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VISION focus

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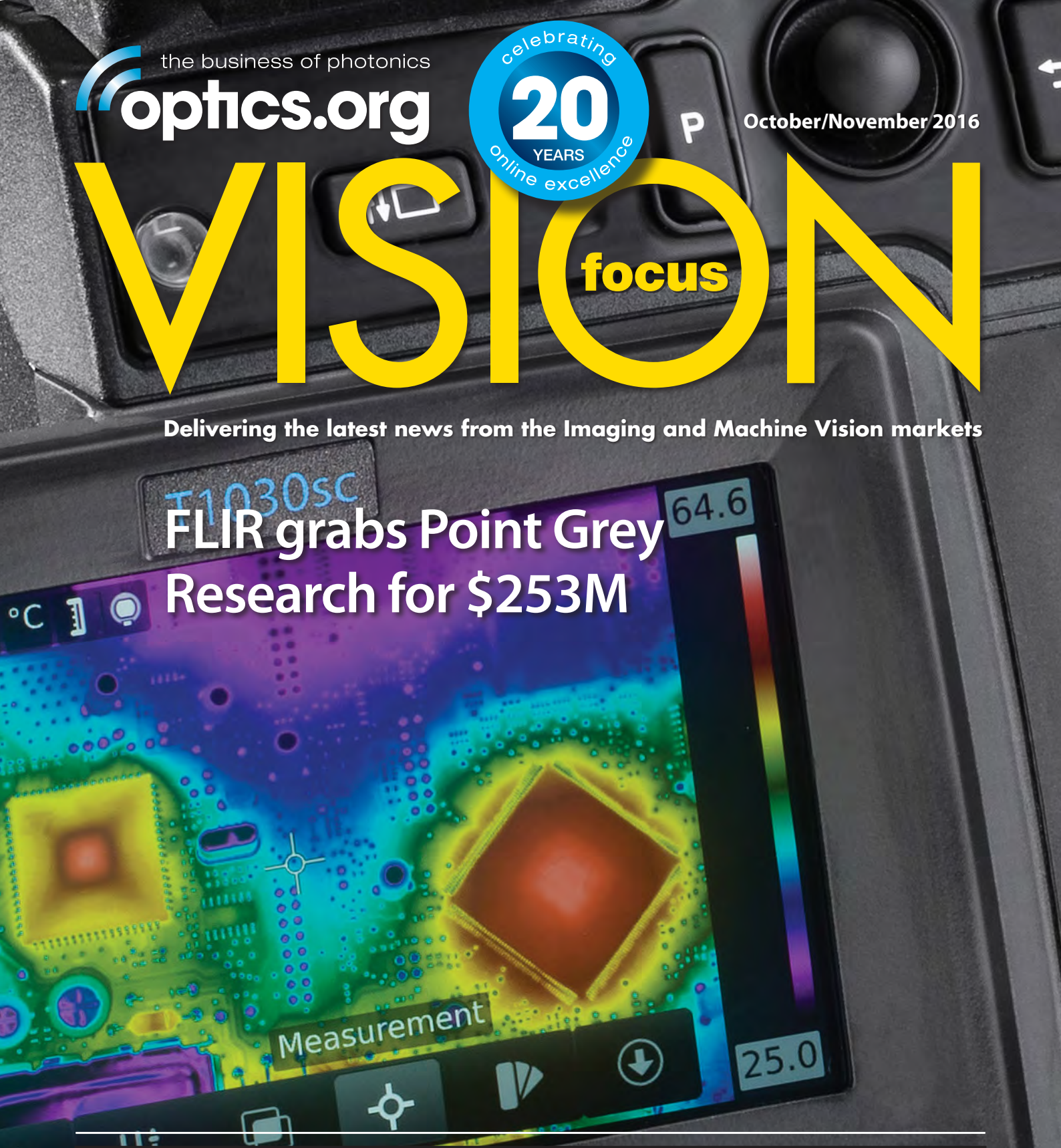

FLIR grabs Point Grey Research for $253M

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Vision and visionaries

Welcome to the latest issue of VISION Focus, the quarterly digital magazine that covers all aspects of vision and imaging, produced by the team that brings you optics.org: the business of photonics.

After a two-year wait, VISION, the world's leading machine vision trade fair, is back at Stuttgart Messe for the 22nd time. Not just a marketplace for component manufacturers to present their latest systems, this expo is a forum for developers, suppliers, integrators and users. VISION is where OEMs, mechanical engineering companies, consultants and academics can share knowledge about the latest innovations from the world of machine vision components – and where to make their next investments.

At the same time, VISION is where end users searching for specific solutions can encounter numerous system integrators. This special edition of **Vision Focus** gives visitors a taste of what's on offer and rounds up some of the latest developments and installations.

Emphasizing that this sector is now big business with far-reaching implications, we report on FLIR's recent acquisition of Point Grey Research for more than $250 million *(page 4)*, how panoramic virtual reality can be delivered via satellite *(page 6)*, and the €5 million European TULIPP project to improve automatic driving systems, drones and body scanning with enhanced imaging *(page 8)*.

A longstanding vision problem – how to make sense of image data collected through turbid media – is tackled by scientists working at MIT Media Lab. One application benefiting from the new technique known as All Photons Imaging will be navigating driverless cars through fog. How does it do this? The API framework "revitalizes the conventionally lost portion of the image signal" *(page 13)*.

This year's VISION exhibition reflects significant changes in 3D MV capabilities and applications. Our feature on page 21 reveals how conventional machine vision is morphing into an intelligent tool for optimization of industrial production, and the critical need for vision systems in Industry 4.0 manufacturing processes.

Now is a great time to be working in the vision business: the German MV industry alone achieved record sales of €2 billion in 2015 and the VDMA, Germany's industrial association, forecasts a further rise of 8% to €2.2 billion in 2016 *(see more about the market on page 22)*.

Enjoy the show – and enjoy **Vision Focus**!

Matthew Peach, Contributing Editor

This Issue

Publication and Editorial Schedule 2016/17

January/February Issue 2017

- Bonus Distribution **SPIE BiOS + Photonics West**
- **Editorial Focus:** industrial applications, sensing, biomedical analysis and treatments.
- Published in advance of BiOS, 28th Jan – 2nd Feb 2017 and Photonics West, 31st Jan – 2nd Feb 2017

April/May Issue 2017

- Bonus Distribution **SPIE Defense+Commercial Sensing**
- **Editorial Focus:** aerospace and defense applications, associated research and development
- Published in advance of DCS *(Defence & Commercial Sensing)*, 11th – 13th April 2017

June/July Issue 2017

- Bonus Distribution: **Laser World of Photonics** - Germany
- **Editorial Focus:** optical components, academic research, software applications.
- Published in advance of Laser World of Photonics - Germany, 26th – 29th June 2017

September/October Issue 2017

- Bonus Distribution: **Electronica**
- **Editorial Focus:** opto-electronic systems, applications in sensing and manufacturing.
- Published in advance of Electronica, 8th – 11th November 2017

FLIR grabs Point Grey Research for $253M

Thermal imaging giant moves into machine vision with cash acquisition of the Canadian camera firm.

Point Grey Research, the developer of high-performance scientific and industrial cameras, is set to become part of the ever-growing FLIR Systems empire by the end of the year, after the two firms agreed a $253 million acquisition.

While US-headquartered FLIR has historically concentrated on infrared and thermal imaging technologies, Point Grey's expertise lies more in the visible spectrum, with particular strength in machine vision applications.

Point Grey's latest technology will be on view at the forthcoming Vision 2016 trade show taking place in Stuttgart, Germany, next month. The company, still based in Richmond, British Columbia, where it was set up nearly 20 years ago, will be showcasing its new 20 megapixel "Blackfly S" camera at the event.

Representing its highest-resolution offering to date, the Blackfly S is based around a Sony "Exmor" CMOS imaging sensor, and is said to be no larger than an ice cube. Point Grey is aiming the new device at a wide range of applications across science, medicine and industry.

Photo: Point Grey Research.

At the Vision 2016 event in Stuttgart Point Grey Research will introduce its new Blackfly S camera model featuring a 20 megapixel Sony Exmor® R IMX183 1-inch CMOS sensor - the Canadian firm's highest resolution camera to date.

Alternative imaging spectrum

FLIR's CEO Andy Teich believes that combining the two businesses will enable FLIR to bring infrared imaging capability to the fast-growing machine vision sector. He said:

"Thermal imaging technology provides vision systems customers an alternative imaging spectrum that offers a rich, largely untapped layer of information that can be further leveraged."

"Top-quality images and high frame rates in a very compact form factor enable our customers to deliver superior performance and accuracy in 3D scanning, industrial inspection, medical imaging, robot navigation, autonomous driving, and many others," said Point Grey's sales and marketing VP Michael Gibbons when the camera was released in August.

10 Gigabit Ethernet connectivity

The company will also unveil a new family of industrial cameras offering 10 Gigabit Ethernet connectivity for machine vision applications combining high resolution and fast frame rates. The first model in the family is a 12 megapixel camera featuring one of Sony's "Pregius" CMOS sensors.

The Point Grey deal is the latest in a series of acquisitions by FLIR, which has for some time been pursuing a diversification strategy to augment its historic strength in defense and homeland security applications, which are more susceptible to the fluctuating spending patterns of governments on their military operations.

Other recent deals have included the 2015 purchase of New Jersey based surveillance software and hardware firm DVTEL, and the June 2016 acquisition of San Francisco's Armasight, which sells rifle scopes, spotting scopes, binoculars, goggles, and illuminating tools into both military and consumer markets.

FLIR has also set up a strategic collaboration with China-headquartered drone specialist DJI Innovations that should see large numbers of unmanned aerial vehicles kitted out with infrared imaging capability.

Earlier this year FLIR executives described the growth in commercial applications of thermal imaging as "explosive", with deployments in agriculture, building inspection, search and rescue, and firefighting all expected to help the company grow its business.

In its latest financial results, posted in July, FLIR reported pre-tax earnings of $115 million on sales of $782 million for the first six months of the year. Although that represented a lower profitability compared with the first half of 2015, the company pointed out that this partly resulted from the costs of an internal ramp of low-cost optics capability designed to improve profitability.

Aside from the Richmond headquarters, Point Grey lists offices in Ludwigsburg, Germany, as well as in Tokyo, Beijing, and Trento in Italy. The firm's 300 employees are currently said to produce more than 200,000 cameras every year.

About the Author
Mike Hatcher is a contributing editor to optics.org.

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Panoramic virtual reality delivered via satellite

SES and Fraunhofer HHI have demonstrated a hybrid approach to 360-degree VR.

Half of a panoramic image of the Berlin Philharmonic Orchestra, captured by the OmniCam-360.

The IBC Conference on electronic media and the entertainment industry held recently in Amsterdam included a demonstration of panoramic video signals transmitted to multiple devices via satellite, part of a research project that could point towards future ways for audiences to see live events.

It's the result of a collaboration between the Fraunhofer Heinrich Hertz Institute (HHI), Berlin, and Paris-based satellite operator SES, and will involve a 10k by 2k-pixel resolution video signal being received at the SES stand before being passed on to a high-definition display and a set of virtual reality (VR) head-mounted devices.

A viewer can then choose a viewing angle, zoom in and out, or turn the picture on the TV display using a simple remote control; or choose to wear a VR headset to which the video signal is delivered simultaneously.

The video has been filmed with the Fraunhofer HHI OmniCam-360 camera, and is being transmitted to the show via SES's Astra 19.2°E group of orbital communications satellites.

HHI and SES intend the demonstration to provide a first glimpse of what a future VR 360-degree video would look like, allowing the viewer the immersive experience of being part of a virtual event, such as sports, concerts or other live shows.

"We use a combination of technologies here to showcase what is possible when using hybrid approaches," said Dr. Ralf Schäfer, Fraunhofer HHI's Head of Division Video. "There is no stadium in the world providing enough seats for all enthusiastic fans. So imagine a live event somewhere in the world, filmed with professional cameras like our OmniCam-360 and then delivered to a huge global audience via satellite. And every single viewer at home has the best seat in the middle of the show."

New video ecosystem

The OmniCam-360 consists of ten 36-degree mirror segments, each equipped with one HD camera, according to HHI product data. The cameras are arranged vertically and around a virtual center, reciprocal to the cylindrically arranged mirror segments.

This set-up produces a covered field of view of about 60 degrees, and allows parallax-free stitching of scenes in a distance range said to be between one meter and infinity, using image stitching technology developed by HHI.

Modifying the design so that there are two cameras per segment rather than one allows the system to generate 3D video content - a total of 20 micro HD cameras for 360-degree 3D panoramic recordings. Arranging the lenses of each camera pair at distances between 40 and 70 mm achieves the intended 3D effect.

For SES, the demonstration forms part of its commitment to the role of satellite technology in the new video ecosystem now taking shape. Its SES Platform Services (SPS) affiliate allows the company to offer tailored distribution solutions for customers in the media industry, in addition to being an infrastructure provider.

"Satellites are the perfect distribution path for these new kinds of video experiences, as they can manage huge volumes of data being offloaded from terrestrial networks," commented Thomas Wrede of SES. "Furthermore, technology standards like the SAT>IP protocol for processing satellite signals not only allow the viewers at home to pick and choose a device - the TV screen, tablet or virtual reality equipment - but also to choose their favorite viewing position."

About the Author
Tim Hayes is a contributor to optics.org.

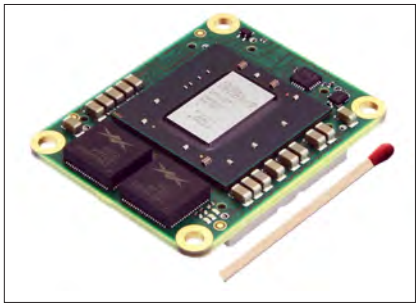
http://optics.org/news/7/8/58

Tulipp project to make complex image processing bloom

Three-year, €4.7m EU drive targets new high-performance, energy-efficient embedded systems for vision, *writes* Matthew Peach.

The new European research and development project, known as Tulipp – Towards Ubiquitous Low-power Image Processing Platforms – is intended to support the development of high performance, energy-efficient embedded systems for the growing range of increasingly complex image processing applications.

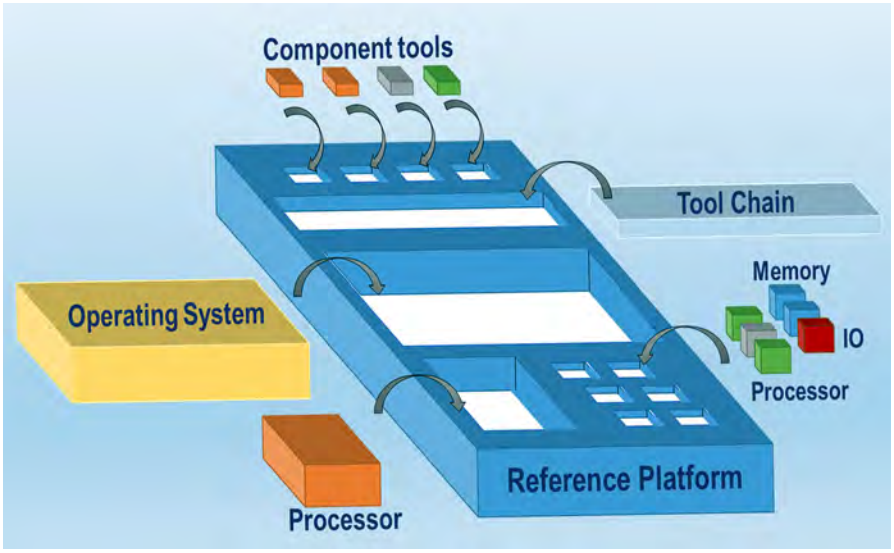
The project, which involves an academic-industrial partnership from across the continent, will run through to February 2019. The total investment in the Tulipp project is €4.7 million, with almost €4 million of that coming from Horizon 2020 – the European Union's biggest research and innovation program to date.



Smart chip: Tulipp's proposed reference platform hardware implementation.

Consortium members include Thales (France) as the project lead and co-coordinator, with other partners Efficient Innovation (France), Fraunhofer IOSB (Germany), Hipperos (Belgium), Norges Teknisk-Naturvitenskapelige Universitet (Norway), Ruhr-Universität Bochum (Germany), Sundance Multiprocessor Technology (UK), and Synective Labs (Sweden), providing additional inter-disciplinary expertise to make the project a success.

The project is intended to develop "a reference platform for vision-based system designers that defines a set of guidelines for the selection of relevant combinations of computing and communication resources to be instantiated in the platform while minimizing energy resources and reducing development costs and time-to-market".



How it will work: Tulipp's reference platform components.

Performance and power

These guidelines are designed to tackle the design issue complexities surrounding the next-generation of embedded image processing applications that are emerging in a range of industry sectors. From an applications perspective, these complexities relate to the need to ensure high-performance computing power coupled with greater power efficiency within the context of embedded design requirements.

The project plan states: "in terms of the available target silicon, software designers must be able to deal easily with parallel programming issues presented by multicore devices as well as the heterogeneity of different programming models and APIs."

In addition, Tulipp will develop three use case demonstrators as proof-of-concept and validation of the reference platform. These use cases will cover different industrial domains with emerging complex image processing requirements and will include: a medical imaging surgical X-ray system designed to significantly reduce radiation doses by 75%; a smart automotive embedded vision system for advanced driver assistance that, in addition to the low-level image processing, intelligently interprets what is on the images to deliver safer driving experiences; and an embedded image processing system to create smart drones and unmanned aerial vehicles for the intelligent search and rescue of survivors at disaster incidents (see panel).

Improvement factors

By the end of the project in 2018, Tulipp expects its work to extend the peak performance per watt of image processing applications by a factor of four and average performance per watt by a factor of ten. Beyond the official completion of the Tulipp project, it is expected that this will be extended to 100x and 200x by 2023.

Philippe Millet of Thales and Tulipp's Project Co-coordinator commented, "Image processing applications stretch across an increasingly broad range of industrial domains and are reaching a higher level of complexity than ever. The Tulipp reference platform will give rise to significant advances in system integration, processing innovation and idle power management to cope with the challenges this presents in increasingly complex vision-based systems."

Companies wishing to join the Advisory Board can express their interest by emailing contact@tulipp.eu

continued on next page

continued from previous page

Tulipp' project to make complex image processing bloom

Tulipp developments

Advanced driver assistance

Advanced driver assistance systems (ADAS) are currently one of the most promising segments for image processing with a steep expected growth rate for the next five to ten years. Driving safety, in parallel with pedestrian safety, has a large focus in the automotive sector, with vision-based systems as one of the enablers for many new and innovative solutions.

ADAS vision systems require real time, low latency processing, at high computational loads. They need to be robust and reliable, and will often be treated as safety critical systems. The Tulipp project addresses these questions – by offering a toolset and standardization, it is planned to help designers focus on the image processing application rather than platform details.

Surveillance and rescue UAVs

Small unmanned aerial vehicles (UAVs) have now entered a large range of applications as their underlying technology has improved and new avenues for use have been identified. Now applications such as surveillance, search and rescue, video production, logistics and research are now just a small subset of their uses.

If the UAV had a more intelligent control system, such as automatic collision avoidance or more robust poise estimation, then these problems would be reduced. The problem is that more intelligence needs more computing power, which is normally very limited on a UAV. The Tulipp solution aims to fill this processing gap by using its advantageous performance-to-weight and power consumption-to-weight figures.

Medical X-ray imaging

Modern day surgery requires that the surgeon has precise control of their movements and at times is able to see the path that bloodflows though veins and arteries. This is not the sort of process that can be seen without the use of complex imaging systems. Depending on the type of surgery being undertaken, it could be X-ray imaging that is used.

Credit: TULIPP PROJECT

Multifunctional: Tulipp is targeting diverse vision-related application areas.

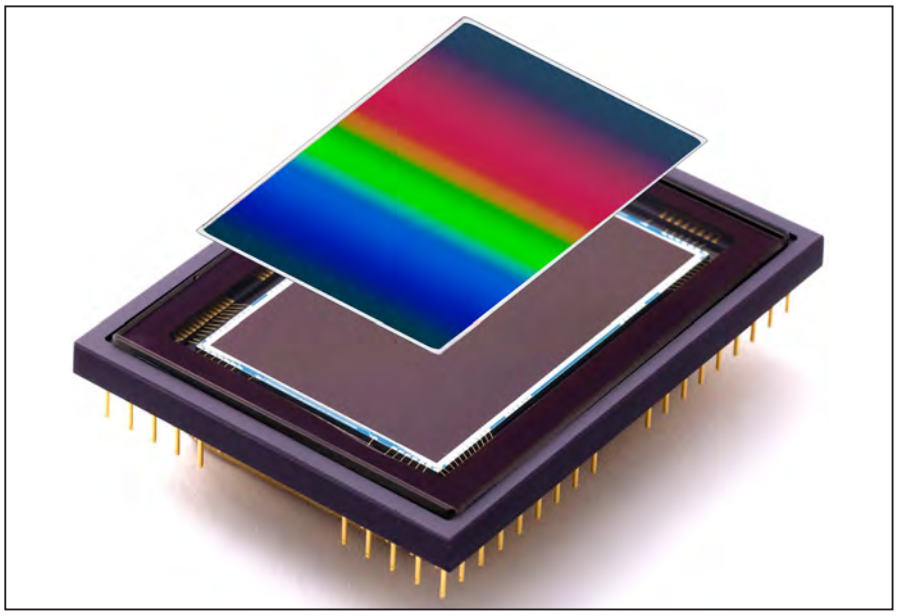
A problem with such technology is that when the radiation levels are set low so as not to put the patient at risk, the digital sensors are very sensitive to noise. Conversely, increasing the radiation level dose does reduce the level of noise, but can have serious adverse effects on both the patient and the surgeon.

In this Tulipp project the developers' aim is to try and reduce the level of radiation by 75%. As a result of this, more powerful image processing would be required in order to still be able to visualize many of the small details in the human body that are crucial during surgery.

Sponsored Editorial

Variable Bandpass Filters for Hyperspectral Imaging

Hørsholm, Denmark– Delta Optical Thin Film A/S announces the launch of several Variable Bandpass Filters that are specifically designed for Hyperspectral Imaging.



Hyperspectral imaging (HSI) has been used for a couple of decades in applications such as satellite imaging, air reconnaissance and other not overly price sensitive markets. Classical Hyperspectral imaging cameras use prisms or grating as dispersive elements. These cameras are bulky, sensitive to misalignment and very expensive. The advent of alternative approaches makes HSI attractive for volume markets or even consumer products, for example cancer detection, precision farming, food testing in supermarkets and many more.

Delta Optical Thin Film A/S develops and manufactures custom Variable Bandpass Filters (LVBPF) for mid-size and full-frame CCD/CMOS sensors (e.g. 25 mm x 25 mm or 24 mm x 36 mm). These filters offer very high transmission and are fully blocked in the light sensitive wavelength range of silicon-based detectors (200 nm to 1150 nm). The combination of LVBPFs with silicon detectors allows the design of very compact, robust and affordable HSI detectors that offer several advantages and benefits over conventional approaches:

- Huge aperture compared to grating and prism
- Higher transmission than grating and prism
- Short measurement time
- High suppression of stray light
- Excellent signal to noise ratio

Delta Optical Thin Film A/S welcomes requests for custom designed Variable Bandpass Filters. Available for immediate testing are filters with the following specifications:

- Centre wavelength range 450nm to 880nm, bandwidth approximately 2% of centre wavelength, transmission 60% to 90%, blocking range 200 nm to 1150nm, blocking level OD4, size 24mm x 36mm
- Centre wavelength range 450nm to 850nm, bandwidth approximately 4% of centre wavelength, transmission 70% to 90%, blocking range 200nm to 1100nm, blocking level OD4, size 25mm x 25mm
- Centre wavelength range 800nm to 1000nm, bandwidth approximately 0.6% of centre wavelength, transmission >70%, blocking range 200nm to 1200nm, blocking level OD4, size 19mm x 8mm
- Centre wavelength range 800nm to 1000nm, bandwidth approximately 1% of centre wavelength, transmission >70%, blocking range 200nm to 1200nm, blocking level OD4, size 19mm x 8mm

The sizes are given as height x length, where height is perpendicular to the wavelength gradient and length is along the wavelength gradient. The filters can be diced to smaller sizes.

About Delta Optical Thin Film A/S

Delta Optical Thin Film A/S *(www.deltaopticalthinfilm.com)* is the leading supplier of advanced, high performance linear variable filters commonly used in a variety of biomedical imaging applications including fluorescence microscopy, flow cytometry, monochromators and micro-plate readers among others.

Delta Optical Thin Film A/S also provides single, multiband, laserline and broadband band pass filters; long pass filters; short pass filters; notch filters; dichroic and polarizing beam splitters along with other custom coated optical components.

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Trade shows:
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New JAI high-speed monochrome line scan cameras in the Sweep Series

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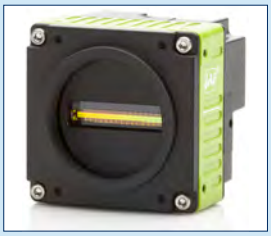
- Up to 100,000 lines per second (100 kHz)
- 3.75 µm X 5.78 µm pixel size



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MORE: **http://www.euresys.com/product/coaxlink-quad-g3-df/?tabproduct=benefits**

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Flir

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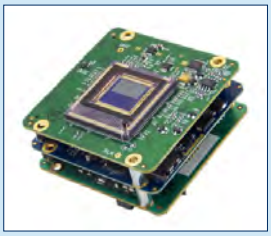

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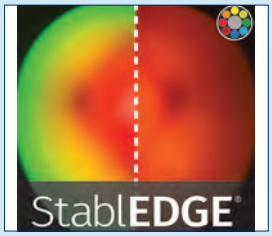

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Put every photon to use

A new approach to seeing through light-scattering obstacles could help driverless cars navigate in fog.

Scattering media are a headache for imaging and sensing applications, interfering with goals as critical as accurately diagnosing a malignant tumor or guiding an autonomous vehicle in bad weather.

Different ways to tackle the problem and sift through the photons being unhelpfully scattered by intervening media have been tried - time of flight calculations, wavefront reconstruction, and control of the illuminating light's coherence to name a few. None has proven ideal.

A research group at MIT is working on a technique that takes a different approach, embracing rather than rejecting the scattered photons to create an all-optical, calibration-free widefield framework for imaging through highly turbid obstacles.

The technique has been christened All Photons Imaging (API), since it captures not just those few lucky photons arriving by direct unscattered transmission from an obscured target - known as ballistic photons - but also the diffused photons that are scattered onto a variety of more indirect paths, and which have interacted more significantly with the medium they passed through.

"Our API framework revitalizes the conventionally lost portion of the signal," commented Guy Satat of the Camera Culture Group at MIT Media Lab. "Other methods lock onto specific photons amidst the scattered signal - whether ballistic, or coherent, or acoustically modulated, for example. But our goal is to extrapolate whatever we can from all the photons, rather than reject the ones that we cannot completely and exactly count. Each photon has a story."

The technique demonstrated its potential by successfully imaging masks shaped as letters and other simple geometric forms, hidden behind a tissue phantom of opaque fat emulsion measuring a full 15 mm thick - and only limited to that size by virtue of the dish used to mold it. Given the success of the experiment, Satat wishes he had been able to go even thicker.

Calibration-free

The samples were illuminated in a transmission configuration, with an infrared laser behind the target and a streak camera recording the variations in intensity of photons arriving on the opposite side. A customized algorithm developed by the project then set about producing an image of the hidden mask from the time-resolved data, and ultimately delivered a two-fold improvement in spatial resolution and better signal-to-noise performance than other techniques have so far achieved.

"The algorithm's first step is to try and estimate the optical scattering properties of the material, and for that you do not necessarily need photons that are directly

continued on page 15

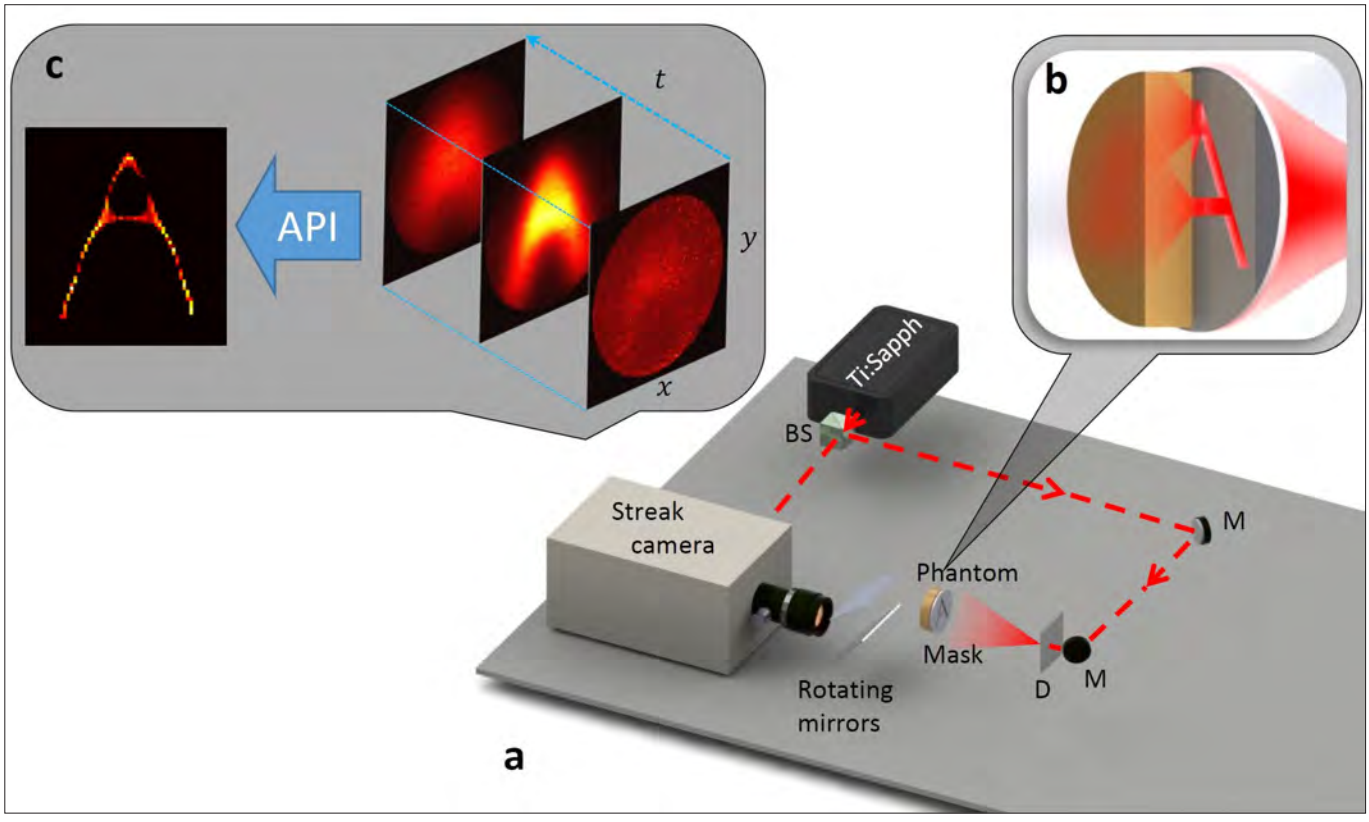


Image: MIT.

Schematic diagram of the MIT team's experimental setup. The samples were illuminated with an infrared laser behind the target, with a streak camera recording variations in intensity of photons arriving on the opposite side.

continued from page 13

Put every photon to use

from the target - you are just trying to get a general sense of what's going on," commented Satat.

Having made its estimate the algorithm then gets to work, considering each pixel of each successive camera frame and calculating the probability that it corresponds to any given point in the visual field. That probability model allows a prediction of what the next frame will look like, for comparison with the actual signal. Sequentially adjusting the model accordingly, it ultimately works back to the pattern of light most likely to have produced the optical signal received by the camera in the first place.

Image: MIT.

Masks shaped as letters and other simple geometric forms could be seen when hidden behind this tissue phantom of opaque fat emulsion measuring a full 15 mm thick.

"This approach is calibration-free, which is what we wanted," said Satat. "Some approaches first make an independent measurement to estimate the parameters of the scattering media, and then apply that to the data. Our process estimates the scattering parameters from the same measurements that contain the hidden object - probably the hardest computational challenge we faced."

Seeing through fog and drizzle

Future improvements to both sources and sensors should boost the performance of the API framework even further, but several attractive industrial and clinical applications have already come to mind. The technique could perhaps be applied directly to mammography, which works in a similar transmission geometry, and the team are working on ways to allow API to operate in reflection mode, bringing the detector and the source onto the same side and opening up a number of remote sensing uses.

"Seeing through fog or drizzle is a major challenge for vision systems on self-driving cars," noted Satat. "The distance scales in the automotive and clinical arenas are quite different, but by the same token the resolution requirements in automotive vision are not so stringent. In fog the fundamental difference is the amount of back-reflection from any illuminating light pulse sent out, but because our technique is time-sensitive we can address that hurdle without too much difficulty."

API might also be valuable in lidar, where scattering is currently tackled through time gating and measurement of only the ballistic photons. The MIT approach could improve matters, by using the scattered photons as part of the signal used for image reconstruction.

"We can see several possible future applications for API," said Satat. "Achieving them may be some way off, but we can already draw the roadmap to get there."

About the Author
Tim Hayes is a contributor to optics.org.

Multispectral camera to improve coastal and road tunnel surveillance

SEERS project developing breakthrough approach to imaging in the infrared domain.

A project supported by Europe's Horizon 2020 research program is developing a multispectral imaging (MSI) platform targeted particularly at surveillance of road tunnels and coastal areas in low visibility conditions.

SEERS (Snapshot Spectral Imager for IR Surveillance) will produce a modular, compact and cost effective snapshot spectral imaging system in the infrared domain of 0.7 to 14 microns wavelength, based on low cost uncooled focal-plane arrays, and with embedded vision and cognitive fusion capabilities.

The project, running until 2018, was created in recognition of growth in the market for surveillance and monitoring of civil infrastructures, now becoming a major area of application for video equipment and services as cuts in defense spending restrict the military sector. In total the market is expected to be worth $57.3 billion by 2020.

Coastal surveillance - monitoring security at ports to combat smuggling and trafficking - along with traffic surveillance in confined environments, where a suitable imaging system could measure air quality and provide environmental data as well as assisting in case of an accident, are two particular examples of the demand for low cost imaging and sensing solutions that now exists, and which SEERS is targeting.

Funded by a grant of €3.75 million from Horizon 2020 via the Photonics Public Private Partnership, and led by Spain's AIMEN, the project is undertaking a new design of multispectral imager, since current MSI cameras are unsuitable for moving objects or real-time observation, according to SEERS. Existing systems employ a filter wheel that needs to be rotated along with sensors requiring cooling, configurations which make them unhelpfully bulky.

The new device, in contrast, is designed to weigh less than two kilograms, and will use a multi-aperture multi-sensor camera capable of capturing several wavelengths simultaneously in one place.

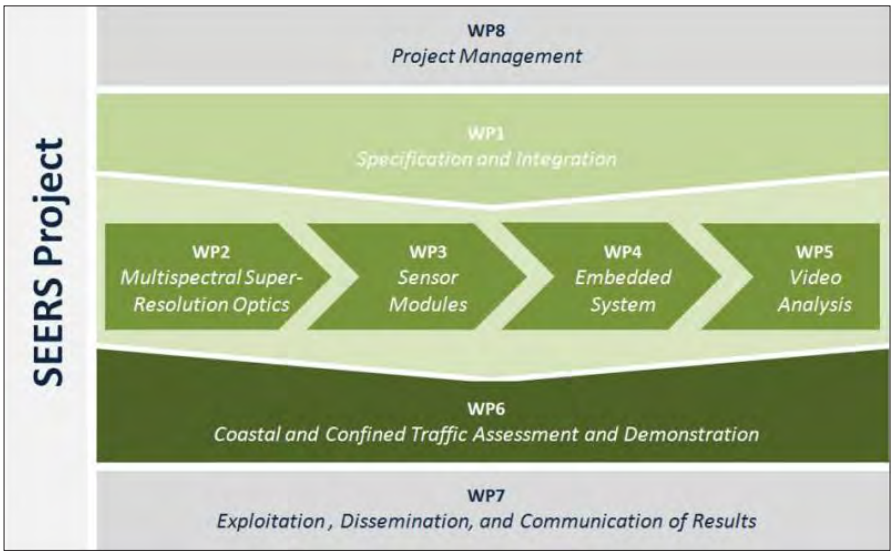
Lower cost imaging

According to SEERS project data, the development process will involve first the design of a suitable snapshot multispectral imager in the IR domain, followed by "an embedded approach to image reconstruction, cognitive image fusion, video pre-processing and event-driven operation." Then the benefits of multispectral imaging to performance and persistence for smart networked operation will be demonstrated, using a novel video analytics solution.

"The SEERS device is equipped with integrated computational imaging," commented project coordinator Anton Garcia-Diaz of AIMEN. "It has no need for cooling and can process the images in real-time, meaning key parts of processing are embedded within the device."

Alongside an embedded processing architecture, the project will address the design of a microbolometer focal-plane array adapted to multi-aperture imaging requirements; an optical design combining that multi-aperture imaging with suitable beam splitting; and development of sensor arrays for both multispectral and super-resolution imaging.

The project's belief is that use of CMOS-compatible focal-plane array manufacturing technology will reduce costs compared to alternative infra-red technology. A commercial monochromatic camera working in the mid infrared range of 3 to 5 microns can cost over €70,000, according to Garcia-Diaz.



Credit: SEERS.

SEERS project structure. Surveillance and monitoring of civil infrastructure is becoming a major area of application for video surveillance equipment like that being developed by the consortium.

"Few imaging systems exist with the capability to identify gases, but even they can cost over €100,000," he commented. "The SEERS project aims to deliver MSI technology in an extended infrared domain at under €40,000, with improved persistence and gas identification capabilities."

SEERS consortium members include AIMEN, New Infrared Technologies (NIT), the University of Glasgow, and Thales Italia.

About the Author
Tim Hayes is a contributor to optics.org.

http://optics.org/news/7/8/60

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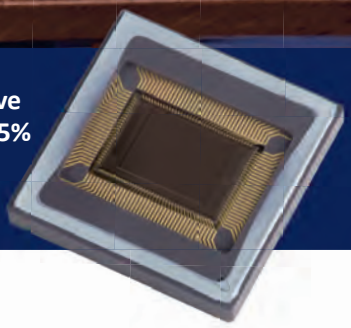

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Optics+Photonics 2016:
Zoom lenses on next Mars Rover: a first for NASA

New cameras being built in San Diego, California, will zoom and offer improved multispectral imaging.

by Ford Burkhart in San Diego

Life on Mars? Maybe 4 billion years ago. NASA is stepping up the search for clues, and an SPIE opening night crowd at this year's Optics+Photonics conference got an exclusive preview on Sunday of dazzling cameras, including the Mastcam-Z, being designed for the next level of imaging science on the planet known for its red dust.

In addition to a novel zoom feature, the set of space-age cameras on the next VW Beetle-sized rover, a $2.1 billion project set to launch in 2020, will have an improved multispectral imaging capability, said Melissa Rice, a professor in geology and physics and astronomy at Western Washington University.

"That will allow us to observe the Martian surface and atmosphere in wavelengths of 400nm to 1,000nm, and to characterize the mineralogy and hydration state," Rice told a full house crowd at the San Diego Convention Center.

Double camera heads

The new 2020 rover – still without its own distinctive name – will be the same size and weight as the Curiosity from 2012. Its payload will make it the first to use the MastCam Z, with the Z for Zoom. Its double camera heads will also provide stereo photos in wide angle. Those cameras are being assembled here in San Diego, at the Malin Space Science Systems facilities.

The 2020 launch will be the first mission to work under the mission goal of collecting samples. Completing that task will take, in all, three full missions. The sampling location on Mars will be debated at a conference by NASA in Monrovia, California, near Pasadena, next February, Rice said.

Rice showed the crowd new scenes of dry, dusty Mars – including one taken by the rover Opportunity just one day before the SPIE meeting opened – that are giving clues to Mars as a very different place a few billion years ago, with flowing streams. "And that may show whether there was enough water, energy, carbon, oxygen, nitrogen, the nutrients for life on Mars," Rice said.

Photo: Amy Nelson / SPIE.

The Mastcam-Z for the next program of imaging on the Red Planet will feature a novel zoom feature, part of the $2.1 billion project set to launch in 2020. Inset: Prof. Melissa Rice, Western Washington University.

Rice, part of the Mars Curiosity Rover team of hundreds of scientists, discussed instrumentation plans for future imaging by the next generation of rover. She traced a history of fuzzy, round images of decades ago, from telescopes, to the fine-grain geology, rather like the moon or Earth, sent back by the first spacecraft to arrive, in 1964.

The 'world' of Mars

"Mars turned from being a planet to being a world," she said. Scientists discovered there the tallest volcanoes in the solar system, with one volcano proving as wide as the State of Washington. Images from Mariner 9 revealed the largest canyon system in the solar system.

"It was a dynamic world of extremes," Rice said, with evidence of liquid flowing across the surface. The information expanded with the Viking 1 Lander in 1976 and the 1997 Mars Pathfinder, which showed gullies that seem likely carved by water flowing down the hills. Current cameras including the HiRISE CCD camera in orbit around Mars, have a resolution of 25 cm per pixel, sharp enough to offer spectacular images of dust devil tracks in the sand dune, which Rice displayed for her audience.

The images show a planet more Earth-like than previously thought, with a history of rainfall and snow melts, but nothing green – so far. "But all the conditions necessary for life seem to have been there, 3.5 billion years ago," Rice said. "Could life have taken hold on Mars? That is the question." The Curiosity rover, having just celebrated its fourth birthday, is still going strong, two years beyond its estimated nominal mission length.

One key is Curiosity's plutonium energy source. Running on low power, just 100 watts a day, the rover covers about 100 meters a day. Older ones used a solar panel system. She showed the crowd a close-up of the rover's wheel track in the dust, "like Neil Armstrong's first step on the moon," she said. "In a way, it is a human footprint on Mars."

Rice, whose specialty is spectroscopic capabilities of the cameras, showed stunning images of blue Martian sunsets. And she relayed the NASA prediction that "within our lifetimes," humans will stand on the reddish-brownish surface of Mars to view those

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Optics+Photonics 2016: Zoom lenses on next Mars Rover: a first for NASA

sunsets themselves. She hoped that there would be a poet among the pioneers.

The 2020 mission, Rice said, will be the first by NASA to have as its mission an explanation of astrobiology – that is, the search for past life. Perhaps 4 billion years past.

About the Author
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http://optics.org/news/7/8/44

SPIE Optics + Photonics 2017 will run between August 6 -10, 2017 – the largest international, multidisciplinary optical sciences and technology meeting in North America. Plan to participate at the meeting where the latest research in optical engineering and applications, nanotechnology, sustainable energy, and organic photonics is presented. More information at spie.org

Vision 2016 to map evolution of 3D MV applications

November's Stuttgart expo will reveal the transformation from traditional vision to production optimization.

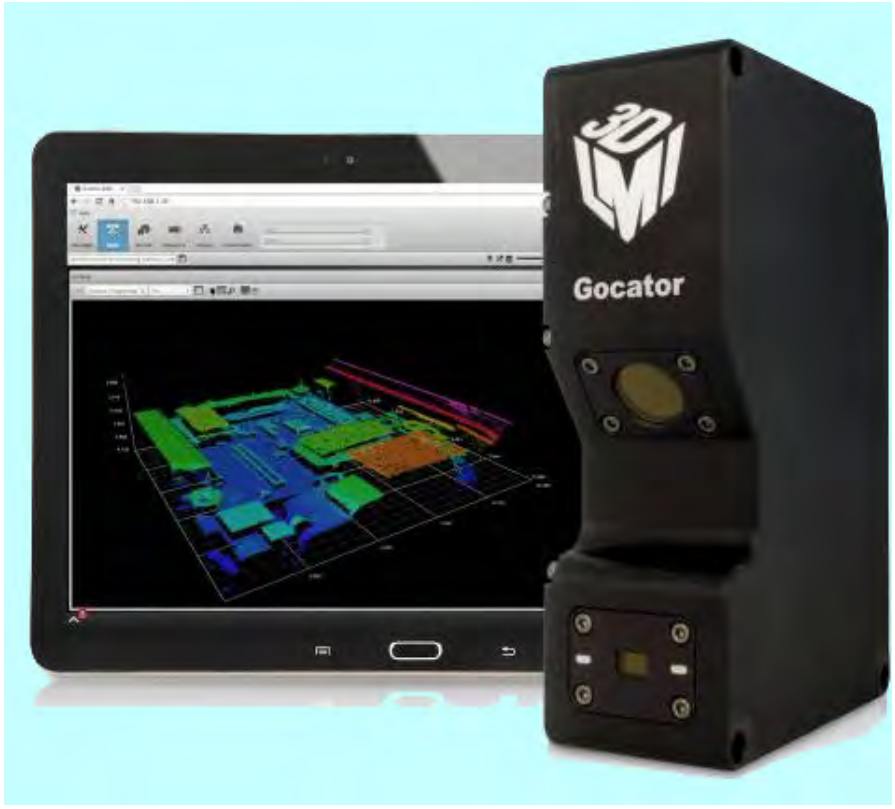
Just ahead of the Vision Show in Stuttgart, Germany, and organizer Messe Stuttgart promoted the event with its latest analysis of the business giving a taster of what visitors can expect at the bi-annual expo and conference.

"Traditional machine vision is morphing into an intelligent tool for optimization of industrial production," says the latest statement. "Vision systems are now taking on far more than just pure inspection tasks.

This year's Vision show, between November 8th and 10th, will showcase 3D technology that will enable users to improve logistics handling and which they can use with wearable data glasses to enable augmented reality."

In-line control

Berlin-based LMI Technologies says its customers are concerned with three significant factors: reliability, rapid and precise measurement, and easy operability. Managing Director Terry Arden said, "Our products are used in 100% in-line control scenarios. Customers often use our technology in harsh environments."



LMI will present its CMOS-based Gocator line profiler and smart 3D sensor range.

For that reason, the devices need to be sufficiently robust to ensure that they still perform extremely well in spite of vibrations or dust. Arden added, "Our sensors deliver a high resolution so that crucial features of a component can be verified with a high repeatability rate."

LMI incorporates CMOS chips and embedded technology into its chips. At Vision 2016, LMI will present its latest CMOS technology (Gocator 2410 smart 3D laser line profiler, and Gocator 3506 smart 3D snapshot sensor), which are said to offer the highest resolution in this sector at 2 and 5 mega pixels, respectively.

Terry Arden, managing director of LMI Technologies.

Demand for 3D vision

Jana Bartels, Product Manager for 3D/Time of Flight at Vision exhibitor Basler, commented: "There is growing interest in 3D cameras for process automation and monitoring to simplify the control of robotic systems, and to optimize and increase the security of man-machine interfaces." Among the highlights she mentioned is a collaborative project between Jungheinrich and the Hanover Institute for Integrated Production with companies Basler and

Jana Bartels, product manager at Basler.

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Vision 2016 to map evolution of 3D MV applications

Götting and the Institute for Technical Computer Sciences at the University of Lübeck.

This project has resulted in the creation of a high-reach fork-lift truck that understands human language and uses 3D machine vision to interpret gestures. "This project points the way to future communications between man and machine," Bartels said.

Basler will present cameras with an LVDS-based BCON interface for embedded vision systems and the new time-of-flight camera. Bartels added, "This will be the first industrial VGA camera available in the mainstream price segment that operates on the Time of Flight principal."

Industry 4.0

Ritchie Logan, VP Business Development at Odos Imaging, Edinburgh, Scotland, believes that Industry 4.0 is now an important driver for innovation in the vision sector. "Industry 4.0 and the new 3D ToF technology are meeting a wide range of user demands. That is helping Odos to develop new solutions in connection with both Industry 4.0 and Logistics 4.0 approaches."

He also commented that the Vision show offers great opportunities for networking: "We return home with all of this visitor data to help us get on with developing new solutions for current challenges." With one eye on the Vision Award, which his firm won in 2014 for its Machine Vision with Depth concept, Odos will this year be presenting developments such as StarForm, a high-resolution 3D ToF camera, and the StarStop event recording camera with freeze motion function.

Moving targets

At Matrix Vision, Oppenweiler, Germany, the rapid acquisition of 3D data from moving objects is a crucial objective. Technical Director Uwe Furtner said, "Our solution, which involves real-time 3D point cloud generation with a sufficiently high resolution level, fully meets this requirement."

Uwe Furtner, technical director at Matrix Vision.

Rapid 3D data capture is also desirable because it represents a valuable addition to Industry 4.0; users can compare CAD data directly online with results of calculated point clouds.

Rather than representing a pure 3D solution, the company's mvBlueSIRIUS product consists of a "6D" camera which provides movement vectors and RGB color data as well as 3D point clouds. Furtner added, "In addition to a pure data calculation, our camera can recognize objects, which can be described in terms of data relating to shape, color, size and velocity."

About the Author
Matthew Peach is a contributing editor to optics.org.

http://optics.org/news/7/8/61

Germany reports record sales of machine vision systems

Ahead of Vision 2016, German MV sector experienced 9% uptick in worldwide business.

By Henry Tipping in Stuttgart

With the German machine vision industry having achieved record sales of €2 billion in 2015 – a rise of 9 percent compared to the previous year – the VDMA, Germany's industrial association, has forecast a further rise of 8 percent to €2.2 billion in 2016.

Dr Horst Heinol-Heikknen, Member of the Board of VDMA Machine Vision, recently presented its latest forecast at a conference in Stuttgart and emphasized that "enabling machines and robots to practically 'see' is revolutionising automation around the globe". The automotive sector has led the majority of this growth, but non-industrial applications included significant growth in intelligent traffic systems helping to enable smart connected cities.

Source: Messe Stuttgart.

Dr Horst Heinol-Heikknen, Member of the Board of VDMA Machine Vision and CEO of Asentics GmbH & Co. KG.

Heinol-Heikknen attributed the strength of the market to advances in machine vision such as 3D imaging and machine learning and the increasing ease with which these features can be integrated within systems, commenting, "if machine vision becomes an organic component of a machine, then it becomes indispensable".

Vision 2016

At the biennial Vision Show taking place in Stuttgart in November, companies such as Basler, Odos, Bosch and Matrix Vision will present products that move beyond traditional machine vision, presenting "intelligent" tools that will optimize production and industrial processes through 3D imaging capabilities. Intelligent tools refers to machine vision that is reactive within the industrial processes and as Heinol-Heikknen said, "not just checking for quality at the end, it will effectively eliminate faulty production".

What drives these efficient processes are the optical components enabling the machines ability to see. ODOS Imaging will present their time-of-flight camera the StarForm, which uses near-IR pulsed laser illumination coupled with high resolution sensors to accurately capture 2D and 3D images of the targeted scene.

Big markets

As one of the largest trade fairs for machine vision, this year will host more than 400 exhibitors from 28 countries. Whilst North America remains the largest export market for machine vision, China now closely follows with high levels of industrial production and a growing need to control quality. The VDMA anticipates growth of 15 percent in Asia in 2016 and this year's Vision Show will see more Chinese companies exhibiting than ever.

Thomas Walter, Divisional Head of Industry & Technology at Messe Stuttgart, emphasised that "the companies represented at Vision are offering technical solutions that can be applied far beyond the industrial sphere". As the systems advance, so to do the users expectations of the machine vision industry – with more exhibitors than ever identifying applications outside of the Automotive sector at this year's trade fair, such as the food and beverage sector, with 15 companies set to exhibit who provide machine vision solutions for recycling and waste management.

According to the VDMA figures, non-industrial applications are making significant contributions to the increase in sales in German-made machine vision, accounting for an average growth rate of 16 percent per year (2011-2015). Growing demand in transport, medical technology and logistics has overtaken growth rates in industrial manufacturing. It is in non-industrial application that the VDMA expects both greater innovation and growth in the future.

Show time

"At Vision 2016, the range of products and services on show is incomparable," commented the VDMA, "ranging from sensors to processors, from cables to cameras, from software to lighting systems. There are also complete machine vision systems and concrete applications for the diverse sectors – from machine construction to the automotive industry to medical technology, and much more besides."

VDMA's Machine Vision group anticipates a record-breaking expo, this year. More than 400 exhibitors – with at least 200 from outside of Germany – are expected. As the conceptual partner of Vision, VDMA Machine Vision will be on-site, organising the three-day series of presentations, known as Industrial Vision Days – described as "an expert forum at which visitors from the industry can expect to see a wide range of technical and application-related machine vision themes".

About the Author
Henry Tipping is a contributing editor to optics.org.

http://optics.org/news/7/9/8

Source: VDMA.

Growing importance of China for Machine Vision exports, expected to increase in 2016.

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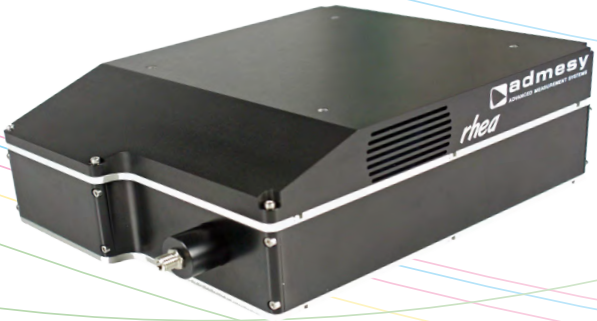

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