Wirtschaftskammer Tirol: Präsentation zu Drohnen Anwendungen der FH Kufstein durch Prof. Mario Döller

# DIGI TALKS 2022: Drone Use Cases

DIH Digital Innovation Hub West

## FH Kufstein Tirol
## University of Applied Sciences

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FFG Forschung wirkt.

# Drone Use Cases
## Amsterdam Drone Conference 2022

DRONE FUSION

https://dronefusion.org/

AMSTERDAM DRONE WEEK HYBRID


# Drone Use Cases
## Experts


### Prof. (FH) PD Dr. Mario Döller

- Computer Science and Computer Vision Expert
- Rector and Prof. for Multimedia Information Systems at the University of Applied Sciences Kufstein Tirol
- Participation in JPEG & MPEG Standardization

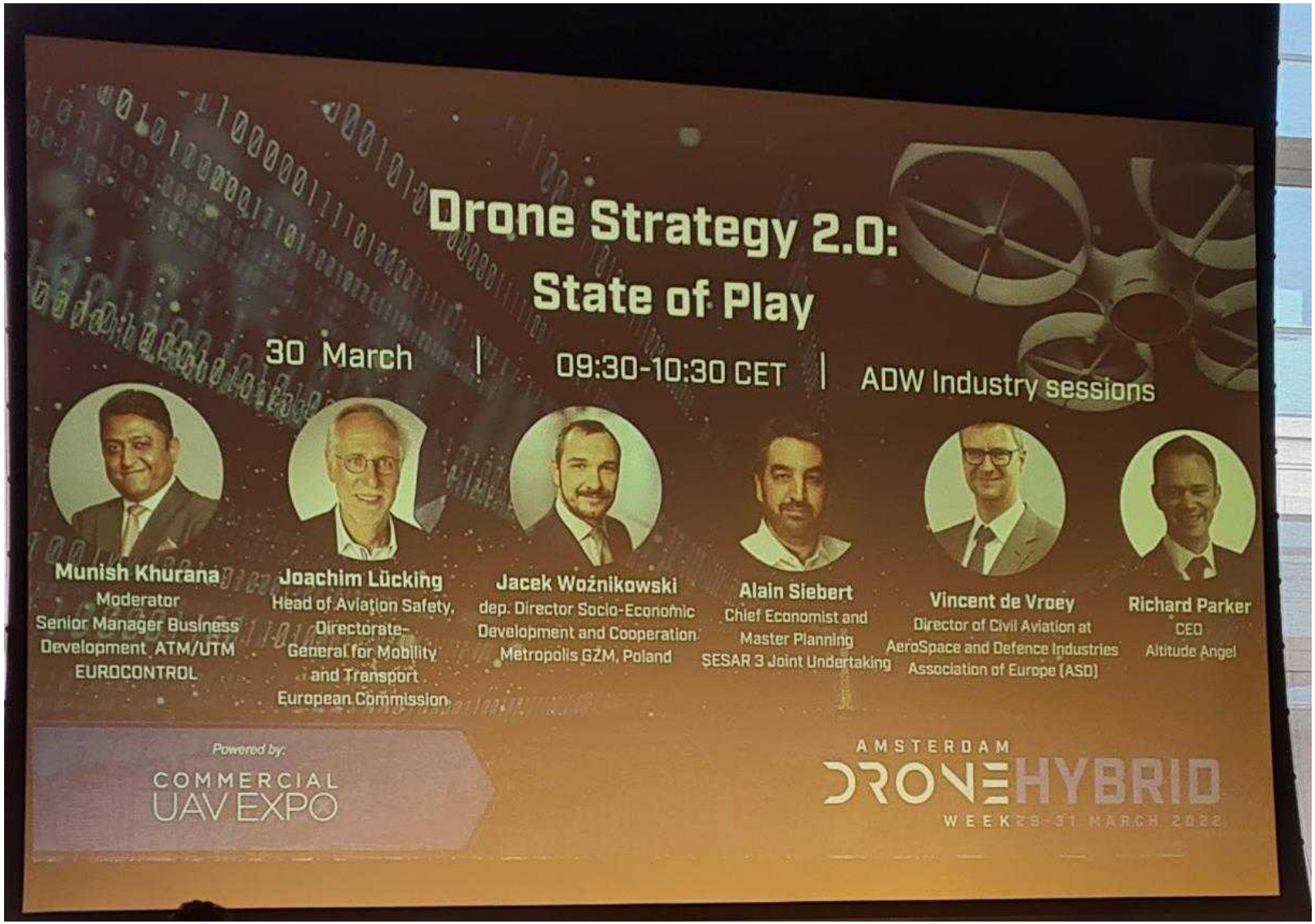
### Mag. Johannes Fischler

- CEO Air&More
- Expert for Drone insurances
- Long-term expertise in supporting and mentoring of drone projects

# Drone Use Cases
## Outline

- Current Regulations
- Manufacturing
  - Special Systems
  - Hydrogen
- Currently active Use Cases
  - Delivery
  - Urbain Air Taxi
  - Emergency Organizations
  - Inspectations
  - Others
- Research in Tyrol
- Insurance for Drones

# Drone Use Cases
## Current Regulations



# Drone Use Cases
## Current Regulations

- EU Regulations for UAS (unmanned arial systems)
  - 2018/1139: Regulation on common rules in the field of civil aviation and establishing a European Union Aviation Safety Agency
  - 2019/945: Regulation on unmanned aircraft systems and on third-country operators of unmanned aircraft systems
  - 2019/947: Regulation on the rules and procedures for the operation of unmanned aircraft
  - 2021/664: Regulation on a regulatory framework for the U-space
  - 2021/665: Regulation on requirements for providers of air traffic management/air navigation services and other air traffic management network functions in the U-space airspace designated in controlled airspace
  - 2021/666: Regulation on requirements for manned aviation operating in U-space airspace

# Drone Use Cases
## Current Regulations

- Three categories: Open (A1, A2, A3), Specific, Certified (EU Regulation 2019/947 and EU Regulation 2019/945)
- Registration for operator necessary (including drone flight license, insurance for drone, rules regarding CE identification, etc.)
- Operating Approval for Specific/Certified flights: Risk analysis by SORA („Specific Operation Risk Assessment")
  - Light UAS Operator Certificate" (LUC) enables one to approve its own flights
- While automatic drones are allowed in all categories, autonomous drones are not allowed in the 'open' category
- Austria: Austro Control Drone Competence Centre (DCC): Dronespace
  - See: https://www.dronespace.at/
  - https://www.easa.europa.eu/the-agency/faqs/drones-uas

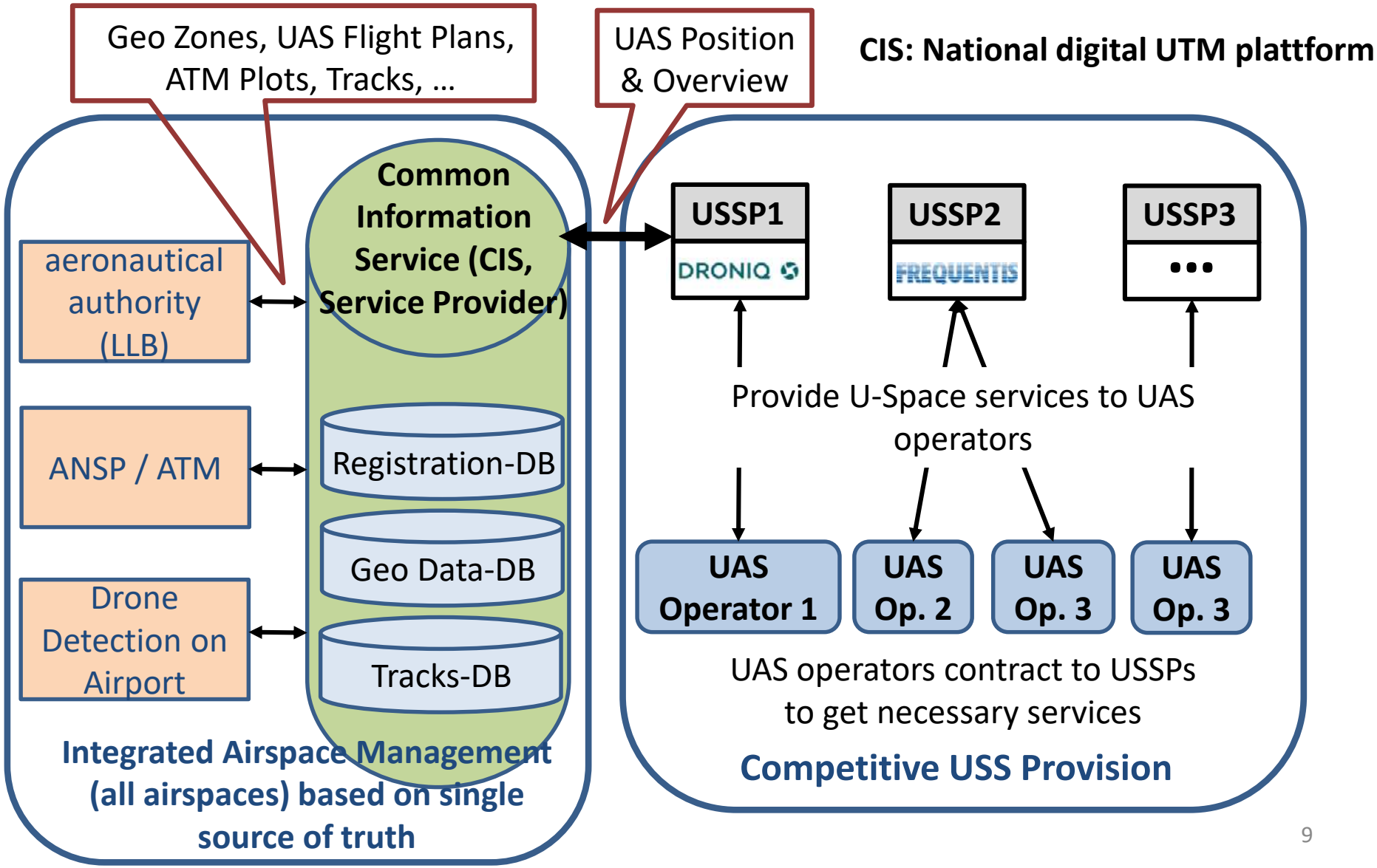
# Drone Use Cases
## Current Regulations

- EU Drone Strategy 2.0: The European Commission is currently developing ‘A Drone Strategy 2.0 for an unmanned aircraft eco-system in Europe

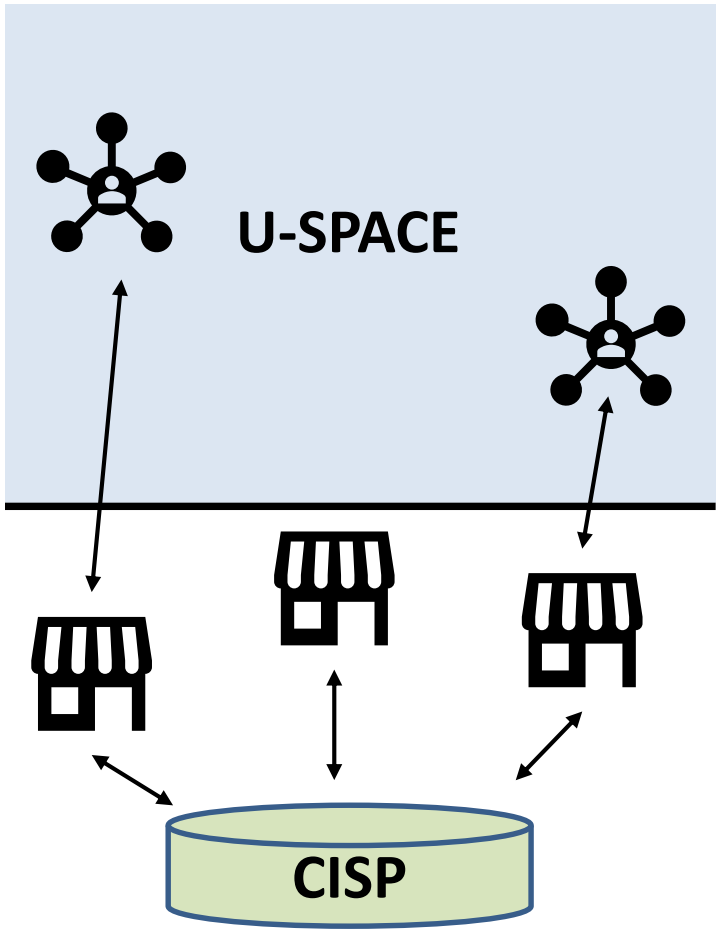
- Other Regulations are at the same level of discussion:
  - FAA:FAA Releases Recommendations for New BVLOS Rules https://uavcoach.com/faa-arc-bvlos/
  - Swiss: https://drone-laws.com/drone-laws-in-switzerland/

- Importance of regulations: Info by Amsterdam Police department: 23.000 recognized flights in Amsterdam in 2021 only 2% have been officially registered

# Drone Use Cases
## U-Space … the current view



# Drone Use Cases
## U-Space … the current process




Approving authority (e.g., Austro Control)

SORA

Flight Permission

Permission Phase

UAS Operator

Flight Plan & U-Space Approval

Request Clearance

Approval

Activate Mission

Flight

Network ID

Network ID

U-Space Service Provider (USSP)

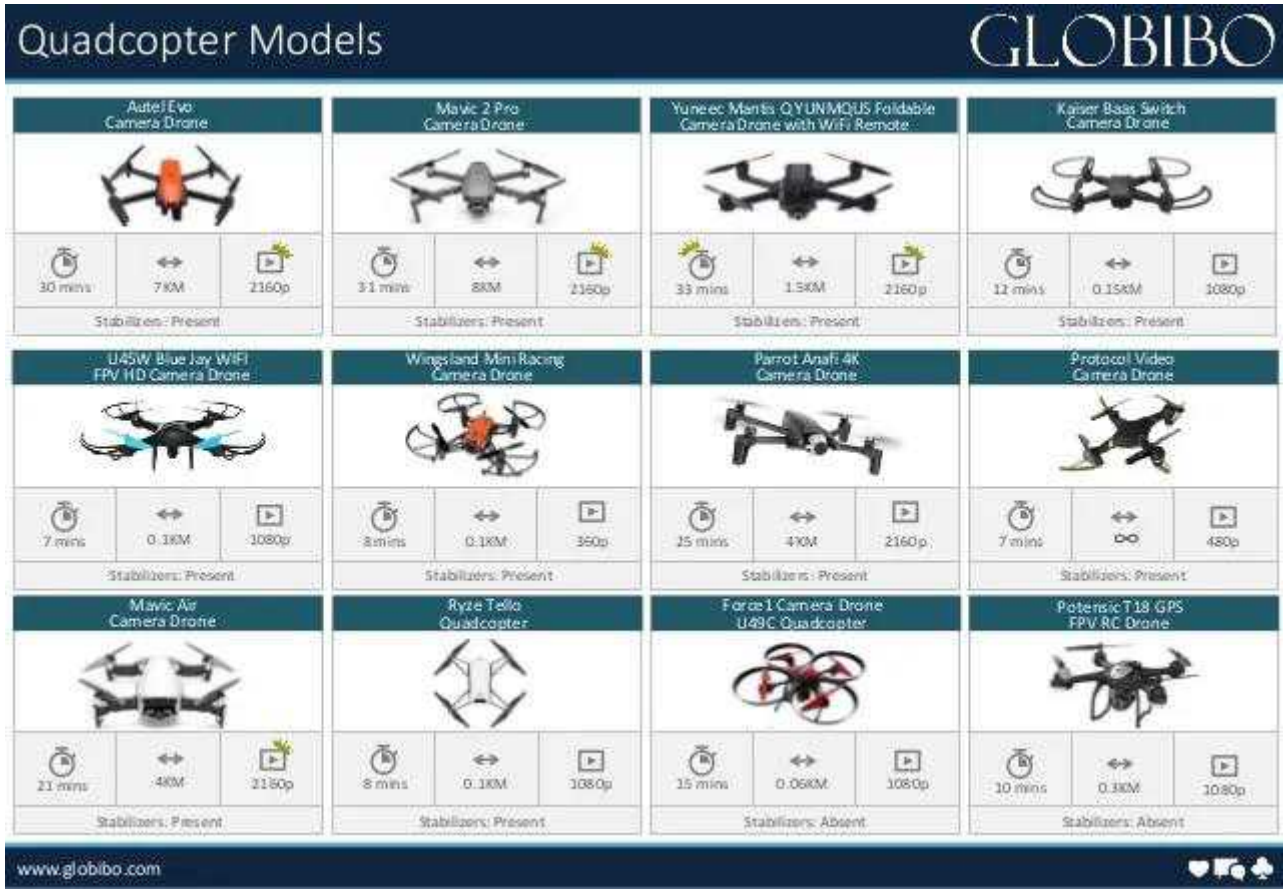
# Drone Use Cases
## Precondition for automated/autonomous flights

- Precondition for automated / autonomous flights
  - sensor systems (LIDAR, visual analysis, etc.) at the drone
  - CNS infrastructure (Communication, Navigation, Safety&Security)
  - regional / global data spaces / UTM (Unmanned traffic management)

# Drone Use Cases
## Excurs CNS Infrastructure

- 3 pillars are the precondition for a safe automated / autonomous flights:

# Drone Use Cases
## Manufacturer




@https://www.slideshare.net/globibo/camera-drones-overview-quadcopters

# Drone Use Cases
## Manufactures (civil market)

### Categories of Drones:

#### Fixed-wing UAV


Similar to airplanes
Require Area to land
Longer duration of flights

#### Multirotor UAV

Similar to helicopter
VTOL (Vertical Take Off and Landing)
Shorter duration of flights

#### Hybrid UAV

Mix of both worlds
VTOL (Vertical Take Off and Landing)
Longer duration of flights

# Drone Use Cases
## Manufactures (civil market)

### Top Manufacturer world wide

https://uavcoach.com/drone-companies/

https://www.aeroexpo.online/aeronautic-manufacturer/uav-82.html

https://www.volocopter.com/

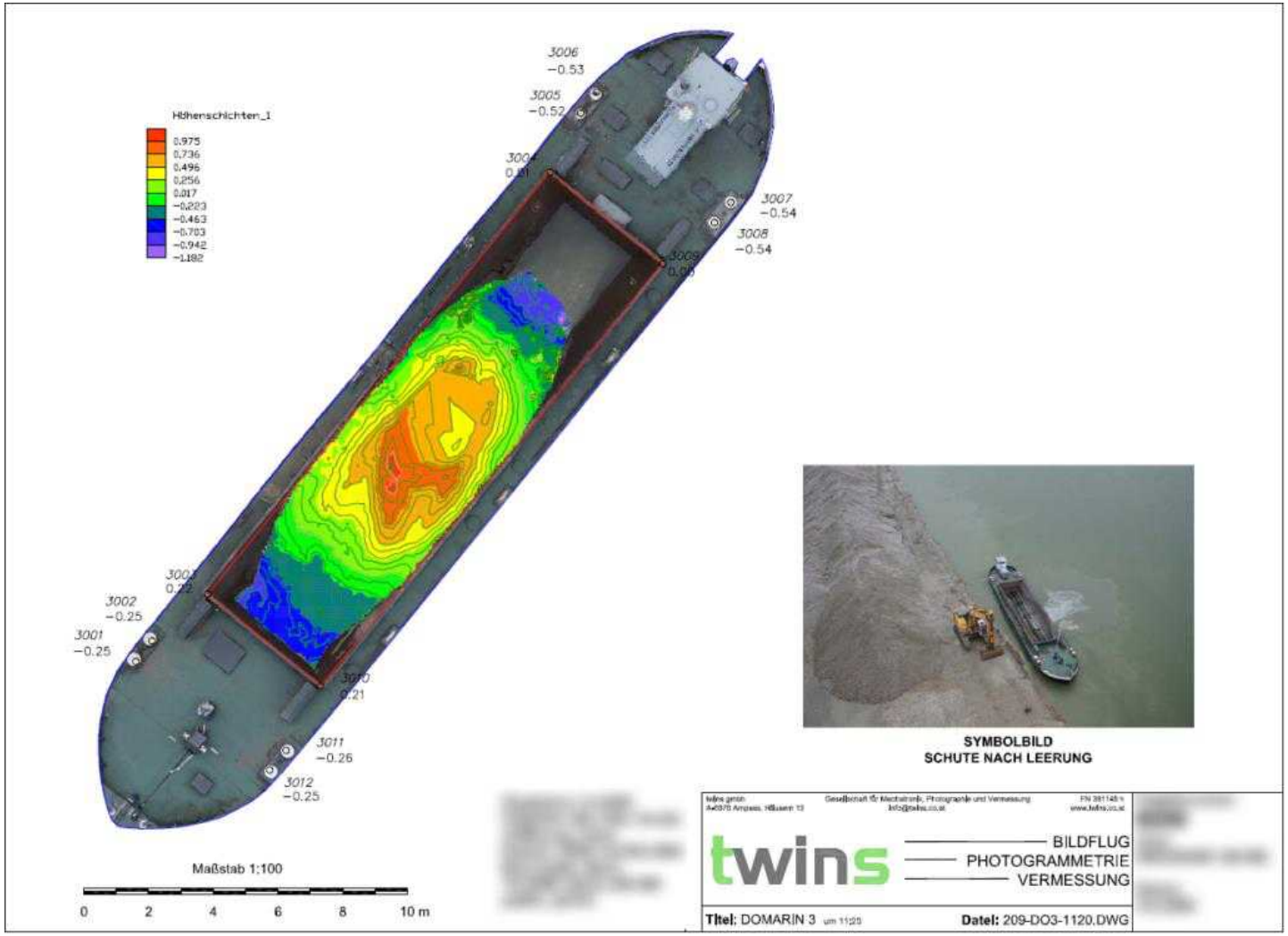
https://www.aeroexpo.online/

https://altigator.com/

https://www.parrot.com

- General: DJI, Parrot, Quantuum, Textron, IDS, Delta Drone, TWINS, Schiebel, Volocopter, Lilium, eHang, …
- Drone Manufacturers Alliance Europe (DMAE)

# Drone Use Cases
## Currently Active Use Cases




@ https://www.twins.co.at

# Drone Use Cases
## public protection and disaster relief (PPDR)

Snow Load

Bezirks-Feuerwehrverband Kufstein

Flooding

Rockfall

# Drone Use Cases

## public protection and disaster relief (PPDR)

Bayerisches Rotes Kreuz

## Reconnaissance

**„Throw Away Drone“**

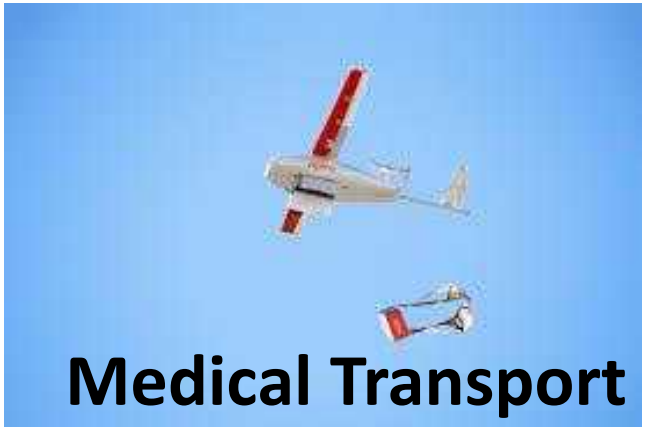
**Continuous Monitoring**

**Control of escape path / emergency route, stream of visitors, etc.**

IuK Tirschenreuth – FG UAS

# Drone Use Cases

## Delivery




Company Zipline: Transport of medical goods in africa
https://www.youtube.com/watch?v=Fx4bqfnzRbw

Company Wing: Transport of pharmacy goods in Finland/Australia/USA:
https://wing.com/

# Drone Use Cases
## Delivery

Company Avy: Healthcare logistics and support of fire department in Netherlands: https://avy.eu/

Company FlyingBasket: Transportation of heavy goods (100kg) in South Tyrol: https://flyingbasket.com/


Company MANNA in Ireland: business to business drone delivery company: https://www.manna.aero/

# Drone Use Cases
## Inspection

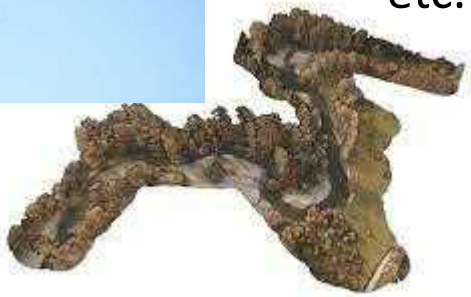
Company BLADESCAPE: Inspection of power systems, agriculture, etc.: https://blade-scape.com/


Company Percepto: Autonomous inspection and monitoring of construction sites, etc.: https://percepto.co/

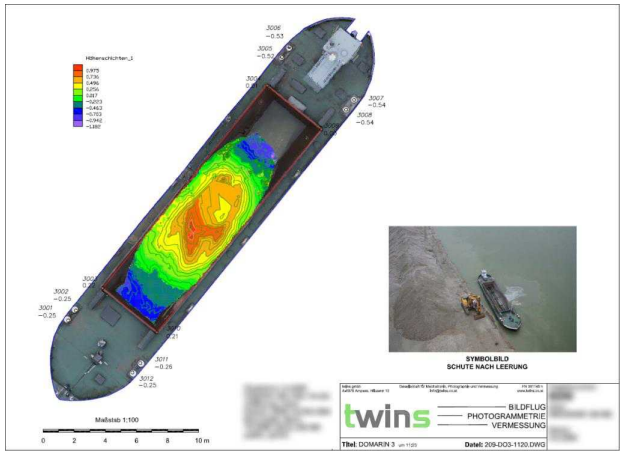
Company AIRTEAM: Roof Monitoring and 3D capturing of Buildings: https://www.airteam.ai/

# Drone Use Cases

## Inspection / Laserscanning / Photogrammetry



Company Skyability: Laser scaning of regions/buildings, photogrammetry, etc. https://www.skyability.com/




Company TWINS: 3D Modelling, Construction monitoring, special drone systems, etc. https://www.twins.co.at/

# Drone Use Cases
## Agriculture

Company John Deere: drone is equipped with a weed scanner and crop sprayer : https://www.youtube.com/watch?v=SKmzjPkf_sQ

Company Droneseed: plants trees in rural areas automatically: https://droneseed.com/ https://www.youtube.com/watch?v=EkNdrTZ7CG4

# Drone Use Cases
## Drone Taxi

- First Flights have been realized in several Cities (e.g., Dubai)
- Regulation in Europe allows piloted flights up to now
- Current work goes in the direction of optimizing drone (e.g., wing based Lilium) and used additionally for delivery (e.g., Volocopter)

LILIUM

VOLOCOPTER


EHANG

# Drone Use Cases
## Drone Taxi - Vertiport

- EASA issues world's first design specifications for vertiports has been released in March 2022
- First companies are providing vertiports for drone taxis
- Mobile vertiport designed by Austrian company (Schwarzmüller)

**Voloport**

Voloport: https://www.volocopter.com/

**Skyportz**

https://skyportz.com/

**Volocopter/Schwarzmüller**

# Drone Use Cases
## Research at FH Kufstein Tirol – Running Projects

- Hydrogen Drone
- Drone for detecting dangerous goods
- Setup of an infrstructure and data space for autonomous mobility
- Drones in the use of facility management
- Drone lab & Drone swarm algorithm

# Drone Use Cases
## Research at the FH Kufstein Tirol

- Data Science & Intelligent Analytics
  - Start WS 2018, Master-BB
- Smart Products & Solutions
  - Start WS 2017, Master-BB
  - Focus on Sensor systems, digitalization of products
- Web Communication & Information Systems

# Drone Use Cases

## Validation area: mobile Infrastructure

- Set up of a mobile infrastructure for safe&secure drone applications
  - Infrastructure is partly acquired by our university and partly integrated by the DLR GfR
  - Application: Traffic monitoring by drones
- Research project of the country of Tyrol with the following partner organisation
  - FH Kufstein Tirol
  - Swarco AG
  - DLR GfR
  - TU Graz

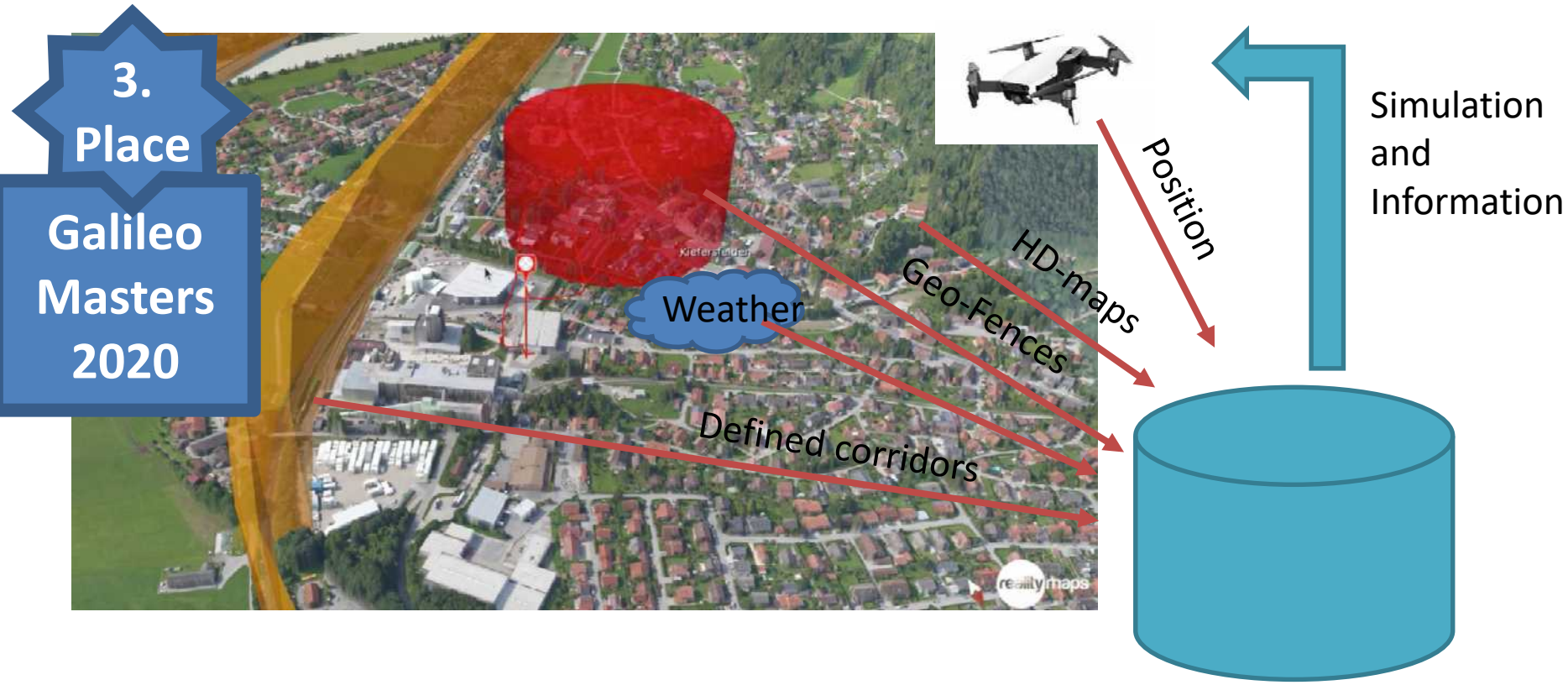
©TU Graz

Finanziert von

# Drone Use Cases

## Validation area: mobile Infrastructure

- Set up of a Mobility Data Space for drone applications




Video for explanation: https://owncloud.fh-kufstein.ac.at/index.php/s/sSi3exBV7pqI3Ww

Krispin Raich, Robert Kathrein, Michael Erharter, Mario Döller, **Spatial Extension model for multimodal traffic management**, In Proceedings of the International Conference on Intelligent Vehicles (ICoIV 2020), Berlin, Germany, 2020.

# Drone Use Cases

## Application: drone based detection of dangerous goods

- Research on drone based detection of dangerous goods in cooperation with the fire department of district Kufstein.
- Aim:
  - Increasing the reaction time of the fire department
  - Creation of an early-warning system

Mit Unterstützung von Bund, Land und Europäischer Union
Bundesministerium Nachhaltigkeit und Tourismus
LE 14-20
EFRE

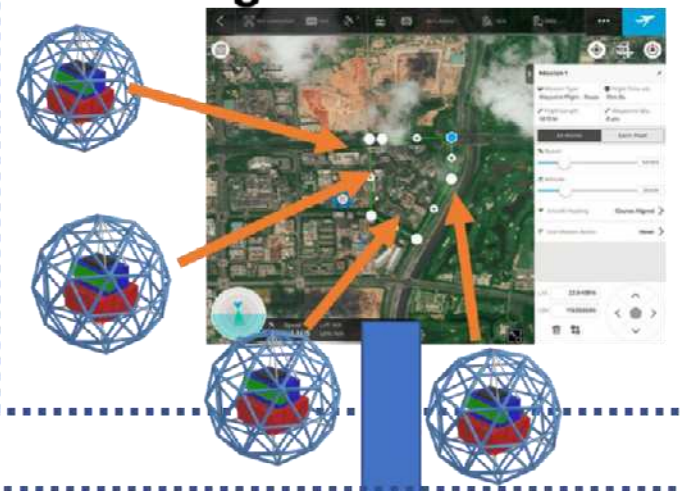


@ https://www.heute.at/oesterreich/burgenland/story/Rollende-Bombe--Tank-Lkw-ueberschlaegt-sich-auf-A2-43872460

# Drone Use Cases

## Application: drone based detection of dangerous goods

**1+2:** sensory platform and navigation



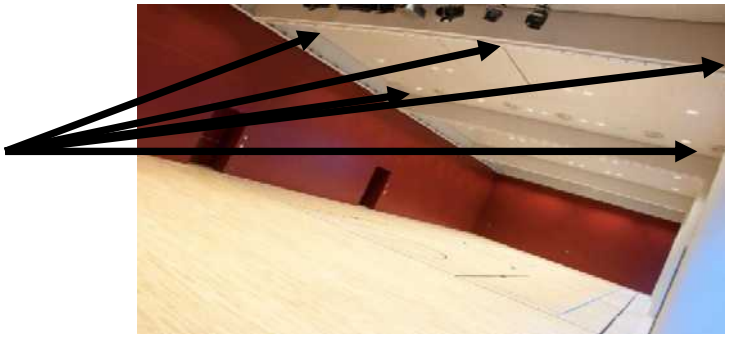
**4:** Communication to pilot / automated system

Supporting system at ground level

**3:** 3D visualization of area

# Drone Use Cases
## Drone Lab

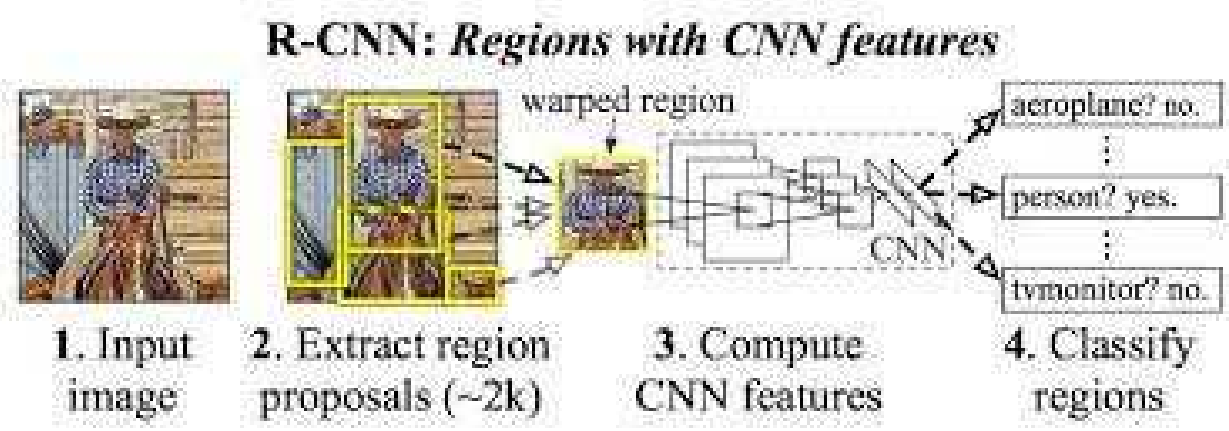
- Drone Lab @ FH Kufstein Tirol
  - Research on automated drone applications.
  - Support of teaching in the respective study programs (Smart Products & Solutions and Data Science) and support of business partner.
  - Motion Capturing System (company Vicon https://www.vicon.com/hardware/)
  - 10 Crazyflies company Bitcraze and other construction kits.

Thank you for listening!

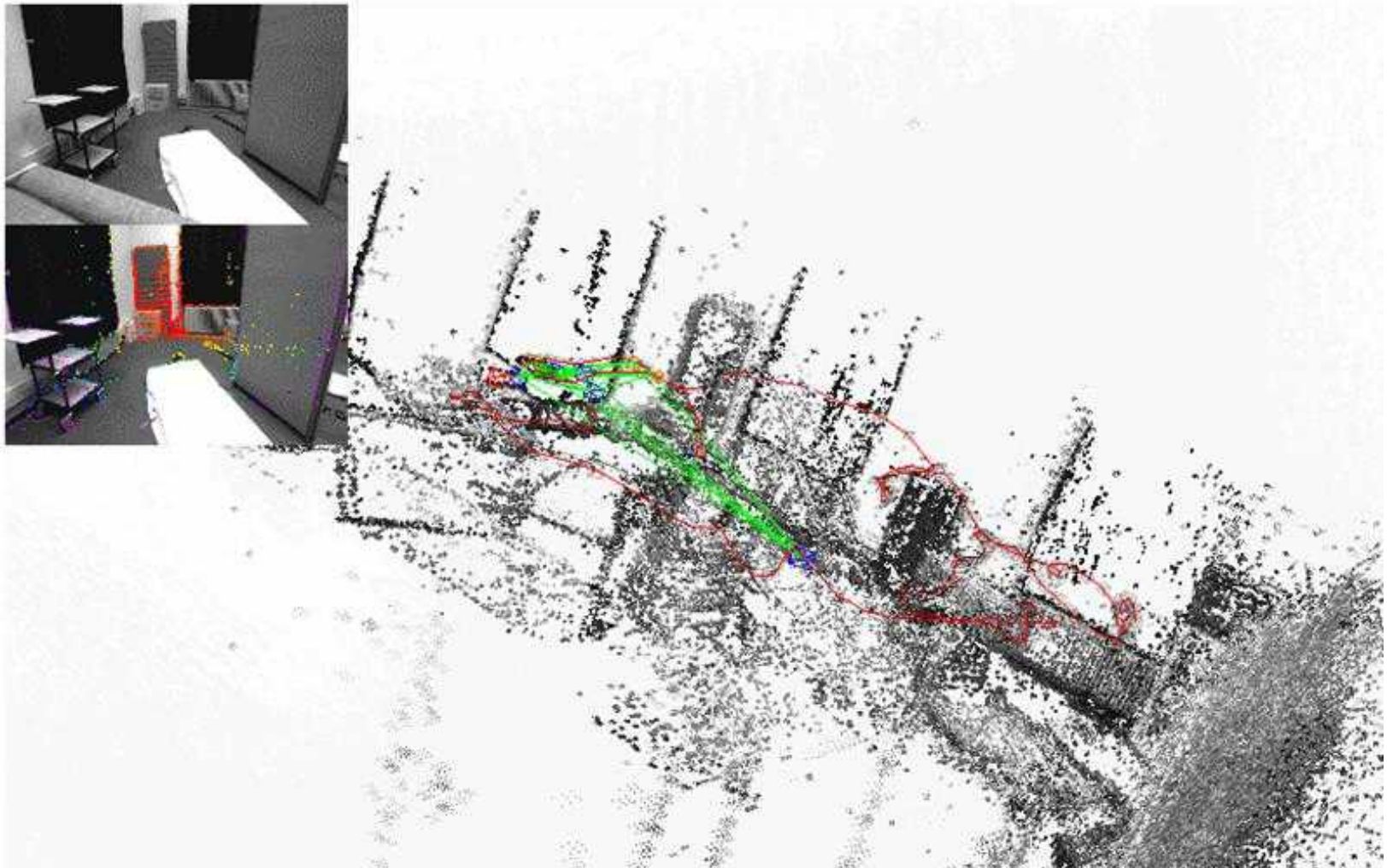
# Drone Use Cases
## Object-classification by AI-Systems

- Visual drone detection and classification by neuronal networks
- Set up Benchmark environment and test/trainings data

# Drone Use Cases
## 3D Extraction and Orientation by Drones

- Automated localization in 3D environment by SLAM algorithm



# Drone Use Cases

## Validation area: mobile Infrastructure

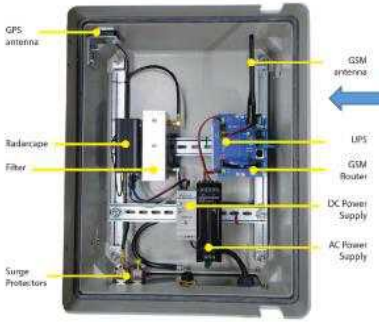
**Zentrale Infrastruktur (Zentraler Knoten)**

Server, Kontrollzentrum, Sensorik auf dem Dach

**Mobile Infrastruktur (Lokaler Knoten)**

Drohnen Detektionssystem

ADS-B / FLARM Sensor Station

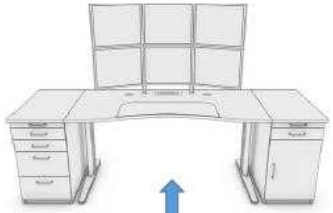



Zur Dachmontage (siehe unteres Bild)

Zentraler Server

Kommunikation über LTE und Clouddienst (optional eigenes Hosting)

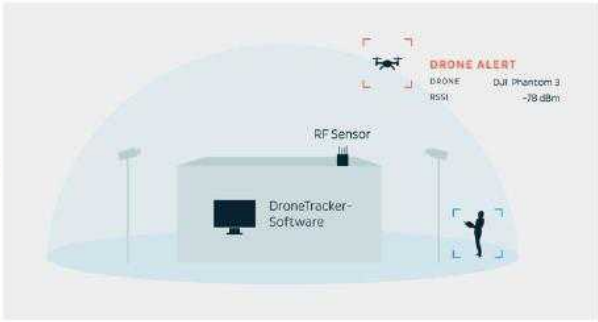
Kontrollzentrum



Ansteuerung der Monitore über **Multimonitorgrafikkarte**

**GNSS Station**

(von DLR GfR eingebracht)




**1 x Sensor RF-100**

**3 x Sensor RF-300**

# Drone Use Cases

## Validation area: mobile Infrastructure

- Excerpt of our air traffic monitoring system

Abbildung 1: Dedrone drone detection system

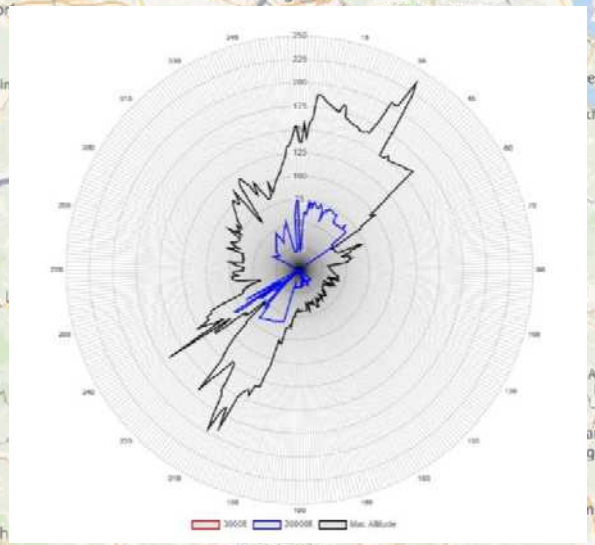
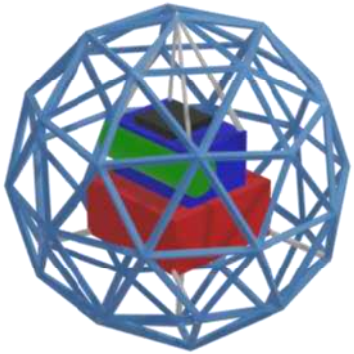


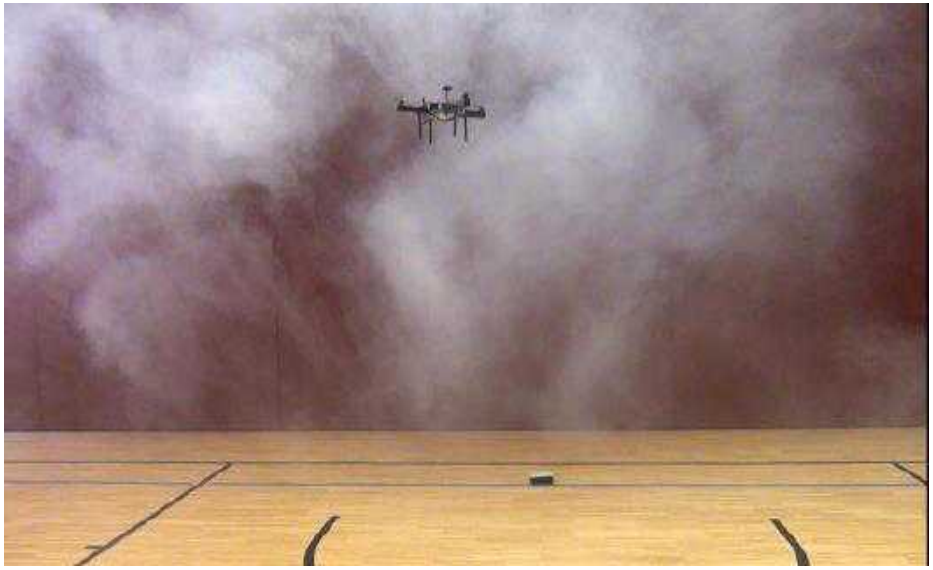
Abbildung 2: ADS-B of our university

# Drone Use Cases

## Application: drone based detection of dangerous goods

- Current results
  - Smoke tests
  - Transfer test of sensory platform
  - Set up of Sensory platform





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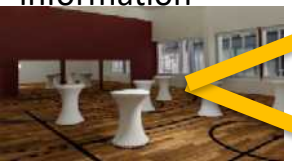
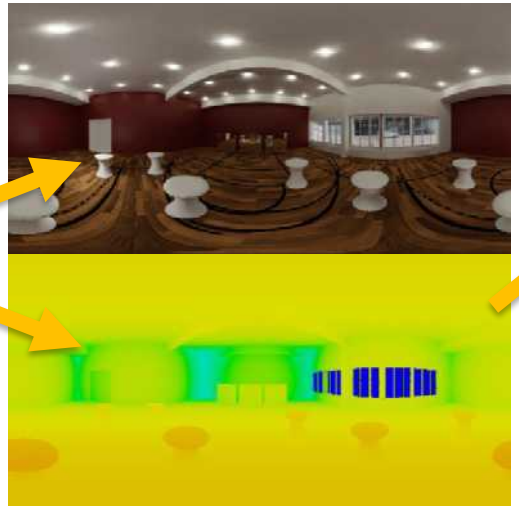
# Drone Use Cases
## Drone Navigation by AI-Systems

- Equirectangular depth detection by 360 degree camera
- Research on GAN-network for automated image based depth detection during drone flight

Rendering of 360 degree images with depth information





Training of GAN


Test with real image