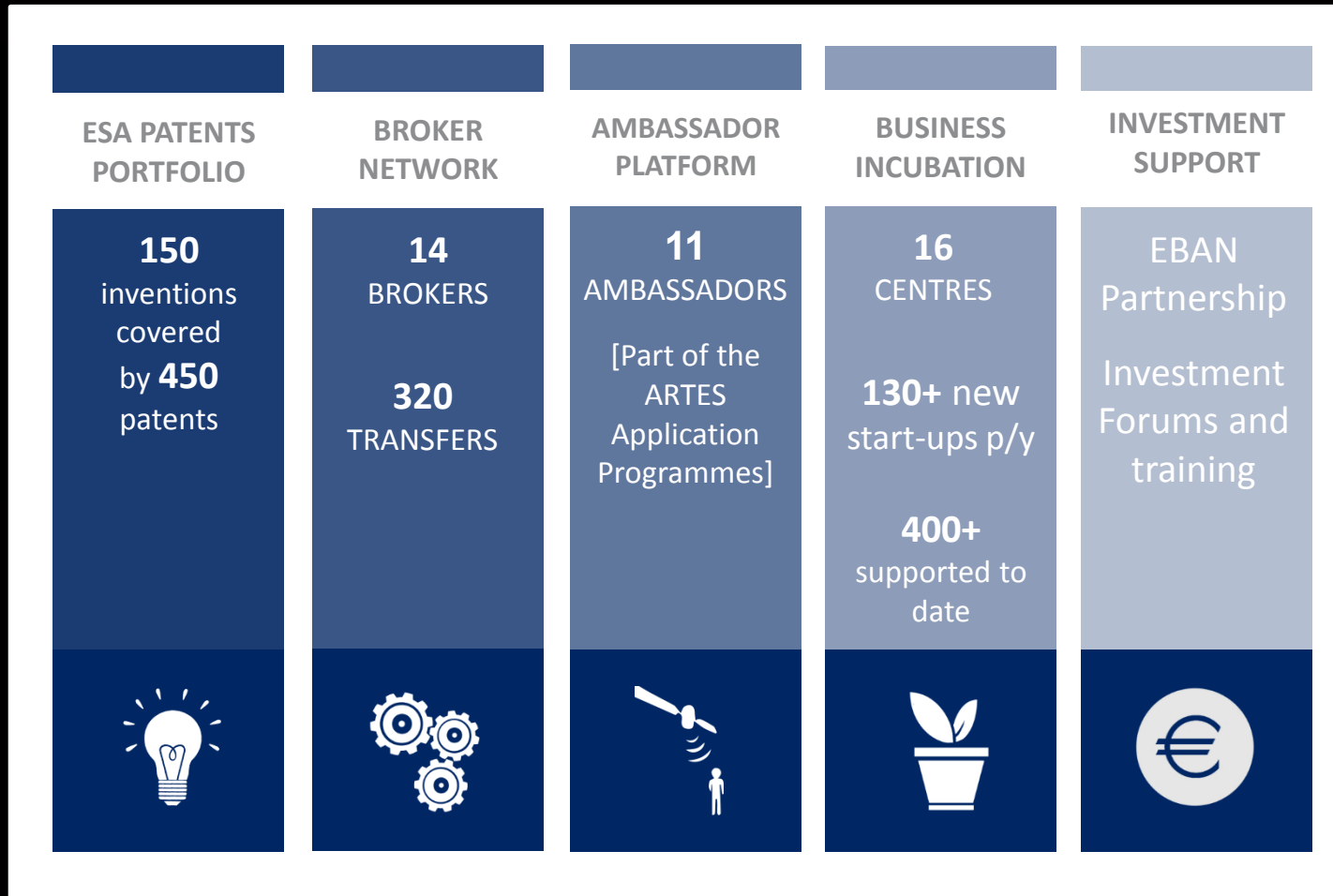
Germany

- Cesah –Germany Broker
- Forschungszentrum Julich
- Karlsruhe Institute of Technology
- Max Planck Institut fur Plasmaphysik



Science & Technology
Facilities Council

ESA MODEL OF TECH TRANSFER

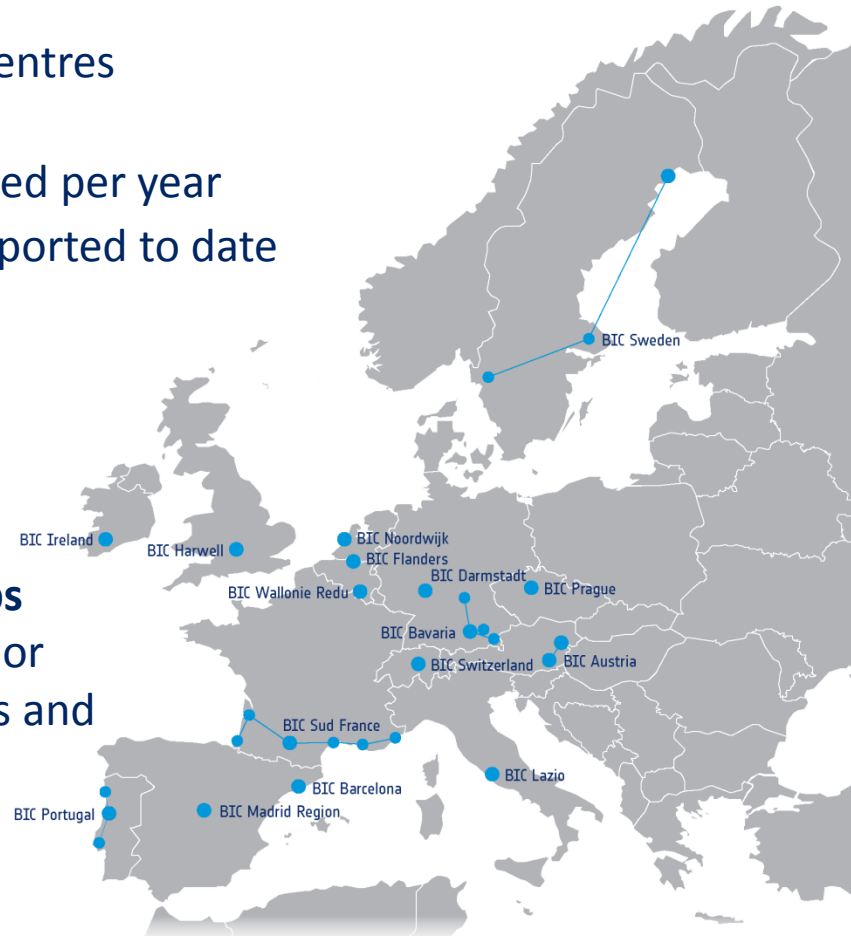


ESA BUSINESS INCUBATION

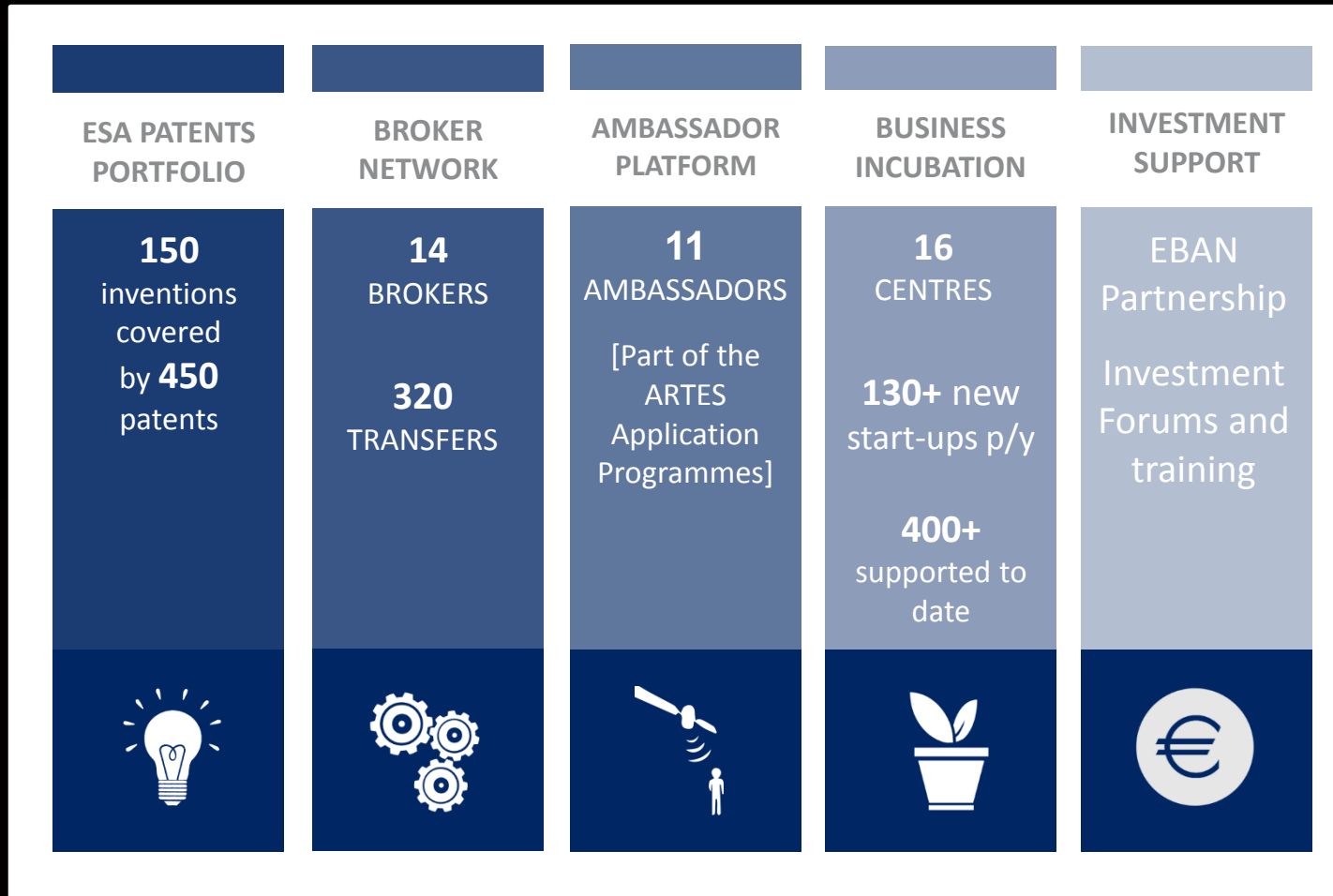
ESA Business Incubation Centres

- Network of 16 Centres
- **130+** start-ups supported per year
- Over **400** start-ups supported to date
- Partnership with EBN

“ESA BICs support **start-ups** utilising **space technology** or **services** to create products and services **back on Earth.**”



ESA MODEL OF TECH TRANSFER

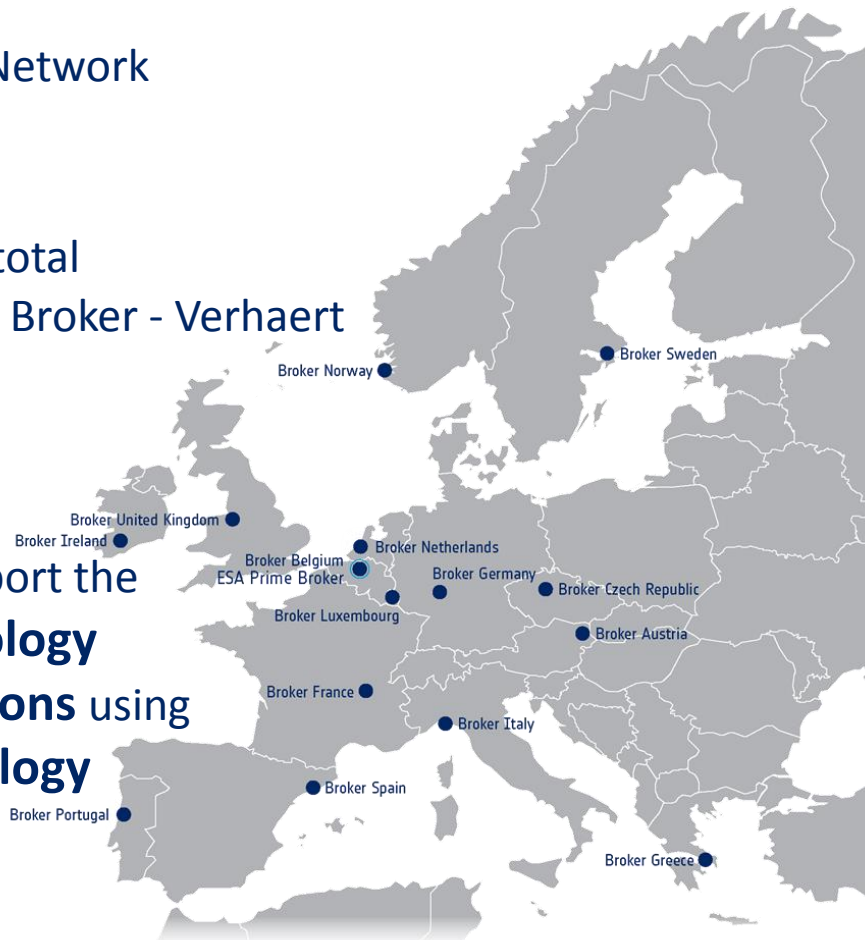


ESA BROKER NETWORK

ESA Technology Transfer Network

- Across **15** Countries
- **~20** Transfers per year
- Over **320** Transfers in total
- Co-ordinated by Prime Broker - Verhaert

“Brokers **create** and support the transfer of **space technology** into **industrial applications** using a combination of **Technology Push** and **Market Pull**”.

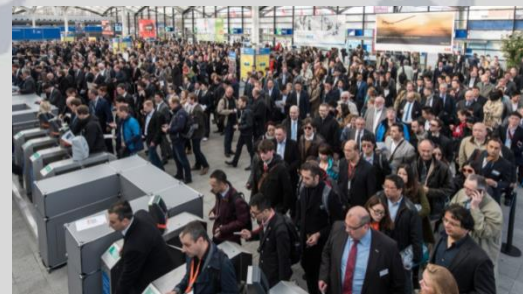


WORK UNDERTAKEN

1. Identify technologies developed that could have commercial applications
2. Write into a 2 page non-confidential documents
3. Assess commercial interest through trade shows and direct contacts.
4. Make introductions between interested companies and fusion centres.
5. Identify successful transfers that have occurred in the past.
6. Collect and compile into 2 page promotional leaflet

Events Attended

- LIFT
- Medtec
- MedTech
- Hannover Messe
- Forensics Expo
- Railtex
- ITER Business Forum
- Sensing in Extreme Environments



WHAT WERE THE OUTCOMES?

Indicator	Objective	Identified	Published
Success Stories	5	7	4
Technology Descriptions	20	24	26 (including 2 EC Patents)
Mediations	5	14 companies interested	N/A

Over 500 companies were contacted during the course of the project.



Power. Passion. Partnership.



Science & Technology
Facilities Council

→ FUSION TECHNOLOGY TRANSFER ACTION (FUTTA)



FUSION FOR THE PRESENT

Fusion activities are generating an increasingly meaningful amount of fundamental technologies for the future of energy. The societal long-term impact of these developments is clear. However, what is the short-term return of the investments in Fusion and the benefits for the European citizens?

EUROfusion recognised the potential of the technologies developed in the fusion programme for use in other industries; a potential, which has hitherto not been realized. The FUTTA project has applied the European Space Agency brokering skills to change this position.

The Technology Transfer Office of the European Space Agency has more than 20 years of experience and has supported almost 300 transfers from space to non-space. The similarities between the types of technologies developed for the Fusion and the Space sectors arise from the fact that both have demanding applications where ultimate performances and reliability are required. Often the environment is extremely harsh and technologies for both Fusion and Space must reach a high Technology Readiness Level.

THE FUTTA PROJECT HAS:

- 1 Identified key areas of expertise within Fusion and written up 26 technologies into descriptions for dissemination.
- 2 Introduced companies working in a variety of industries to the potential benefits that technologies from Fusion could have on their business.
- 3 Increase the amount of technical synergy between the fusion and space industries.
- 4 Identified success stories of technology transfer that have occurred.

ARE YOU READY TO ENERGIZE YOUR INNOVATION?

The ESA Technology Transfer Brokers initiative, through its brokers in Germany and the United Kingdom, offers an extensive support in the identification of the most innovative and cutting-edge Fusion technologies that can be useful for your business.

The Science & Technology Facilities Council (STFC) is a world-leading multi-disciplinary science organisation, and our goal is to deliver economic, societal, scientific and international benefits to the UK and its people – and more broadly to the world. STFC also manages ESA's Technology Transfer Brokerage and Business Incubation Centre in the UK.

cesah - the Centre for Satellite Navigation Hesse is a centre of competence for space technologies supported by its shareholders State of Hessen, Darmstadt City of Science and renowned industrial and research institutions. cesah manages the ESA Business Incubation Centre (BIC) Darmstadt and is the ESA Technology Transfer Broker for Germany.

For more information about FUTTA and how Fusion can help your business, please contact us:
For UK: esattn@stfc.ac.uk
For Germany: techtransfer@cesah.com

More information of the technologies in: www.esa-tec.eu/fusion-technologies/.

Innovate? Do it with Energy!



This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 341320.

The space you need to get your business off the ground

→ FUTTA - EXAMPLES

Self-Passivating 'Smart' Alloys

Tungsten is the material typically used as the cover layer of the inside of a fusion reactor. A failure of the cooling system could lead to extreme temperatures in this layer leading to the formation of W03 (Tungsten Tri-oxide) gas. As the Tungsten has been in a highly radioactive environment the gas formed is also radioactive – meaning that any leakage would be dangerous to the surrounding environment.

One of the core competencies of Forschungszentrum Jülich is the development and characterization of smart self-passivating alloys that prevent the generation of W03 in case of such accidents. This know-how is now planned to be used for the production of other smart alloys that could be suitable for use in receivers of solar-thermic power plants.



Solar Thermic Power Plant.
Photo Credit: Business Wire



Optimum Grating.
Photo Credits: Prof. Dr. W. Biel, Forschungszentrum Jülich

Optimum Grating Parameters for a VUV Spectrometer

A proprietary piece of software has been developed at Forschungszentrum Jülich which uses various numerical methods to determine the optimal grating parameters, which allow for the production of gratings for Visual-UV spectrometers that have minimal line width leading to higher efficiencies.

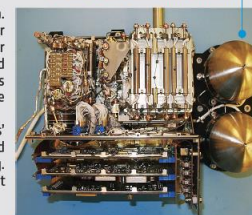
Its application within fusion was to allow diffraction gratings to be made on concave or toroidal surfaces but this can also be used within the field of extreme ultraviolet reflectometry & reflectometry. These are used within the fields of photoelectron spectroscopy, solar imaging, and lithography.

Fusion to Space

Ptolemy is an instrument on board the Philae lander of Rosetta. It consists of a miniature gas chromatograph and mass spectrometer that is designed to determine the composition of the comet. In order to do this, the ice of the comet must be converted into gas and passed through the instruments. The connecting pipework and fittings was designed and manufactured using techniques developed as part of the fusion energy programme.

The knowledge and techniques developed in the 'Special Techniques' group at Culham Centre for Fusion Energy working on fusion allowed the many different materials to be connected via advanced brazing. Also, there is a very large variation in temperatures throughout the mission that need to be tolerated which utilizes the vast know-how from the fusion community.

Ptolemy. Photo Credit: Open University



Hubble during Servicing Mission. Photo Credit: NASA

Ion Beam Analysis for Hubble Space Telescope

IBA Datafurnace is a code used to analyse the outputs from thin film Ion Beam Analysis. This technique is often used within the fusion community to analyse the wall tiles from the inside of the tokamak to see what plasma deposits have built up. This was also subsequently used to investigate the Wide Field and Planetary Camera 2 from the Hubble Space Telescope after it was brought back to Earth in 2009. The analysis was able to show that a variety of different elements has built up on the outer casing of the camera due to impact from interstellar matter. It is very rare to have such an opportunity as it is not common for satellites to be returned to Earth after prolonged exposure to a space environment.

More information of the technologies in: www.esa-tec.eu/fusion-technologies/.

The space you need to get your business off the ground

GERMANY

UNITED KINGDOM

WHAT WERE THE OUTCOMES?

Soft Metrics

- Awareness of TT within fusion community was raised.
- Increased general public knowledge of fusion benefits.
- Industry was made aware of the benefits of fusion technology
- Highlighted the potential of TT both internally and externally.

“Very interested in looking into further synergies between the space and fusion industries. I believe that there is great potential for the intelligent data management from Earth Observation satellites to be utilised in fusion – even if just the methodology. Potential for technology to come the other way too”.

“Fusion is a genuine option for innovation. We would never have considered it before”

Technology is currently at too low a TRL for us to bring into one of our innovation streams.



REFLECTIONS / NEXT STEPS

Thoughts

- Well facilitated by CCFE and EUROfusion.
- General willingness within the fusion community to get involved.
 - *“Isn’t developing energy through fusion enough?!?”*
- Enabling processes and mechanisms are not all yet in place.
 - Technologies are at low TRL
 - Funding to bridge this in not in place.

Possible Actions

- Define rationale for TT and communicate with all centres.
- Co-ordination at a European level would be a great enabler.
 - Encourage individual centres to set up own TTO.
- Support broader industry involved with fusion to undertake TT.
 - Put in place processes, mechanisms, and funding.



STFC EXPERIENCE



Science & Technology
Facilities Council

**“FUSION IS A GENUINE OPTION
FOR INNOVATION!”**

FOR MORE INFORMATION, PLEASE CONTACT:

MATTHEW EDWARDS

SCIENCE & TECHNOLOGY FACILITIES COUNCIL

EMAIL: MATTHEW.EDWARDS@STFC.AC.UK

TEL: +44 (0)1925 603 141