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Dutch Eyes on the Skies

SPIE.

22-27 June 2014

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Voorwoord

Beyond the Solar System, all astronomers have to work with is the light that falls to the Earth from distant cosmic objects. Newer, larger telescopes are always needed to boost scientific progress, and the next generation of facilities will represent a huge advance. Many scientific and engineering challenges are involved in the design and construction of the largest telescopes and their mirrors, and technological developments will be essential to their success. Holland has a proud reputation of excellence in technology ranging from ancient windmills to modern semiconductor equipment and satellites.

The next European giant telescope is the European Extremely Large Telescope. With a diameter of 39.3m this will require almost 800 hexagonal mirror segments, each 1.45m across, supported by 2400 actuators. TNO and VDL-ETG (both present at the Holland pavilion) designed and build the only prototype of the primary mirror segment support system that meets the challenging requirements. It is essential for ESO and the E-ELT to collaborate with these excellent suppliers in order to accomplish a robust and reliable telescope. NOVA (also present at the Holland pavilion) is involved in the scientific instrumentation behind the European Extremely Large Telescope. NOVA is the Principal Investigator institute of METIS, the mid infrared instrument. The extremely accurate and reliable cryogenic positioning systems by Janssen Precision Engineering (also on the Holland Pavilion) are key to the success of many scientific instruments on a number of telescopes, including METIS. METIS is an advanced version of MIRI, the mid infrared instrument developed for the James Webb Space Telescope, the successor to the Hubble Space Telescope, to be launched in 2018 and displayed on the Holland pavilion. It will orbit the Sun at L2, approximately 1.5 million kilometres beyond the Earth. The very same location that SRON – the Netherlands Space Research institute – used for their HIFI instrument on board of the Herschel satellite and will use for the upcoming SPICA-SAFARI mission. SRON develops the space based detectors and instrumentation for TeraHerz radiation, and also for X-rays.

We stay in space, but now look down on Earth from the International Space Station, using the NightPOD camera, developed by Cosine measurement systems. The remote sensing products of Cosine have applications in space, but also on the ground, such as the hyperspectral imaging in the food industry. Technology of Sense (part of the Holland pavilion) developed APMON, the Advanced Particle deposition MONitoring system, a clever device that monitors contamination 24/7 and ensures clean products in space equipment, but just as well monitors medical and semiconductor processes.

All these fantastic technologies will create even bigger and better telescopes that will revolutionise our understanding of the Universe – and hopefully enable us to make discoveries that we cannot yet imagine. Holland can deliver the technology needed and the quality that is neccessary for these projects to be successful.

Cees Kole
Ambassador of the Netherlands,
Ottawa, Canada at Ministry of Foreign Affairs, Netherlands

Dutch Scientific and Big Science

Holland has been joining many Big Science programs for over 60 years. Examples are: optic- and radio astronomical telescopes like the E-ELT, SKA and Lofar; particle accelerators like the LHC; fusion reactors like ITER, but also light sources, free electron lasers and neutron facilities. Regardless that these projects are very important for Dutch scientists who are obviously belonging to the top in the world, many highly technological companies in the Netherlands are involved in building these large instruments. There is no doubt that innovation is driven by science and the development of scientific instruments. Innovative companies are the first to emerge when a crisis ends.

After SPIE in Amsterdam in 2012 this SPIE in Montreal again Holland is present a Dutch booth in fact a complete pavilion since this SPIE is a unique opportunity for Dutch firms to meet the best engineers and scientists The Netherlands Industry is playing a major role in future astronomical development for:

Dutch Eyes on the Skies

Dutch Scientific used to be an organisation of firms developing for science in close cooperation with scientific research institutes and their engineers. Now Dutch Scientific has been re-invented by the *Dutch Industrial Liaison Network* for Big Science and will be supporting all Dutch high-tech systems companies for doing business with Big Science. The Dutch ILO-net is a network of Industrial Liaison Officers in the Netherlands supported by the Dutch government and NWO.

The Netherlands Organisation for Scientific Research (NWO) that funds thousands of top researchers at universities and institutes and steers the course of Dutch science by means of finances and research programmes. Since companies listed in this booklet are very well equipped for translating their scientific knowledge to commercially applicable solutions, Dutch Scientific proudly presents a number of frontline high-tech companies who can support you with any project in which you want to be successful.

June 2014

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NWO
Netherlands Organisation for Scientific Research

Dutch Scientific

Contents

Cosine

Cosine develops and builds measurement systems for its customers. These find use in scientific, industrial, medical, environmental, energy, agri/food, security, semiconductor and space applications, with customers ranging from small high-tech companies to the European Space Agency, IBM and EADS.

The Cosine team consists of 20 highly educated people who develop transparently in close collaboration with the customer. With its broad experience in different technological areas they provide innovative, out-of-the-box measurement solutions. Technologies span the field of applied physics, with extensive experience in spectroscopy, lasers, radiation and 3D imaging systems.

Marco Beijersbergen
Management Team

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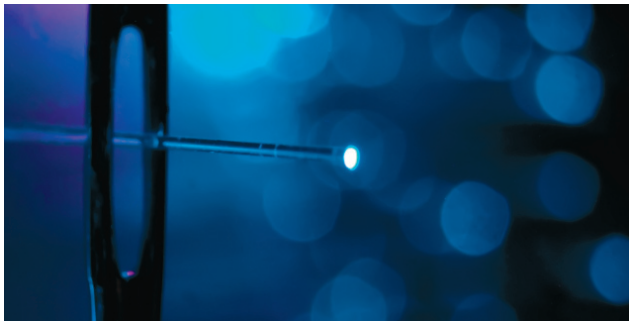


cosine | measurement systems

Janssen Precision Engineering

Precision engineering and mechatronic solutions in ambient, vacuum and cryogenic environment.

Company profile

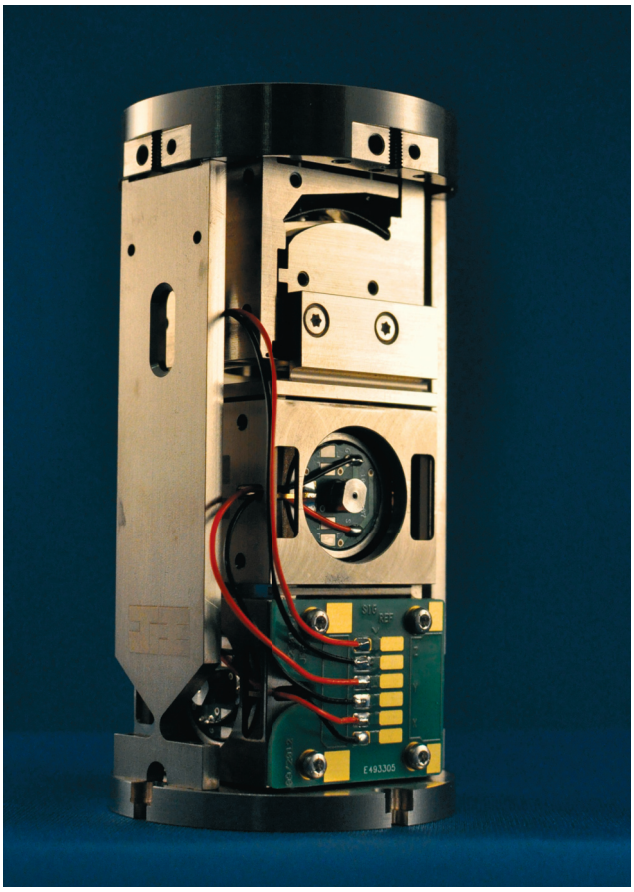
JPE is an independent engineering group for development and realization of high-tech machinery and instruments. Especially where accurate and stable performance is involved in the sub-micron area.
The company was founded by Huub Janssen in 1991 after several years of experience in the high-tech industry of companies like ASML and Philips. Nowadays, we have built up a team of professionals which are able to find and implement solutions for very challenging engineering requests. JPE has gained multidisciplinary knowledge of technical issues at every level. From system level down to component level, from definition and design, up to prototyping and qualification. By following a systematic approach with high involvement, quality and efficiency are guaranteed.

We develop high-end opto-mechanical applications to be used in deep vacuum as well as cryogenic environment. Our developments typically find their way in an international market like:market like:

- semi-conductor industry,
- astronomy and space,
- scientific experimental instruments

Competences

- precision engineering
- mechatronic solutions
- nanometer positioning
- positioning in cryogenic environment



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Founder & CEO

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NOVA

NOVA, a federation of universities in the Netherlands, focuses on astronomical research, enabled by development of scientific instrumentation for large telescopes operated by ESO and ESA.

NOVA develops innovative astronomical instrumentation for optical, infrared and TeraHerz observations with the largest telescopes on earth and in space. This includes spectrographs, polarimeters and interferometers for the ESO Very Large Telescopes and Extremely Large Telescope.

Astronomy is a high-tech, fundamental science with a large public appeal, driven by the combination of human ingenuity and technological development. NOVA is the Netherlands high-end research school in astronomy and consists of the universities of Amsterdam, Leiden, Groningen and Nijmegen. NOVA works closely with the NWO institutes ASTRON and SRON. NOVA's mission is to conduct scientific research at the highest international level and to train the next generation of astronomers. To achieve this mission, NOVA designs and builds instrumentation, in particular in its function as the national base for the European Southern Observatory (ESO).

NOVA's instrumentation program focuses on the European Extremely Large Telescope (E-ELT), on the design and construction of receivers for ALMA, on pioneering cameras for the Cerenkov Telescope Array (CTA), and on optical counterparts to gravitational wave events through the BlackGEM telescope array.

Astronomical research is high-tech and big data. NOVA works with industry to collect, process, interpret and simulate the extremely weak signals that require the most advanced technologies to be picked up.

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Technology of Sense B.V.

Technology of Sense B.V.

Technology of Sense (TOS) is a young (2012) technology-driven company based in Enschede, The Netherlands and is active in the growth market of monitoring surface contamination.
TOS introduced a new technological development: the Advanced Particle Deposition MONitor (APMON), designed for cleanrooms, controlled environments or clean production areas.

APMON: the missing link in contamination control.

The APMON, winner of the cleanroom award, is developed in association with TNO, the Dutch Central Organization for Applied Scientific Research. The APMON monitors 24/7 the cleanroom quality on particle deposition. Particles < 20 mu are removed by airflow systems, however particles larger than 20mu can only be taken away by cleaning. In order to protect your vulnerable product particle deposition should be controlled. The APMON based on a holographic principal, monitors every 5 minutes critical areas 24/7. The information is direct available by the user friendly software, which also provide report functions for in depth information, information which can be used for direct measurement. The APMON has a very high Return of Investment and low pay back time.

Advantages of the APMON

- Monitoring operation quality of the cleanroom
  - Investigate local cleanroom quality
  - Determine events of (higher) particle deposition
- Evaluate the effect of control measures
  - Cleaning, clothing, behavior
- Risk assessment during processes
- Consistency in quality
- Improve working methods with respect to the product
- Determine the impact of measures to improve local cleanliness
- Determination of cleaning frequency
- Create awareness of personnel

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Technology of Sense

TNO

It is TNO's mission to help the advanced Dutch industry in innovating. One of the focus areas of TNO is Big Science with activities in ground based astronomy, nuclear fusion, CERN/CLIC as well as in space instrumentation and other projects.

Product information

TNO provides system architecture, multi-disciplinary (pre)design, alignment plans and execution, calibration plans and execution, and control of high-end opto-mechanical instruments and mechanisms. Realization and delivery of these systems is preferable done with industrial partners, certainly for larger instruments and for series production. Thus, TNO hopes to open new markets for these industries.
The instruments that TNO develops are characterized by picometer stability and sub-nanometer positioning accuracy; often operating in extremely hostile environments with long life time; and where necessary with intelligent image interpretation.
TNO's expertise in (adaptive) optics, mechanical engineering, control, image processing and contamination control enables the development of a wide range of complex instruments and mechanisms. Our flexure or magnetic bearing-based mechanisms have low friction and zero hysteresis. We produce quality optics with low wave-front error from a variety of materials including Aluminium, Fused Silica, Silicon Carbide and Molybdenum. We know how to prevent, monitor and remove contaminants, ensuring long life times. And our abilities to process and interpret images are worldwide unrivalled.

References

For nuclear fusion, TNO developed endoscopes (CXRS, Lidar), a control system for the plasma, contamination control tools and image processing for *in-situ* repair. For ground based astronomy,
TNO has been playing important roles in the ESO programmes VLTI and E-ELT on delay lines, mirror actuation and laser launchers. TNO has developed tools for extreme precise measurements and control on aspherical optical parts and for rapidly finding particles on wafers. TNO's experience in space is applied in HIFI for Herschel, metrology for Gaia, OMI and soon also TROP-OMI and delay lines for Darwin. Important commercial customers of TNO in the field of high-end optomechanics are ASML and Carl Zeiss.

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Business developer

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Turnover: 494,6 M€ | 4,400 employees

www.tno.nl

TNO innovation for life

SRON Netherlands Institute for Space Research

SRON's mission is to bring about breakthroughs in international space research. Therefore the institute develops pioneering technology and advanced space instruments, and uses them to pursue fundamental astrophysical research, Earth science and exoplanetary research. As national expertise institute SRON gives counsel to the Dutch government and coordinates national science contributions to international space missions. SRON stimulates the implementation of space science in our society.

Advanced sensor technology

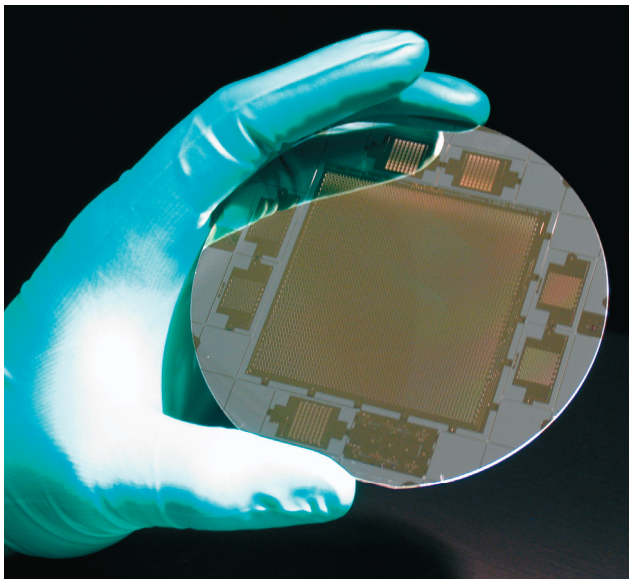
In its cleanrooms SRON is developing ultrasensitive sensors for X-ray and infrared radiation. SRON is currently working on three types of sensors: the Kinetic Inductance Detectors (KIDs), Transition Edge Sensors (TESs) and superterahertz bolometers. These detectors are highly sensitive and dependent on the type and the optimisation chosen, images can be made or spectroscopic 'fingerprints'. Possible applications are in the areas of terahertz security equipment at airports and X-ray micro-analysis for the detection of small concentrations of harmful substances in materials. The measurement results from the superterahertz technology can be used in the analysis of biomedical processes (e.g. cancer detection), agriculture and food technology.

Compact electronics

SRON is also working on the development of integrated read-out and control electronics in the form of Application Specific Integrated Circuits (ASICs). Ever higher requirements are being placed on electronic circuits in space research whereas the weight of space missions is increasingly lower. The solution is the development of complex integrated circuits that continue to function in the harsh conditions of space. A number of these integrated circuits also can very well be used outside of space research.

SRON is part of the Netherlands Organisation for Scientific Research (NWO) is the national research council in the Netherlands and has a budget of more than 500 million euros per year. NWO promotes quality and innovation in science.

More information? See www.sron.nl or contact:



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SRON
Netherlands Institute for Space Research

VDL Enabling Technologies Group

VDL Enabling Technologies Group is a globally operating tier one contract manufacturer of parts, mechatronic modules and systems. VDL ETG focuses on long term / strategic partnerships with its customers.

Product information

VDL ETG provides solutions based on its core competences: Precision Technology, Vacuum, Material Handling, Material Positioning, and Industrialization. This throughout the entire product life cycle: basic research, proto typing, ramp-up, volume, and end-of life.

Products

Mono parts, complex high-end modules, complete (mechatronic) systems.

Markets

VDL ETG serves a number of OEM industry key segments: Semiconductor Equipment, Analytical, Medical, Solar, LED, and Science & Technology.

Science & Technology

VDL ETG is specialized in the (co)development and manufacturing of high precision parts, sub-assy's, complex modules. All products require high / ultra precision turning & milling, high-end metrology, bonding, RF testing, and heat & surface treatments. The defined production strategy determines yield, cycle time, and cost of ownership. Our strength is to rapidly translate highly innovative, complex product designs into tangible products ready to enter small series production. Typical key markets within Science & Technology: accelerator, FEL, aerospace, and instruments.

References

Semiconductor Equipment: ASML, AMAT, KLA Tencor, CymerAnalytical: KLA Tencor, FEI – **Medical**: Philips, Elekta, Waters – **Solar & LED**: AMAT, Veeco – **Mechanization Projects:** P&G, Kellogg's, Bosch – **Science & Technology**: ESO, ESA, ESRF, TNO, PSI, CERN

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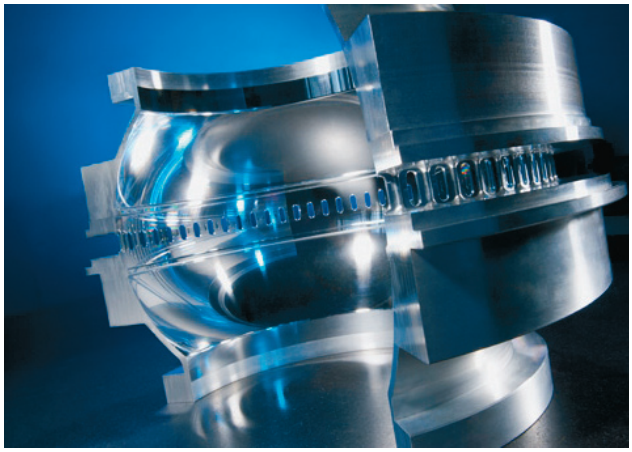

ILO's for Big Science

Name ILO / Affiliation	Email	Facility / organisation	Theme
Eric W. Boom, Former Dutch Space Business Development Manager	ericboom@upcmail.nl		
Toon Verhoeven (FOM-DIFFER/ITER NL)	A.G.A.Verhoeven@differ.nl	ITER (F4E) – FR ESS – SE JET (EFDA) – UK Asdex–U* – DE Wendelstein–7X* – DE IFMIF* (IEA)	Fusion facilities.
Rob Klöpping (FOM-Nikhef)	klopping@nikhef.nl	CERN – CH ESRF – FR ILL* – FR EMBL – DE DESY* – DE Neutrino Telescopen	Accelerator, neutron and X-ray facilities.
Wilfried Boland (NOVA + ESO)	boland@strw.leidenuniv.nl	E–ELT ALMA	Optical telescopes.
Emiel van der Graaf (KVI)	vandergraaf@kvi.nl	ZFEL – NL, Groningen XFEL* – DE	Free electron laser facilities.
Ronald Halfwerk (ASTRON)	Halfwerk@astron.nl	LOFAR – NL SKA	Radio Telescopes.
Gerard Cornet (SRON en NSO)	G.Cornet@sron.nl	ESA ruimtemissies	Space observation satellites.
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