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VISION focus

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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. This issue is focused on the developments at the BIOS – Biomedical Optics – and Photonics West 2018 conferences and exhibition, taking place in San Francisco's Moscone Center.

In addition to the latest business news, market trends and product applications from the imaging and machine vision world, we have features on how vision systems are key to automation and harmonization of European border control; how augmented reality glasses are helping surgeons operate on tumors – without requiring the use of radio-isotopes; and, as Pixium begins US trials of a so-called 'bionic' retina, can this technology restore the sight of patients who have lost it to age-related macular degeneration.

The exploration of space and situating of optical equipment on satellites contiunues to create a large and valuable marketplace for vision systems. This issue we report on two such developments. Teledyne's e2v sensors are to equip the LSST telescope; SLAC is building this immense camera, to record images covering an area 49 times that of a full moon. Also, the Webb telescope has completed its cryo tests and now 18-mirror space telescope are being shipped to California to be integrated with the spacecraft ahead of its 2019 launch.

Each issue of VISION Focus magazine is promoted to more than 25,000 industry professionals. From hyperspectral imaging to machine vision applications, VISION Focus magazine delivers the industry news that matters in an easily accessible format. We also publish printed copies at major events and exhibitions, so if you're attending either the AIA Vision show in Boston (April 10 – 12) or the SPIE DCS exhibition in Orlando (April 15 – 19) make sure to grab a copy of the latest issue.

This year's big event is of course the Vision Show, the world's leading machine vision trade fair returning to Stuttgart (November 6 – 8). Our November issue will be distributed throughout the show, packed with dedicated coverage of the latest innovations being launched and the impact they have on industry.

You can also meet our editorial and sales teams at BIOS (booth 8424) and Photonics West (booth 1206) as well as at other key industry events throughout the year. Come and let us know about your latest innovations and your views of the vision industry.

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This Issue

Publication and Editorial Schedule 2018/19

April/May Issue 2018

- Bonus Distribution **SPIE Defense+Commercial Sensing**
- **Editorial Focus:** aerospace and defense applications, associated research and development
- Published in advance of DCS *(Defence & Commercial Sensing)*, 15th – 19th April 2018

June/July Issue 2018

- Bonus Distribution: **Astronomical Telescopes + Instrumentation**
- **Editorial Focus:** optical components, academic research, software applications.
- Published in advance of Astronomical Telescopes + Instrumentation, 12th – 14th June 2018

October/November Issue 2018

- Bonus Distribution: **Vision**
- **Editorial Focus:** opto-electronic systems, applications in sensing and manufacturing.
- Published in advance of Vision, 6th – 8th November 2018

January/February Issue 2019

- Bonus Distribution **SPIE BiOS, Photonics West, SPIE Medical Imaging**
- **Editorial Focus:** industrial applications, sensing, biomedical analysis and treatments.
- Published in advance of Photonics West, 2nd - 7th Feb, Lase, 2nd - 7th Feb, SPIE Medical Imaging, 16th - 21st February 2019

Vision systems key to automation and harmonisation of EU border control

Finland's VTT Technical Research Centre has developed a set of best practices for automated border control as part of the international FastPass project. Key to this aim are vision systems for facial and number plate recognition.

Passenger self-service at border control is a growing trend at Europe's external frontiers. Harmonised solutions will provide faster border checks and shorter waiting times for passengers. At the same time, security and cost-effectiveness will be promoted as equipment and usability are harmonised at EU level.

In cooperation with diverse European partners, VTT Technical Research Centre of Finland has developed a set of best practices for the development and introduction of next-generation automated border control systems. The automated border control systems (ABC) developed through the €15.5 million FastPass project – including facial, fingerprint and automated number plate reading systems – will serve as a general model for future automated border control solutions around the world, says VTT. They will also provide a model for the technical and operational integration and compatibility of future systems.

Sirra Toivonen, who is in charge of the project at VTT, commented, "During the project, we evaluated the risks and vulnerabilities in relation to automated border control systems to identify individuals. We have developed border control processes that have been successfully tested and evaluated in various operating environments at airports, on cruise ships, and for passenger cars at land

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Vision systems key to automation and harmonisation of EU border control

borders. We developed alert systems based on intelligent data-processing."

Jukka Hosio, CEO of partner company Deltabit Oy, said, "FastPass provides a great opportunity to develop of our fingerprint recognition technology in cooperation with VTT's world-class experts and other companies.

Petri Bäckström, CEO of another partner Mirasys Oy, added, "This project has enabled the development of new features in our control software, improving our ability to respond rapidly to emerging customer needs. We do not believe that these advances would have occurred without extensive international collaboration via FastPass."

The innovative operational models developed have now been field tested and evaluated at border-crossing points including an Austrian airport, a Greek port and a land border in Romania. However, self-service machines have yet to become established; passengers, in particular, are still learning about and getting use to them. If more people pass efficiently through automatic border control systems, staff can focus more effectively on passengers who require closer control.

FastPass outputs

FastPass is a harmonized, modular reference system for all European automated border crossing points. The FastPass project offers an effective solution to many complicated and conflicting operational, technical and ethical questions.

The consortium has analyzed the various requirements of the end-users (border guards and travellers). Based on this, and taking into account the ethical and legal implications, technologies were developed in different areas – biometrics, video surveillance, passport scanning. Those technologies were integrated in a modular way, resulting in a next generation technology known as eGate.

The solution has been tested at three different border control points _ the Port of Piraeus in Greece, the Airport of Vienna in Austria and the land border crossing point of Moravita in Romania. Those demonstrations run over several months and attracted thousands of voluntary

passengers. An in-depth evaluation of those tests was then done, providing interesting conclusion on the FastPass work.

Vision system applications

FastPass has achieved effective facial recognition without stopping subjects by using an innovative technology. During the FastPass demonstration, speed of face detection and face recognition on-the-move has demonstrated good performance. However, the most challenging issue observed through the operation is that users' cooperation has significant impact on the face image quality presented at both the kiosk and gate.

Manufacturers have developed different ways for dealing with this situation, which have in common that they use a display as an eye catcher in order to gain the passenger's attention and thereby guiding their viewing direction to the camera. In a border crossing environment, external lighting condition also has a significant impact on the face image quality.

Lighting changes, which could happen often at a land border, can significantly affect the image acquisition under visible spectrum. Thus, additional hardware or software to correct lighting impact is recommended. Face recognition systems are generally divided into two categories: visible range based and near infrared based.

Most traditional face recognition systems capture faces under the visible spectrum. One of the main challenges for these systems is the facial appearance change under visible illumination. Recently, the focus has been moved to using near infrared face images.

Thus, using near infrared face recognition could be another option against illumination impact. However, the images stored in a passport is generally an traditional colour image, thus, robust face recognition algorithms are also required for matching between near infrared face to the passport colour face.

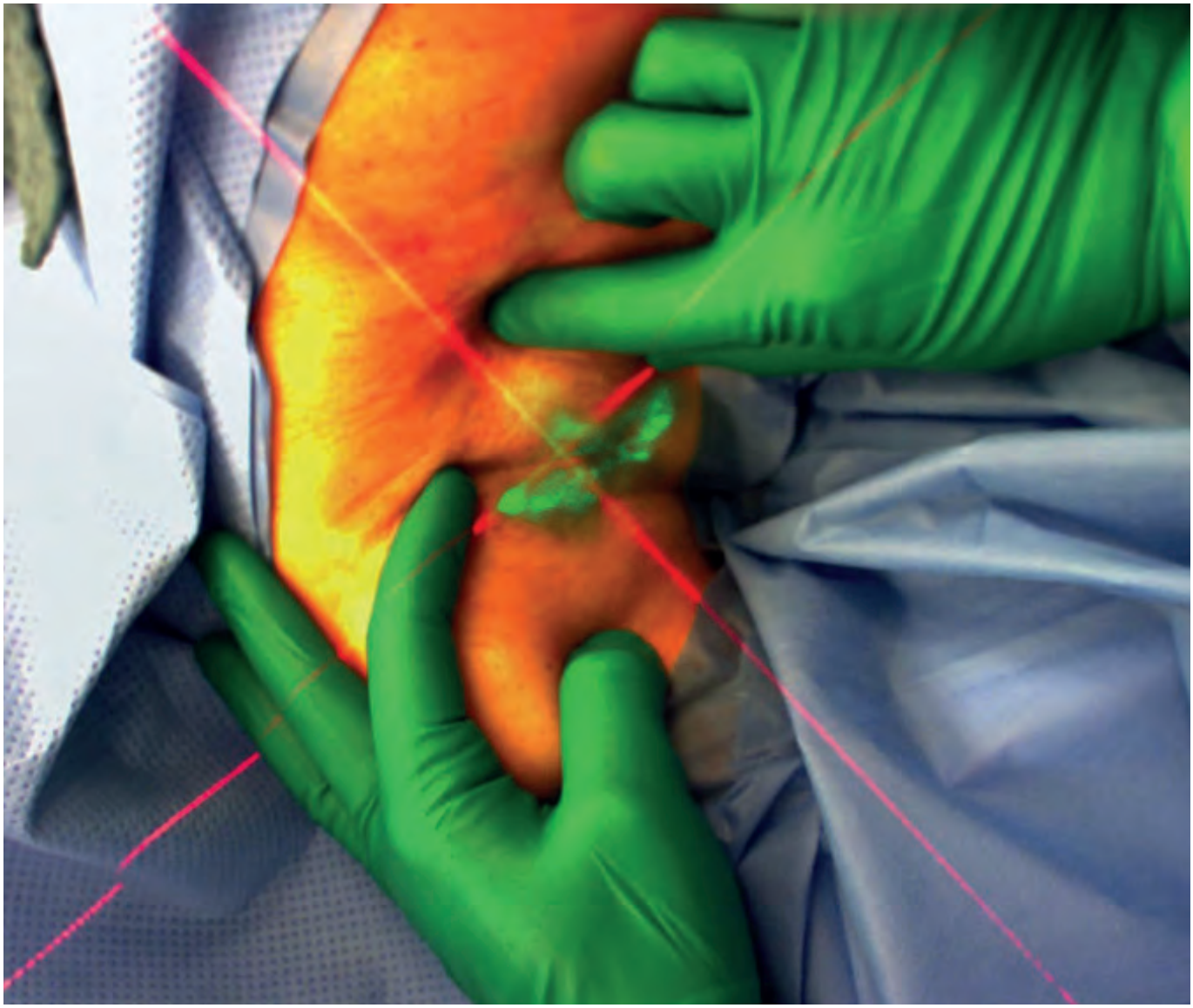
Recommendations

Based on the FastPass research and operational observations the agencies involved have recommended the following:

- Additional sound or light signals should be deployed to attract attention from the users to ensure that they will look into the camera
- Face camera position could be modified in order to attract more attention from the users and capture good quality frontal face images
- Automated camera calibration should be improved to protect the system against wrong manual settings
- Additional correction on uncontrolled external light influences should be applied to ensure robust and high quality face capture
- Face spoofing detection against 3D masks is challenging while the person is on-the-move especially when the user is less cooperative. Thus, faster detection is necessary for on-the-move scenarios

The report also presents a novel solution for an ABC to conquer the challenges of the land border ABC. Due to the requirement that travellers should stay in their cars and the fact that each car has different dimensions, the devices for the border process have to be automatically moveable and their position adjustable for different cars and they must work reliably outdoors.

By Matthew Peach, Contributing Editor to optics.org



AR glasses enable surgeon to precisely locate the lymph node during surgery.

AR glasses help surgeons operate on tumors

NIR cameras capture fluorescence and produce a 3D reconstruction of the affected lymph node - without requiring radio-isotopes.

Malignant tumors often form metastases that spread to other parts of the body via the lymphatic system. High surgical skills are required to identify the precise location of the affected lymph nodes, enabling them to be completely removed. Researchers at the Fraunhofer IGD (Institute for Computer Graphics) researchers have developed a navigation aid that simplifies such interventions.

An augmented reality (AR) system called 3D-ARILE superimposes a virtual image of the exact position of the lymph nodes using data glasses. It will be presented to the public for the first time at the Medica trade fair, in Düsseldorf, Germany, from November 13 to 16.

According to the German Federal Statistical Office, the number of patients treated for skin cancer in German hospitals has grown significantly in recent years. Malignant melanoma, or black skin cancer, is the diagnosis that most people fear. Cancer cells can, for example, be transported by the lymph fluid to the lymph nodes. This leads to the growth of secondary tumors, or metastases. The first lymph nodes to be affected are referred to as sentinel lymph nodes.

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AR glasses help surgeons operate on tumors

Locating sentinel lymph nodes

Despite advances in medical science, it is still difficult for doctors to determine the precise location of sentinel lymph nodes during surgery and to check that the affected lymph nodes have been completely removed. 3D-ARILE, developed by researchers at the Fraunhofer IGD, provides doctors with a navigation aid for lymph node removal. The Clinic for Dermatology at Essen University Hospital and Trivisio Prototyping collaborated with the Fraunhofer researchers on this project.

The novel augmented reality system, based on the use of data glasses, helps surgeons locate lymph nodes with the aid of virtual markers. What makes these AR glasses special is that they work in combination with powerful medical navigation software, a stereoscopic, near infrared camera system, and indocyanine green fluorescent dye. "To make the affected lymph nodes visible, the fluorescent dye is injected into the patient in the direct vicinity of the primary tumor.

It then spreads along the lymphatic pathways and collects in the sentinel lymph nodes," said Fraunhofer IGD research scientist Dr Stefan Wesarg. The dye fluoresces when exposed to infrared light, in this case generated by infrared LEDs. NIR cameras capture the fluorescence and produce a 3D reconstruction of the affected lymph node.

This virtual image showing their exact position is superimposed in real time and can be viewed by the surgeon through the data glasses. The necessary software was developed by the research team in Darmstadt. "In our case, the malig- nant tissue is marked in green. In this way, the surgeon can verify that every last trace has been removed," said Wesarg.

Fluorescent dye instead of radioactive nanocolloids

Until now, doctors used technetium-99m as a medical tracer. By replacing this radioisotope with ICG fluorescent dye, patients can be treated without risk of radiation side-effects. Time is another key factor. The level of radiation emitted by lymph nodes containing the radioactive marker is very low.

This made it necessary to use scintillation (or gamma) cameras that required around 30 minutes to capture the images needed to determine the precise location of a lymph node. The data glasses, by contrast, display the site of the affected lymph node instantly.

© Trivisio.

Live clinical tests of the software and hardware at Essen University Hospital.

This greatly relieves the stress on the OR staff, who no longer need to watch an additional monitor and compare the image on the screen with that on the camera's display. "As a result, the doctor can focus entirely on the patient and carry out surgeries without hassle," says Wesarg.

Comfortable glasses

Another advantage of the AR glasses is that they are light and extremely comfortable to wear, as dermatologists at Essen University Hospital have confirmed after carrying out numerous tests. The partners who developed the system remained in close contact throughout the project, enabling them to design a navigation aid optimized to the surgeon's needs.

The augmented reality system comprises hardware and software components. The hardware was developed by Trivisio Prototyping. In addition to the data glasses with an integrated camera and two displays, designed specifically for medical applica- tions, the company also developed two infrared and two visual cameras. These four optical devices are integrated in a cube-shaped unit suspended over the operating table.

The Fraunhofer IGD research team was responsible for developing the software. It includes an image processing system, which detects fluorescent light emitted by the lymph nodes, uses this data to calculate their 3D coordinates, and displays their position in the data glasses. The software also performs the necessary calibration of the hardware system.

By Matthew Peach, Contributing Editor to optics.org

http://optics.org/news/8/11/26

FLIR rises on record backlog

Thermal imaging giant reports strong bookings momentum and sales boosted by addition of Point Grey Research.

The stock price of FLIR Systems has risen to an all-time high after the thermal imaging and surveillance company posted rising sales and a record-breaking backlog in its latest financial quarter.

For the three months ending September 30, Oregon-headquartered FLIR reported pre-tax earnings of $84.5 million as revenues jumped 15 per cent year-on-year to $464.7 million.

Jim Cannon, who was installed as FLIR's new CEO in the summer, said that strong bookings momentum in the quarter drove order backlog to $709 million – the highest level in the company's history.

Point Grey boost

A 20 per cent year-on-year rise in quarterly sales of commercial products was again boosted by the addition of Point Grey Research in late 2016 – with Cannon saying he was "absolutely thrilled" with the machine vision subsidiary's performance and growth since then.

The CEO added that, even though growth in Point Grey business may slow a little in the near term, the FLIR team was "bullish" about the machine vision space, and the potential combinations with the thermal imaging technology that FLIR is better known for.

Point Grey was one of four acquisitions completed by FLIR in 2016, and with its strong balance sheet the company is intending to continue in that vein. Cannon and stand-in CFO Shane Harrison indicated that FLIR remained "very active" in assessing further deals to grow the firm.

Looking ahead, the CEO said that the closing quarter of the year would pose a few challenges, with some revenues pulled forward into the just-reported quarter. But he still expects FLIR to meet its full-year sales target of around $1.8 billion – compared with $1.66 billion in 2016.

"FLIR Method"

A US Army veteran who served in both the Desert Storm and Desert Shield campaigns in Iraq, Cannon also introduced the concept of "The FLIR Method". The internal scheme is designed to increase profitability and cash generation, while from the start of 2018 FLIR will be structured around three business units instead of the current six.

Announced in September, that restructure will see FLIR's results aligned to "industrial", "commercial", and "government and defense" sectors – a return to the kind of structure that prevailed before the company's 2014 realignment around six key market-themed segments under previous CEO Andy Teich.

Elements of the "FLIR Method" include lean management and customer-driven innovation, with Cannon telling an investor call to discuss the latest thinking:

"Each of our business units will have dedicated FLIR Method leaders at various facilities globally, who will lead the focus on enhancing our productivity, refining our product pricing strategy, standardizing our core business terminology to better share best practices globally, implement expanded talent development programs, boost our acquisition and integration processes, and continue to develop world-class products that exceed our customers' expectations."

The new CEO also highlighted some of FLIR's latest product introductions – including a new thermal bullet camera for perimeter security applications, a new drone camera with a hybrid sensor capable of in-flight switching between visible and thermal imaging, and a new suite of thermal imagers aimed at electricians and other trades.

- *After releasing its latest results October 25, FLIR's stock price rose 6 per cent to close at an all-time high of $46.52 – equivalent to a market capitalization of around $6.4 billion.*

FLIR's stock price has made significant gains since the appointment of new CEO Jim Cannon this summer, and is currently trading at an all-time high.

Image: nasdaq.com.

By Mike Hatcher, Contributing Editor to optics.org

http://optics.org/news/8/10/40

Light L16 camera aims to beat DSLR performance

Camera leveraging advances in both optical components and systems technology ramps up production.

The L16 camera developed by venture-backed California-based Light recently commenced shipping to pre-order customers. This marks the next phase of the company's plans for a novel optics architecture intended to match or exceed the performance of DSLR cameras, but do so from a more consumer-friendly unit.

The camera's design employs 16 different lenses and optical modules within the one chassis, capturing a scene at several different focal lengths and then applying algorithms specifically developed for the purpose to combine the multiple exposures into a single high-resolution image.

Although only slightly larger than a current smartphone, the L16 is designed to deliver significant improvements in image quality and photographic performance over that currently possible from consumer cameraphones, as well as capturing certain image information that a conventional camera would not gather at all.

"The problem that besets DSLR photography is the bulk of the equipment involved and the need to carry multiple lenses," commented Rajiv Laroia of Light. "Smartphones are much easier to carry, but cannot deliver the same image quality, which is frustrating for photographers using them."

Laroia, whose previous industrial background was in the comms sector for AT&T Bell Labs and Qualcomm before he turned to the optics of photography, designed a solution that would leverage both the recent advances in optical component technology that smartphones have spurred, and some novel systems technology developed for this particular purpose.

Adjustable depth of field

The L16 replaces the bulk and weight of a traditional single-lens camera with several small lenses and sensors, that lie at 45-degree angles across a flat plane. The internal architecture exploits some of the principles behind folded optics to keep the chassis height on a par with that of the smartphones which customers are used to carrying, despite the presence of 16 individual optics units delivering three different focal lengths of 28, 70, and 150 mm.

Credit: Light.

The L16 employs multiple small lenses and sensors, within the same camera chassis.

In use, the L16 intelligently chooses the best combination of the three different focal lengths for each scene, depending on the level of zoom, and adjusts its mirrors to support various fields of view. At least ten of the individual cameras fire simultaneously in each shot, capturing slightly different views of the same scene.

"In normal DSLR cameras, a single conventional lens essentially takes the same entire picture through every part of its aperture," said Laroia. "But we are taking multiple individual pictures from different apertures and then combining them digitally. In a sense we do in the digital domain what a conventional lens does in the analog domain."

Once a scene has been captured, the computational algorithms developed by Light overlay exposures from the higher focal lengths on top of those from lower focal lengths, to enhance the level of detail in the final photograph. The result is one high-resolution 52-megapixel photograph, formed from multiple perspectives.

Fusing the multiple captured scenes together for a final image also allows the depth of field to be changed computationally after a photograph has been taken, as the processing algorithms can effectively adjust the aperture values being displayed. Plenoptic cameras demonstrate a similar ability too, although via a different technique, but Laroia believes that the Light architecture can deliver a better result than the plenoptic approach and derive more accurate depth information from the captured visual data.

Founded in 2013, Light has been developing the L16 and its optical technology since 2015, raising $25 million in Series B funding that year and a further $30 million in Series C finance in 2016. The goal is for the combination of high resolution and accurate depth information delivered by Light's optical architecture to find applications in various sectors such as security or aerial drone surveillance, but in the meantime the company anticipates having a significant impact in consumer- and professional-level photography within a few years.

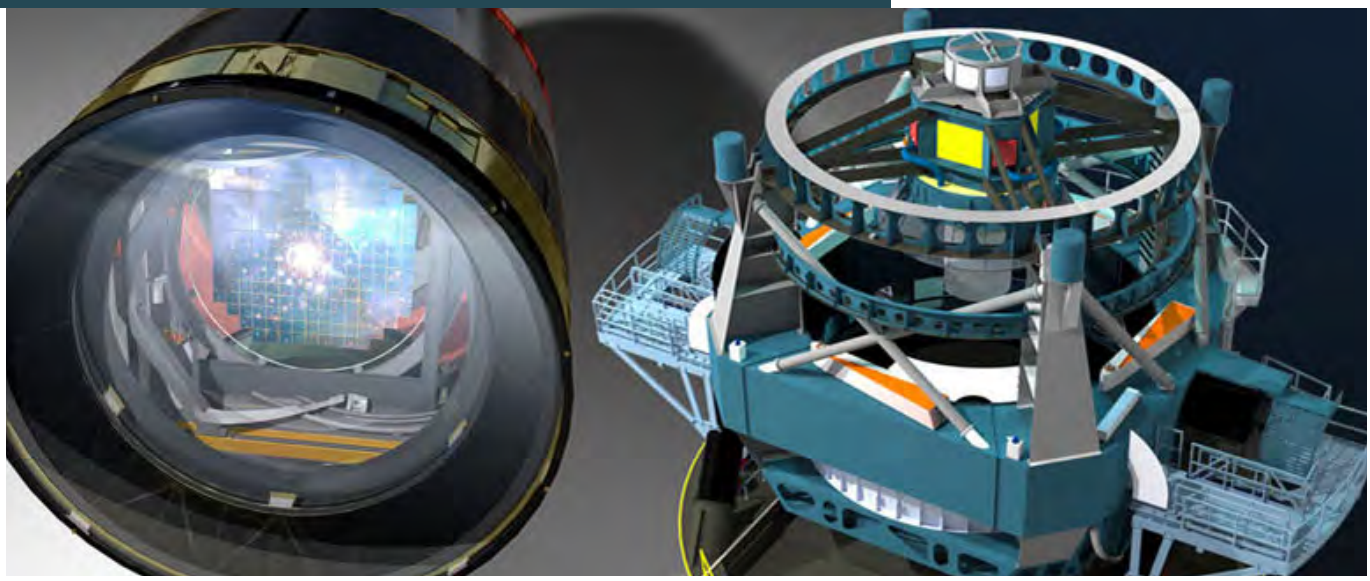
"The improvements in the quality of optical components and reduction in their unit price that the smartphone has driven has allowed us to make this significant step forwards," said Laroia. "Only five or ten years ago the components were simply not in place to allow the L16 architecture, but today they are."

By Mike Hatcher, Contributing Editor to optics.org

http://optics.org/news/8/10/36

Teledyne e2v sensors to equip LSST telescope

SLAC is building this immense camera, which will record images covering an area 49 times that of a full moon.



Graphic: LSST.

The Large Synoptic Survey Telescope will catalog a vast array of astronomical objects during a decade-long census of the night sky starting in 2022.

Teledyne e2v has won multimillion-dollar contract by SLAC National Accelerator Laboratory (SLAC) to supply customized CCD image sensors for the Large Synoptic Survey Telescope.

The 8.4 meter telescope is currently being constructed in Chile to carry out a ten-year survey of the sky to address fundamental astronomy questions about dark matter, dark energy, near Earth asteroids, transient optical objects (such as supernovae), and the formation of our Milky Way galaxy.

Teledyne e2v has designed a sensor to achieve exceptional sensitivity and stable performance with an extremely flat focal surface which delivers 3,200 megapixels of image data per exposure. The camera will incorporate 189 large-area sensors which will be delivered to SLAC for construction into the cryogenically-cooled camera.

Approximately one third of the science sensors have already been delivered in a previous contract phase. The contract award follows previous prototype and First Article contracts and requires Teledyne e2v to deliver essential components for the LSST.

Three-mirror design

The LSST was identified as a US national scientific priority by the 2010 USA National Research Council decadal survey. It has the largest digital camera ever built for ground-based astronomy and will be one of the world's most powerful astronomical survey telescope, when commissioned in 2021. The telescope has a novel three-mirror design to provide high efficiency and a wide field of view.

SLAC is building the immense camera which will record images that cover an area of 49 times that of a full moon. The powerful telescope will capture images of the entire sky every few nights in multiple colour bands. These will be used to construct a detailed catalogue of the sky, providing brightness, colour and time variability information at a greater depth than ever before.

"This telescope and camera will stimulate the astronomy world with a huge survey data set which will be followed by many astronomers worldwide and will set a new standard against which other instruments will be compared," commented Dr. Paul Jorden, Astronomy Product Specialist at Teledyne e2v. "The sensors have very challenging design features and we have demonstrated that they can be made in large quantities and delivered to a tight schedule."

Dr Giuseppe Borghi, VP Business Development, added, "This is a key achievement for the group, and for our Teledyne e2v UK team, in particular. We are proud to have supported this project for several years and have overcome a number of technical challenges by working closely with our customer. We look forward to seeing how this extremely innovative telescope will help develop our understanding of the Universe."

The sensors will be at the heart of the LSST camera. They have been designed for high sensitivity and will be optimized for enhanced red wavelength sensitivity. The large camera requires an extremely flat focal surface, and so the sensors are designed to achieve a surface flatness precision one-twentieth of the width of a human hair."

The 189 sensors will be built in a custom package that enables all of them to be assembled into a closely-packed mosaic to form the three gigapixel array with minimal lost area and a mere 0.25 mm gap between sensors across the 630 mm diameter focal plane. The sensors have 16 output channels that enable them to read the image in a few seconds and allow a high rate of image collection.

By Matthew Peach, Contributing Editor to optics.org

http://optics.org/news/8/10/25

Cognex delivers bumper quarter

Spike in sales of machine vision equipment for consumer electronics production generates record revenues and profit.

Cognex, the Massachusetts-based machine vision specialist, has posted record-breaking sales and profit in its latest financial quarter, thanks largely to a spike in demand from consumer electronics manufacturers.

In the three months ending September 30, the company saw its pre-tax income double year-on-year to just over $112 million, after sales soared 76 per cent to $260 million.

'Spectacular' quarter

Cognex founder Robert Shillman described that performance - the first time the firm has posted quarterly revenues of more than $200 million - as "spectacular", with the Cognex workforce expanding quickly to meet the increased level of business.

While demand from customers producing consumer electronics goods in Asia was the primary reason for the sales spike, European sales also jumped by more than 25 per cent year-on-year, thanks to deployments across the automotive, logistics, and food and drink sectors.

Although that explosive level of growth will not be maintained through the rest of the year, Cognex CEO Robert Willett said that a strong flow of orders meant that Q4 was still "shaping up nicely", with quarterly sales expected to come in at around $175 million.

If correct that would translate to full-year sales of around $740 million, compared with the $521 million in 2016 that already represented a new record for the firm.

The recent sales boom is transferring to the bottom-line performance as well, with Shillman labelling the latest quarter - in which Cognex delivered an enviable operating margin of 42 per cent - as "ridiculously profitable".

The Cognex executives also highlighted good progress in the relatively new area of 3D machine vision, which now accounts for around 5 per cent of company sales.

Applications of that technology stretch from identifying problems on robot-populated consumer electronics production lines - for example looking for loose screws dropped into battery spaces - to checking rubber lettering on car tires.

"We have a sales force that's really very good at applying technically challenging machine vision to all those markets, and we have products that are increasingly advantaged and easy to sell," CEO Willett told an investor conference call discussing the latest results.

Acquisition progress

Cognex has acquired six smaller companies over the past year or so, including three that specialize in 3D machine vision, and Willett indicated that all those acquisitions are performing well.

"EnShape, Chiaro and AQSense [are] really helping us open up new opportunities in 3D [vision] for Cognex and for the industry," he said. "And then GVi [is] helping us get into automotive, and Webscan is helping with barcode verification."

As Cognex continues to pile up cash - its balance sheet now shows close to $800 million in "cash and investments" - more of those smaller-scale deals seem likely in the future, with Willett saying that the company is not interested in growing its footprint just for the sake of additional sales.

"We're not really looking to bolt-on revenue," he told investors. "We're looking to bolt-on quality."

Photo: Cognex.

One of Cognex' recent acquisitions is the 3D machine vision specialist EnShape, and 3D technology is said to now represent around 5 per cent of Congex' fast-growing sales.

- *Following the spectacular results, Cognex' stock price briefly touched an all-time high of $129 before settling back as markets digested the latest guidance.*

Closing at just over $123 on the Nasdaq exchange on October 31, the company's market capitalization has doubled since the start of the year and currently stands at around $10.7 billion.

By Mike Hatcher, Contributing Editor to optics.org

http://optics.org/news/8/10/48

Image: nasdaq.com.

Like many companies in the photonics sector, Cognex' stock price currently sits at, or close to, an all-time high. The machine vision company's valuation has more than doubled over the past year, with sales topping half a billion dollars for the first time in 2016 and continuing to rise sharply. With little competition aside from Japan's Keyence, Cognex is also posting high profits, and now commands a market capitalization just shy of $11 billion.

Hamamatsu and Mitsubishi back perfusion imaging startup

California-based Modulated Imaging completes series A round for technology offering early warning of diabetic ulcers.

Modulated Imaging, a 2008 spin-out from University of California, Irvine, that is developing medical imaging technology based around structured light illumination, says it has raised $2.9 million in a series A round of venture funding.

Backed by the investment wings of Japan's Hamamatsu Photonics and Mitsubishi, alongside Grey Sky Venture Partners and Fresenius Medical Care Ventures, the company is aiming to target a range of medical, aesthetic and research applications with a technique called spatial frequency domain imaging (SFDI).

A key potential application of SFDI is identifying diabetes patients likely to develop foot ulcers resulting from poor vascular circulation – side-effects that often go undiagnosed until expensive treatment, and in some cases even amputation, is necessary.

In addition to the venture funding, the company said it also received a $1.2 million "commercialization readiness" grant from the National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS), part of the US National Institutes of Health (NIH).

According to a US Securities & Exchange Commission (SEC) filing in August, the company had been seeking up to $4 million in equity finance.

Vascular lesions

David Cuccia, whose UC Irvine research forms the basis of the SFDI technique, is both CEO and CTO of Modulated Imaging. He said in a company announcement: "This infusion of funds allows us to take our imaging technology to the next level, supporting key clinical studies and the development of our next-generation Ox-Imager technology.

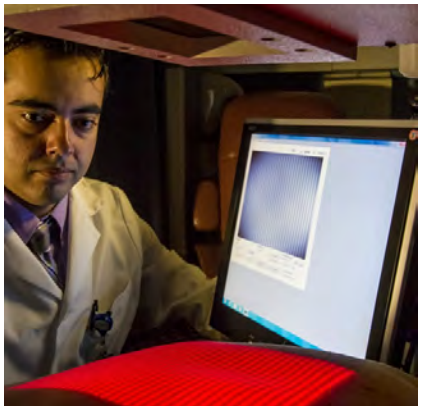


Photo: Modulated Imaging.

Using structured light at different wavelengths enables measurement of blood and tissue oxygenation levels - and should lead to earlier diagnosis of foot ulcers in diabetics that can require expensive treatment and, ultimately, even amputation.

"We appreciate the enthusiasm and support from Grey Sky, Mitsubishi, Fresenius Medical Care, and Hamamatsu, as well as from the clinical community. We will continue to build upon our unique approach to resolving an unmet medical need, and providing meaningful information that advances patients' health and wellness."

Modulated Imaging announced earlier this year that the US Food & Drug Administration (FDA) had approved its Ox-Imager CS product, which is designed to help diagnose lower-limb vascular issues such as diabetic foot ulcers.

On its web site, the company explains that the SFDI technique is able to identify the likely onset of these potentially dangerous lesions, before they actually develop. "Poor peripheral circulation coupled with poor foot care can cause an onset of diabetic foot ulcers," it says. "These ulcers are painful, difficult to heal, and can lead to amputation."

Patients with diabetes often do not realize that they have a problem until the ulceration has reached a critical stage, adds the firm. "Our technology can measure peripheral perfusion, and allow primary care doctors to screen subjects and prescribe preventative measures prior to ulcer formation."

Cuccia, who says that the approach could potentially save more than $6 billion in ulcer treatment annually, added that clinical studies already taking place in California and Arizona will now expand to other locations. A miniaturized version of the Ox-Imager CS system is also under development, and work on that is set to accelerate thanks to the latest venture cash.

Tissue oxygenation

The SFDI approach, initially developed through a series of small business innovation research (SBIR) grant awards, works by measuring tissue oxygenation saturation from oxy- and deoxy-hemoglobin levels, which are in turn determined according to their relative absorption and reflection of different wavelengths.

Aside from Cuccia, the Modulated Imaging board includes Bruce Tromberg, director of UC Irvine's Beckman Laser Institute and Medical Clinic. Alongside Gabriela Apiou from the Harvard Medical School, Tromberg also co-chairs a conference dedicated to translational research within the "BiOS" symposium at SPIE's annual Photonics West event.

Originally housed within UC Irvine's "Photonic Incubator", in 2014 the expanding company moved to its first commercial space in San Juan Capistrano, but quickly outgrew that location as well and now operates out of a 6000 square foot building in Irvine.

Hamamatsu Photonics researcher Mitsuharu Miwa, said to be a pioneer in perfusion imaging, said in the company's latest announcement:

"Hamamatsu Photonics has invested in Modulated Imaging once again due to its innovative work with photonics to improve human health. Modulated Imaging's technology is very much in sync with Hamamatsu's own development of optical imaging for medicine, so it is an ideal relationship."

By Mike Hatcher, Contributing Editor to optics.org

http://optics.org/news/8/11/31

Pixium retinal implant approved for human trial

French regulatory authority allows feasibility study for treatment of advanced dry age-related macular degeneration.

Paris-based Pixium Vision has received clearance from health authorities in France for a trial of its potentially sight-restoring new retinal implant, known as "PRIMA".

The company, which raised €15 million in venture finance in 2013 before completing a €34.5 million initial public offering (IPO) on the Euronext stock exchange the following year, says that the wireless device will be tested on patients suffering from advanced dry age-related macular degeneration (AMD).

AMD is the leading cause of blindness in the developed world, and impacts the central area of vision by damaging the area of the retina – the macula – that has the highest concentration of cone cells and is responsible for high-resolution, color vision.

Other bionic retinal implants, for example the "Argus II" device developed by US-based Second Sight, have also been tested in clinical trials.

378 electrodes

Pixium describes the PRIMA device as its "next-generation miniaturized sub-retinal implant", and says that the approach it uses was first conceived at Stanford University in the US.

Just 2 mm across and 30 µm thick, the photovoltaic PRIMA implant features 378 electrodes. Implanted under the retina, it converts pulsed near-infrared light received via external glasses fitted with an integrated mini-camera into electrical signals transmitted to the brain via the optic nerve.

Khalid Ishaque, Pixium's CEO, said in a company release: "PRIMA enters an exciting phase of its development, with a first patient expected to be implanted before year-end."

Entitled "feasibility study of compensation for blindness with the PRIMA system in patients with dry-AMD", the study is designed to evaluate the tolerance of PRIMA and to demonstrate a level of central visual perception among patients who have lost their sight due to atrophic advanced dry-AMD.

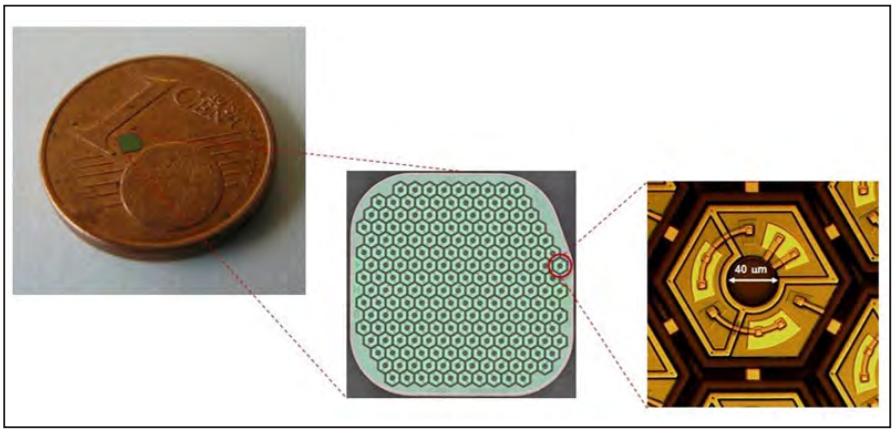


Image: Pixium Vision.

Measuring just 2mm across and tens of microns thick, Pixium's 'PRIMA' sub-retinal implant is set to be trialed in patients suffering from central vision blindness caused by dry age-related macular degeneration (AMD).

The plan is to recruit five patients, with interim evaluation at a six-month follow-up before a fuller evaluation after three years. The study will be conducted at Fondation Ophtalmologique Rothschild and Hôpital des Quinze-Vingt in Paris, with vitreoretinal surgeon and ophthalmologist Yannick Le Mer as principal investigator.

Pixium says that it is also in discussions with the US Food and Drug Administration (FDA) about a similar feasibility study with PRIMA in the country.

Coincidentally, Second Sight recently received conditional approval from the FDA to test its new "Orion" implant on up to ten patients at US hospitals in Los Angeles and Houston. Like Pixium, the Sylmar, California, company is hopeful of implanting the first patient with its Orion prosthesis before the end of this year.

Equity line agreed

Meanwhile, Pixium said last month that a six-month follow-up study of patients who have had the company's "IRIS II" device implanted to treat retinitis pigmentosa showed that the prosthesis had a shorter life span than expected.

Although one patient had received a replacement, Pixium said that it had "temporarily halted" new implantations, and was looking at the possibility of using a different surgical method.

The ageing global population means that the more than 4 million people thought to be suffering from AMD currently - and without an effective, approved treatment option - is a number set to grow significantly.

The potential for sub-retinal implants to solve that major unmet clinical need has attracted a handful of venture capitalists and other investors to the emerging field – although they will need to tolerate significant losses during the extensive period of clinical trials before enjoying any financial return.

Pixium, which posted a net loss of €6.4 million on revenues of only €1.3 million in the first half of 2017, says that it has just established a new line of equity financing with investor Kepler Chevreux.

The deal could see an additional €6.2 million invested in Pixium over the next two years, with CEO Ishaque saying that the agreement "secures the company's medium-term financial requirements under flexible conditions".

As of June 30 this year, Pixium held €14.9 million in cash and equivalents.

By Matthew Peach, Contributing Editor to optics.org

http://optics.org/news/8/10/35

Webb telescope completes cryo tests

18-mirror space telescope ready to be shipped to California and integrated with spacecraft ahead of 2019 launch.

Following more than three months of environmental, thermal and optical testing, the James Webb Space Telescope (JWST) is said to be ready for shipment to California, ahead of its integration with a spacecraft and planned launch in 2019.

Since July 10, scientists and engineers from NASA's Johnson Space Center and Harris Corporation have been putting the 18-mirror instrument through its paces by simulating the vacuum and extreme cold that JWST will experience in space.

The tests also included an alignment check of the 18 gold-plated, hexagonal segments that make up the primary collector optic, with the Harris team developing a multi-wavelength interferometer system to verify optical quality and placement of each mirror element.

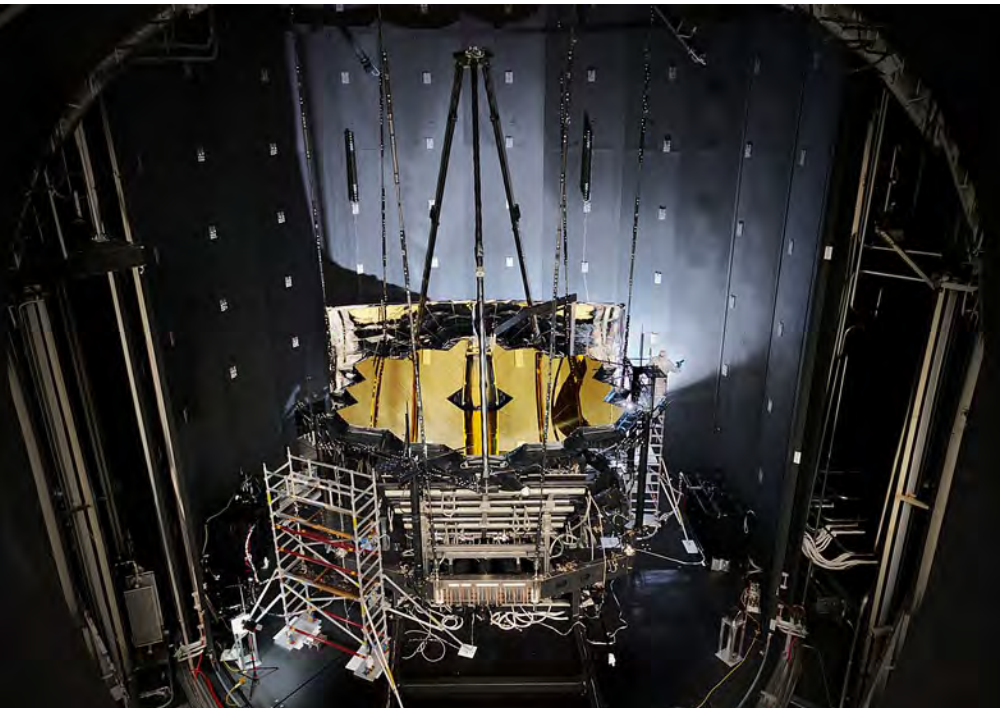


Photo: NASA/Chris Gunn.

A joint project between NASA, the European Space Agency, and the Canadian Space Agency, the James Webb Space Telescope is seen here inside the giant 'Chamber A' at NASA's Johnson Space Center in Houston. Having survived Hurricane Harvey's impact shortly after testing began, the cryogenic testing was completed November 18. This marked JWST's final cryogenic testing, and ensured that the observatory is ready for the frigid, airless environment of space.

Surviving Harvey

JWST project manager Bill Ochs said in a NASA release: "After 15 years of planning, chamber refurbishment, hundreds of hours of risk-reduction testing, the dedication of more than 100 individuals through more than 90 days of testing, and surviving Hurricane Harvey, the OTIS [optical telescope and integrated science instrument module] cryogenic test has been an outstanding success."

The tests in Houston are said to have continued even as Hurricane Harvey slammed into Texas in late August and inundated the city with flood waters.

Although the Johnson Space Center (JSC) in Houston was closed to most employees and visitors through September 5, the JWST tests were able to continue - while members of the team also volunteered for the wider clear-up effort and distribution of food and drink to those affected by the giant storm.

The tests appear to have been a complete success, with JSC test project manager Jonathan Homan commenting: "With an integrated team from all corners of the country, we were able to create deep space in our chamber and confirm that Webb can perform flawlessly as it observes the coldest corners of the universe."

Homan added: "I expect [Webb] to be successful, as it journeys to Lagrange point 2 [after launch] and explores the origins of solar systems, galaxies, and has the chance to change our understanding of our universe."

Mid-infrared instrument

While inside the locked test chamber, engineers monitored JWST with thermal sensors and specialized camera systems, checking the telescope's temperature and tracking the physical motion of its various components during the cool-down procedure.

JWST features a mid-infrared instrument (MIRI) that will be used to peer into deep space across the 5-28 μm wavelength range, and because it is highly sensitive to the thermal background requires an additional cryo-cooler to maintain an even lower temperature (just 7K) than the rest of the telescope's instruments.

Following the anticipated launch from French Guiana now scheduled for spring 2019, MIRI will observe the highly red-shifted light from very earliest and most distant galaxies, as well as much nearer but fainter comets, objects in the Kuiper belt outside our own solar system, and proto-planetary dust swirls.

To do that, MIRI is fitted with three arsenic-doped silicon detector arrays, with a pulse tube pre-cooler and a Joule-Thomson Loop heat exchanger to reach the 7 K operating temperature.

The next stage for JWST will see the equipment shipped to California for integration with the host spacecraft that will ultimately carry the telescope into orbit. Its final destination will be the "L2" Lagrange point, around a million miles from Earth but in an orbit that – along with its five-layered sunshield – will protect JWST from the light and heat of the Sun and enable it to pick up weak mid-infrared signals.

The L2 position also means that, unlike Hubble, which goes in and out of Earth's shadow every 90 minutes, Webb will have an unimpeded view of the cosmos and be able to perform scientific operations continuously.

By Mike Hatcher, Contributing Editor to optics.org

http://optics.org/news/8/11/33

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