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VRI Vlaamse Ruimtevaartindustrie Flemish Space Industries

N E W S L E T T E R

EDITORIAL

VRI and Europe

The European dimension has always been a part of VRI's activities and of its member's day-by-day life. The participation in the ESA programs is the most significant part thereof. Therefore, VRI has been an active member of the European association for SME's in space, SME4SPACE for several years now. VRI has decided to develop this segment of its activities. Up to now the Italian colleagues took the lead, but their task is not a simple one. The organization on a European level of such an industrial grouping requires an enormous engagement, which cannot only be borne by one single organization.

VRI is prepared to take up additional responsibilities and already contacted ESA HQ in Paris. For VRI this will not be an easy task either, especially now that the support of the Flemish region was withdrawn. Flanders decided not to support any longer organizations like ours. This is regretful. Even more so because we are able to prove that, through the intense cooperation between VRI members, our sector has seen a continuous strong growth. But we think that a stronger connection with related European organizations can strengthen our activity.

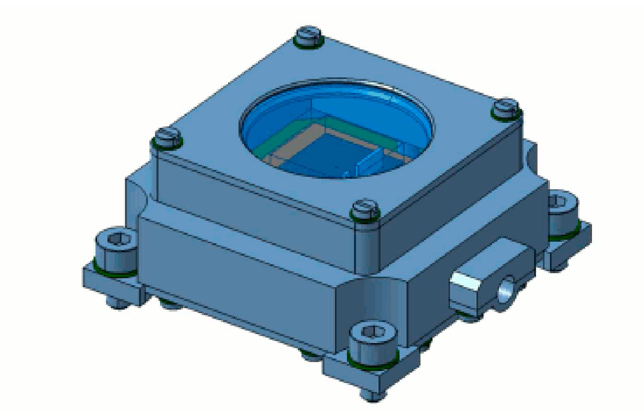
The representation of SME's within ESA and towards the European Union, needs to be strengthened.

With our limited resources and with our well-known modesty, we intend to support this.

Hans Bracquené

SUN-SENSOR-ON-A-CHIP

CMOSIS has created prototypes of a miniature high-accuracy digital sun sensor, named SSoaC: Sun Sensor on a Chip. This was for ESA (TRP 21835/08/NL/ST) and cooperating with SELEX Galileo SpA (prime contractor and responsible for the final product) and BAE Systems (optics). The motivation for this project is miniaturisation leading to smaller and lighter sun sensors that consume less energy and are more economical. In order to achieve this the project employs the integration of a large amount of functions on one IC, as well as microsystems technologies.



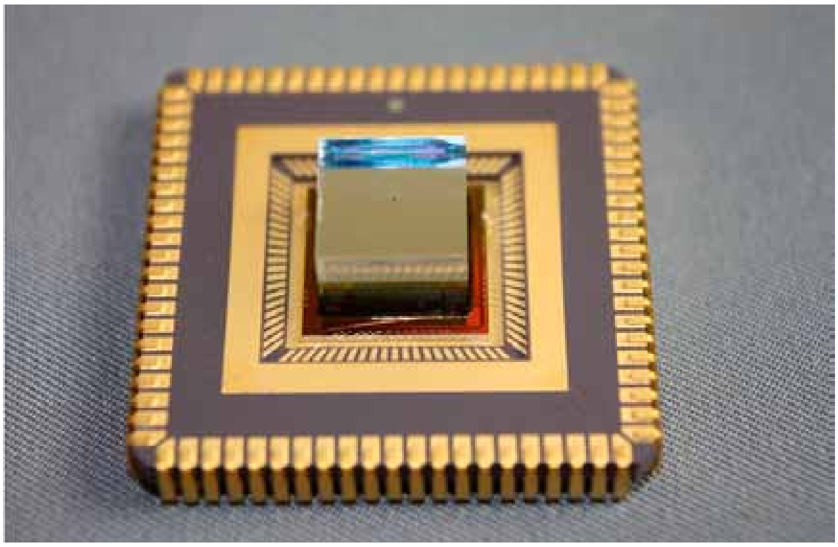
Together with star trackers and navigation cameras sun sensors belong to the optical navigation instruments on spacecrafts. A sun sensor is a visible-spectrum camera that continually images the sun, communicating its relative position to the spacecraft's attitude and orbit control system.

The CMOSIS sensor, manufactured in UMC's 0.18µ CMOS CIS technology is a veritable system-on-chip. It integrates a 512 x 512 pixel image sensor, 10-bit ADCs, digital signal processor, SpaceWire and UART telecommand and telemetry interfaces, three voltage regulators, a clock oscillator, and LVDS transceivers. It is highly tolerant of gamma radiation and all types of single event, thanks to specialist circuit layout techniques and redundancy in the analogue domain, and to IMEC's radiation-hardened standard cell libraries for its logic and IO cells.

The SSoaC chip requires only an external 5V supply voltage (it tolerates up to 6.7V!), a clock crystal, and a few passive components. It detects the sun in a conical field of view of 128° and autonomously keeps track of that star, even when tumbling at a rate of up to 600°/s. This enables the SSoaC's use on spin-stabilised satellites. The chip calculates the sun image barycentre to an accuracy of 16 bits, or better than 0.05°. Advanced and robust detection algorithms render the sensor insensitive to bright objects in its field of view, such as earth, space craft parts, or proton and ion impacts. Power consumption is limited to 200 mW, even at the highest update rate of 80 images per second.

The optics comprises of a pinhole in a glass/titanium/glass sandwich. It is directly bonded onto the silicon chip by BAE Systems' Advanced Technology Center in Bristol, using MEMS techniques (Micro-Electro-Mechanical-Systems). This assembly task is done manually on each individual prototype, but future production versions will employ wafer-scale bonding, thus reducing the part's cost even more.

SELEX Galileo in Florence developed a miniaturised instrument housing smaller than 45 x 45 x 22 mm and 60



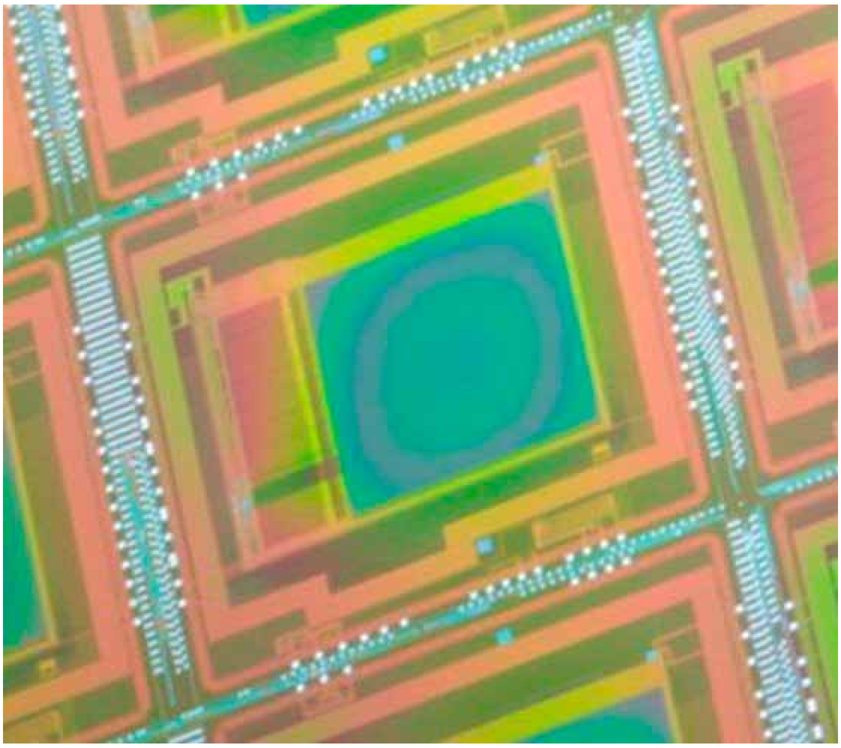
grams. SG is also responsible for the overall sun sensor product, including final assembly and characterisation.

Through its significant reduction of dimensions, mass, power, and cost the SSoaC now allows for the first time to deploy high-accuracy sun sensors on small platforms such as nano-satellites and planet rovers. It can also serve redundant configurations on larger spacecraft.

Presently the performance of sensor chip prototypes with integrated optics is being evaluated. In a next stage an industrialisation process will be started. This includes the evaluation and qualification of the SELEX Galileo instrument, including the CMOSIS chip.

To CMOSIS' design engineers this activity is the latest step in the conquest of space by CMOS active pixel sensors, an evolution they helped to start back in 1997, while still at IMEC.

More information: **www.cmosis.com**



CMOS SENSORS CONQUER NEW MARKETS

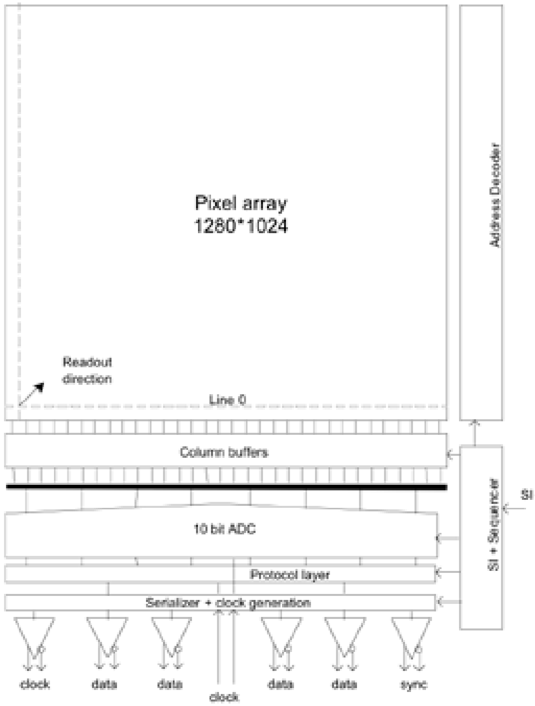
Cypress VITA family sets new throughput standards for CMOS image sensors

There is a broadening range of demanding new applications that are opening up exciting opportunities for well-designed CMOS image sensors. Besides high-end machine vision there are 2D barcode readers, the rapidly growing high-end security market, and a new breed of intelligent traffic management systems. All of these are addressed by the new Cypress VITA family offering configurability and various different operating modes, such as a pipelined and triggered global shutter as well as a conventional rolling shutter with correlated double sampling (CDS) correction to reduce noise and increase the dynamic range.

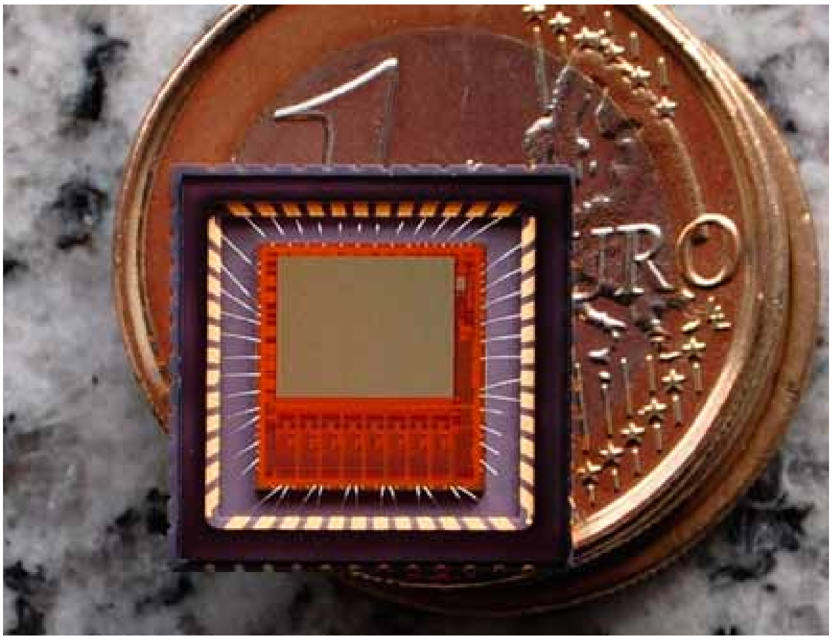
The VITA family is based on a common platform design principle – all major functional blocks such as pixel layout, column structure, PGA, ADC and LVDS, are found in all four products comprising the VITA family. Additional features include:

- automatic exposure control
- multiple ROIs
- optional parallel output
- PLL
- charge pump
- programmable biasing.

Figure 1 shows a block diagram of the 1.3 megapixel sensor VITA1300. The central pixel array is surrounded by a timing/interface frame, which controls the image capture functions, and by an analog front-end, which samples the pixel data and performs the analog-to-digital conversion and output sequencing.



1. VITA 1300 block diagram



2. Photograph of the VITA 1300 CMOS sensor housed in the 48-LCC

The pixel array consists of 4.8μm square pixels arranged in a standard SXGA (1280 x 1024) matrix. This layout provides a 1.3 megapixel resolution in an industry-standard 1/2″ optical format.

Currently, there are four sensor configurations available. As listed in Table A, the VITA2000, 5000, and 25K are expansions of the VITA1300 specs – in regard to resolution, frame rate, optical format, number of LVDS outputs, pixel size (4.5 x 4.5μm_ in the high-end 25K), as well as power consumption. They are packaged in ceramic LCCs, except for the 25K, which comes in a ceramic mPGA. A smaller-size Chip Scale Package (CSP) version is under development for VITA1300.

SPEC/Type	VITA 1300	VITA 2000	VITA 5000	VITA 25K
Resolution (x, y)	1280 x 1024	1920 x 1080	2592 x 2048	5210 x 5120
Pixel	Global / Rolling	Global / Rolling	Global / Rolling	Global / Rolling
Pixel size	4.8µm	4.8µm	4.8µm	4.5µm
Frame rate	150	100	75	53
Optical format	1/2"	2/3"	1"	35 mm
# LVDS outputs	4	4	8	32
Power	400 mW	450 mW	600 mW	3.5 W
Package	48-LCC / CSP	52-LCC	68-LCC	355µPGA

Table A: VITA family features and data

EUROSENSE MEASURES THE IMPACT OF NATURAL HAZARDS ON A EUROPEAN SCALE

The Flood Risk Analysis services of EUROSENSE offer several customized services consisting in the production and maintenance of geo-information to support decision making in flood risk management duties. In the frame of the SAFER (Services and Applications For Emergency Response) project this portfolio was extended with multi-risk services applicable on a European scale. This delivered geo-information is indispensable in all phases of the risk management cycle and for all kinds of risk and emergency situations.

Over the last decades many regions in Europe have suffered from natural hazards. Disasters like e.g. floods, fires, and earthquakes are affecting people more than ever. The threatening of human life and property enhances the need of an effective risk management. Earth Observation (EO) maps and services can support the multiple phases of disaster management (prevention, early warning, in-crisis or post-crisis).

The "multi-risk concept" of EUROSENSE comprises the mapping of the impact, the affected people and socio-economic losses caused by natural hazards. These assets maps are indispensable to support decision making and prevention measurements in risk management. Figure 1 illustrates this multi-risk concept. The development of these assets maps meets different challenges: ensure (i) the harmonization at European level and outside the EU, (ii) the multi-risk transferability, and (iii) the delivery of dynamic multi-media or multi-format products to interact with users. The potential damage can be expressed in several ways: either quantitative (e.g. economical damage and affected people), or qualitative by analysis of the impact (e.g. on the environment).

The concept consists of 3 scales of generic products: pan-European, regional and local.

The pan-European level combines 3 European-wide harmonized and comparable input data: land cover maps (Corine), national statistics (Eurostat) and street map data. The basic European assets map is compatible with "rapid mapping" products which quickly present the impact of the disaster event during the crisis phase. In combination with the basic assets map they give an estimation of the affected people and the economical damage, useful for crisis management actors to indicate priority zones.

The regional assets map uses regional land use data (e.g. Urban Atlas), regional statistics and a critical infrastructure database (power plants, hospitals, refineries, etc). This assets product should mainly be used in prevention phase and post-crisis. This product also estimates the impact on the environment, cultural heritage and political infrastructures.

The third product is a very detailed assets map including data on social classes, language and crisis behaviour.

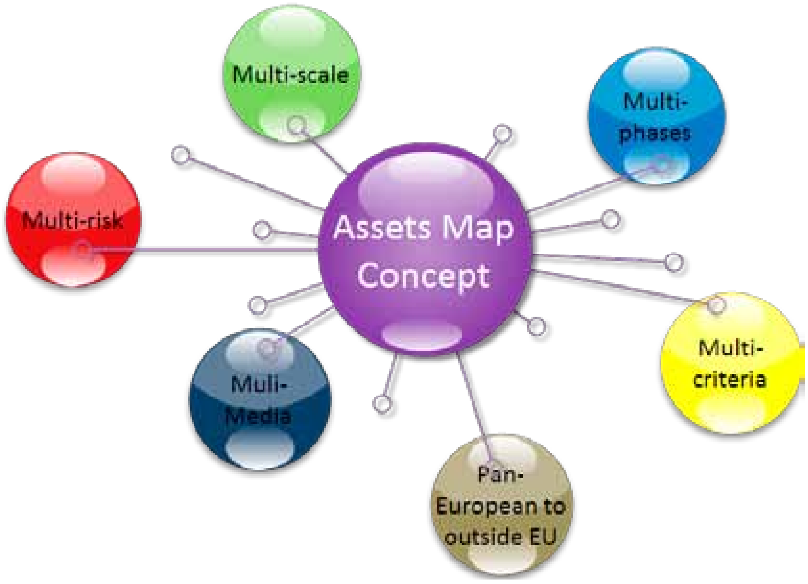


Figure 1: Multi-risk concept

The described products are produced in the frame of the GMES-project (Global Monitoring for Environment and Security) SAFER, funded by EC (European Commission). SAFER will reinforce the European capacity to respond to emergency situations: fires, floods, earthquakes, volcanic eruptions, landslides, humanitarian crisis. Referring to the recent floods (July 2010) in the Siret basin in Romania, the SAFER products of EUROSENSE will be further developed for this region. Besides SAFER, EUROSENSE is actively involved in several other GMES-projects including the development of the European Urban Atlas product (Geoland2).

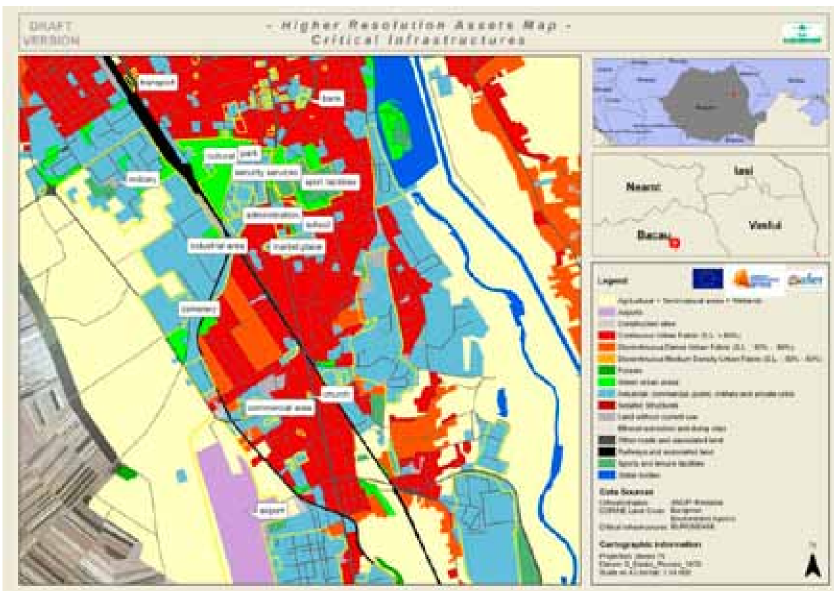


Figure 2: Regional assets map product based on detailed land use data (Urban Atlas) and critical infrastructures

SODI

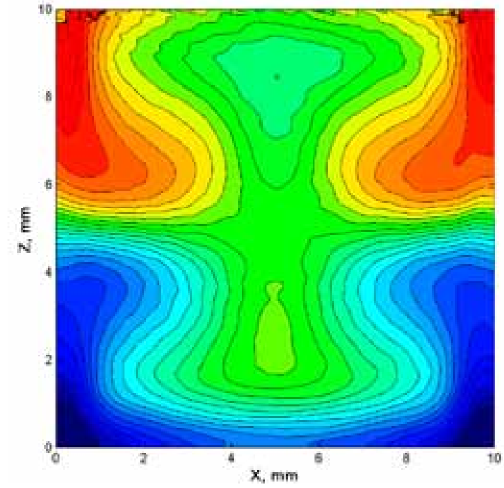
QinetiQ Space nv

Since the integration of the SODI experiment on the ISS, performed by Belgian astronaut Frank De Winne and his colleague Robert Thirsk in October 2009, two of the three experiments have been conducted. The scientific results are currently being studied by the Science Teams but the results are exceeding the expectations to a point where additional scientific experiments on the SODI hardware is being envisaged.

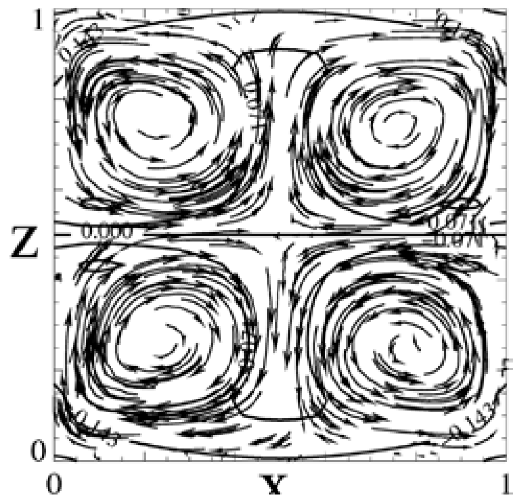
SODI, short for Selectable Optical Diagnostics Instrument, is a fluid science experiment. It actually consists of three sub-experiments: IVIDIL, COLLOID en DSC.
The main SODI hardware, together with the IVIDIL experiment cells, was uploaded to the ISS by Space Shuttle on August 29th 2009. It was integrated into the Microgravity Science Glovebox (MSG), a located in the European Columbus module, by Frank De Winne and his Canadian colleague Robert Thirsk. In January 2010, when the SODI-IVIDIL experiment ended, nearly 200 Gb of scientific data was acquired. It mainly consists of interferometric images of the scientific liquids in the experiment cells while these were exposed to temperature gradients in combination with acceleration forces. Investigated by the SODI-IVIDIL experiment are the effects of heat and mass transfers under vibrations and precise measurements of diffusion and thermo-diffusion coefficients in binary fluid mixtures. The processing of the raw science data is still ongoing at the ULB (MRC), but the first results provide evidence of the correctness of the theoretic models.

Frank De Winne during the integration of SODI in MSG

SODI-IVIDIL in MSG



(IVDIL experiment onboard ISS, run #13). The concentration field is perturbed by vibrational convection.



(numerical results) The flow pattern in the middle of the cell produced by vibrations (velocity shown by arrows)

SODI-COLLOID is the second experiment in line and was finished September of this year. A team of the University of Amsterdam uses this experiment to study the aggregation of colloids in a liquid. The scientists use the so called Casimir effect (an effect similar to known quantum effects) to regulate the attraction between particles in the liquid. One of the results are so called photonic crystals, which play an important role in the extremely fast optical computers of the future.

The last experiment, SODI-DSC, is used to determine the diffusion coefficients of liquid mixtures. This information is important to determine the quantities of remaining crude oil in the terrestrial underground. The SODI-DSC experiment is planned to start in 2011.

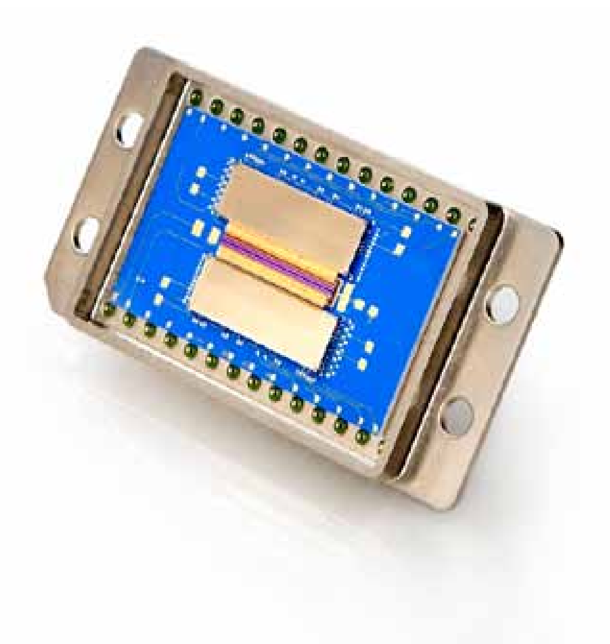
The SODI hardware includes a powerful computer allowing real time analysis of the images taken from the experiment liquids. This allows the instrument to detect specific phenomena (like phase separation) in the liquid. In this way, the instrument is able to learn at what temperature regions the interesting phenomena take place and can perform detailed investigations in that region. Imaging techniques used are Mach-Zehnder interferometry, Digital Holography and Near Field Scattering.

The SODI hardware was developed and build by QinetiQ Space, with Lambda-X from Nivelles as subcontractor for the optics.

A NOVEL HIGH RESOLUTION INGAAS LINE-SCAN CAMERA FROM XENICS CONQUERS MANY APPLICATIONS IN THE NEAR INFRARED

D. De Gaspari and K. Jacobs

Xenics, involved in several space projects such as Proba-V, is responsible for the design and development of the short-wave infrared detectors. A development which is a particular technical challenge supported through ESA's General Size and Technology Program (GSTP). Proba-V ("V stands for Vegetation) will fly a reduced-mass version of the Vegetation instrument currently on board SPOT satellites to provide a daily overview of global vegetation growth. To match the Vegetation instrument's 100° field of view, a total of three very long linear detectors of 1024 pixels each have been designed. These detectors are mechanically butted together to have a slight 80 pixel overlap. The detectors are made from indium gallium arsenide, which delivers high sensitivity without the need for active cooling.



Based on these newly developed high-resolution linear sensors, a novel standard NIR camera platform "Lynx" has been introduced.

The camera marks a breakthrough in simplification and cost reduction for NIR technology, which opens numerous applications in the realm of industrial manufacturing. The GigE Vision compatible Lynx camera is perfectly suited for scientific, machine vision, spectroscopy and Optical Coherence Tomography (OCT) applications. Practically all these applications require high line-rate sensors, that are compatible with high resolution and low noise combined with high dynamic range.

The Lynx camera is capable of providing all these features. It comes with either a 512, 1024 or a 2048 pixel arrays at a line rate of 40 kHz (10 kHz for the 2048 pixel array) and with an extremely small pixel pitch (merely 12.5 µm), which enables more accurate inspection and smaller particle detection at wavelengths where visual camera's (based on CMOS or CCD) have no sensitivity. It can be combined with a thermo-electric cooler (TEC) of up to 3 stages, offering low dark-current, and consequently high resolution combined with a high dynamic range.

Up till now, these resolution levels could only be obtained using complex multi-camera solutions. Use of the Lynx not only makes these types of setups simpler, but also much cheaper than before.

www.xenics.com