EPIC Online Technology Meeting on Photonics for Defense – Active and Passive Imaging Systems

LIDAR-based sensor for detection of small cross-section targets in complex scenarios

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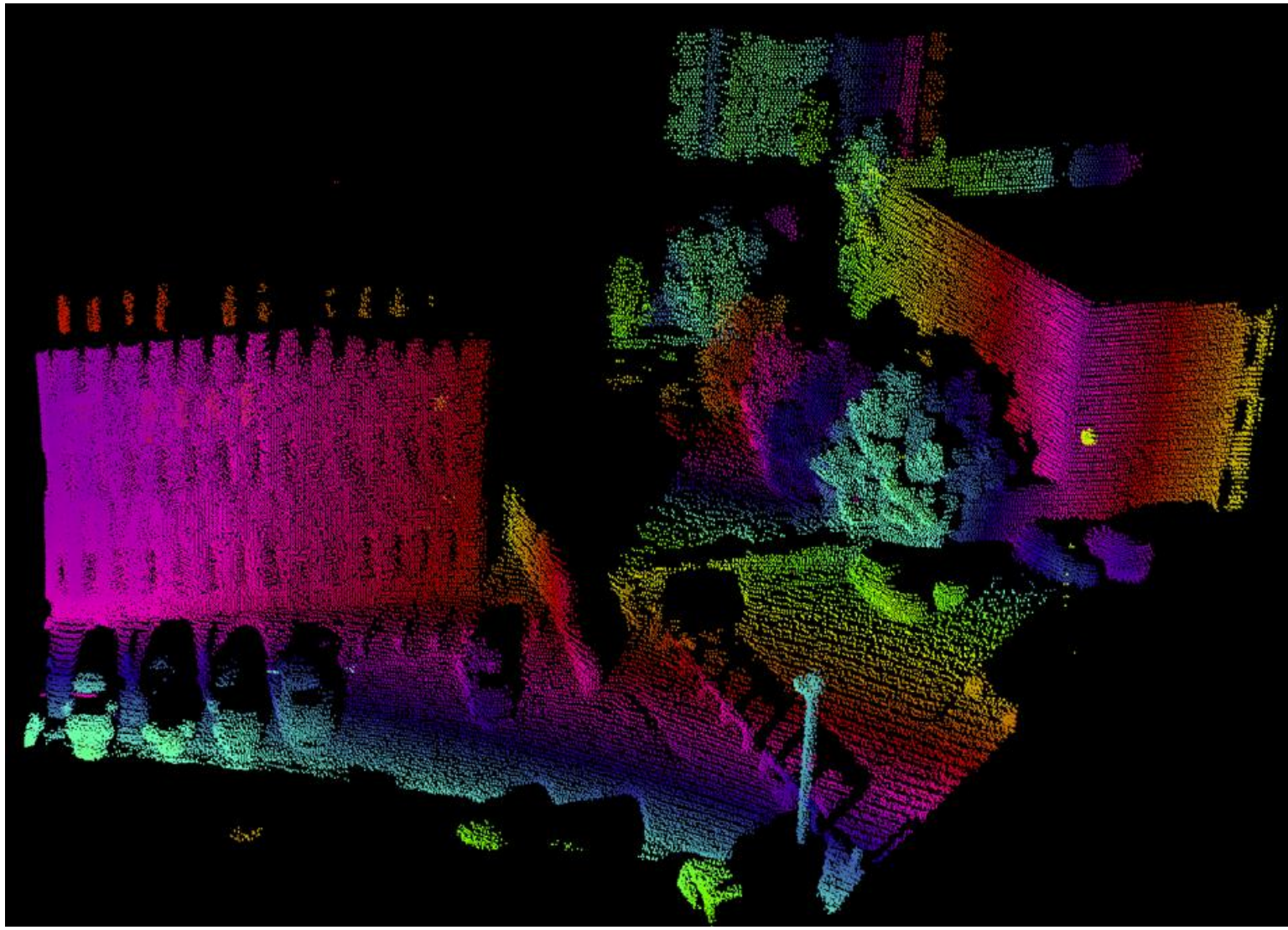
3D LIDAR imaging



PRODUCT: Multimodal perception system

AT A GLANCE:

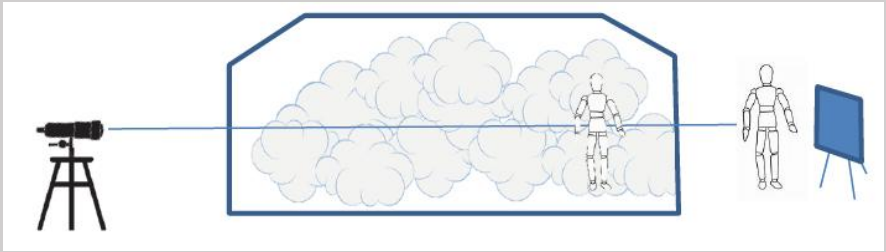
- System composed by **three imaging modes**:
  - High-res solid-state 3D LIDAR (patented)
  - RGB camera
  - Thermal camera
- Embedded **data fusion** in-house calibrated
- Embedded **AI-perception** software for automatic object detection
- Due to the triple imaging approach:
  - Minimum **false alarms**
  - Performance guaranteed in **all environmental** conditions: day/night or bad weather (rain, snow, dust and smoke)

Example use cases

DEFENSE:

Polarized LIDAR for object detection though degraded visual environments

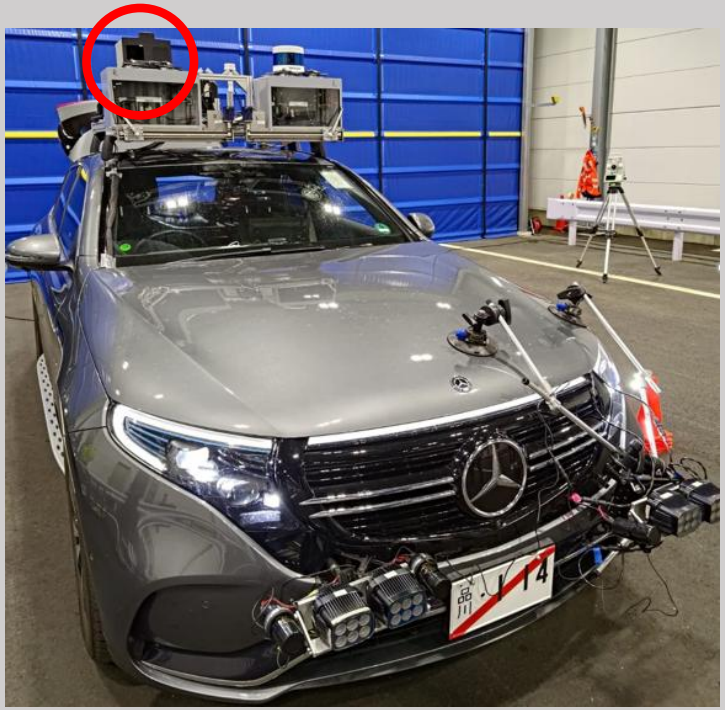
Design of a L3CAM LIDAR combined with active polarimetric imaging for enhanced situational awareness into fog and smoke.



AUTOMOTIVE:

Long-range LIDAR for penetration into challenging environments

Design of a L3CAM LIDAR with controllable polarization states for penetration into fog and smoke.

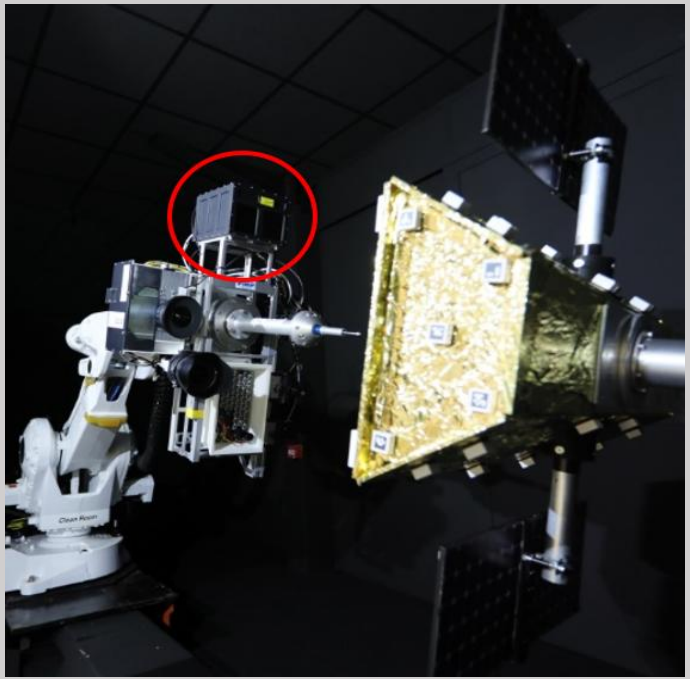


Example use cases

SPACE:

Development of a space qualified solid-state LIDAR for orbital servicing.

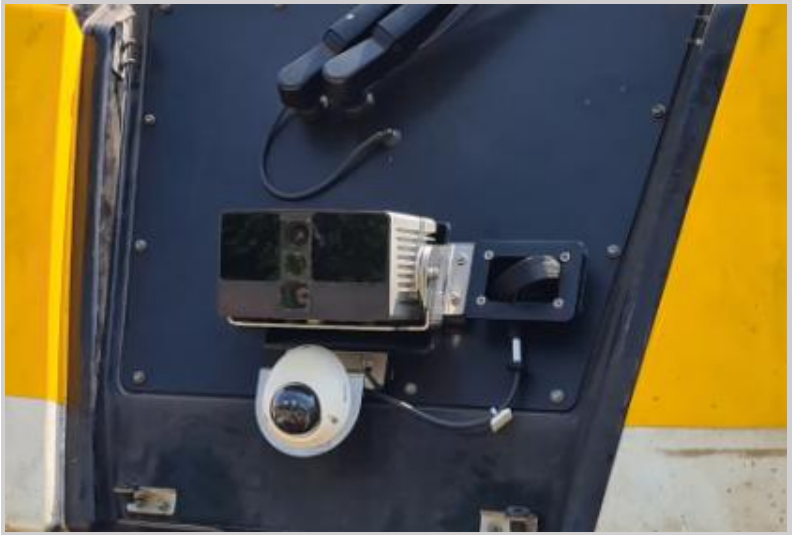
Design based on the L3CAM technology. Redesign for fail-safe operation and space standards.



RAILWAY:

Development of a multisensory platform for Railway Autonomous Shunting and obstacle detection applications

The project focus on the design of a custom multisensory unit that joints high-resolution LIDAR with multiple cameras (RGB and LWIR)

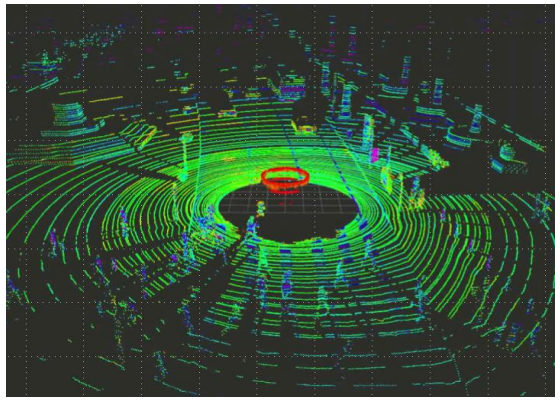


Why LIDAR for small targets?

- Reliable in complex urban scenarios

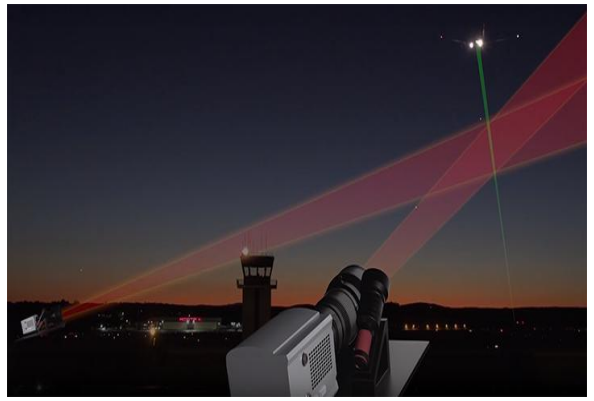
- Compatible with a moving platform

- 360º with a single unit



- Small cross-section targets
- Multi-target compatible
- Static and moving

- Moderate LPD/ Low LPI
- Low SWaP

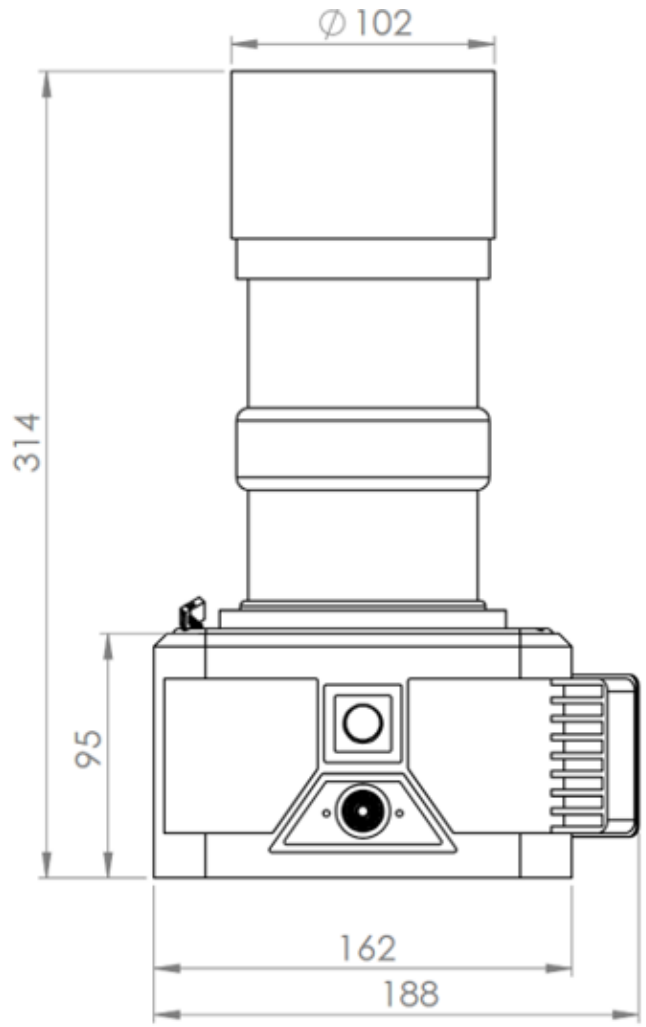


- Wavelength agnostic
- Long ranges (km attainable)

Technology comparison

	PROS	CONS
LIDAR	• Reliable with complex scenarios • Static and moving targets • Low LPI, resistant to jamming • Low SWaP and 360º	• Affected by fog • Range limited to few km • Less mature technique
RADAR	• 360º with a single unit • Long range possible • Fog penetration	• False detections in complex scenarios • High LPD/LPI • Susceptible to jamming
EO	• Passive solution -> good LPD/LPI • Very high spatial resolution • Mature technology	• 360º only with multiple units • No range information • Sensitive to fog

AD2501 specs



OPTICAL PERFORMANCE

LIDAR	
FOV	360 x 20 deg [HxV]
Point cloud spatial resolution	1000 x 300 px [HxV]
Angular resolution	0.36 x 0.067 deg [HxV]
Range *(Target diameter = 0.35m)*	500m @ 10% object reflectivity 1100m @ 50% object reflectivity
Angular sampling accuracy	< 0.01 deg
Point rate	600 KHz
Frame rate	2 Hz
Laser product class	Class 1 per IEC 60825-1:2007 & 2014
Range accuracy	±2 cm
Number of returns	4
Laser wavelength	1030 nm
Laser beam divergence	0.08°

MEMS-based beam steering patented concept

Development roadmap

IDEA CONCEPTION

Conceptual design and business case analysis

DEVELOPMENT STARTS

AD2501 Prototype development

PATENT

AD2501 PRODUCTION

Fabrication, integration and testing of the demo prototype

DEMONSTRATION PHASE (*)

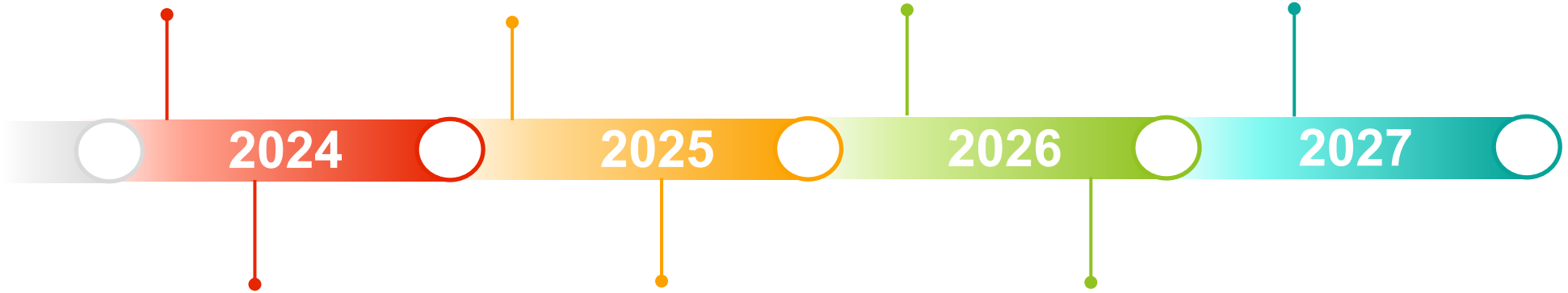
Demos to customers, stakeholders, proof-of-concept in different environments

INDUSTRIALIZATION

Demos to customers, stakeholders, proof-of-concept in different environments

COMMERCIALIZATION PHASE

TRL9 achieved
Certifications
Commercialization

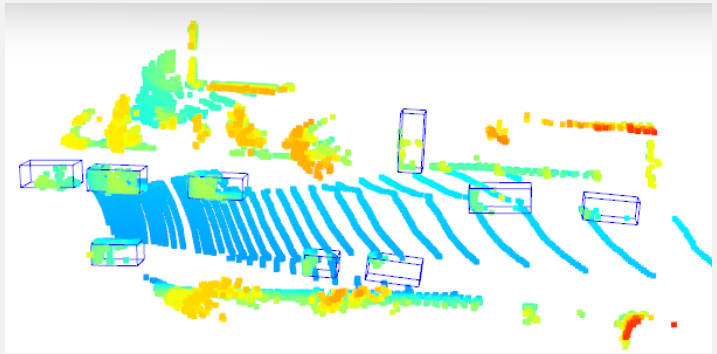


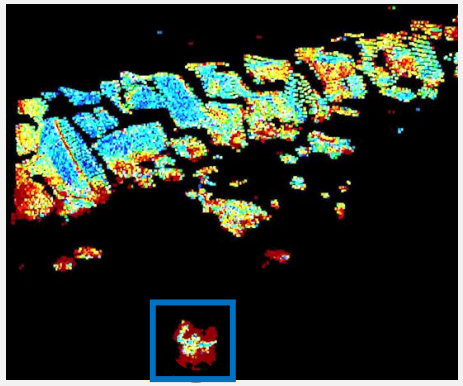
(*) Searching demos and POC with customers in the civil and defense markets

Multimodal UAV DRI+T

TRACKING + DETECTION

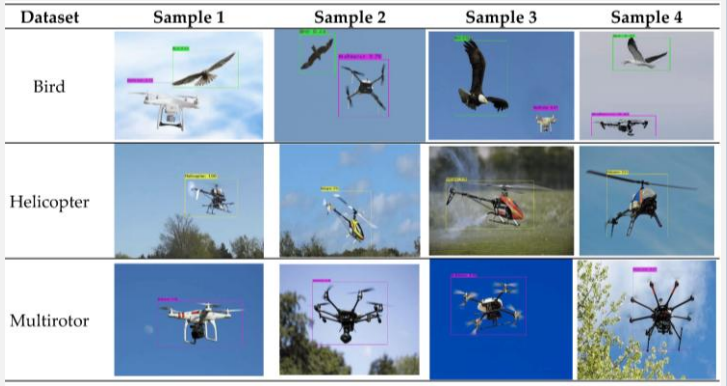
LIDAR 3D
High-density 3D data



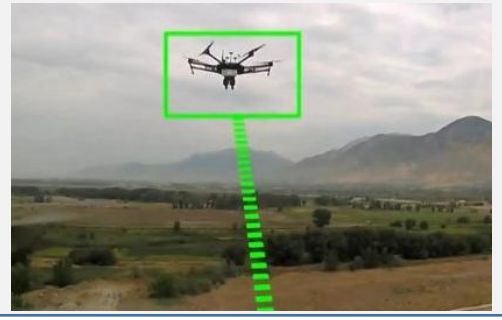


RECOGNITION + IDENTIFICATION

2D IMAGES
High-resolution complementary data

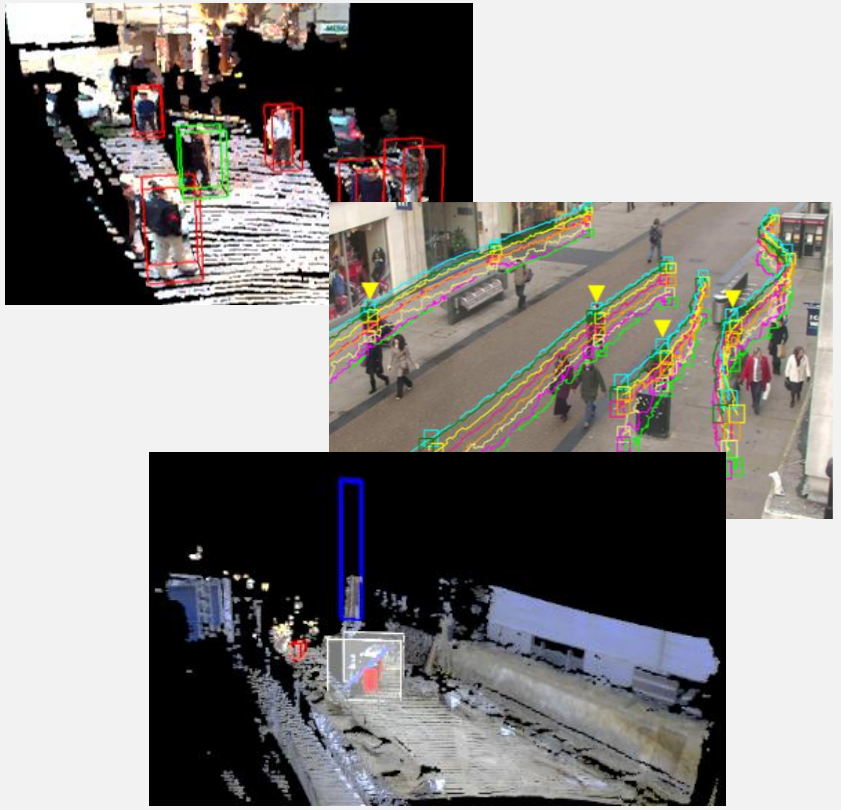


Source: *Samadzadegan, F., Dadrass Javan, F., Ashtari Mahini, F., & Gholamshahi, M. (2022). Detection and Recognition of Drones Based on a Deep Convolutional Neural Network Using Visible Imagery. Aerospace, 9(1), 31.* https://doi.org/10.3390/aerospace9010031

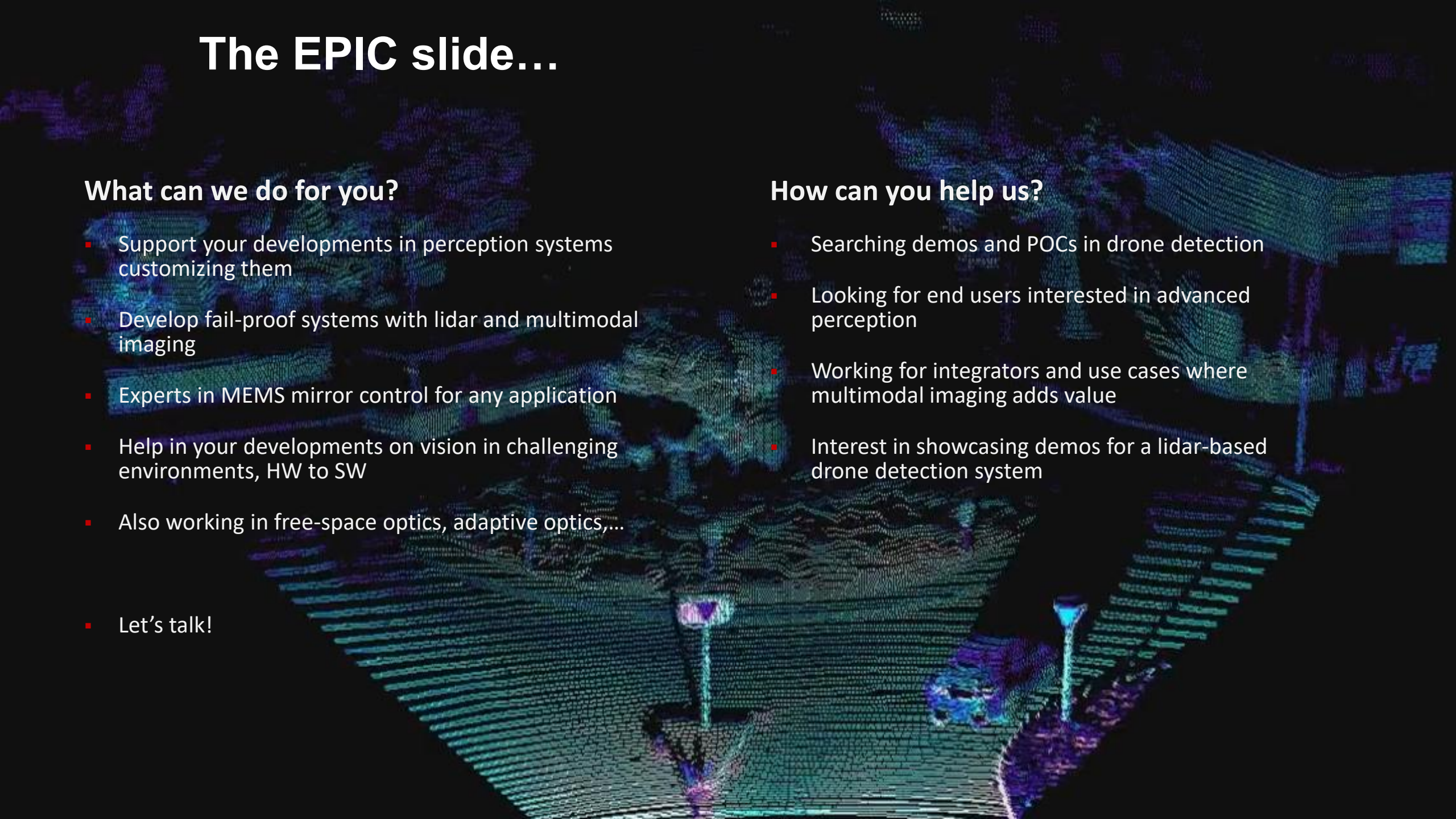


ROBUST AI-BASED DRI+T PERCEPTION

3D + 2D FUSION
All sensors benefits



The EPIC slide…



What can we do for you?

- Support your developments in perception systems customizing them
- Develop fail-proof systems with lidar and multimodal imaging
- Experts in MEMS mirror control for any application
- Help in your developments on vision in challenging environments, HW to SW
- Also working in free-space optics, adaptive optics,…

- Let’s talk!

How can you help us?

- Searching demos and POCs in drone detection
- Looking for end users interested in advanced perception
- Working for integrators and use cases where multimodal imaging adds value
- Interest in showcasing demos for a lidar-based drone detection system

THANKS FOR YOUR ATTENTION!

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