

### **Case study 2: New technology patented for ITER leads to successful high-tech start-up (MAGICS Instruments)**

#### **The company**

MAGICS Instruments NV is a spin-off company from KU Leuven and SCK•CEN (the Belgium Nuclear Research Centre). MAGICS' core competence lies in the design of radiation hardened integrated circuits, and more specifically in electronic devices that reliably operate in space and nuclear environments. MAGICS addresses customers' demands by offering ASIC solutions, customized IC design services or rad-hard IP licensing. Having started with the two founders, the company now has five employees.

#### **Main case-study characteristics**

Katholieke Universiteit of Leuven developed electronic chips for F4E that are able to sustain the radiation environment, convert the analogue data picked up by sensors to a digital format and transmit the information through a single wire. Two researchers of the University got a license for using the design of these chips and created the spin off called Magics. The license of the technology has allowed Magics to gain credibility and an entry point within the nuclear and space industry. In 2017 the annual revenue of Magics has increased 60% and its team has grown to 5 people. They are now targeting the global emerging markets with their radiation hardened ASICs for predictive maintenance, condition monitoring and smart robotics. Further strong growth of the company is expected for 2018.

<b>Main characteristics</b>	
Company	Magics Instruments
Country	Belgium
Contract title	In-Pile Creep Relaxation and Post-Irradiation Thermal Creep Testing (GRT-291)
Contract value	EUR 0.19M
Contract period	2012; 2016
ITER Component	Diagnostics
F4E Work Package Code	55

#### **Description**

In the frame of the ITER project a contract was awarded by Fusion for Energy, to a research group from KU Leuven and SCK•CEN who have been developing hardened integrated circuits capable of resisting high radiation environments, a key challenge that was identified and included in the Euratom Fusion Technology Program in the 1990s. The project triggered the creation of Magics Instruments NV in late October 2015, which commercialises hardened integrated circuits able to operate in radioactive environments.

#### **Main impact**

##### **New business opportunities**

As a result of the ITER contract, two students at KU Leuven started a new company that got the license to further develop radiation hardened chips. SCK-CEN and KU Leuven became the shareholders of this company.

While the biggest share of MAGICS' revenues still comes from ITER contracts (roughly 50% of the EUR 400,000 in revenue obtained in the 2017 financial year), the company has managed to gain a share in several markets where radiation hardened sensors can be useful, e.g. space and nuclear fission. The size of the hardened-circuit markets amounted to roughly USD 1bn in 2015.

Non-ITER clients of MAGICS are not to be disclosed, but are in the area of service suppliers (engineering firms) to nuclear power plant operators. The company's products outside ITER mainly facilitate remote handling for nuclear reactors and nuclear waste management. MAGICS products also find application in the space sector. Despite the fact that the products of MAGICS in theory could be also useful in defence industries, the company chooses for ethical reasons not to become involved in this market.

MAGICS seeks to increase their revenues to €1M in 2018 and to €3M in 2020. Main goal for 2018 is to venture into emerging markets (Russia, India, China). The company is currently setting up distribution and sales channels in these countries to make market entrance possible. MAGICS is also looking for further business opportunities in the space market, in particular also with emerging new commercial providers such as SpaceX.

#### **Employment and growth**

In 2017, the company employed five people. Aim for 2018 is to double the number of employees to 10 and further growth in the future is envisaged.

#### **Human capacity building**

The five employees of MAGICS are highly skilled and specialised in the companies' products offered.

#### **Innovation and technology transfer**

MAGICS started out developing micro-electronics for nuclear reactors (chips for remote handling robotics in radioactive environments). During the incubation phase at KU Leuven the founders of the company gained project experience with integrated circuits because of the Fusion for Energy contracts. This gave the business of MAGICS significant traction with other clients. As of 2017, MAGICS has provided 5 non-patented high-radiation systems on chip for ITER to control remote handling equipment and to read-out sensors in harsh environments. The company is now developing novel technology that brings machine learning/AI from the server onto the chip. This would put pressure off network bandwidth and improve e.g. condition monitoring and preventive maintenance in space and maintenance of new energy sources (ITER).

#### **Networking and synergies**

The ITER contract has been very important for MAGICS network and references. Big Science projects such as ITER are 'early technology adopters'. This helps SMEs like MAGICS to design and improve their product in an incubator phase. ITER also serves as a 'Lighthouse Project' for MAGICS, providing the company with a significant reputation boost in the industry and with potential clients. The execution of the ITER contracts helps prove to potential clients that the technology works and that it can be applied.

Synergies and networking are fostered within the ITER ecosystem, e.g. in the ITER Business forums; [http://www.iterbusinessforum.com/home.aspx?f\\_lang=en](http://www.iterbusinessforum.com/home.aspx?f_lang=en)). The forums and events are also the places where consortia are formed, opportunities for knowledge-sharing in fusion arise, and where suppliers

can showcase their novel technologies in workshops. MAGICS further still maintains close cooperation with SCK-CEN and KU Leuven in order to stay up to date with the latest technologies.

### **Conclusion**

The MAGICS case demonstrates the use of ITER as an early adopter and incubator for new technologies to innovative start-ups. Its functioning as a lighthouse project further serves as a powerful reference to demonstrate to potential clients the value in practice of the technologies developed.