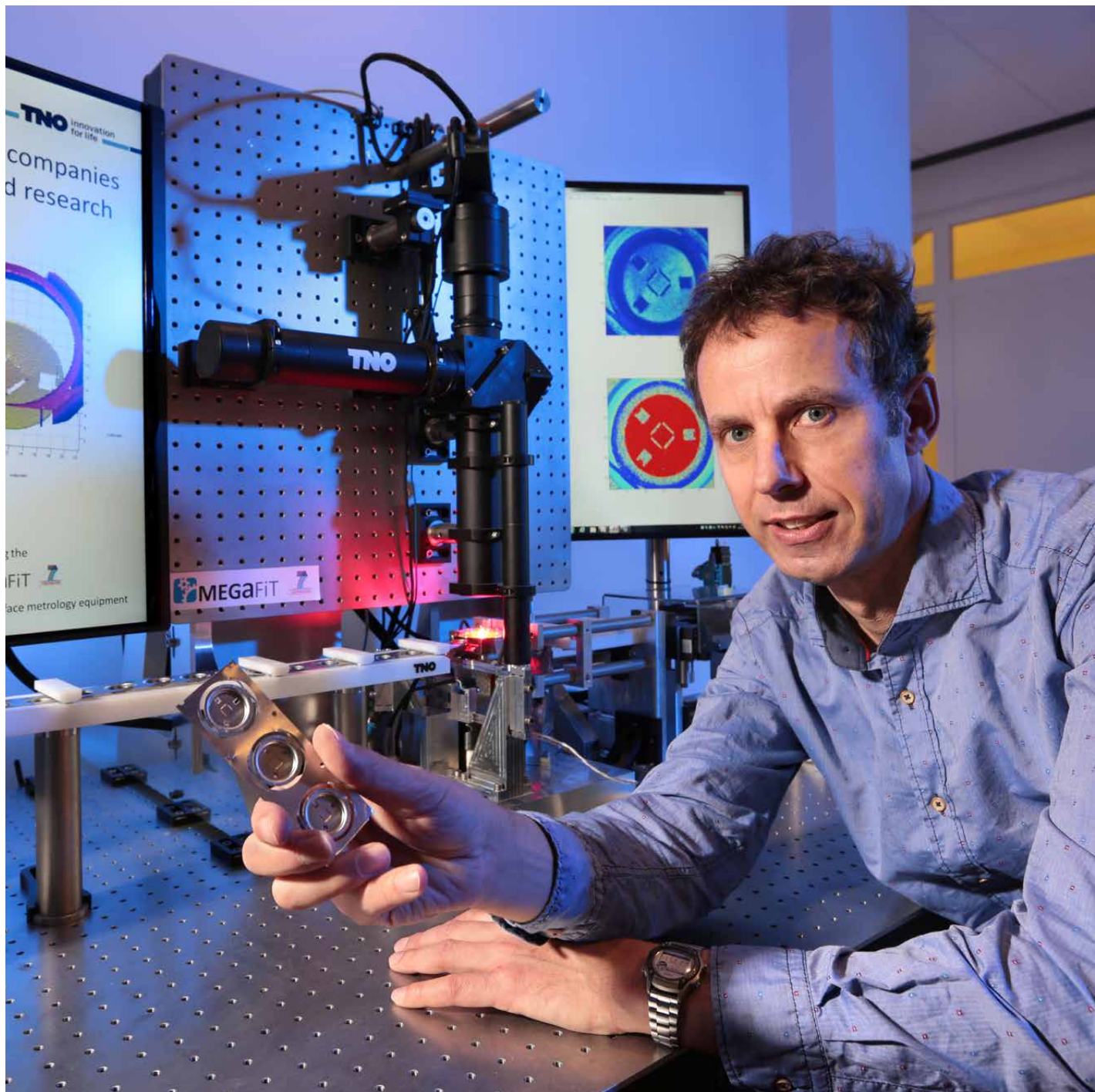


2014

TNO innovation
for life

Showcases -
ANNUAL REPORT



3D-SENSOR ENSURES ERROR- FREE PRODUCTION

'I am always excited to see a TNO innovation with real impact. That is certainly true of our 3D sensor, which maximizes the efficiency of production processes and virtually eliminates wastage.' System engineer Rob Snel has played a key role in the development of the 3D sensor. It is one of the products of the European MEGaFIT project, on which fifteen partners including Philips and Siemens worked from 2012 until the end of 2014.

MEGafIT stands for "Manufacturing Error-free Goods at First Time". 'It's all about completing the quality cycle,' Rob explains, 'whereby we apply a feedback system to reduce the wastage when die-cutting products or components from metal sheets. The 3D-sensor is essential to the project. It can measure two components a second to an accuracy of one micrometre: the thousandth part of a millimetre. The data is immediately fed back to the die-cutting machine. Any errors are corrected immediately so that the next components are guaranteed to be within extremely fine tolerances. This avoids the need for "reworks" and eliminates unnecessary wastage.'

The 3D sensor is roughly the size of a 1.5-litre bottle. It is fitted 'in line' to the die-cutting machine itself and despite the vibrations can measure components with astonishing accuracy, doing so a thousand times more quickly than the systems it will replace.

Rob Snel is now in talks with a Dutch company interested in producing the 3D sensor on a commercial basis. 'They will also undertake the marketing and maintenance programme. Our sensor is not a standard product but can be customized for various industrial processes. In partnership with the prospective manufacturer, we have already approached various companies in the automotive, steel and semi-conductor industries, as well as manufacturers of consumer articles and medical products.'

The 3D sensor and the entire MEGaFIT project are part of the "Smart Industry" programme. 'Full details of the programme can be found at the website www.smartindustry.nl,' Rob continues, 'but in a nutshell it aims to strengthen Dutch industry and the national economy by applying state-of-the-art IT and sensor technology wherever possible. This will enhance efficiency, flexibility and quality, and will allowing manufacturers to offer 'tailor-made' products. Now do you understand why I am so excited about the 3D sensor?'



HOW HARD ARE THE BUILDINGS SHAKING?

‘The province of Groningen has experienced several earth tremors in recent years. Both the frequency and intensity of the tremors are increasing’. According to mechanical engineer Marc Hamburg, senior project manager on TNO’s NAM Monitoring Network project, the effects of the tremors on homes and other buildings remain largely unknown. ‘How hard does a house actually shake during a tremor? How much damage is caused, if any? We can gauge the effects by placing vibration sensors close to the foundations of the houses, and by monitoring their physical state of repair.’

The tremors are the result of subsidence caused by gas extraction activities. The company responsible for those activities is NAM, which commissioned TNO to begin installing the sensor network in early 2014. ‘We have now placed sensors under 180 houses and twenty public buildings within a radius of fifteen kilometres around Loppersum, together with the specially designed IT infrastructure. The readings from the sensors are automatically transmitted to our data centre, and we also inform residents of the findings. They can then see for themselves what effects an earth tremor has had on their property.’

If there is a tremor measuring 2.5 on the Richter scale anywhere in the region, a TNO employee will visit every building which has been subject to vibrations exceeding the threshold value at which physical damage is likely to occur. He then inspects and carefully records any damage to the property. Four earth tremors were recorded between the start of the project and mid-January 2015.

Homeowners take part on a voluntary basis. ‘They attach much importance to TNO’s independence and impartiality. We communicate as openly as possible and try to give as much information as we can. We also listen to what people tell us – that is very important. So far we have held two information meetings and of course we had close contact with residents while we were installing the sensors. We intend to remain in close contact to maintain support for the monitoring project.’



REPLACING THE F-16

'It's something that happens only once in your working life, says Dolf Bos. 'After over fifteen years of deliberation, the government has decided that the F-16 is to be decommissioned and replaced by the American F-35 fighter.' Bos was project leader of TNO's 'Support in the replacement of the F-16' project. He and his 'wingman' Bram Visser have recently been seconded to the Royal Netherlands Air Force and are now in southern California, where two F-35s purchased by the RAAF are stationed at Edwards Airbase. Four Dutch pilots trained in America will test both aircraft over a period of five years.

For several years, TNO has supported the Ministry of Defence in its preparations for the replacement of the F-16. 'We have conducted two large-scale comparisons of the various alternative aircraft, as well as environmental noise assessments for a scenario in which the engines are tested following maintenance. We also produced a full lifetime costs analysis for the F-35.'

A new back office is being set up at TNO in The Hague. Its staff will provide support to the first operational tests in America and will eventually assist the RAAF's in its adoption of the F-35. Two simulation environments are under development. One will provide support in logistics and maintenance, while the other is concerned with matters of tactics and procedures. Missions can be planned and practised in advance. 'So far, the F-35 has only been tested by the manufacturer. The RAAF must determine whether the weapons system meets all its operational requirements. By taking part in the tests in America, we can refine the mission scenarios and ensure that the simulations are up to date.'

Dolf Bos and Bram Visser will assist the RAAF during the operational testing at Edwards Airbase. 'The F-35 is the most advanced fighter aircraft in the skies,' says Bos. 'As an aviation engineer, I really want to be involved.'



SOLAROAD:

SUSTAINABLE ENERGY FROM A 'SMART' ROAD SURFACE

It is not often that TNO attracts quite so much attention from the regional, national and even international media as it did with the opening of the first 'SolaRoad' on 12th November 2014. The man responsible, Sten de Wit, is delighted. His idea met with some scepticism when first proposed in 2009. It is now a reality: a 70-metre section of a cycle path that generates electricity from solar panels embedded in the road surface. 'There has been a lot of interest from America,' says Stefan. 'That's a "double whammy". Our tiny country was already known for its many green cycle paths, and now one of them produces electricity!'

The SolaRoad has a translucent glass surface which protects the fragile solar cells below. The surface is textured to provide good grip, even in wet conditions. 'The transparent coating is the innovative part,' explains Sten de Wit. 'The solar cells produce direct current which is then converted to alternating current by an inverter, and then fed into the national grid.'

A consortium was formed for the project, comprising the Province of Noord-Holland (which owns and manages the road infrastructure), Ooms Civiel (manufacturer of the surface material and responsible for construction), Imtech (electrical installations) and TNO (project initiator, knowledge and overall project management). The partners jointly funded the project. De Wit: 'The TNO SolaRoad project team was led by my colleague Wim van der Poel. He forged a very strong group which drew on the expertise of some forty TNO staff members at various times. SolaRoad illustrates a key strength of our organization: multidisciplinarity. We bring together knowledge in road construction, materials science, solar energy, grid technology and many other areas to arrive at innovations like this.'

The response from cyclists has been overwhelmingly positive. The SolaRoad provides a safe and comfortable surface, with the added benefit of producing electricity. 'The project results are in line with expectations,' De Wit states. 'We have encountered only a few teething problems. A section of the translucent surface became detached due to winter frost, for example. We made temporary repairs and will implement a more permanent solution before long. SolaRoad is a true innovation project. Eventually, we hope that much of the national road network, a total of 140,000 kilometres, will generate electricity in this way. That's more than the total surface area of all the roofs on which solar panels could be installed!'



GAMING BRINGS ARITHMETIC LESSONS TO SUDAN

'I still get goose bumps when I see a video of children playing our game with such concentration,' says educational scientist Hester Stubbé-Alberts, 'especially when I see the progress in their numeracy skills. We really are making a difference.' Stubbé, a member of TNO staff, was responsible for the design of the game in question. Since 2012, she has been coordinating a project in which children in remote villages in Sudan learn basic arithmetic by playing a Dutch computer game. 'Many villages have no school. You can't expect young children to trudge two hours through the sweltering desert to reach one that does!'

Stubbé is greatly enjoying the project. 'The cooperation between all the various partners has been excellent.' Those partners are War Child, Afhad University for Women (Khartoum) and games developer Flavour (Amsterdam). 'We have also enjoyed much support from the Sudanese Ministry of Education and from Unicef,' Hester Stubbé adds. Following a small-scale experiment in 2012-2013, a pilot project involving six hundred children in 19 villages began in October 2014. Each village has a morning group and an evening group. 'The children find the graphic design very appealing. Playing the computer game teaches them basic arithmetic. The objective is to build a hut for Mohammed, a character in the game. Every time a child enters the correct answer to a sum, another piece of the hut is added. This really motivates the children, because helping others is the highest ideal for Sudanese people of all ages.'

Each village has a local facilitator who looks after the tablet computers and can provide basic technical support. He or she has been given a mobile phone and is in daily contact with the project managers in Khartoum. The costs of the calls are reimbursed. The villages have no electricity, but War Child has installed a solar panel in each village so that the tablets can be charged. 'In late 2014, Unicef selected our e-learning method as a showcase project in the Innovations in Education programme,' Stubbé proudly states. 'That is international recognition for our approach. Our partnership has produced a game which is absolutely ideal for the target group. The research undertaken by TNO gives War Child the evidence base it needs to upscale the idea. Within a year, at least one million children could be using this game to learn for a better future.'



HEALTHBREAD: WHITE BREAD WITH THE NUTRITIONAL VALUE OF WHOLEGRAIN

'The nice thing about the HealthBread project is that, through our knowledge and expertise, consumers in Italy, Germany and Austria can now buy a much healthier product.' Food technologist Martijn Noort was TNO's project manager on the European 'HealthBread' project (2012-2014). TNO devised and designed the project, which built upon the earlier EU HealthGrain project (2005-2010), intended to find ways of increasing the nutritional value of processed cereals. The coordinator of the entire EU project was also a member of TNO staff: Jan-Willem van der Kamp, recently voted Bakery Personality of the Year 2014.

The objective of HealthBread is to develop a product which has the same flavour and texture as white bread, but all the healthy, natural ingredients and nutritional value of wholegrain products. 'In southern Europe, consumers prefer white bread. The Dutch and Germans buy darker products, including multigrain varieties. Many are not true wholegrain, however. They are made using refined flour with some colouring and a few grains or seeds added to the mix.'

TNO's partners in the HealthBread consortium included its Finnish counterpart VTT and eight commercial bakeries, including two Dutch companies: Kamstra of Wolvega and Uljee of Rotterdam. The project refined and built upon the knowledge gained in HealthGrain, which was applied to develop a dough mix with a precise grain content. The baking process was also adapted to include a longer 'proving' (rising) period. 'The result is bread that not only has greater nutritional value but also tastes good, with a good colour, texture and volume,' states Martijn Noort. 'The next step will be for bakeries to develop and market commercial products based on our knowledge. We have therefore joined forces with the Netherlands Bakery Centre to produce a communications handbook.'

Following the 'roll' out in Germany, Italy and Austria, the HealthBread concept will soon be introduced in France, Turkey, the United States and... the Netherlands! 'Kamstra and Uljee are very enthusiastic about HealthBread and, together with TNO, wish to press ahead and make a good product even better. Innovation never stops, and if they succeed I for one will be extremely happy,' says Noort.

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› For further information about TNO, or if you have any questions or suggestions further to this report, please contact infodesk@tno.nl

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The Board of Management at the Van Leeuwenhoek Laboratory in Delft, where TNO and TU Delft conduct joint nanotechnology research.