Overwatch

UNICORN

Collaris2

DIREKTION
Disaster Resilience Knowledge Network

WORKSHOP

MANAGEMENT CLUSTER

Funded by
the European Union

International Symposium on Safety, Security, and Rescue Robotics 28.-31.10.2025, Galway, Irland

Insights

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DRZ
DEUTSCHES RETTUNGSROBOTIK ZENTRUM

CREXDATA
Critical Action Planning over Extreme-Scale Data

ARMA
Collaborative Autonomous Robots for eMergency Assistance

SSRR2025 in Focus

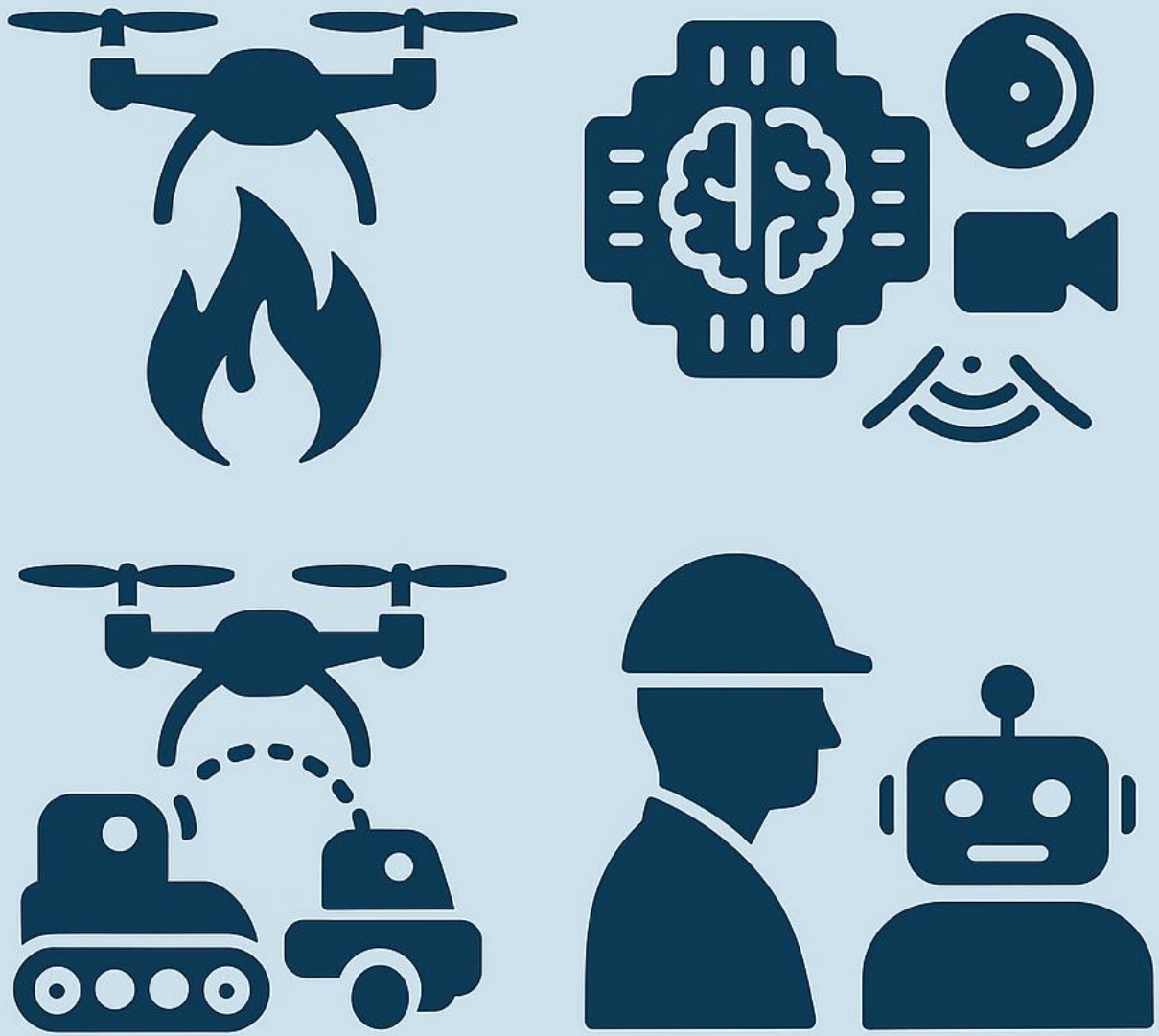
www.ssrr2025.org/papers

What I looked for in the Papers:

- Relevance to **real-time situational awareness**
- Use of **AI, drones, robots, EO data, or multi-sensor fusion**
- Direct connection to **climate-driven hazards**
- Evidence of **operational readiness**

High-Level trends

1. Robotic systems becoming operational tools
2. AI & sensor fusion enabling real-time SA
3. Air–ground teaming becoming practical
4. Shift toward user-centred, operationally validated design

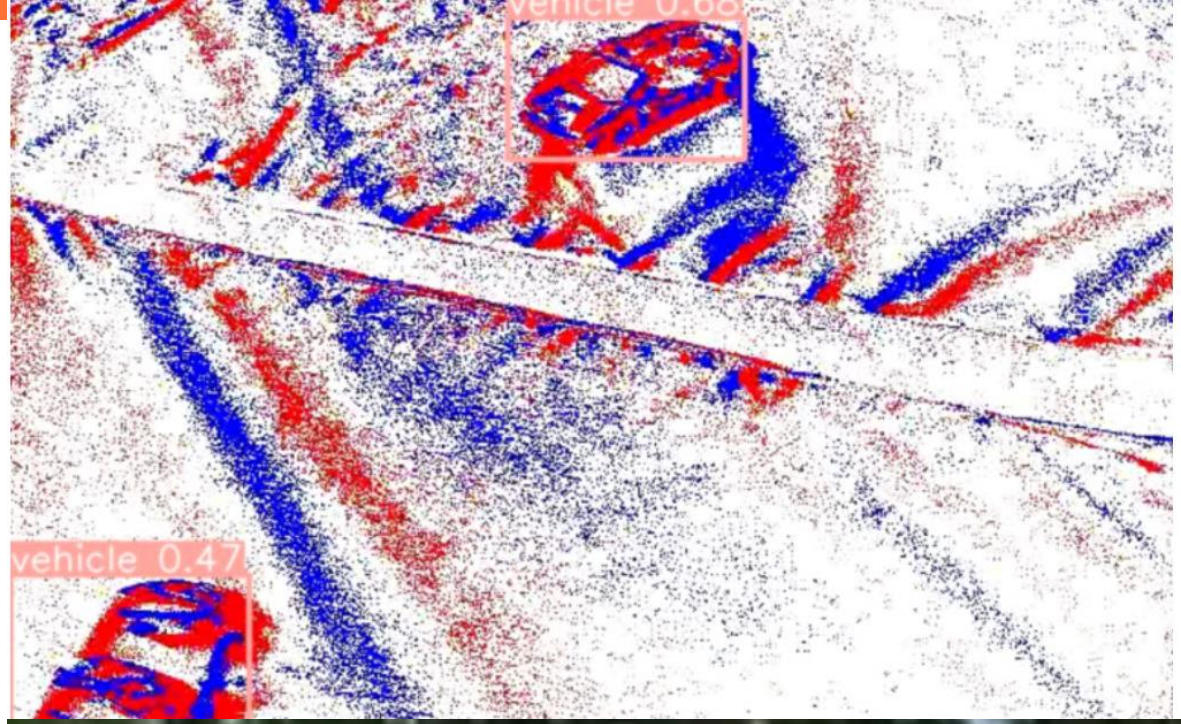


1. Robotic Systems as Operational Tools

- Impulse-based firefighting drone for active suppression *(#29)*
- UAV autonomously guiding a turntable-ladder fire monitor *(#65)*
- Active landslide monitoring UGV with multi-modal sensors *(#57)*
- Autonomous UGV for soil/terrain hazard inspection in nuclear settings *(#41)*
- Consumer-level UAVs adapted for GNSS-denied operational inspection *(#52)*

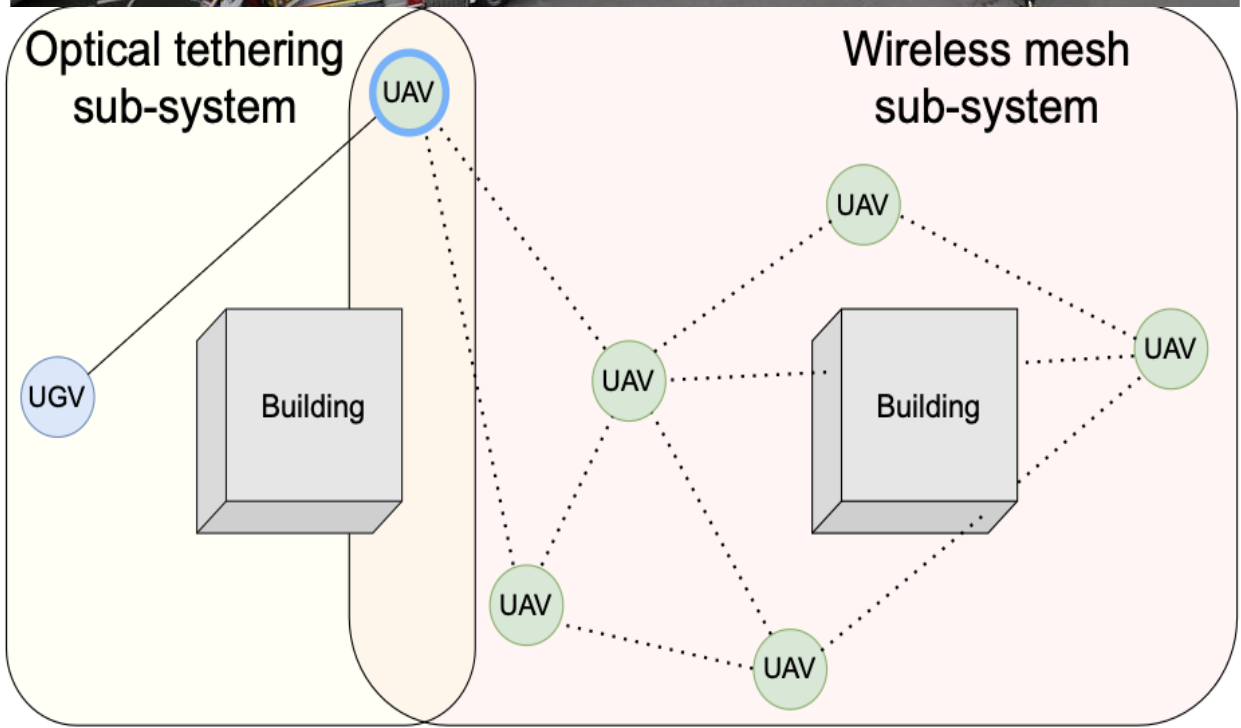
2. AI & Sensor Fusion for Real Time SA

- Ultra-low-latency onboard object detection using FPGA/event camera *(#04)*
- Hyperspectral–LiDAR–RGB fusion for environmental risk indicators *(#57)*
- LLM-based navigation and semantic interpretation in GNSS-denied caves *(#22)*
- Sim-to-real terrain classification for off-road SAR navigation *(#53)*
- RGB–thermal–geometric fusion for fire & human detection *(#35)*



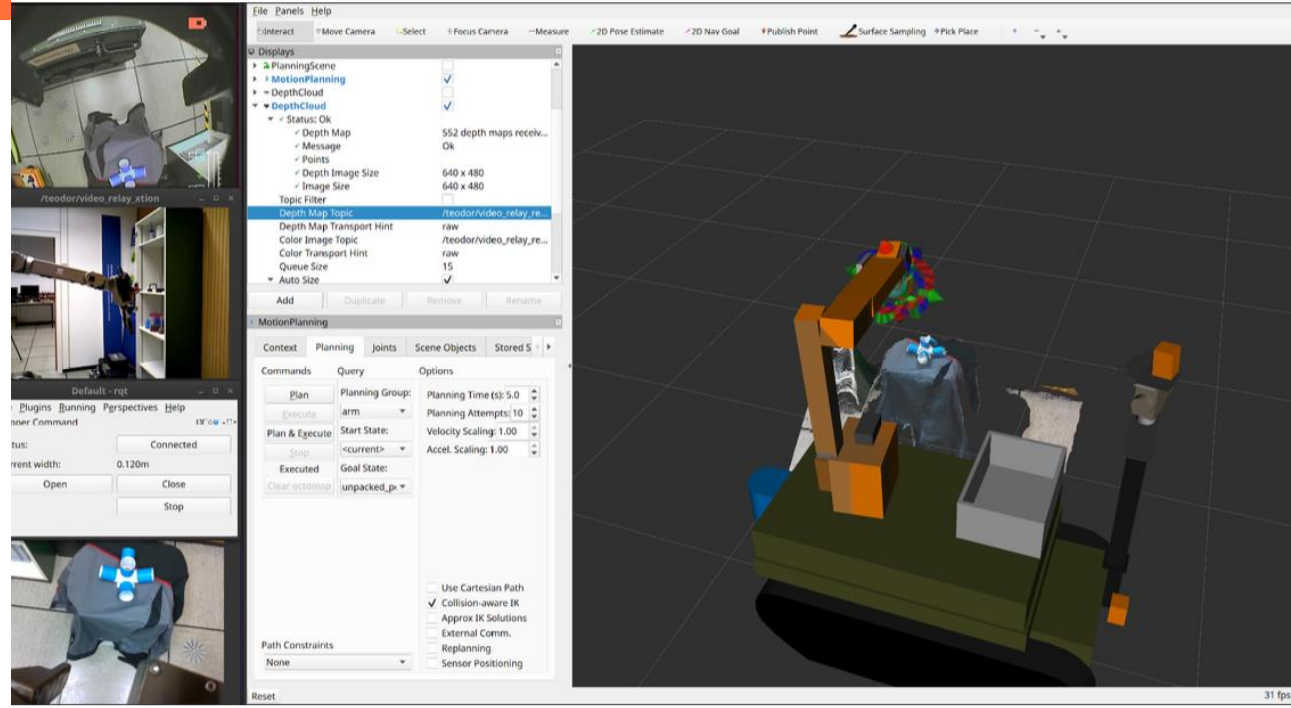
3. Air-Ground Teaming

- Aerial–ground firefighting cooperation (UAV + ladder truck) *(#65)*
- Dual-mode UGV–UAV decontamination & sampling in urban environments *(#39)*
- Tethered UAV acting as comms backbone for UGVs in CBRNe settings *(#34)*
- Drone + ground robot cooperation for nuclear inspection *(#41)*
- Sniffer robot integrated with SOPs + aerial overwatch (exercise context) *(#05)*



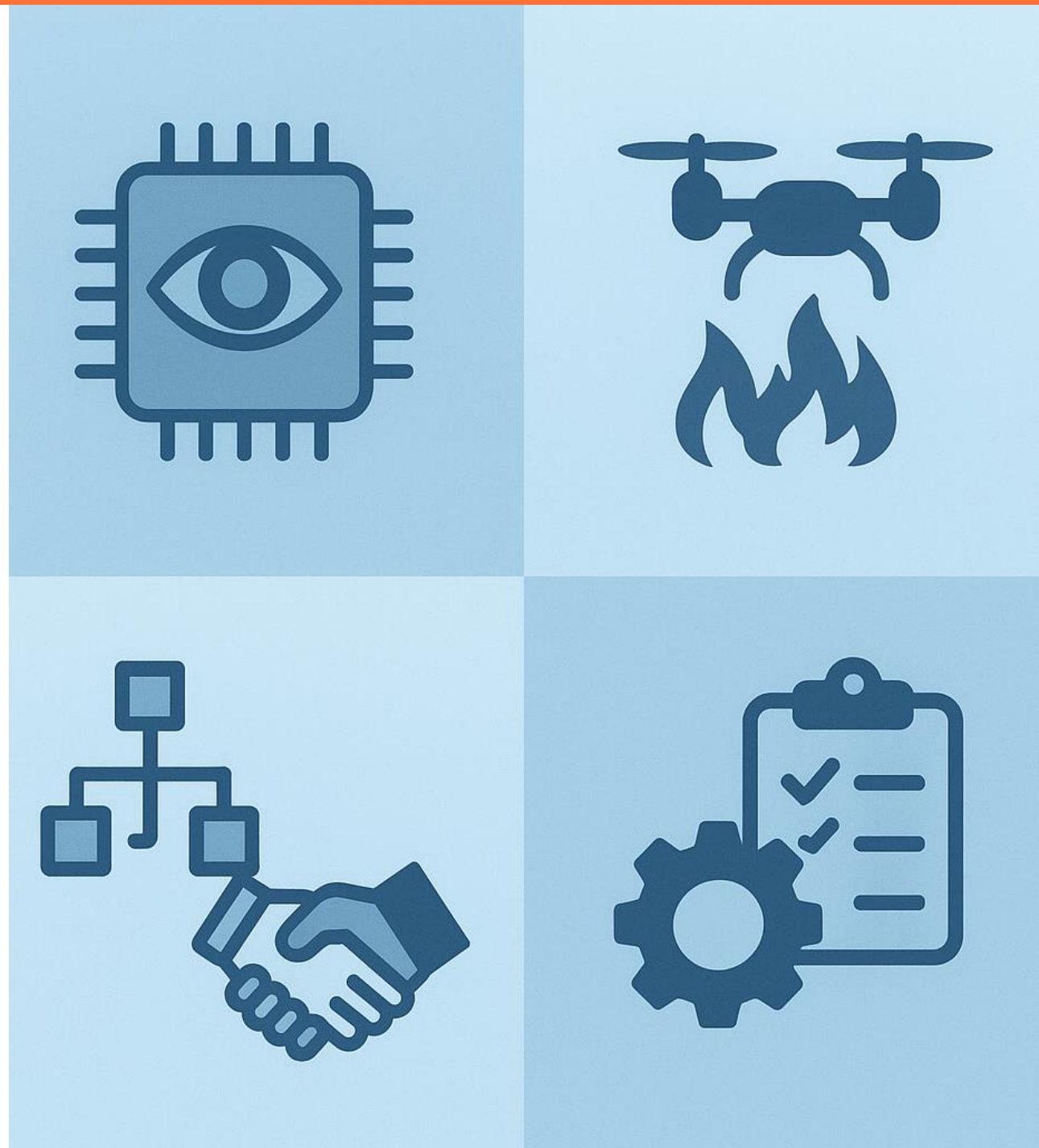
4. User-Centered & Operationally Validated Design

- First responder study: what semantic information they need *(#32)*
- VR vs screen-based robot control usability experiments *(#61)*
- High-fidelity collapse simulator for safe algorithm training *(#60)*
- Radiation-tolerant robotic systems from Fukushima operations *(#09)*
- Sniffer robot integrated with SOPs, deployed in exercise context) *(#05)*
- Real chemical-plant incident: UGV-operated valve during fire *(#42)*



Implications & Conclusions

- SA value arises from fusion, not isolated tools
- Operational readiness depends on realistic validation, user involvement is crucial
- Cluster(s) can accelerate convergence
- Opportunity: create a European capability uptake pipeline from R&D to operations



German Rescue Robotics Center

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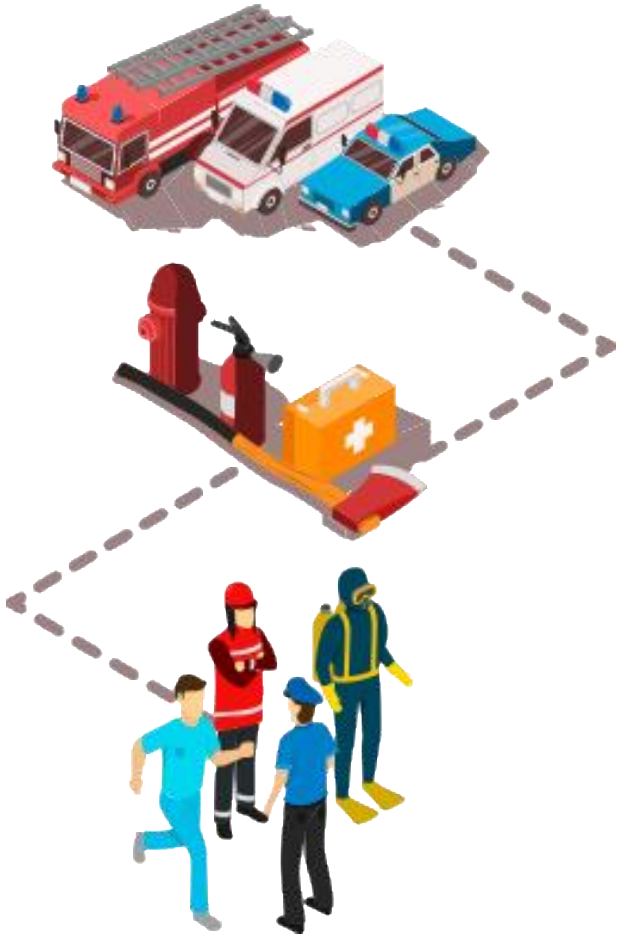
- Innovation center for rescue robotics
- Non-profit association of stakeholders
- Mission: bridging R&D and operational practice
- Living Lab: real-world test sites, UGV/UAV fleet, sensor labs
- Strong links to fire services, police, THW, civil protection



THANK YOU!

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