



## 4th Executive Infrared Imaging Forum

### DRAFT PROGRAM

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### Yole Développement

Eric Mounier

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*With almost 20 years of experience in MEMS, Sensors and Photonics applications, markets, and technology analyses, Eric Mounier, PhD provides deep industry insight into current and future trends. As a Fellow Analyst, Technology & Market, MEMS & Photonics, in the Photonics, Sensing & Display division, he is a daily contributor to the development of MEMS and Photonics activities at Yole Développement (Yole), with a large collection of market and technology reports as well as multiple custom consulting projects: business strategy, identification of investments or acquisition targets, due diligences (buy/sell side), market and technology analysis, cost modelling, technology scouting, etc.*

*Previously, Eric Mounier held R&D and Marketing positions at CEA Leti (France).*

*He has spoken in numerous international conferences and has authored or co-authored more than 100 papers.*

*Eric has a Semiconductor Engineering Degree and a Ph.-D in Optoelectronics from the National Polytechnic Institute of Grenoble (France).*

### Evolution of the uncooled IR landscape

In 2018, 1.4M uncooled IR cameras were sold, a number expected to increase at a 15% compound annual growth rate through to 2024. This growth is mostly driven by legacy thermography, surveillance and defense markets, in conjunction with the dramatic increase of thermal camera use in firefighting and personal vision systems (PVS).

It is also noteworthy that China is investing in R&D and ramping up microbolometer production in order to address its domestic thermal imaging market. How things will roll out in the future?

Moreover, thermal cameras for automotive applications caught a lot of attention at CES 2019. Either for safety or redundancy (complementarity with other sensors), there is clearly a trend in the making.

From detector to lens and finally to the full system, we will give an overview of the uncooled IR camera market, in order to better understand the ecosystem. See you at the CIOE IR executive forum!

### LYNRED

Aurélien Dariel

*Product Marketing Manager*

*Aurelien DARIEL, graduate engineer in Physics in 1998, joined Sofradir 13 years ago as project manager for the development of infrared detectors for space applications. He is now Product Marketing Manager in charge of infrared uncooled products at LYNRED*

## **The smallest VGA/12-micron thermal image sensor, designed for SWaP applications with volume production capabilities**

Sofradir and ULIS have just merged to form LYNRED. Thanks to this large heritage in infrared sensors, LYNRED can bring the most advanced infrared solutions on the market.

LYNRED has developed Atto640TM, the world's smallest VGA/12-micron uncooled thermal image sensor to address SWaP (Size, Weight and Power) reduction requirements across the full range of commercial and defense thermal image applications and to respond to market growth. Based on WLP (Wafer Level Packaging) and 12 µm pixel technologies which are key issues for making compact thermal imaging systems, Atto640TM is designed for volume manufacturing, and provides a larger format to the existing QVGA 12-micron Atto320TM detector.

Atto640TM is ideally suited for Leisure and Surveillance applications, but also for ADAS (Advanced Driver Assistance System). This presentation details benefits for these applications.

## **FLIR Systems**

Ted Hoelter

*VP of Engineering*

*Ted Hoelter is the Vice President of Engineering in FLIR's Industrial Business Unit, responsible for detector, ROIC and camera core design functions for both microbolometer and cooled focal plane arrays. Since joining FLIR in 2003, via FLIR's acquisition of Indigo Systems, Ted has held the positions of Systems Engineer, Systems Engineering Director, and Chief Scientist reporting to FLIR's CTO. Prior to joining Indigo Systems in 1998, Ted worked for eight years at Amher Engineering, a Raytheon company, where he worked in various engineering roles on*

## **Thermal Cameras for Safer Cars**

>600,000 FLIR thermal sensors have been deployed in cars by Veoneer to extend the driver's vision 4x farther than their headlights illuminate. This talk will illustrate how thermal cameras complement the other sensors in automotive applications and introduce the machine learning and simulation work that FLIR has done to jump start the widespread adoption of thermal cameras as standard equipment in automotive safety application such as automatic emergency breaking.

## **Heimann Sensor**

Joerg Schieferdecker, PHD

*CEO*

*Jörg Schieferdecker, CEO and co-founder of Heimann Sensor GmbH, started his infrared career 39 years ago at the Dresden University of Technology. Dr. Schieferdecker has worked for Heimann Sensor, EG&G Heimann and WF Berlin for 35 years in the fields of Infrared sensor development and management. He received a PhD for microelectronics and a PhD for infrared Sensors at Dresden University of Technology. During its business career Jörg Schieferdecker became author of over 80 patents. He developed and brought into mass production the world first batch manufactured Silicon Thermopile Sensors and first monolithic thermopile array sensors.*

*His ambition in Heimann Sensor is, to bring every year at least one technology leading product to the world market.*

*He was born Jan. 17th in 1956, is 41 years married and has two daughters and four grand kids. In his spare time he enjoys outdoor activities like mountain marathons, skitours, rock climbing, mountainbiking and climbing high mountains. He acts in voluntary functions for the local German Alpinistic club in Wiesbaden.*

## **New Thermopile Arrays for Thermal Imaging, Person detection, building control and security applications**

The recent progress in technology allows high volume production of lower resolution thermal arrays at low unit costs. Thermopiles benefit from a particularly easy monolithic integration of the IR-sensitive pixels into the CMOS-Si-Technology and do not require any mechanical choppers or shutters for ambient drift compensation.

This paper introduces the family of digital thermopile arrays from 8x8, 16x16, 32x32, 80x64 pixels completed by a new 120x84 pixel array.

The thermopile arrays can be packaged both in vacuum tight housings for applications needing highest thermal resolution (e.g. medical applications) and in a package at atmospheric pressure for high volume applications (e.g. low cost imaging, person detection, IoT, HVAC and mobile applications).

The digital output reduces the number of necessary connections: 4 pin housings with I<sup>2</sup>C interface are sufficient for 8x8, 16x16 and 32x32 arrays, while the 80x64 and 120x84 arrays with SPI interface are packaged in a 6-pin housing.

Thanks to integrated 16 Bit AD converters on-chip the sensor arrays can be operated with high frame Rates up to 50 Hz and allow wide dynamic ranges with object temperatures up to 1000 °C.

All thermopile arrays and array modules are equipped with an infrared optics. These infrared optics are designated for the required field of view in the application. e.g. from 12-18 deg FOV for far distances up to 120x90 deg FOV for ultra wide field of view.

## **System Plus Consulting**

Romain Fraux  
CEO

*Romain Fraux is the CEO of System Plus Consulting (part of our Yole Group of companies), that focuses on Reverse Costing analysis of electronics, from semiconductor devices to electronic systems.*

*Supporting industrial companies in their development, Romain and his team are offering a complete range of services, costing tools and reports. They deliver in-depth production cost studies and estimate objective selling price of a product, all based on a detailed physical analysis of each component in System Plus Consulting laboratory.*

*Romain has been working for System Plus Consulting for more than 12 years and was previously the company's CTO.*

*He holds a bachelor's degree in Electrical Engineering from Heriot-Watt University of Edinburgh (Scotland), a master's degree in Microelectronics from the University of Nantes (France), France and a Master of Business Administration.*

### **Uncooled IR imagers: Structural and cost review of low-cost solutions**

Over the past ten years, the uncooled infrared (IR) imaging market has been driven primarily by defense applications. The cost/performance ratio has not yet opened the way to consumer applications. However, this is changing. Manufacturing costs are decreasing, with the introduction of new manufacturing processes such as wafer level optics, wafer level packaging, and silicon lenses.

Where the market demands small arrays below 32x32 pixels, microbolometers are not cost competitive, so thermopile and pyroelectric sensor suppliers are growing in this market segment.

Based on pictures extracted from physical analyses of several microbolometers and thermopiles, the presentation will highlight the latest trends and the evolution in term of manufacturing process and package integration, with a focus linked to miniaturization and cost reduction.

### **Hangzhou Hikvision Digital Technology Co., Ltd**

Ling Zailong

*General Manager of Thermal Department*

### **Presentation of thermal technology, product and market trend**

The market is promising, do not focus on the competitive landscape reshaping and market share distribution only, all we need is to play advantages, sincerely cooperation and open up the future together

### **Ningbo Sunny Infrared Technologies Co.,Ltd**

Xueren Wang

*R&D Manager*

*Xueren Wang is graduated from University of Waterloo with a master degree. He is now the R&D manager of Ningbo Sunny Infrared Technologies who's mainly in charge of pre-research team in R&D department. He joined the Sunny Infrared since 2017 and rapidly extended the regular product line. Until now, he has published 4 papers and submitted 2 patents. With his contribution, Sunny Infrared has built a professional R&D pre-research team with rapid response and comprehensive ability, which established great influence on market sales share.*

## **Challenges and breakthroughs of compact thermal imaging lenses**

At present, the industry-recognized WLO technology mainly solves the problem of small-diameter ( $<5\text{mm}$ ) and large-volume lens manufacturing to achieve cost reduction. At present, there is not such a huge demand in the entire far infrared field. Civil infrared technology is mainly used for temperature measurement, security, car night vision, sighting and consumer products. The market is relatively scattered and the single product capacity is small, which is not enough to support the mass production of WLO technology, while SWLO technology can just make up for the shortcomings. Through the research on the exhaust technology in the molding process, the problem of unstable and inefficient lens quality of vacuum molded lens is solved; Design and develop the corresponding mold processing technology to ensure that the lens meets the design index requirements, while reducing the mold cost and processing cost; in addition, the single-mode and small-quantity technical features can effectively reduce the start-up cost of WLO molding, thus effectively filling the demand in small and medium batches. The market space under the molding.

