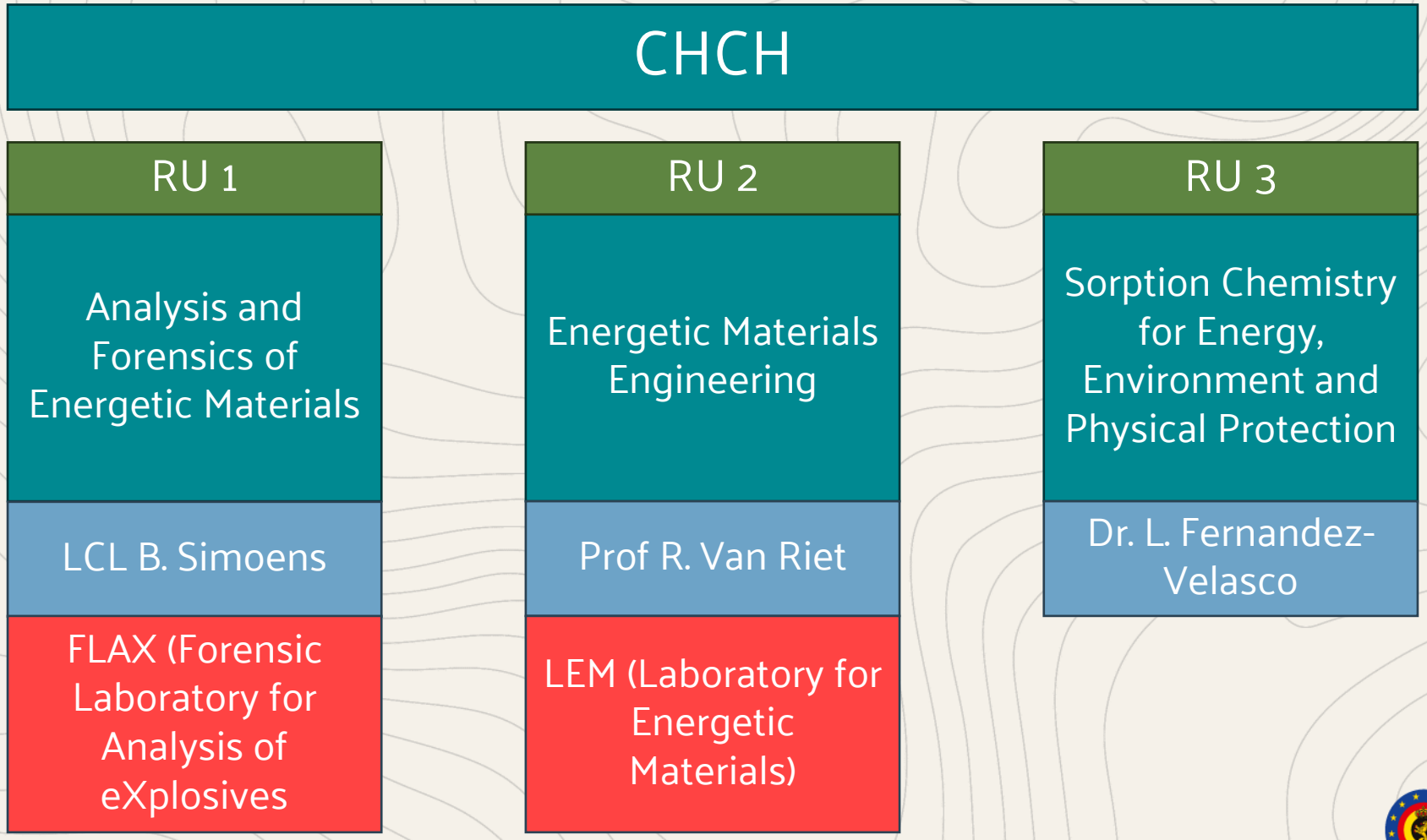
Research structure @ CHCH



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RU 1

RU 1
Analysis and Forensics of Energetic Materials
LCL B. Simoens

1 Detection

- Is there something to detect? What is there to detect? (DETEX, DFR)
- How can we detect/identify it?
  - -Based on NIR (PhD UNIL)
  - -Based on electrochemistry (ThreatSens, DEFRA)
  - -Based on radiospectrometry (SpectrEx, DFR)

2 Synthesis and characterisation of ‘new’ substances

3 Aid to the community

RU 2

RU 2

Energetic Materials Engineering

Prof R. Van Riet

1 Detonics

Advanced detonation characterization of improvised (tertiary and homemade) explosives in a counter-terrorism context

2 Propulsion

Novel propellant formulation
Solid and hybrid

3 Pyrotechnics

Novel energetic nanomaterials based on nanoporous carbon, reactive materials for improved lethality

4 Ageing

Munition in-service surveillance

NANOPYRO
ENERGETIC MATERIALS FOR TOMORROW

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RU 3

RU 3
Sorption Chemistry for Energy, Environment and Physical Protection
Dr. L. Fernandez-Velasco

1 CBRN Detection

Surveillance and reconnaissance techniques for chemical and biological threats.

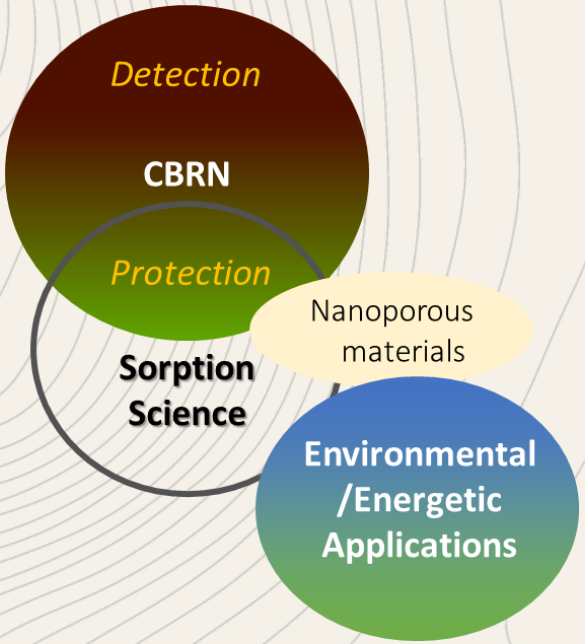
2 CBRN Protection

Estimating breakthrough times of gas filters under more realistic operational circumstances.

3 Sustainable energies

Creation of innovative "humidity to electricity" renewable energy conversion technology towards sustainable energy challenge

Nanoporous materials for tailored hydrogen storage in military applications



RU 3

CBRN: detection

TeChBioT

European Defence Fund (EDF) project, 8 partners
3 units involved: CHCH (coordination) + MWMW (AI) + DLD (chemical and bio labs)
Dec 2022- Jan 2026

*Development of a **portable** and **universal detection technology** based on ion mobility spectrometry (IMS) with optional pyrolysis and gas chromatographic pre-separation (GC) for **fast detection and identification of non-volatile biological and low-volatile chemical agents.***

HT-GC-IMS/ GC-IMS

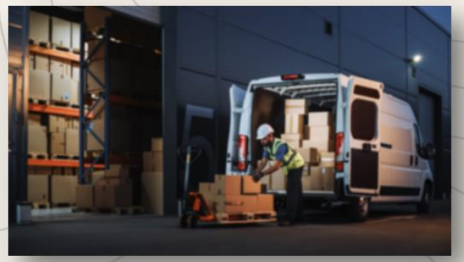
Low-volatile CWAs
Narrow urban areas

HT-GC-IMS/ GC-IMS/ IMS

Volatile CWAs
Large areas (UAVs)

Py-HT-GC-IMS

Non volatile BWAs
Vehicle (power)



***Combined with Artificial Intelligence (AI) and Deep Learning (DL)** models to reduce the dimensionality of the 2D spectral data and enable distinguishing of bacteria, fungi, viruses, low volatile chemical warfare agents, and toxic industrial compounds at pptv concentration levels based on their unique fingerprint within a complex environment.*

https://techbiot.eu/

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CBRN: protection (Sorption)

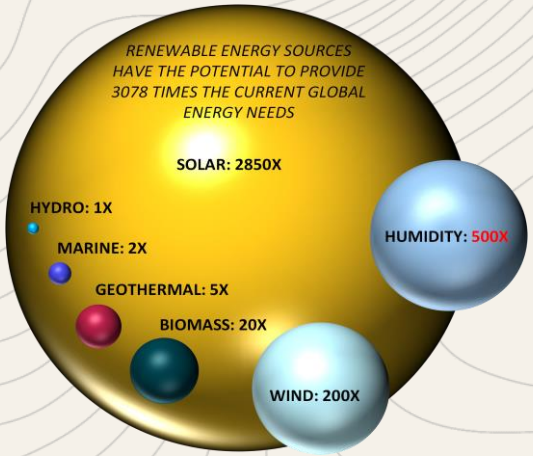
MSP21/07 project: Estimating breakthrough times of gas filters under more realistic operational circumstances
CHCH & DLD

RU 3

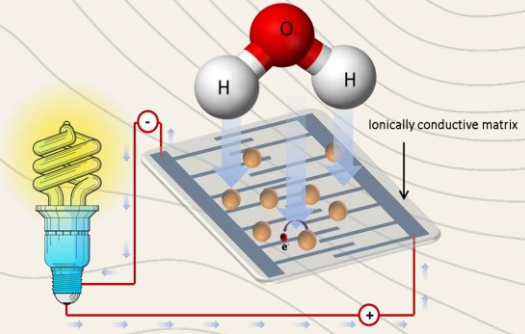
Renewable energies (Sorption)

- Characterization of nanoporous materials
- Specialized in **water adsorption** (carbon-based materials, MOFs, COFs, metal oxides…)
- Multiple collaborations: Universities of Basque Country and Budapest, VITO, Kazakhstan (former joint NATO project)
- Currently:

CATCHER: European project
European Innovation Council action, 7 partners
2022-2026
CHCH is leading WP2 of the project (characterization/optimization materials)



Development of innovative technology to exploit the atmospheric humidity for direct conversion to electricity, thus gaining a new sustainable source of renewable energy.



ZrO_2-based materials

At this stage of the project we are beyond the proof-of-concept and already have a prototype able to charge a mobile phone.

catcher

https://catcherproject.eu/

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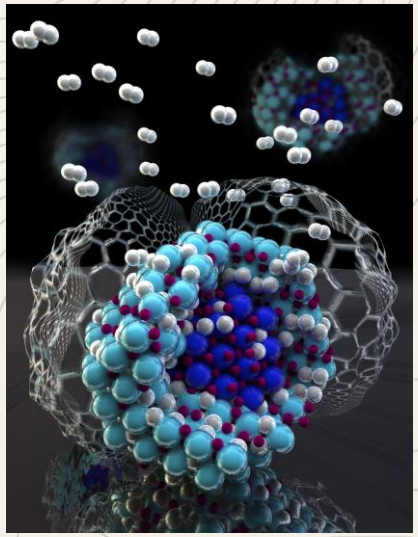
RU 3

Renewable energies (Sorption)

nStorH (June 2025-April 2029)
Promoter: L. Fernández
Researcher: P. Melo Bravo
Partners: Universities of Lorraine (France) and Basque Country (Spain)



Objectives:
- Develop novel hybrid nanoporous materials for hydrogen storage through adsorption processes
- Transition the Belgian Defence to renewable energies:
    - Reduce reliance on fossil fuels and increase the army's self-sufficiency.
    - Enhance safety and autonomy in remote regions and crisis situations.

Complementary to project MSP/21-06 (RMA-DLD), focused on hydrogen generation.

Combining the outcomes of both projects aims to generate, store, and use hydrogen at the tactical edge of the battlefield.

ROYAL MILITARY ACADEMY
PROF DR. IR XAVIER NEYT

12 Sep 2025

DEFENCE

Communications, Information, Systems and Sensors Department

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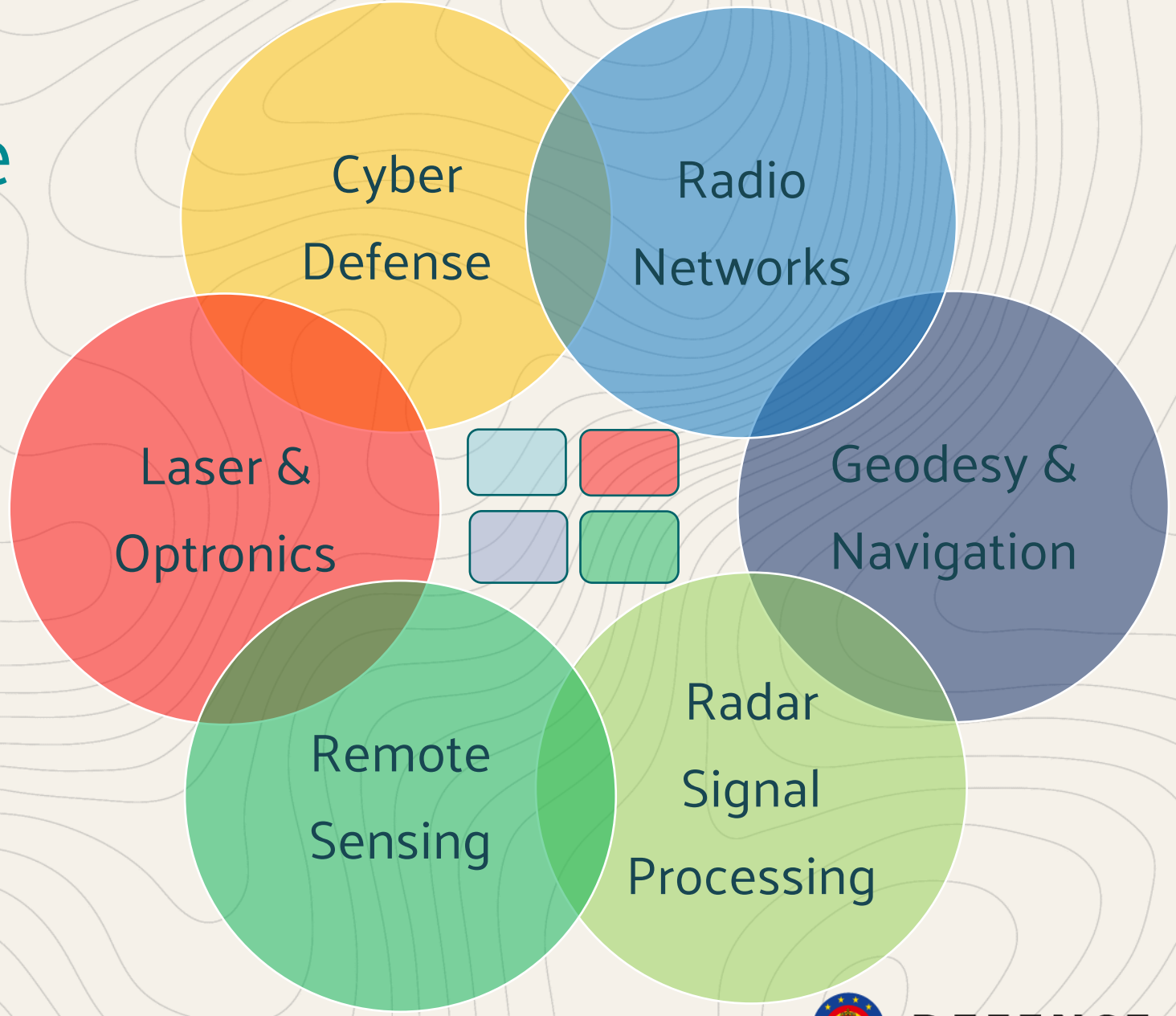
Department structure

- 6 Research Units
  - Supported by 4 labs
    - Cyber Lab
    - Laser & Optronics Lab
    - Drone Lab
    - Radio Frequency Lab



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RU: Laser & Optronics

Laser & Optronics

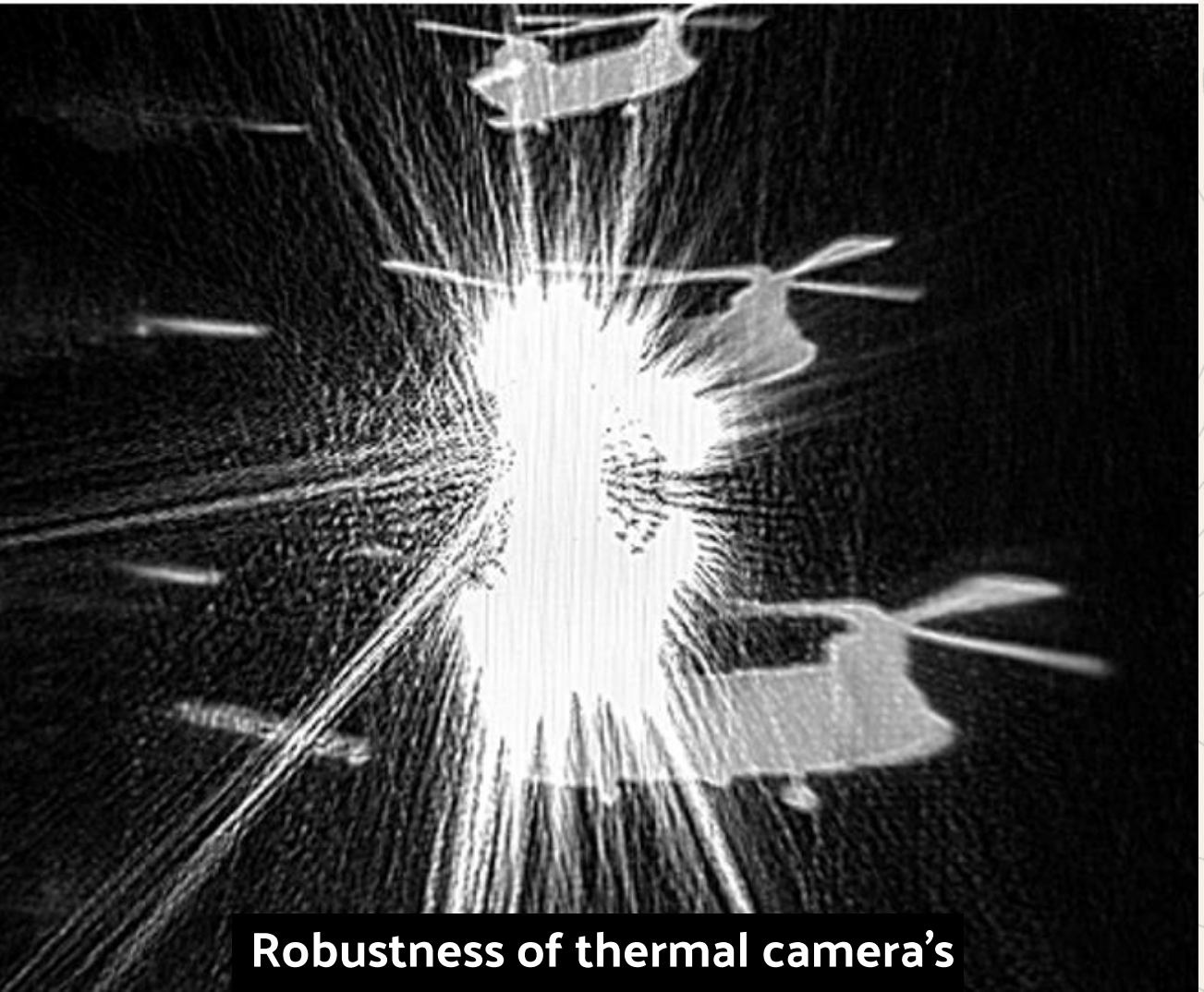
Laser dazzling HEL

(C)-UAV

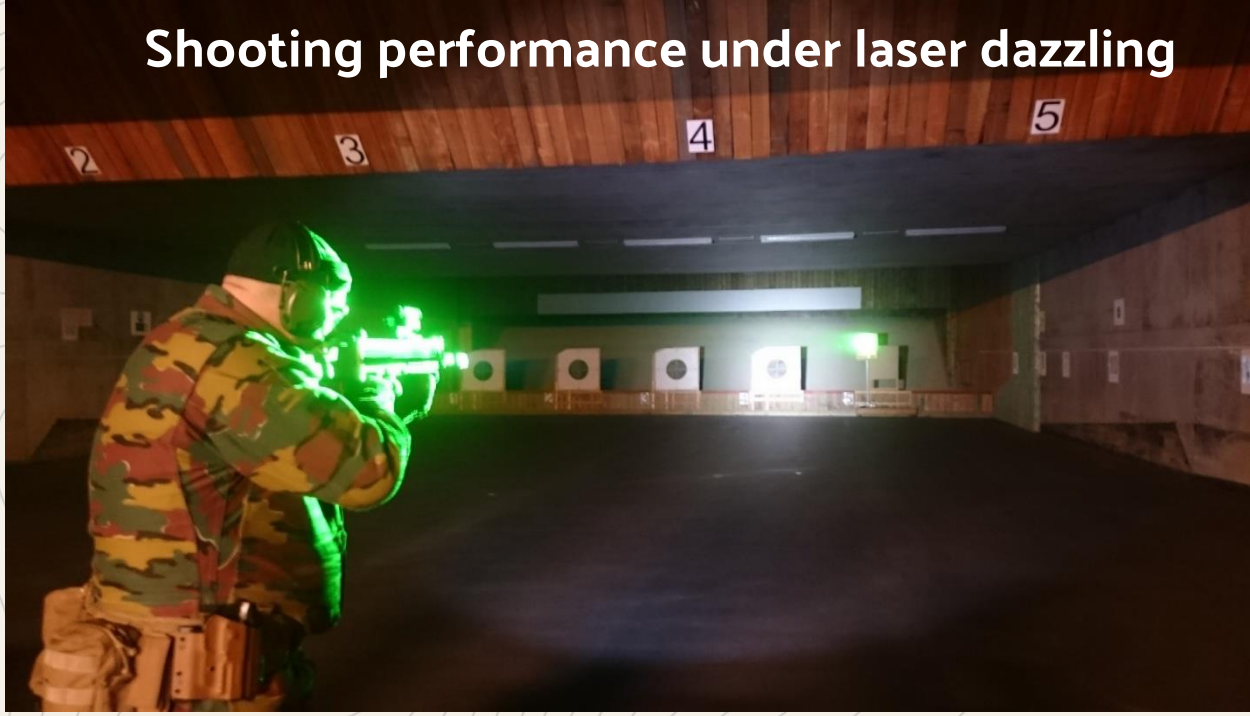
Camouflage & decoys

Persistent surveillance (Navy)

Laser dazzling HEL

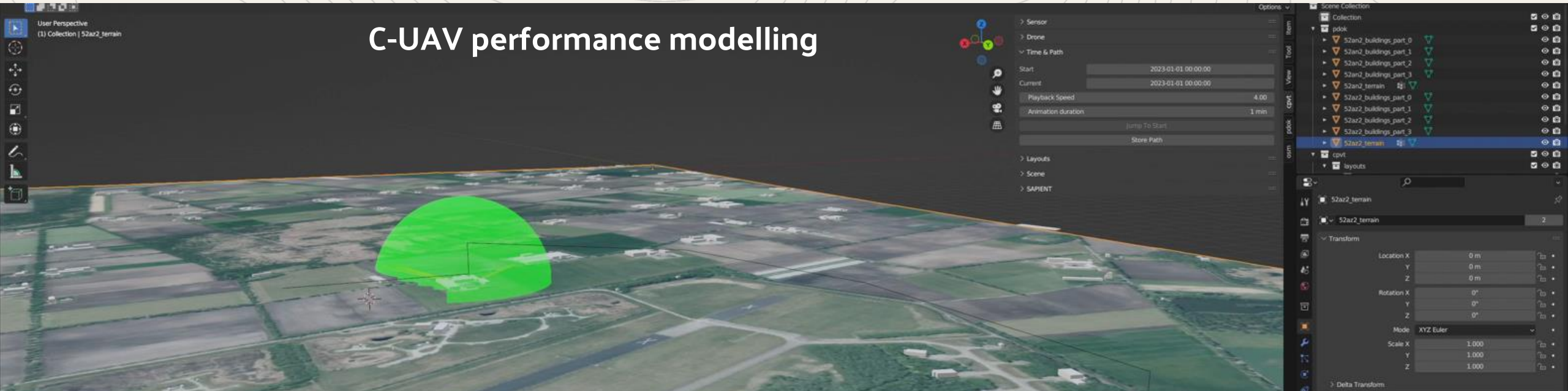


Robustness of thermal camera's



(C)-UAV

Free space optical communication



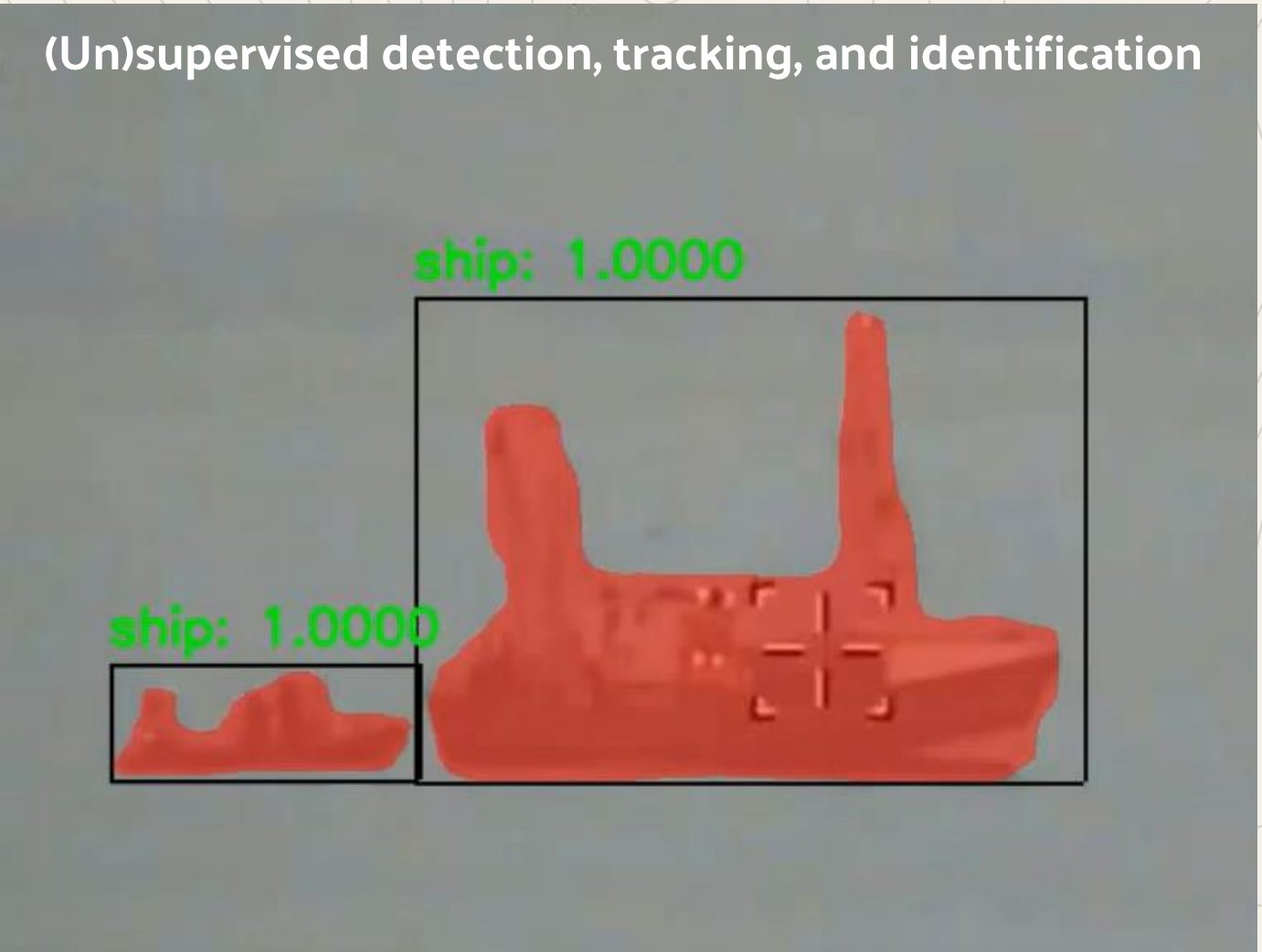
Camouflage & decoys

Multispectral assessment

Camouflage net evaluation

Persistent surveillance (Navy)

(Un)supervised detection, tracking, and identification



Data acquisition for algorithm training

RU: Cyber Defense Lab

Cyber Defense

- Wim Mees & Thibault Debatty
  - Research to support **teaching** and **CyF**:
    - Management of Security
    - Digital Forensics
    - Intrusion Detection
    - Military Cloud
    - Software Supply Chain integrity
    - Offensive Security
  - https://cylab.be

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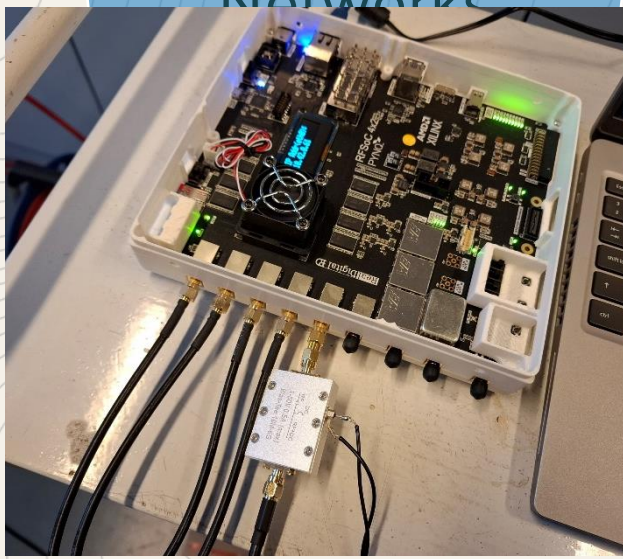
RU: Radio Networks

- Maj Mathias Becquaert

Radio Networks



5G/6G

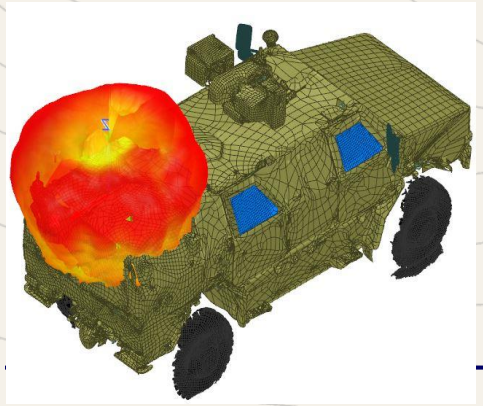
SatCom

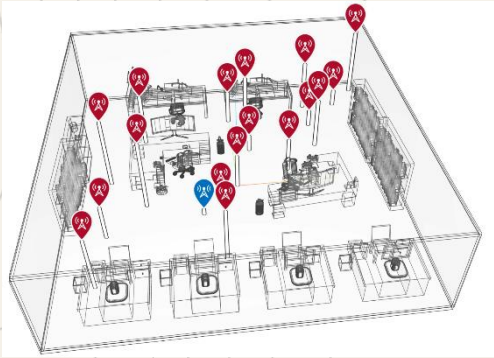
Tactical radio networks

Jamming

(C-)UAV

Indoor positioning





RU: Geodesy & Navigation (GENA)

Geodesy & Navigation

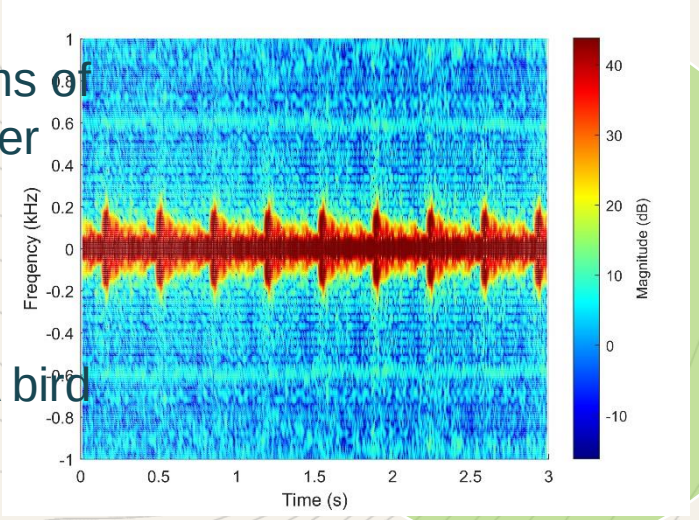
- Alain Muls
  - Ensuring reliable GNSS navigation and positioning
    - Interference source identification
    - Detection of Jamming, Meaconing & Spoofing
  - Benchmarking Positioning, Navigation and Timing (PNT) Systems
  - **Application development**
    - **Automated unpaved runway assessment (A400M)**

RU: Radar Signal Processing

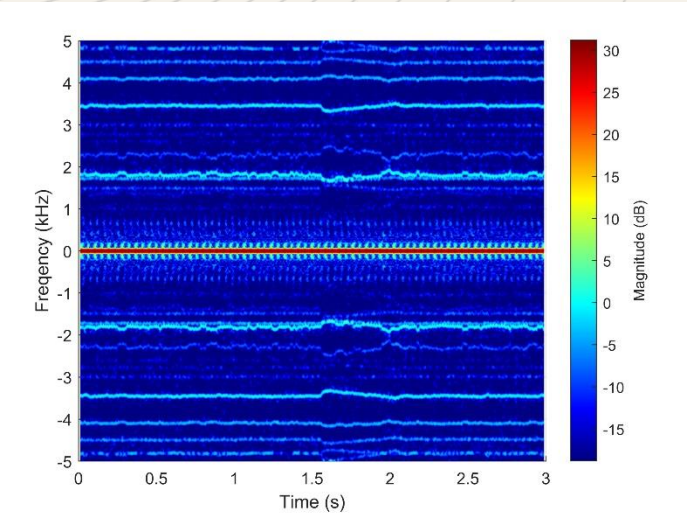
- Xavier Neyt
  - **Radar for UAV detection**
    - **Exploit AI to discriminate (birds vs UAV, payload)**
  - Radar expertise for Defense
    - Surveillance radars, C-RAM radars
  - Radar counter measures
    - Stealth technologies

Spectrograms of Micro-Doppler signature

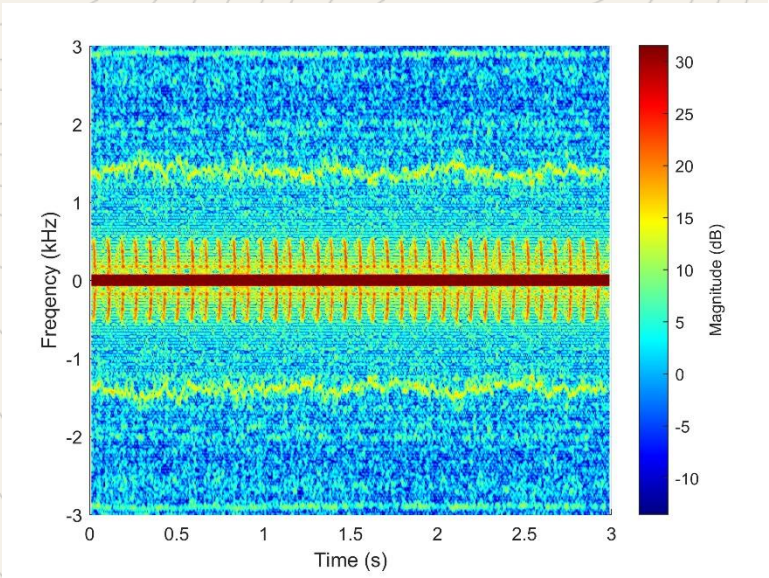
A bird



A fixed wing UAV



A rotary wing UAV



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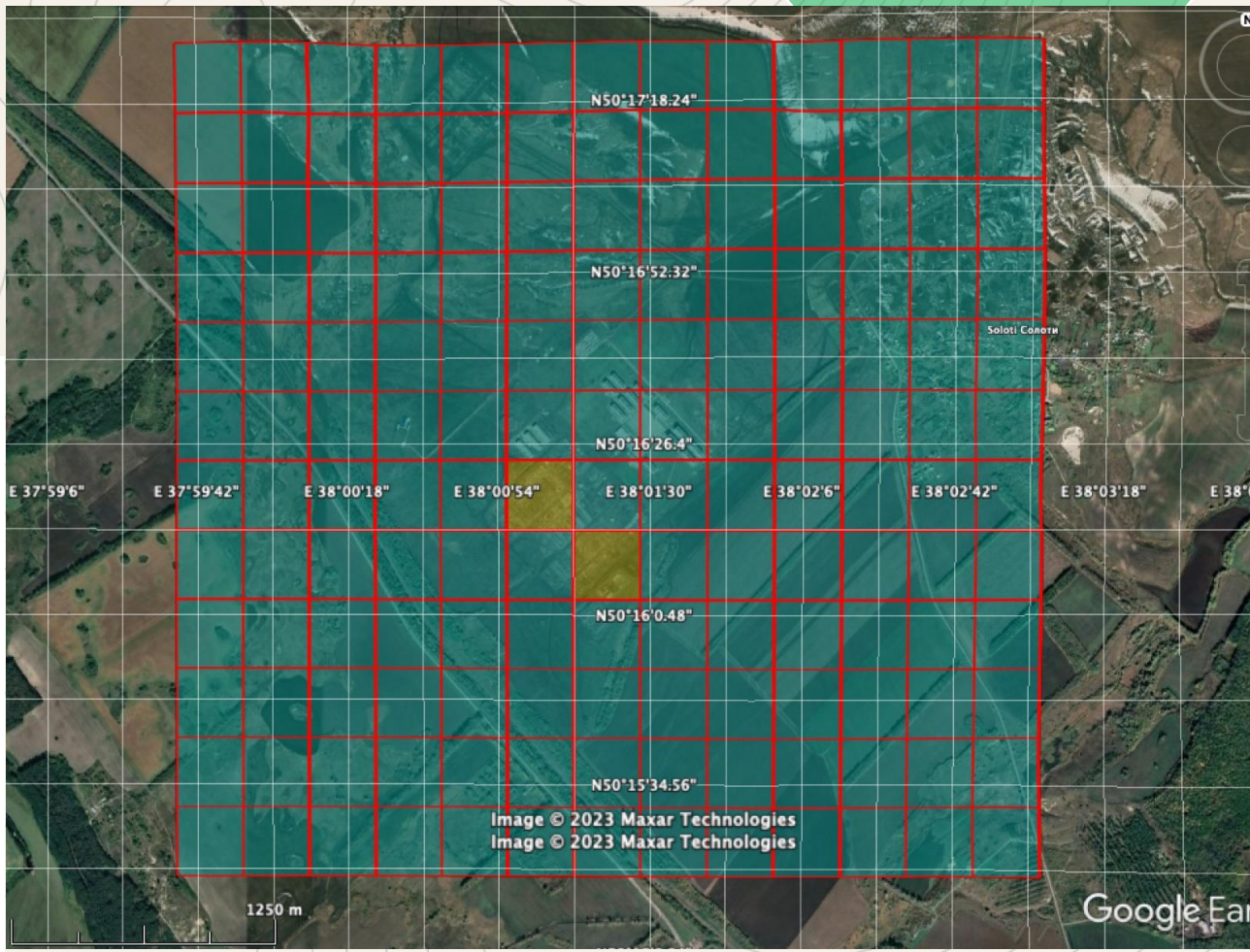
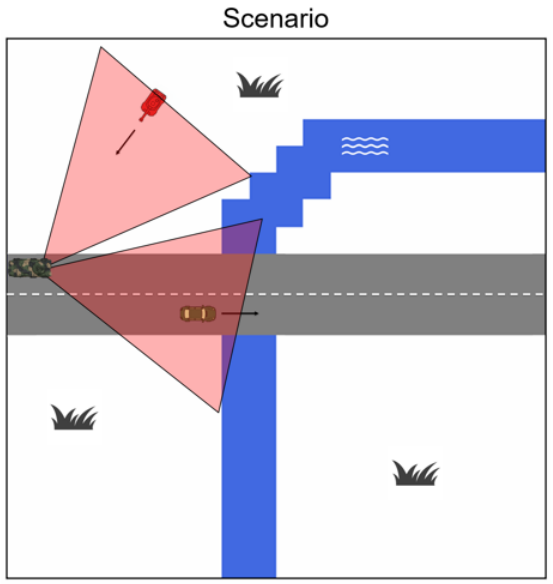
RU: Remote Sensing

Remote Sensing

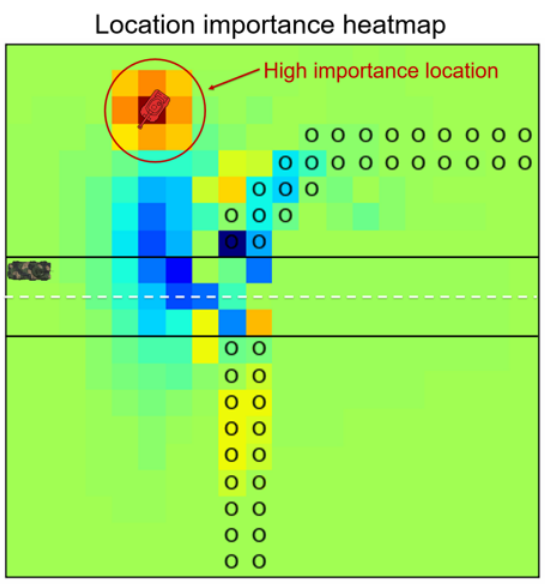
- Xavier Neyt
  - **Satellite imagery data exploitation**
    - **Large Scale Change Detection**
  - Image-based GNSS-denied positionning
  - **Battlefield situational awareness**
    - **Threat evaluation & situational awareness**

Expansion of a RUS military base at the UKR border





Scenario illustrating an unmanned ground vehicle (UGV) on a

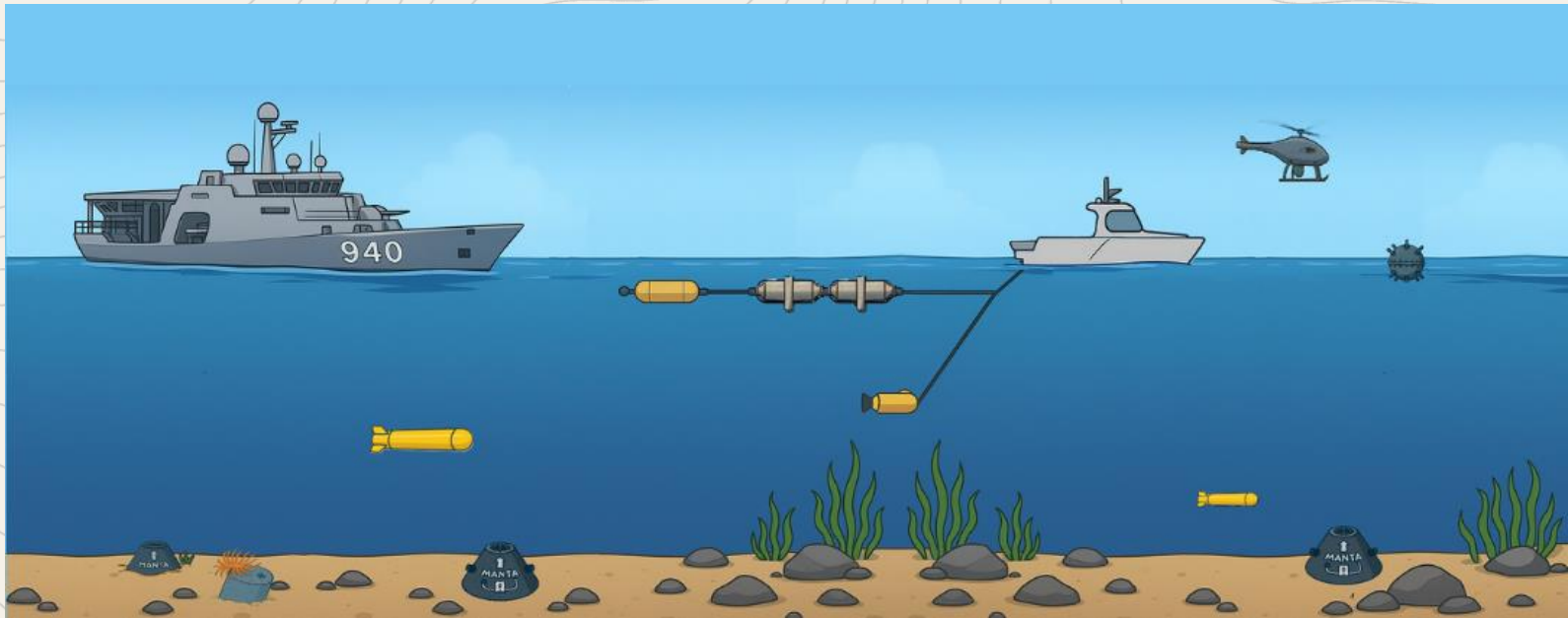


The location importance heatmap is an eXplainable AI (XAI)

RU: Remote Sensing

Remote Sensing

- Olga Lopera
  - **Underwater mine counter measure**
    - Automatic target (mine, UXO) detection
    - Seafloor classification
      - On synthetic aperture sonar images
    - Burried seamine detection
      - Low-frequency sonar
    - Minesweeping
    - Floating mine detection



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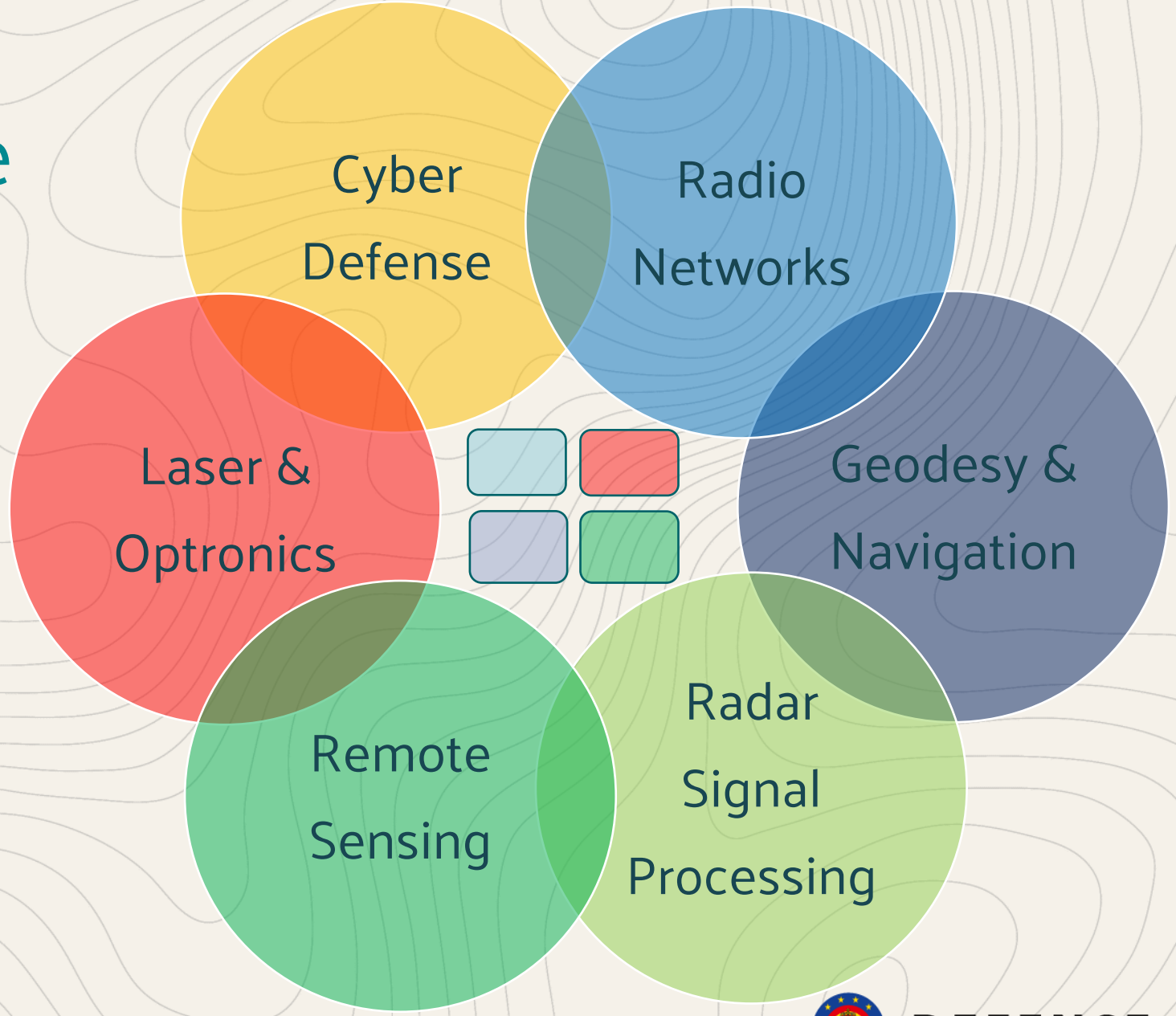

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12 September 2025

LT KOL Dr Ir Maarten VERGOTE
Director LPP-ERM/KMS

Dept PHYS (LPP-ERM/KMS)

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