

Optronics and Secure Communications



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Dr. Judith Dijk

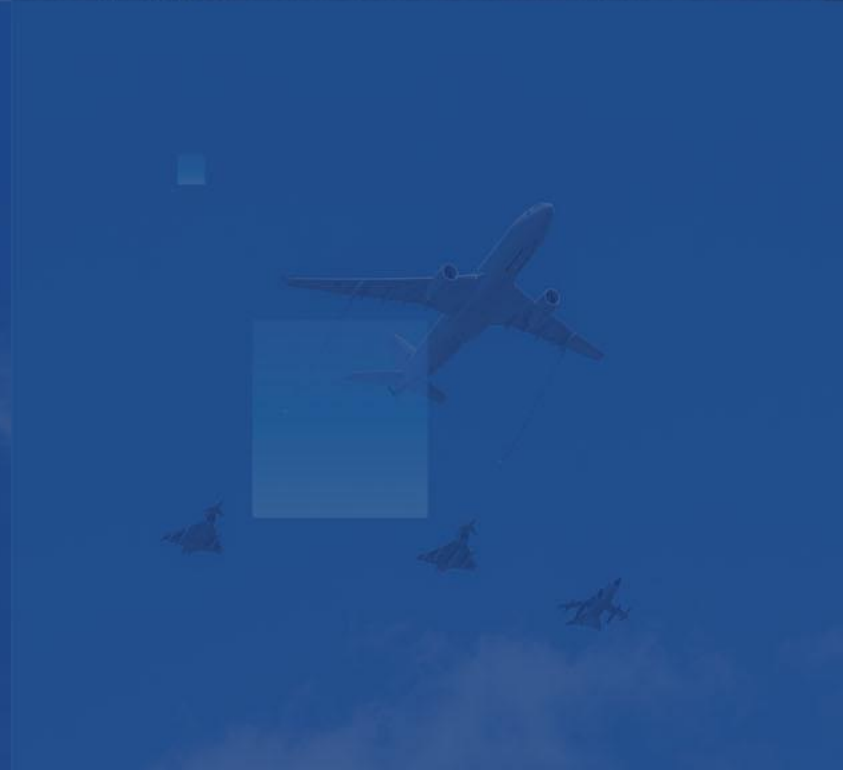
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Introduction

Optronics combines the fields of optics and electronics to detect, control, and generate light.

Applications

- **Cameras:** RGB, night vision, infrared
- **Lasers:** active imaging, laser range systems, laser weapons,
- **Communication:** fiber optics & laser communication



Trends



World-wide

- War in UKRAINE
 - Quick update cycles
 - Need for GNSS denied operation
- Dependence on non-European countries



New threats

- Autonomous systems
- Drone swarms
- Hypervelocity missiles

Applications using optronics



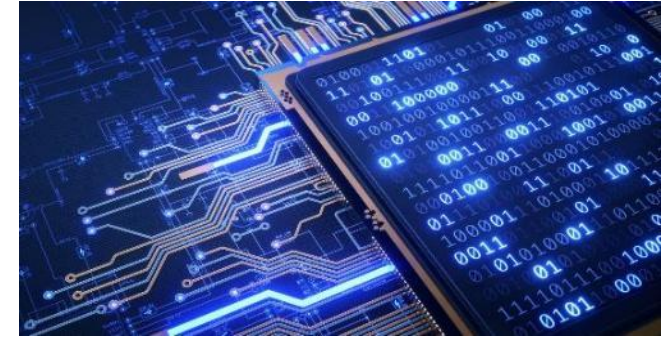
Operational Needs

- Improved Detection, Recognition, Identification for current and emerging threats
- Weapons & Countermeasures
- Visual degraded situations
- Operation on moving platforms



Technological developments

- More sensitive detectors
- New optronic systems
- Event cameras
- Polarimetric



Emerging defence technologies

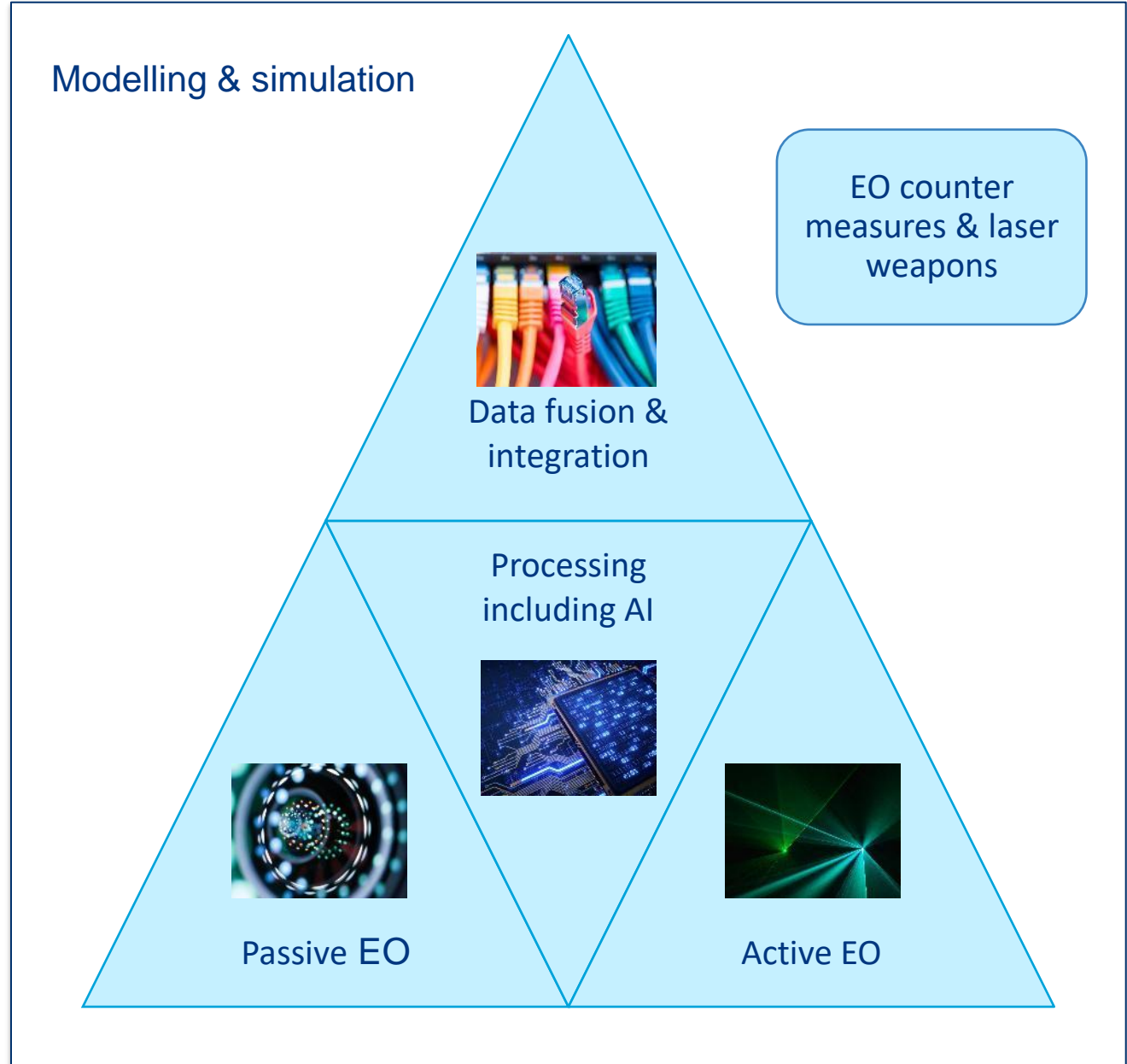
- Artificial intelligence
- Quantum sensing

CapTech Optronics

Electro-optical systems & technology

The Optronics CapTech aims to propose and coordinate R&T activities in the field of Electro-optical systems.

The results of the R&T activities will enable significantly improved defence capabilities on identified gaps in military needs



Challenges



Detection, recognition, identification and tracking of challenging targets and threats



Operating in Degraded Visual Environments (DVE)

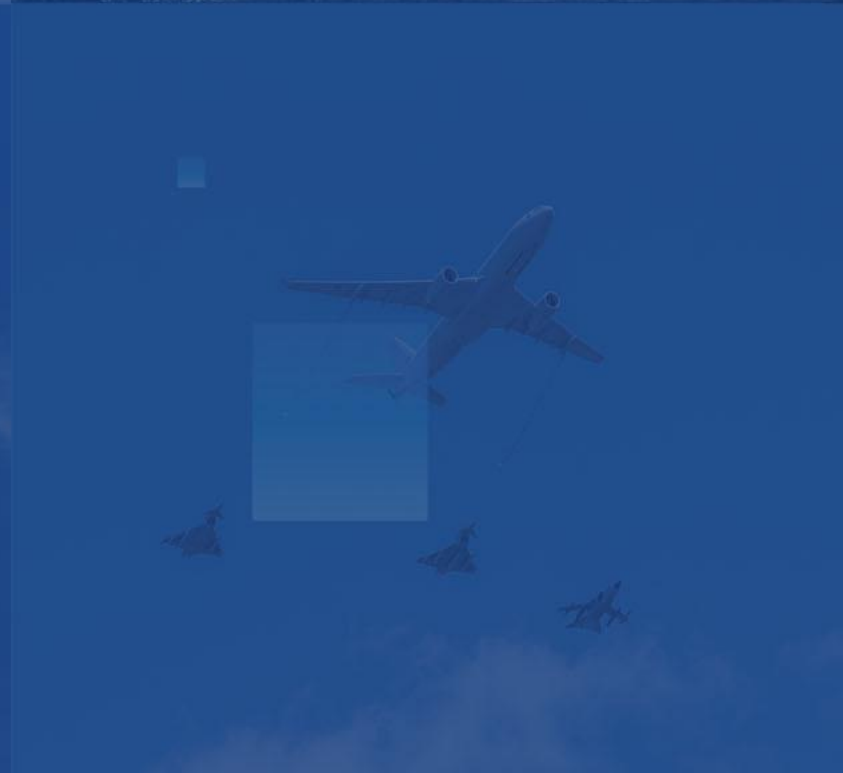


Weapons, counter measures and communication using laser technology



Operation on moving platforms

Secure communication



LASER

Light Amplification by Stimulated Emission of Radiation

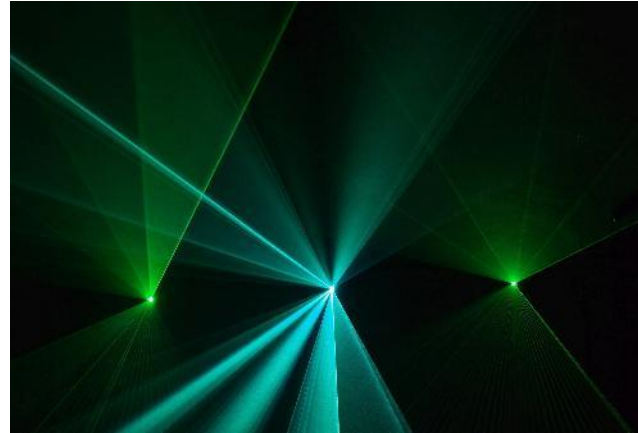


Secure communication



Fiber optics communication

Using light propagation through an optical fiber



Free space optical communication

Using light propagation in free space (air, outer space, vacuum, ...)

Using laser for transferring data

Compared to RF systems

- ✓ More data can be transmitted at a time
 - As infrared light has a shorter wavelength
- ✓ Less power needed
 - Because the transmission is directed to the target
- ✓ Equipment is smaller in size and weight
- ✓ More secure
 - Because of point-to-point connection
- ✓ Immune to Electromagnetic Interference

Fiber optics communication use

- Drones with fiber optics communication are currently used in the war in Ukraine.
- The drones are flying low to the ground, and are connected to a controller via thin fiber-optic cables
- These cables unwind as the drone flies farther away from the controller.
- Both Russia and Ukraine are using these drones



<https://www.rferl.org/a/ukraine-fiber-optic-drones-russia/33344310.html>

Laser communication in the news

Poland to launch satellites for testing laser communication

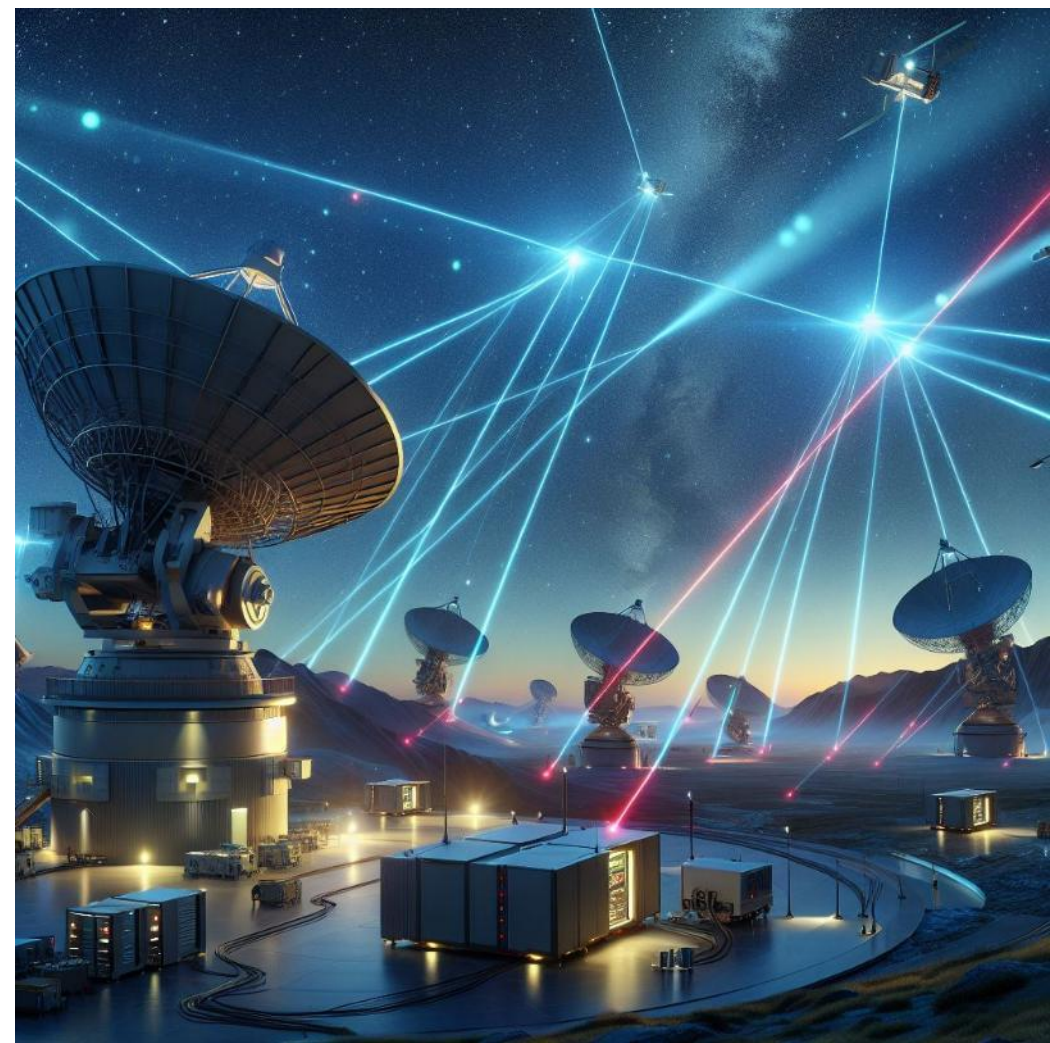
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Poland is set to launch three small satellites into space to test laser communication, marking a major step in the country's technological advancements.

'It cannot be jammed, intercepted or detected'

"Radio silence is a reality on today's battlefield," said Col. Jacek Wojtanowski, an optoelectronics specialist at WAT, speaking to Poland's PAP news agency.

He added: "The war in Ukraine has shown that using radio emitters, such as radars, makes them easy targets. Once activated, they can be quickly located and destroyed by missiles or drones. Laser communication offers a solution—it cannot be jammed, intercepted or detected."



[Poland to launch satellites for testing laser communication - English Section](#)

Pros and cons



Pros and cons

- ✓ High Bandwidth
- ✓ Minimal signal loss
- ✓ Resistance to Interception
 - ✓ Physical connection with the fiber needed
- ✗ Physical connection needed between transmitter and receiver
- ✗ Installation & Maintenance Costs
- ✗ Removal of fibers after one time use



Pros and cons

- ✓ High Bandwidth
- ✗ Signal loss
 - ✗ Atmospheric effects
 - ✗ Beam dispersion
 - ✗ Interference from background light sources
- ✓ Resistance to Interception
 - ✓ Potential eavesdropping will result in an interruption of the data transmission
 - ✓ The existence of laser beams is hard to detect when you are not in the line of sight
- ✓ No physical connection needed between transmitter and receiver
- ✗ Stable platform and tracking needed

Questions?

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