



From Space Technology to Global Markets

*Successful Irish Industrial Engagements
in the European Space Agency*

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Foreword

The success stories featured in this publication outline the achievements of Ireland's industry in the European Space Programme, leading on to commercial success in global markets.

The organisations featured in this publication represent a sub-set of a much broader range of Irish organisations including research groups, which have successfully participated in European Space Agency (ESA) programmes.

ESA programmes in Ireland are managed by Enterprise Ireland (EI) on behalf of the Office of Science and Technology (OST), Department of Enterprise Trade and Employment (DETE). The strategy being pursued by Ireland in relation to ESA is to support Irish participation in ESA programmes, which can lead to competitive advantage for participating Irish firms as well as strategic research within the Irish third-level sector.

The views expressed in the case studies represent those of the participating organisations.

Message from the Minister



Ireland has been a member of the European Space Agency (ESA) since its establishment in 1975 and is an active participant in ESA programmes ranging from space science, satellite communications, satellite navigation, and launcher development. Ireland has established a reputation within the European space community as a centre of innovative leading edge technologies and world class research.

The Enterprise Ireland strategy 'Transforming Irish Industry' has set very ambitious targets to substantially increase the number of Irish firms performing research and development. Projects funded by ESA are particularly relevant in this regard. Participation in ESA programmes has led to a significant increase in R&D, product development, innovation and investment in intellectual capital within participating firms.

Irish industry plays an active and significant role in ESA development programmes with over 60 Irish companies having participated to date. The base of Irish industry participating in ESA programmes has been continuously evolving and now encompasses companies in a range of sectors including precision engineering, telecommunications, software development, advanced materials, electronics, and optoelectronics. ESA participation has also served to enhance the reputation and credibility of participating firms in global markets through spin-out of product and technologies for wider applications. In this latter regard, the future development of Irish industry through innovation and internationalisation is a key priority for Government.

Similarly, Irish university research groups have established a reputation in undertaking world class science through the ESA science programme, building on the considerable research capability established through national programmes.

This publication serves to illustrate a number of case studies of how Irish companies and research groups have successfully engaged with the European space programme and exploited their technology in global markets.

Ireland will continue to play an active role in the ESA programmes, concentrating on those programmes in which Irish industry and research community can make a significant contribution.

A handwritten signature in black ink that reads "Micheál Martin". The signature is written in a cursive, flowing style.

Mr. Micheál Martin T.D.

Minister for Enterprise, Trade and Employment

From Space Technology to Global Markets

Successful Industrial Engagements in the European Space Agency (ESA)

The world's strongest companies have long recognised that innovation fuels success. But for smaller companies, especially those at an early stage of development, it can be difficult to turn promising ideas into commercial achievement. In the coming pages, we will look at a group of innovative Irish organisations who have bridged this gap, thanks to successful engagements in the European Space Agency (ESA).

As the agency responsible for shaping Europe's space capabilities, ESA administers a number of key projects which are designed to find out more about the Earth and its space environment, and which aim to support the development of space related systems and technologies. Ireland is a full member state of ESA, and with support from Enterprise Ireland, more than 60 Irish companies have had the opportunity to participate in ESA space programmes, ranging from space science and advanced satellite components to launcher development. Irish companies and researchers have demonstrated an impressive ability to bring leading edge technologies and world class science to the European Space Programme.

A contract secured with ESA acts as an invaluable catalyst for any company. First, and most importantly, ESA work gives a company's engineers and scientists the opportunity to engage in practical, long-term R&D projects, thereby strengthening the company's knowledge and intellectual property base. An ESA contract also typically leads to working proofs of concept or ready-for-market products, which can be sold onward to both space and non-space industries or used as a lead for business development. The ESA name is also a globally recognised seal of approval, allowing Irish companies to quickly establish credibility in their target markets.

Space is not the sole market for space technologies – in many cases, it is the first of many markets, and as we will see, Irish companies have commercialised their ESA work in an impressive variety of alternative sectors, including aerospace, automotive, medical devices, telecommunications and financial services.

Strengthening Ireland's knowledge economy

The organisations profiled here represent a sample of a broader Irish industrial and research base active in ESA programmes. These companies are specialists in a diverse range of areas, from photonics to telecommunications, but all share a common view: their future strength lies with their ability to devote their time, and their financial resources, to R&D that enriches their organisation. While ESA provides valuable opportunities for the companies it works with, the real catalyst for success is each organisation's individual commitment to and belief in the value of R&D. Irish companies who follow the example of these organisations, and put R&D at the heart of their strategy, greatly improve their prospects for growth.

Ireland has already distinguished itself as one of Europe's most dynamic economies, thanks to the high-calibre innovators at the heart of so many Irish organisations. At Enterprise Ireland we will continue to work closely with these organisations so that they and their industry sectors continue to strengthen Ireland's position in the global knowledge economy.



Tony McDonald,

ESA Programmes Manager, Enterprise Ireland

December 2005

“While ESA provides valuable opportunities for the companies it works with, the real catalyst for success is each organisation's individual commitment to and belief in the value of research and development.”

Tony McDonald, ESA Programmes Manager, Enterprise Ireland

ACRA Control Ltd

ESA Project: Advanced pre-flight testing equipment for ESA satellites

After spending countless hours conceiving, drafting and constructing a new aircraft design, all firms in the aerospace industry must eventually face a "real world" test of their work. In the testing phase, the efforts of countless individuals are measured and re-measured in order to ensure that a new aircraft or spacecraft is safe and fully operational. Thankfully, firms such as Dublin-based ACRA Control are there to improve the process.

ACRA Control's main product is KAM-500, technology that makes it possible to measure and record important data – such as temperature, voltage, pressure and vibration – during an aircraft's early flight tests. The firm's technology also records avionics data – or information passed over an aircraft's computer system – to gather even more records on a new or re-designed jet, helicopter or spacecraft.

"It's something like a black box," explains Fergal Bonner, the company's Managing Director. "But a black box only records a few minutes of data and only from a few sources. We are recording information from everywhere." Moreover, the KAM system is incredibly rugged, allowing engineers to place sensors anywhere in an aircraft – including inside the engine compartment. A 'plug and play' design and air-to-ground telemetry also make KAM-500 one of the most sophisticated systems of its kind.

The European Space Agency would seem to agree. In 2002, ESA contracted ACRA Control to develop higher-density KAM units to be used for ground testing of satellites. "Basically, they wanted more advanced units. For example, if we had a unit that could measure 32 channels of voltage, they wanted one that could handle 48 channels. They also wanted it to be smaller, and lighter," Fergal said.

In the end, ACRA Control delivered. But the payback went far beyond the value of the ESA contract alone. "The work helped us directly with Airbus. The technology we developed was used for testing the new Airbus A380," said Fergal, referencing Airbus' ambitious double-decker airliner which had its first flight in April 2005. "We also have an application in to Boeing for testing on the X-37 spacecraft, which goes to show how valuable a reference from ESA can be."

See accompanying CD for more information.



"We've been growing our research and development expenditure by about 20 percent a year for the last several years. We also expect to continue to grow at that rate and the assistance we get from ESA will help us maintain that growth, and will give us an edge in the market."

Fergal Bonner, Managing Director, ACRA Control

Aircraft Management Technologies (AMT) Ltd

ESA Project: Development of software to improve communication between aircraft and ground crew

In today's competitive environment, airlines must run their businesses at peak efficiency to maximise profitability, and technologies that can help are much in demand. This is the market that Dublin-based software firm Aircraft Management Technologies (AMT) has built its business upon, and with help from the European Space Agency, AMT has now moved into a lucrative industry niche: creating the framework technology used by developers to write software for aircraft.

It was in 2004, the Chief Executive Officer Bernard Hensey explains, that AMT made an important strategic shift away from its original focus, which was selling software directly to airlines. "We had to concentrate on where we fit in the value chain, so we changed our focus, to sell to system integrators and original equipment manufacturers (OEMs)," says Bernard. "The ESA project, plus our success in securing other European research funding at that time, made it easier for us to make the switch. We differentiate ourselves on R&D now – it's critical for us."

What ESA provided was part-funding to let AMT develop a crucial part of its product set: a communications software module. All voice and data contact between an aircraft and the ground is wireless, using channels ranging from satellite to Wi-Fi (802.11x), and each channel carries different costs. AMT's communications module will let the airline control which channels are used, and when. For instance, the software can ensure that low-cost channels are favoured for routine information transfer such as updates to manuals, while urgent communications, such as passenger sickness, may use priority channels.

AMT is now completing its ESA work, but already AMT is finalising a sale of its full product set to a commercial customer. The ESA work has also prompted a significant rise in AMT's R&D spend, and the company is recruiting additional staff. ESA's support came at the perfect time, Bernard says, not only because it facilitated AMT's strategy shift, but because it focussed the company's energies on rapidly completing a product set that the market wants.

"We had the communications module in our product roadmap from the beginning, and possibly we would have self-funded the development of it, but it wouldn't have been easy," he says. "What's so valuable about ESA is that they behave like a customer. That is a great discipline for product development, because it means you don't endlessly explore and pick away at things. You have deliverables, and you have to deliver."

See accompanying CD for more information.



A photograph of Bernard Hensey, Chief Executive Officer of Aircraft Management Technologies. He is a middle-aged man with short, graying hair, wearing a light blue button-down shirt. He is smiling and leaning on a dark metal railing. The background is a blurred outdoor setting with a cloudy sky.

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Bernard Hensey, Chief Executive Officer, Aircraft Management Technologies

BetaTHERM Ireland Ltd

ESA Project: Development and production of sensors and NTC thermistors for the space industry

Positioned high above Earth's surface, European Space Agency satellites are continually monitored and measured to ensure that their sophisticated systems are working properly. Countless sensors do the crucial job of measuring temperature changes to which are often the first indication of a problem. It is thanks to Galway-based BetaTHERM that ESA is able to keep such close tabs on its orbiting nerve centres.

BetaTHERM is in the business of making sophisticated temperature sensors and Negative Temperature Co-Efficient (NTC) thermistors, which are used in a range of industries, from aerospace and automotive to medical and heating ventilation and air conditioning (HVAC). "The company's sector is a highly technical one, which requires BetaTHERM to constantly remain focused on product innovation", explains Jude Neylon, the company's Business Development Manager.

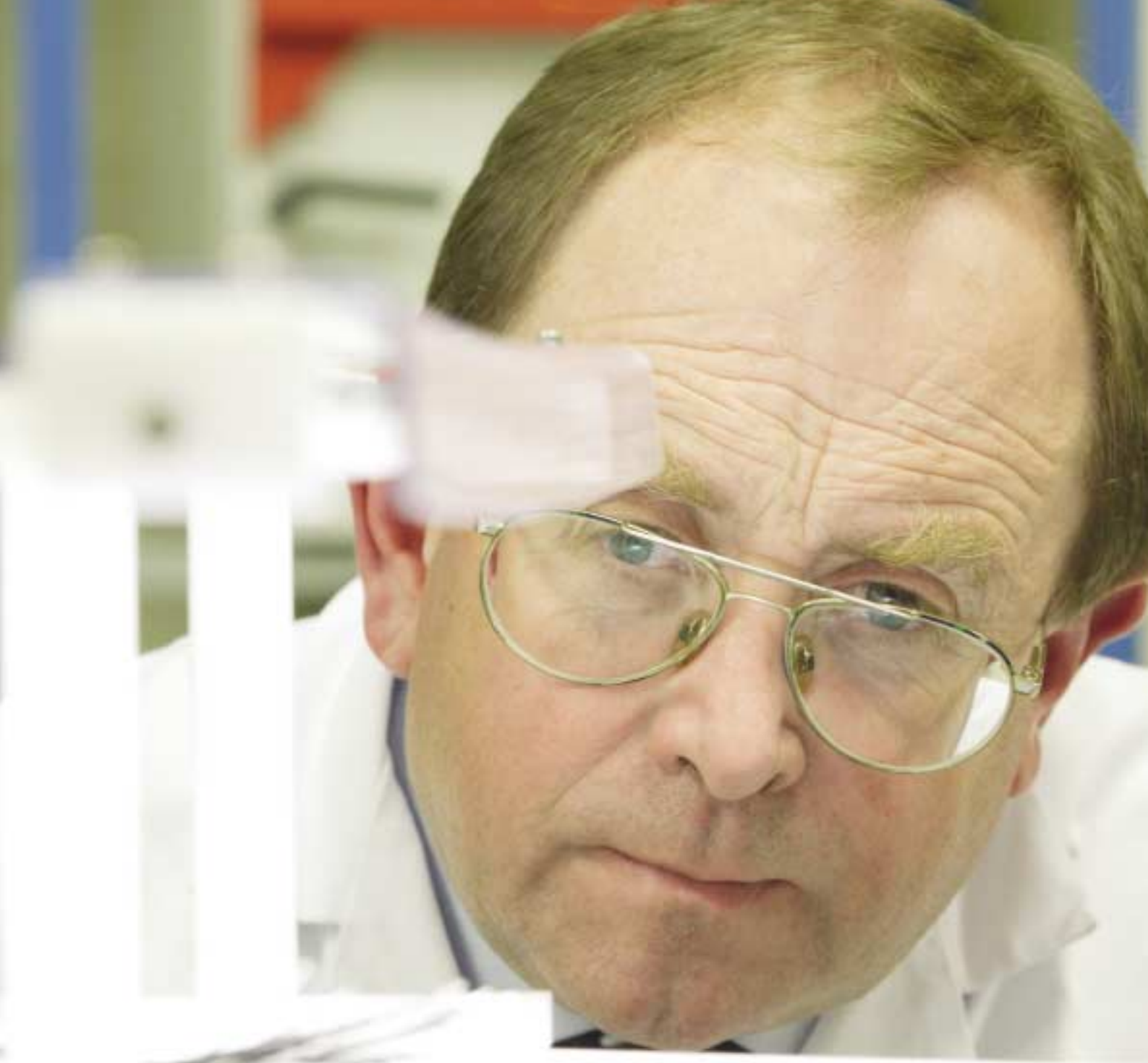
"Our products are not just standard commercial type thermistors," Jude says. "They are used for measuring high precision temperatures in satellites or for measuring the temperature of blood, so they need to be very accurate and extremely reliable," he explains. But Jude also notes that the company's business was not built overnight. BetaTHERM first started supplying ESA contractors with temperature sensors more than 10 years ago. Its entry into this new market quickly gave rise to a new, more intense focus on research & development, which itself would eventually hit 5 percent of the firm's rising turnover.

"ESA support, and support from Enterprise Ireland, has been crucial in helping us to develop our products," Jude adds. "It's not just the financial support that I am referring to; it is also the technical advice and consultancy, which is a considerable contribution." This contribution has had the desired effect, with sales in the firm's aerospace division doubling each year for the past two years. BetaTHERM also now stands as one of the most advanced makers of thermistors and temperature sensors in Europe, and the firm is also making ever-deeper inroads into other technology driven sectors, such as healthcare.

"ESA accreditation is also a valuable thing," Jude explains, adding that a listing under the Qualified Parts List (QPL) for thermistor components and probe assemblies has delivered enormous benefits to the company, helping it to acquire new customers who might otherwise have opted for a different supplier. "It was hard work, but people really recognise 'ESA accreditation' and reaching that milestone was a monumental achievement for us."

See accompanying CD for more information.





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Jude Neylon, Business Development Manager, BetaTHERM Ireland

Computer Applied Techniques (CAPTEC) Ltd

ESA Project: Software development and validation for a range of ESA satellites

Ireland's expertise in software development is well established. With the country's software firms already exporting to customers all over the globe, it only makes sense that some Irish firms are looking to space for new markets. At the forefront of the charge is Dublin-based Computer Applied Techniques Limited (CAPTEC).

CAPTEC is involved in a wide range of specialised activities within the software industry, including the development of image processing software, data compression software, critical applications and even specialised operating systems. According to CAPTEC Managing Director Fred Kennedy, the company's big break with the European Space Agency came with the Hipparcos mission in the late 1980s, a project that aimed to produce an astrometric catalogue of stars.

Following that project, CAPTEC became involved in a raft of other initiatives, including the development of specialised software used on ESA scientific satellites ISO, SOHO, and XMM satellites – all projects that pioneered the use of the Ada software language.

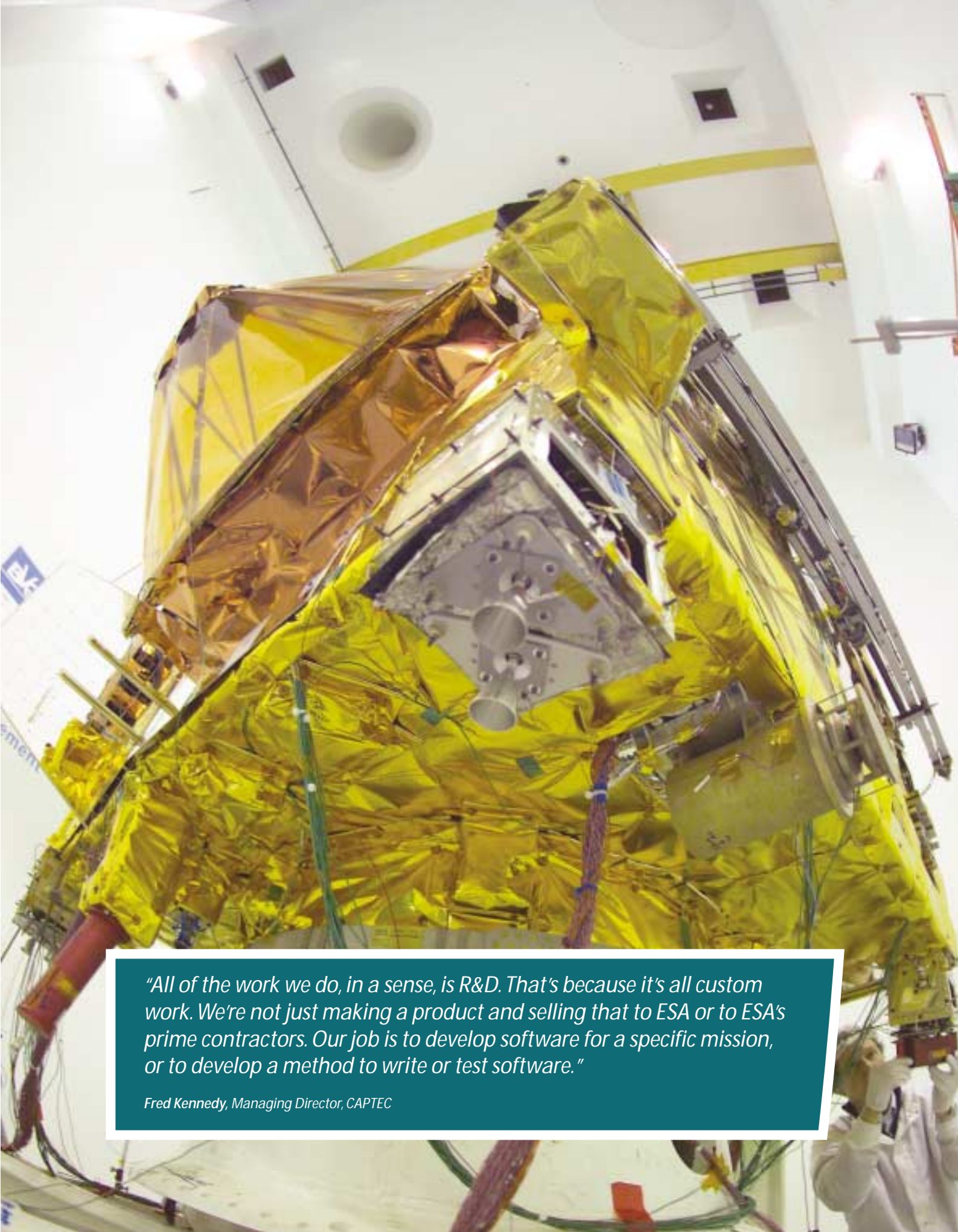
"We had become experts in developing on-board software for satellites, which meant that we were in a good position to begin carrying out independent software validation (ISV) for ESA," Fred explained. One of CAPTEC's initial ISV roles related to the software on the Huygens probe, which in 2004 landed on the surface of Saturn's largest moon, Titan. That work was quickly followed by additional software validation relating to the Mars Express, Herschel-Planck and Venus Express missions. CAPTEC also carried out ISV work ahead of the Rosetta mission, a ten-year undertaking that concludes with an up-close analysis of the comet 67 P/Churyumov-Gerasimenko.

Custom software: pure research & development

"All of the work we do, in a sense, is R&D," Fred said. "That's because it's all custom work. We're not just making a product and selling that to ESA or to ESA's prime contractors." Despite the fact that each ESA project is unique, CAPTEC is able to repeatedly win new ESA contracts, in part because it has built up an impressive portfolio of skill sets and intellectual property.

The CAPTEC Managing Director also said that the wealth of knowledge and expertise built up over the years in ESA projects has also helped to expand the company's skill when it comes to developing imaging software for the healthcare industry – a burgeoning division within CAPTEC. "The space activity very definitely benefits medical imaging, and vice versa," Fred said, adding that the company now puts about 10 percent of annual turnover back into the company in the form of R&D spend.

See accompanying CD for more information.



"All of the work we do, in a sense, is R&D. That's because it's all custom work. We're not just making a product and selling that to ESA or to ESA's prime contractors. Our job is to develop software for a specific mission, or to develop a method to write or test software."

Fred Kennedy, Managing Director, CAPTEC

Duolog Technologies Ltd

ESA Project: Development of semiconductor intellectual property for wireless communications networks

Society's desire to communicate has never been greater, and companies who provide the core technologies that enable communications have a rich market to exploit. Irish company Duolog Technologies is at the cutting edge of this industry, creating designs for advanced semiconductors that allow all kinds of devices to communicate with each other, without wires. Duolog's business model is to license its intellectual property (IP) to major semiconductor companies. It's a difficult niche in which to excel, but thanks to work secured for the European Space Agency, Duolog is making impressive strides.

"The semiconductor IP market is a double-edged sword," explains Michael Phelan, Duolog's Sales Director. The benefits for a company like Duolog are significant once its technology is licensed by a chipmaker – but because IP development is expensive and high-risk, it's difficult for a small company to excel without major financial backing. "To be serious in any market, you have to demonstrate competence," Michael says. "ESA has allowed us to develop the functions that people wanted and demonstrate them working."

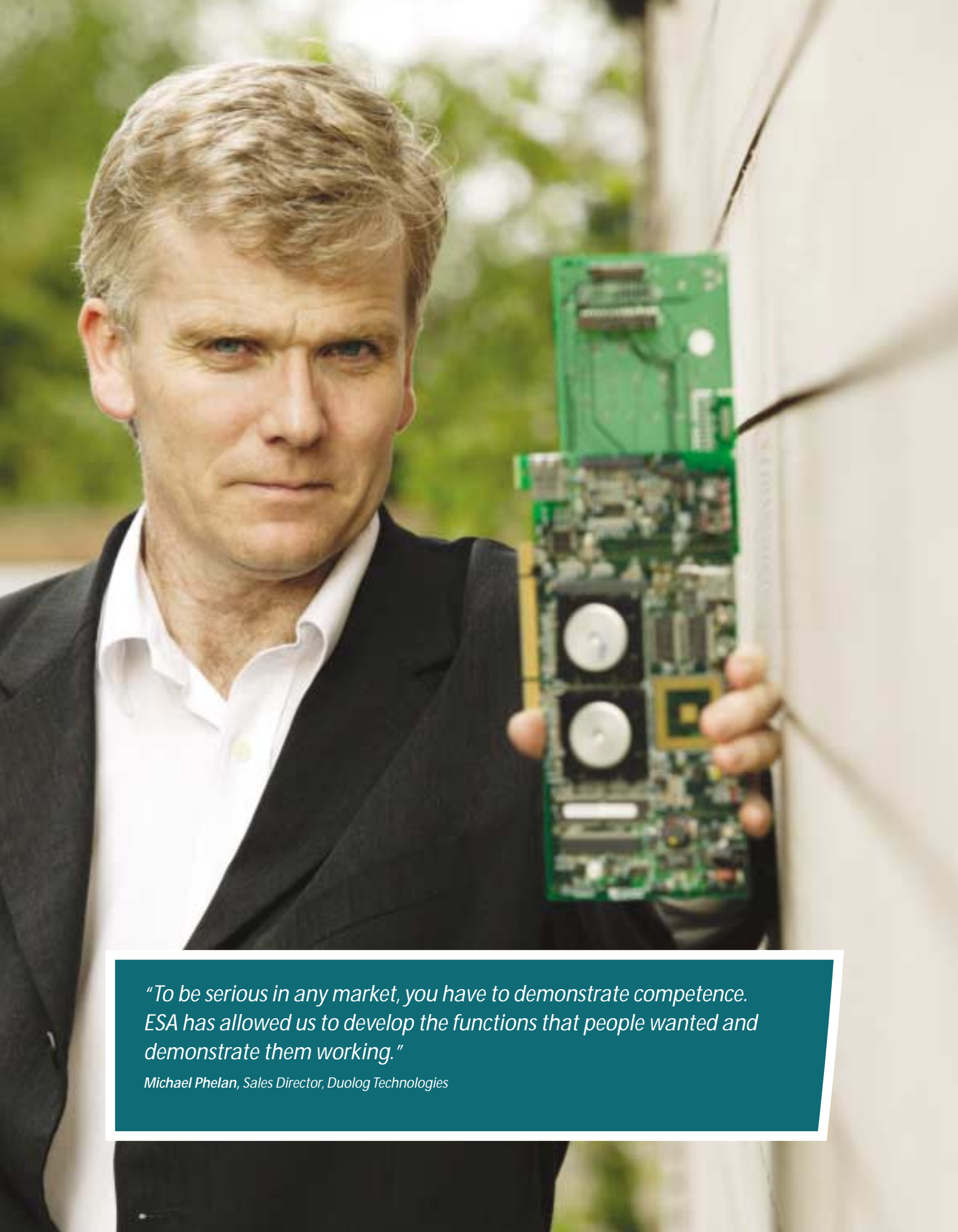
The work secured for ESA helped Duolog create essential parts of its overall product set, including designs for core technologies that will allow wireless local area networks to link with satellites. These designs have allowed Duolog to develop relationships with four new customers in the wireless area.

"These new customers contribute between €300,000 and €3 million of design business, as well as intellectual property sales, to Duolog annually," Michael says. He also anticipates that, following Duolog's successful ESA work, its current annual €1.5 million R&D spend will rise to more than €2.5 million during 2006.

A hot market now being eyed by Duolog is low-power, short-range wireless communications known in the industry as "Zigbee". This kind of technology is ideal for use among a group of sensors, for example among a series of smoke detectors inside a warehouse.

"There are companies out there who would do business with us if we had a Zigbee solution, but they won't take the risk on a concept – they want to see significant development already undertaken," Michael says. "The ESA funding we're now seeking would allow us to develop the semiconductor IP necessary to implement a Zigbee chip and thus secure business with these companies."

See accompanying CD for more information.



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Michael Phelan, Sales Director, Duolog Technologies

Eirecomposites Ltd

ESA Project: Advanced manufacture of high-performance thermoplastic composites for spacecraft

Ever since the 1960s, aircraft and space vehicles have incorporated strong, lightweight materials known as fibre-reinforced polymer composites. Until recently, high manufacturing costs limited participation in the industry and curtailed use of these materials. Now, an upsurge in innovation means fresh opportunities for new players, including Galway based Eirecomposites.

Eirecomposites, a group of companies born out of research at the National University of Ireland, Galway and the University of Limerick, is a leader in the design, manufacture and testing of high-performance composites. The company is heavily involved in R&D projects for applications that range from commercial aircraft to Formula 1 racing, but a key market is space. One of the company's foremost R&D projects is being undertaken for the European Space Agency, investigating whether new thermoplastic composite materials, now under development, are strong enough for space.

The ultimate aim of the research is clear: finding ways to manufacture space-worthy composite materials at a lower cost. It's a goal that's of tremendous interest not only to ESA, but to the broader aerospace market, since it could allow items like satellite components to be built much more cheaply, without any reduction in performance.

The work is ongoing, but already Eircomposites' ESA work has led directly to new orders and new enquiries from customers in manufacturing and testing.

"Working on an ESA project gives us a lot of credibility with potential customers. It unlocks more international and European Union funding to develop new technology and introduces us as suppliers to more firms," notes Conchúr Ó Brádaigh, Joint Managing Director of Eirecomposites. "In fact, we've already signed a deal with a satellite company for production of composite components for space."

With a core of Ph.D and Masters degree engineers on staff and more than €300,000 a year devoted to R&D, Eirecomposites is a prime example of an Irish company whose success is fuelled by its research prowess. Its R&D investment amounts to fully one third of its turnover, an investment which has borne fruit as the company has attracted clients that also include Airbus and BAe Systems.

"The kind of expertise we build up working with ESA, I believe, makes it possible for us to participate in more research and to find more customers," he concludes.

See accompanying CD for more information.



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Conchúr Ó Brádaigh, Joint Managing Director, Eirecomposites

Farran Technology Ltd

ESA Project: Development of Monolithic Microwave Integrated Circuits (MMIC) technology in the 100 GHz band

Without robust security, commercial airlines would have few passengers. Likewise, excessive security policies by airlines, governments and airport authorities run the risk of alienating air travellers and weakening this linchpin of the world economy. The trick is to find methods that ensure passenger safety, but also allow for convenience. Thanks to the support of the European Space Agency, Cork-based Farran Technology has done just that.

Farran Technology has long been supplying ESA with high-frequency microwave components and subsystems, which were used mainly for communications. After 2001, however, the firm's focus took a dramatic turn. "ESA was an important partner, but we also had customers in the telecommunications industry, which hit a downturn in 2001. We were backed into a corner," explains Tony McEnroe, Managing Director of Farran Technology. "Later that year, September 11th occurred and suddenly there was much more demand for new airport security technology. We had the expertise to develop something new, so that's what we did."

Borne out of Farran's re-focus of its core business was an advanced imaging system known as Tadar, a device that can help airport security personnel to spot dangerous items concealed on a person's body. Tadar's sensors detect energy naturally emitted or reflected from objects, by using approximately 3mm wavelengths that are harmless to people. At this wavelength clothes become transparent but dense objects such as explosives and weapons hidden under clothing block the body's natural radiation and reflect a clear profile of the blocked energy field. In effect, the company's technology allows for machines that function like an X-ray machine, but pose no health risk to people or animals.

ESA: Supporting Farran's rebirth

In fact, it was an ESA project that the company carried out in partnership with the National Microelectronics Research Centre (NMRC) and Fraunhofer Institute that helped the company to reinvent its business. "The ESA project was to develop Monolithic Microwave Integrated Circuits (MMIC) technology for operating in the 100 GHz band," Tony says. "ESA wanted the technology for satellite to satellite communications. But it was this same MMIC technology that formed the basis of our Tadar camera, which also operates on the 100 Ghz frequency."

"We might not be in the position we are in if it were not for the support of ESA. On one hand they are a customer like any other. But they also help to fund the development of technology through design programmes," Tony said. "That kind of support has been extremely important because the rate of technical changes has been extremely fast."

"For a small company to keep pace with that, we would have had to spend 40 percent of our revenue on R&D, which would not be sustainable," Tony says. "But funding from ESA means we can spend less, but still develop world-beating technology."

See accompanying CD for more information.



"We might not be in the position we are in if it were not for the support of ESA. We have two relationships with ESA. On one hand they are a customer like any other. But they also help to fund the development of technology through design programmes...funding from ESA means we can spend less, but still develop world-beating technology"

*Tony McEnroe,
Managing Director, Farran Technology*

Fibrepulse Ltd

ESA Project: To research the potential use of fibre optics in satellites

The notion that space is a place of boundless opportunity is as true for humanity as a whole as it is for any single individual or organisation. Mayo-based Fibrepulse Limited is the perfect example of how an inventive and enthusiastic business can rapidly and thoroughly transform itself in order to take advantage of opportunities that exist in space.

Founded in 1998 by Managing Director Rory Casey and Technical Director Shane Scott, Fibrepulse spent its early years riding on the crest of the telecoms boom. In those days, the company's main business involved the termination of fibre optic cable – a technical and precise process that entails the attachment of connectors to the ends of telecoms cables in order to create links useable by large communications firms.

Against the backdrop of the wider telecommunications boom in the late 1990s and in early 2000, Fibrepulse's business was red hot and its explosive growth during the period was evidence of that. But, as Rory explains, the telecoms meltdown in 2001 hit Fibrepulse – and the rest of the industry – very hard.

The turnaround came in December 2002, when Fibrepulse attended an Enterprise Ireland organised seminar which focused on opportunities in the space industry. "We would not have even looked at the industry if it were not for the meltdown," Rory says. However, by 2004 Fibrepulse had signed a General Space Technology Programme (GSTP) contract with the European Space Agency that involved partners Europe and North America. Though the work is still on-going, the consortium aims to have a demonstrator model by the end of 2005, an important development that could herald the first step in a transition from copper wiring to fibre optic cables in satellites.

Although the technical accomplishments associated with Fibrepulse's ESA work have been remarkable, the firm's transition from traditional manufacturing to what Rory describes as "lower volume, higher value" manufacturing is equally impressive. In fact, after just a few months of work on its ESA project, Fibrepulse has already signed several new contracts with customers seeking fibre optic cabling for use in harsh environments, such as in the mining industry or healthcare.

"We have found that working with ESA is a great badge to have when you talk with new customers," Rory said. "They say 'Oh, you do work for ESA. Well, I'm sure you can handle our job as well.' Our horizons have been significantly expanded."

See accompanying CD for more information.





"We have found that working with ESA is a great badge to have when you talk with new customers. Our horizons have been significantly expanded."

Rory Casey, Managing Director, Fibrepulse

METOP
Multi Purpose

Intune Technologies

ESA Project: Development of "tunable" laser technology for weather sensing systems

In the information age, few technologies are more promising than photonics, the technology of generating and controlling light. That's because light is a virtually perfect tool for carrying information, whether the light travels via laser, fibre-optic cable or another medium. It was in 1999 that Irish photonics experts John Dunne and Tom Farrell founded Intune Technologies to unlock the power of light as an information asset. Thanks to contracts secured with the European Space Agency, the young company has already won customers worldwide in industries ranging from oil and gas to telecommunications.

Intune, working with the Trinity College Dublin Physics Department, created a unique laser for ESA to use in a LIDAR system (the light equivalent of radar). The novel aspect of the Intune laser was that an operator could "tune" it to steadily emit different colours of light. This would allow the LIDAR system to generate detailed 3D images of clouds and weather systems, empowering meteorologists to extend weather forecasts by several days.


Most importantly, says John Dunne, the core technology created for ESA is applicable to a vast array of industries. "The intelligence of the weather sensing tool can be used for a great variety of gas detection systems," he explains. Intune is now targeting companies who use a number of single-colour laser systems to monitor different types of gas emissions from their industrial furnaces. "Intune's technology could let them track multiple species of gas with just one system, which could be cheaper and would also give them real-time information to let them improve their system performance."

Following its work for ESA, Intune has increased its R&D spend by 25 percent and has recently secured a second ESA project, and it aims to win a further two by 2007. In fact, Intune estimates that 60 percent of its projected commercial revenue will be directly or indirectly related to its ESA work.

Since the start of the space age, US companies have been able to use their aerospace industry as a route to market, and John says that ESA provides that same invaluable opportunity in Europe. "ESA enabled Intune to formally enter the aerospace market and validate, over a short period of time, the suitability of our technology and skill-sets," Tom concludes. "It's such a valuable reference point from which to enter other markets."

See accompanying CD for more information.



A man with dark hair, wearing a light blue button-down shirt, is standing in a modern building with a glass and metal facade. He is holding a smartphone in his hands and looking towards the camera with a slight smile. The background shows a complex grid of metal beams and glass panels, suggesting a high-tech or industrial environment.

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Tom Farrell, Chief Technology Officer of Commercial Systems, Intune Technologies

Klas Ltd

ESA Project: Technical improvements to the KlasHopper satellite communications device

A prime objective of the European Space Agency is to ensure that investment in space delivers benefits to the people of Europe. That mission means much more than the development of satellites and other spacecraft; it also includes provisions which compel the agency to promote existing space technology – an ambition that has real implications for Meath-based Klas Limited.

After forming in the early 1990s to develop technology for budding digital communications services, Klas reorganised its business in 1997 to take advantage of the rapidly emerging market for satellite communications. Specifically, the company developed a new product that made it possible for individuals with satellite phones to upload and download data to computers.

"Anyone who tried to connect their satellite terminal to a laptop to send e-mails or other files would quickly discover that it just wasn't possible," explained Brendan McCann, the Managing Director of Klas. "Satellite phones were not really designed to be modems and the networks they use were not really designed to handle data." Klas' flagship product, KlasHopper 200/400/600 M4, helps overcome this problem. Essentially, the technology behind the product compensates for the limitations inherent in satellite phones, allowing the devices to be used as both phones and modems.

Brendan explained that ESA's interest in the technology was borne out of the agency's ambition to promote as many applications for its Inmarsat satellite network as possible. "They want to see applications like KlasHopper succeed, which is why ESA helped to fund continuing development of our technology."

In fact, the €150,000 ESA contract secured by Klas received is what enabled the company to produce advanced versions of KlasHopper 200/400/600 M4, which open up a wider array of computer applications to users and cater for individuals with newer PC operating systems.

"All R&D is to some degree speculative. It means taking a risk on a market segment," Brendan said, noting that the risk is especially dangerous to smaller firms. "Participation in ESA programmes has enabled us to deepen our knowledge base without the same level of risk normally associated with new projects. That's where ESA support was the most useful to us."

See accompanying CD for more information.





"Participation in ESA programmes has enabled us to deepen our knowledge base without the same level of risk normally associated with new projects."

Brendan McCann, Managing Director, Klas

Mapflow Ltd

ESA Project: ARMAS – Active Road Management Assisted by Satellite

No economy can be successful without a robust transport infrastructure. In Europe, the authorities recognise that an innovative solution is needed to fund more investment in Europe's roads. That's where the ARMAS project aims to help, with a pioneering "virtual" road toll system. Still under development, the system uses in-vehicle black boxes and global satellite positioning data to help determine the exact route a driver has travelled, so that a fair and precise toll can be calculated after each journey.

The project has achieved remarkable results already – both for the European Space Agency, which is funding the research, and for the researchers themselves, including Irish software company Mapflow. ARMAS has given Mapflow an invaluable opportunity to refine its flagship location-based software for vehicle tracking. As a member of the ARMAS consortium, Mapflow has also made extensive IT industry and public sector contacts, and is now a recognised expert in the area of using global satellite positioning data for tolling.

This expertise has already allowed Mapflow to earn significant commercial revenue from organisations examining new road congestion relief systems. With a refined technology and substantial industry credibility, Mapflow is ideally placed to pursue public tenders for virtual tolling systems, which are expected in the next few years. Even more importantly, Mapflow is bringing its ESA know-how to the commercial sector.

"There's a lot of interest in the UK insurance market on using global satellite positioning data to determine how a person has been driving, and changing their policy accordingly," said Harvey Applebe, Chief Technology Officer for Mapflow. "The opportunity for Mapflow in having put together these systems for ESA is that we can go to the insurance companies and say, look, we can tell you with confidence which road that person was driving on. The fact that we've done this work for ESA has been a real door-opener."

Mapflow Commercial Director Jonathan Guard says the company's relationship with ESA has been an essential catalyst, both for its R&D work – an area where Mapflow invests up to 20 percent of revenues – and for overall growth. "The biggest contribution ESA has made is in providing the credibility that's allowed us to target other organisations," he said. "Enterprise Ireland has been instrumental in helping us build up those contacts with ESA, and in helping us develop the products and expertise to expand into new commercial markets outside Ireland."

See accompanying CD for more information.





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Jonathan Guard, Commercial Director, Mapflow

Marotta Ireland Ltd

ESA Project: Design, manufacture and testing of structural components, valves and fluid control systems for spacecraft

Components used in spacecraft must be carefully designed, flawlessly manufactured and meticulously tested. Any firm that can handle all three elements of the production cycle brings to the table a valuable mix of skills that cannot be overstated. Marotta Ireland is one such company.

Established in 1982 under the name Devtec, Marotta is a long-time partner of the European Space Agency. In 1987 the company started work on the new European heavy lift launcher series known as Ariane 5, which was developed to carry satellites into space. It was ESA prime contractor Snecma who contracted Marotta to design, produce and test engine supports, which are the structural elements that connect the major sub-assemblies of the rocket's Vulcain engine.

It was the Ariane 5 programme that marked a turning point for the company, in part because the original programme expanded into three separate programmes which saw Marotta go to work on two versions of the Ariane 5's main engine, as well as components in the upper stage Vinci engine. By 1991, the company's business began to expand in new ways, resulting in a major manufacturing contract with aerospace giant Boeing. "I think there was a clear connection between our ESA experience and Boeing's decision to work with us," said Gerard Fenner, Sales and Marketing Manager with Marotta Ireland.

"Our involvement with ESA has completely changed the focus of this company. We've always been a research-driven company, but Ariane 5 really helped us to focus more on R&D, particularly in the early years of the project, before we got into the main production phase. It's helped to drive not just our sales, but also our reputation," Gerard said.

Even now, its work with ESA continues to help the company find new avenues to focus its energies. Alongside the Ariane 5 project, Marotta Ireland has been contracted to design and produce fluid control and pressure regulation components for the propulsion systems in the upcoming Alphabus line of telecommunications satellites.

Moreover, these new contracts are driving a dramatic increase in new research and development expenditure, which Gerard says will more than double to 25 percent of turnover in the next financial year. "Ariane 5, almost 20 years ago, is what really kicked off our R&D programme, and now, with these new ESA projects in the pipeline, the same thing is happening again."

See accompanying CD for more information.



"Our involvement with ESA has completely changed the focus of this company... It's helped to drive not just our sales, but also our reputation."

Gerard Fenner, Sales and Marketing Manager, Marotta

Skytek

ESA Project: Development of software to present step-by-step guidance on the execution of complex procedures

Scientists and engineers who successfully complete astronaut training must execute literally thousands of procedures when in space, from handling volatile chemicals to performing delicate protein growth experiments. Irish software company Skytek has provided an essential mechanism that allows the European Space Agency and the US National Aeronautical and Space Administration (NASA) to present on-screen, step-by-step guides for any procedure astronauts undertake. Following the successful launch of Skytek's software with NASA's historic Return to Flight mission in July 2005, the Irish company has had the chance to further refine its product, and is now actively marketing its software to wider industries.

As Paul Kiernan, Skytek's Technical Director, explains, Skytek hasn't merely put ESA and NASA manuals into electronic form. Instead, with Skytek's tools, the space agencies can do this themselves. "We wrote the software to let them create and visualise the procedures," he says. "Our system hides all the complex language. They just have to focus on what they know and what they want to explain to the astronauts." Skytek initially developed the software with ESA funding, and following delivery of a finished product to ESA, Skytek secured NASA's support to further refine the tool. The company is now incorporating features requested by the astronauts themselves, including the facility to present instructions to two astronauts completing procedures in parallel.

Thanks to ESA's support, Skytek now has a core product that has already delivered a strong pipeline of new sales for the Irish company, and aircraft maintenance expert Lufthansa Technik is set to roll out the Skytek system across its fleet in 2006. The ESA experience was invaluable, Paul says, both for the discipline it placed on Skytek's developers, and for the stamp of approval it has given the company.

"Because of the methodologies that ESA imposes for the development of software, we have become much stronger as a small company in the procedures we use for software development, including how we define functionality and carry out testing," he says. "When we present to customers, once we say this software has been developed for ESA and to their standards, there are no further questions about how strong the company is with regard to software development. It gives us real credibility from the moment we walk through the door."

See accompanying CD for more information.



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Tyndall National Institute, University College Cork

ESA Project: Development of an imaging device to detect bone deformation caused by a microgravity environment

The International Space Station is one of the most exciting projects in modern space exploration, offering humans their best chance yet to discover what it's like to live in space. One of the unfortunate effects already known about exposure to the microgravity environment, however, is bone deformation. To combat this degradation, scientists must know more about how it occurs, and that's the insight that a research team at University College Cork (UCC) is helping to provide, with support from the European Space Agency.

As part of the Ballistic and 3-D Holographic Imaging of Bone project, a research team at UCC's Tyndall National Institute and Physics Department is collaborating with other universities and commercial partners, including Agfa, to create an imaging device that will be able to map the bone deformation as it happens. With ESA support, the UCC team is contributing the semiconductor laser which is at the heart of the device, and which will generate ultra-short, ultra-intense pulses that can let scientists "see" inside bones.

As Dr. Guillaume Huyet, a principal investigator on the project, explains, the technology has promising potential applications outside the space industry. "There are obvious applications in osteoporosis treatment in hospitals, but there are also other applications in areas like security," he says. "The ultra-intense pulses can be used to generate Terahertz waves, which can be shone through a sample and reveal concealed items, such as weapons on passengers at airport check-ins." This area of Terahertz imaging is considered one of the hottest areas in photonics research today, and Dr. Huyet says that the project has given UCC and its researchers an excellent opportunity to take part in high-profile research.

"Also, developing international collaborations as we're doing with this project is very important!" he says. "Collaboration is extremely significant, and it also helps us get access to other European funding. There are many funding opportunities between European groups, and being involved in collaborations as we are with this ESA project, we are more likely to be asked to participate in similar projects in the future. It certainly allows us to make our work more visible."

See accompanying CD for more information.



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Dr. Guillaume Huyet, Tyndall National Institute

UCD Engineering and Materials Science Centre

ESA Project: IMPRESS and CETSOL – analysis of the formation of alloys in a microgravity environment

With some research projects, there are no laboratories on Earth where the right conditions exist for the purpose of experimentation and analysis. It is for that reason that researchers at University College Dublin (UCD) Engineering and Materials Science Centre must turn to space for work on a project which could lead to important gains for European industry.

For Dr. David J. Browne and a team of researchers at UCD, space holds the key to better understanding of the way alloys are formed. That's because alloys – or combinations of two or more types of metals – have until now only been produced here on Earth, where gravity can affect the microstructure of the metal.

However, it won't be long before astronauts working on the Materials Science Laboratory on the International Space Station (ISS) will be able to analyse alloys cast in a microgravity environment, thanks to a European Space Agency-led project called IMPRESS (Intermetallic Materials Processing in Relation to Earth and Space Solidification).

At the heart of IMPRESS – an integrated project part-funded under the European Commission's Sixth Framework Programme (FP6) – is Dr. Browne's team at UCD, which is designing the furnace to be used on the space station – an effort that requires the team to build a system light enough to be carried into orbit, but powerful enough to heat a titanium-aluminium alloy to temperatures of around 1500°C.

"The idea is to learn more about the solidification process, and to apply what is learned to industry here in Europe. Obviously, we're not talking about building a foundry in space, but we think we could enhance processes on Earth if we could remove the effect of gravity from the research."

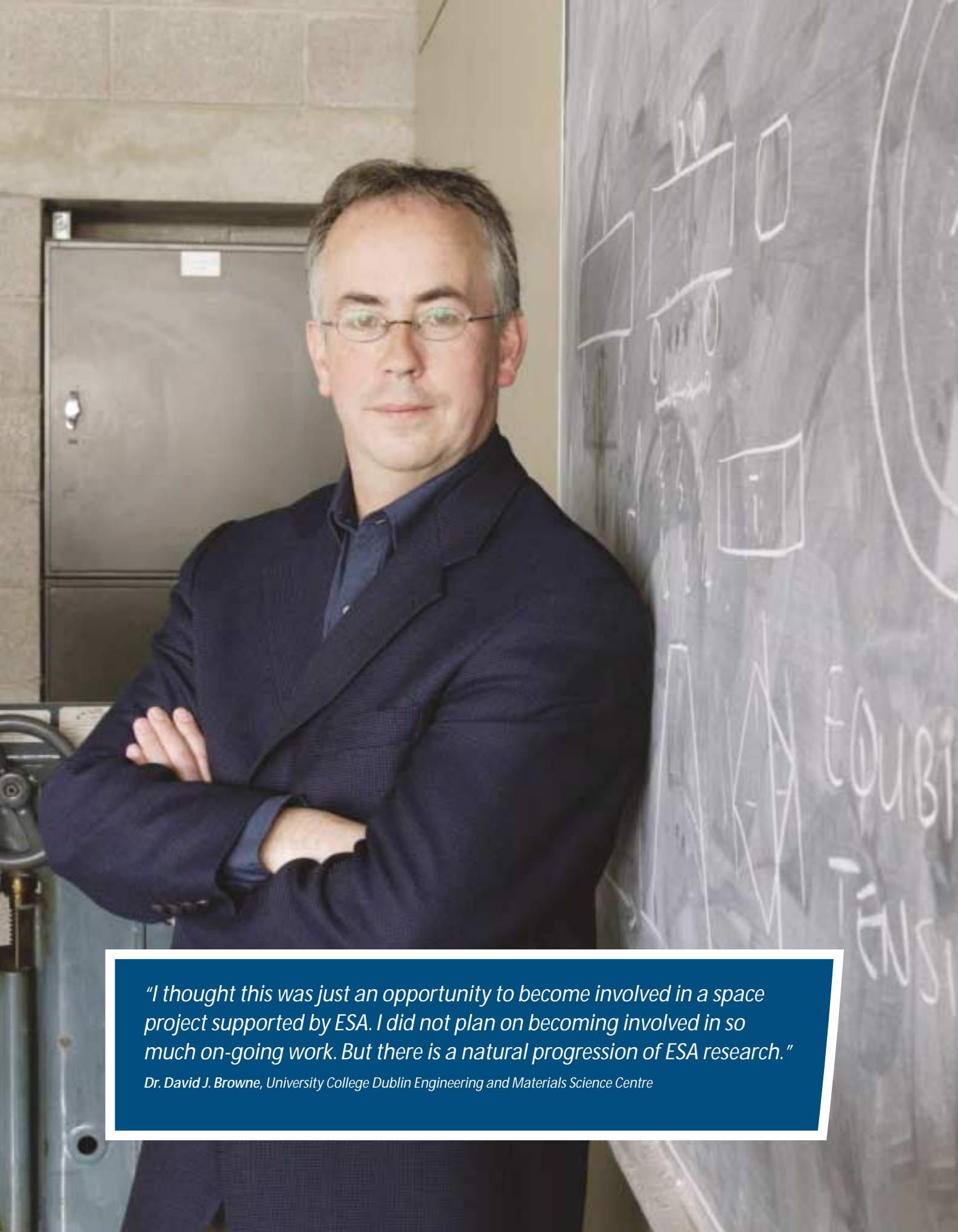
While the IMPRESS project itself is an ambitious undertaking, it is not the only ESA-led work that Dr. Browne's team at University College Dublin is engaged in. Prior to becoming part of the initiative, the UCD Engineering and Materials Science Centre carried out key research under a still-active ESA project called CETSOL (Columnar to Equiaxed Transition in Solidification Processing).

"CETSOL and IMPRESS are related," Dr. Browne explains. "In CETSOL we are developing models that will be put to use in IMPRESS. We were invited to work on IMPRESS because of our experience in CETSOL. These things build on each other," he said, adding that his team has submitted another application to participate in an ESA-backed MAP (Microgravity Applications Promotion) project known as XRMON.

"From a UCD perspective, this kind of research means more funding for the university and helps us to attract more researchers from all over the world," Dr. Browne concluded. "If we had not taken the time to take the first step, we wouldn't be where we are now."

See accompanying CD for more information.





"I thought this was just an opportunity to become involved in a space project supported by ESA. I did not plan on becoming involved in so much on-going work. But there is a natural progression of ESA research."

Dr. David J. Browne, University College Dublin Engineering and Materials Science Centre

Web-Sat Ltd

ESA Project: Development of affordable satellite-based communications services

For anyone who's accustomed to fast, reliable internet access, it's easy to forget that in parts of the world with poor telecoms infrastructure, getting online using normal channels is virtually impossible. Companies who can deliver reliable internet access to these regions are poised for success, and that's exactly what Dublin-based Web-Sat has done. Thanks to research originally done for the European Space Agency, this satellite internet service provider has won customers throughout Europe, the Middle East and Africa and is recognised as a pioneer in its industry.

Web-Sat is a spin-off of Armstrong Electronics, a distributor of satellite equipment and services. It was Armstrong who secured an ESA contract in 1994 to develop interactive television programmes in Eastern Europe. Viewers were invited to phone in with questions, but unreliable telecoms infrastructure made this difficult. With ESA support, Armstrong explored new, affordable ways of getting viewers' questions back to the television studio, and an important idea was born: using the internet to send data between two points via satellite. Soon after, Armstrong developed the idea for Web-Sat, and a pilot in 1999 quickly became a commercial service.

"Without ESA support, Web-Sat would not exist," said Doug Armstrong, Web-Sat's Managing Director. "We knew about satellite transmissions, but we knew very little about the internet and TCP/IP [the internet communications protocol] in the mid 1990s. The work for ESA let us develop this knowledge."

In just six years, Web-Sat has built an expanding export business: 17 international distributors sell the Web-Sat service in their territories, and around 40,000 computers worldwide now use Web-Sat for internet access. Each PC has a satellite dish that connects it to Web-Sat's Dublin internet hub. Web-Sat clients include a "who's who" of non-governmental bodies, such as the Red Cross and the World Health Organisation, plus various governmental bodies.

Web-Sat has not forgotten its research roots: it invests up to €350,000 a year in its research division, which includes two Ph.D's and is devoted to exploring ways of maximising the amount of data that can be sent via satellite. The company's research work is firmly focussed, as it has always been, on delivering commercial benefit.

"In 1994, we said we didn't want to get involved in purely academic research – it had to have a commercial spin-off," he said. "Now, we have done that successfully."

See accompanying CD for more information.



"We knew about satellite transmissions, but we knew very little about the internet and TCP/IP (the internet communications protocol) in the mid 1990s. The work for ESA let us develop this knowledge."

Doug Armstrong, Managing Director, Web-Sat

Detailed Accounts of Successful Irish Industrial Engagements in the European Space Agency



Links

Enterprise Ireland
www.enterprise-ireland.com

Space Ireland (Directory of Irish Space Companies)
www.space-ireland.com

European Space Agency
www.esa.int

European Space Agency - Industry Portal
www.esa.int/home-ind

ESA Tendering
<http://emits.esa.int>

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European Space Agency - ESA

ESA, the European Space Agency: 17 European countries pooling their research and development resources in all space-related fields: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom. Canada is an associated member of ESA for certain programmes.



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