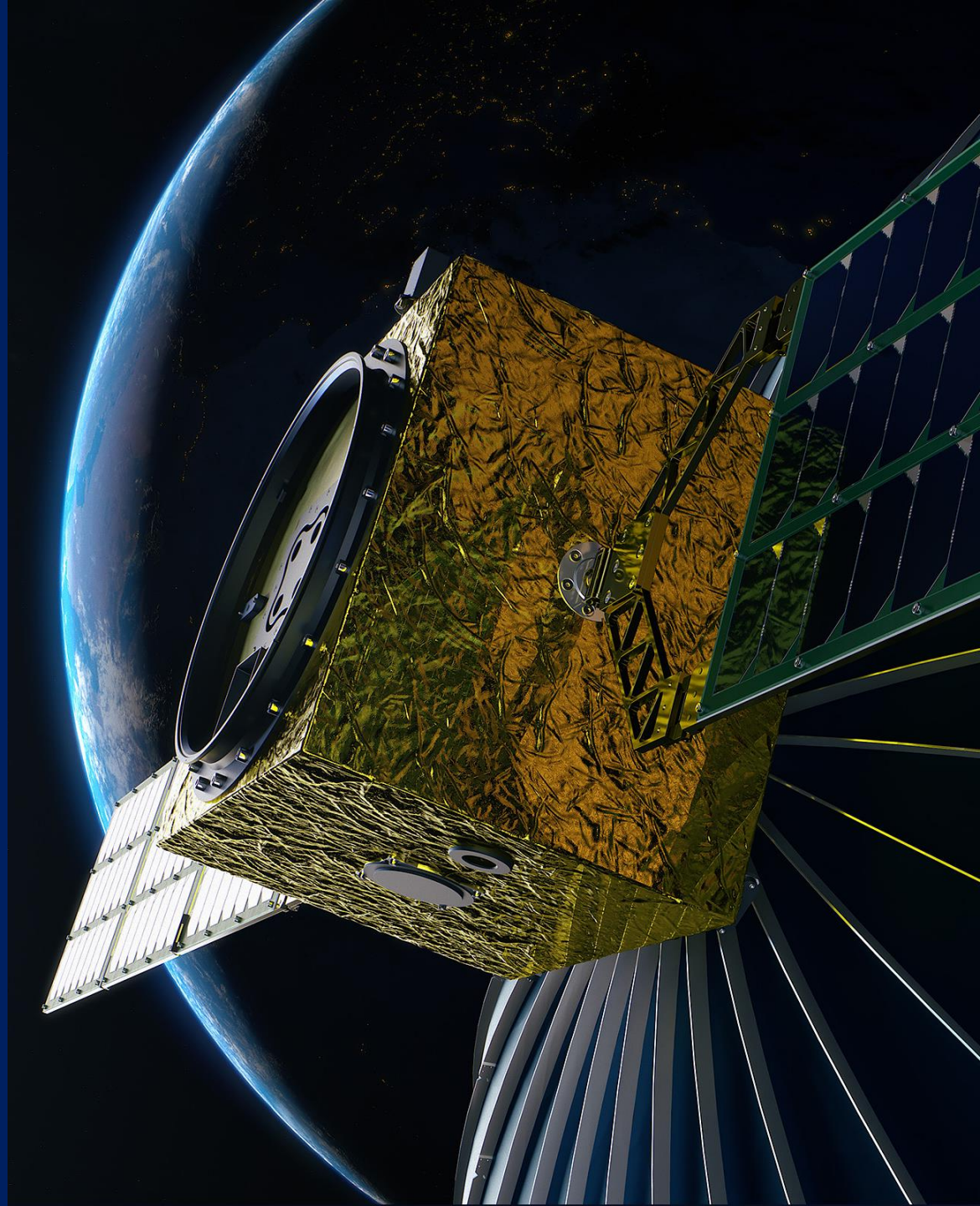
creotech

Satellite & UAV Data Infrastructure & Applications

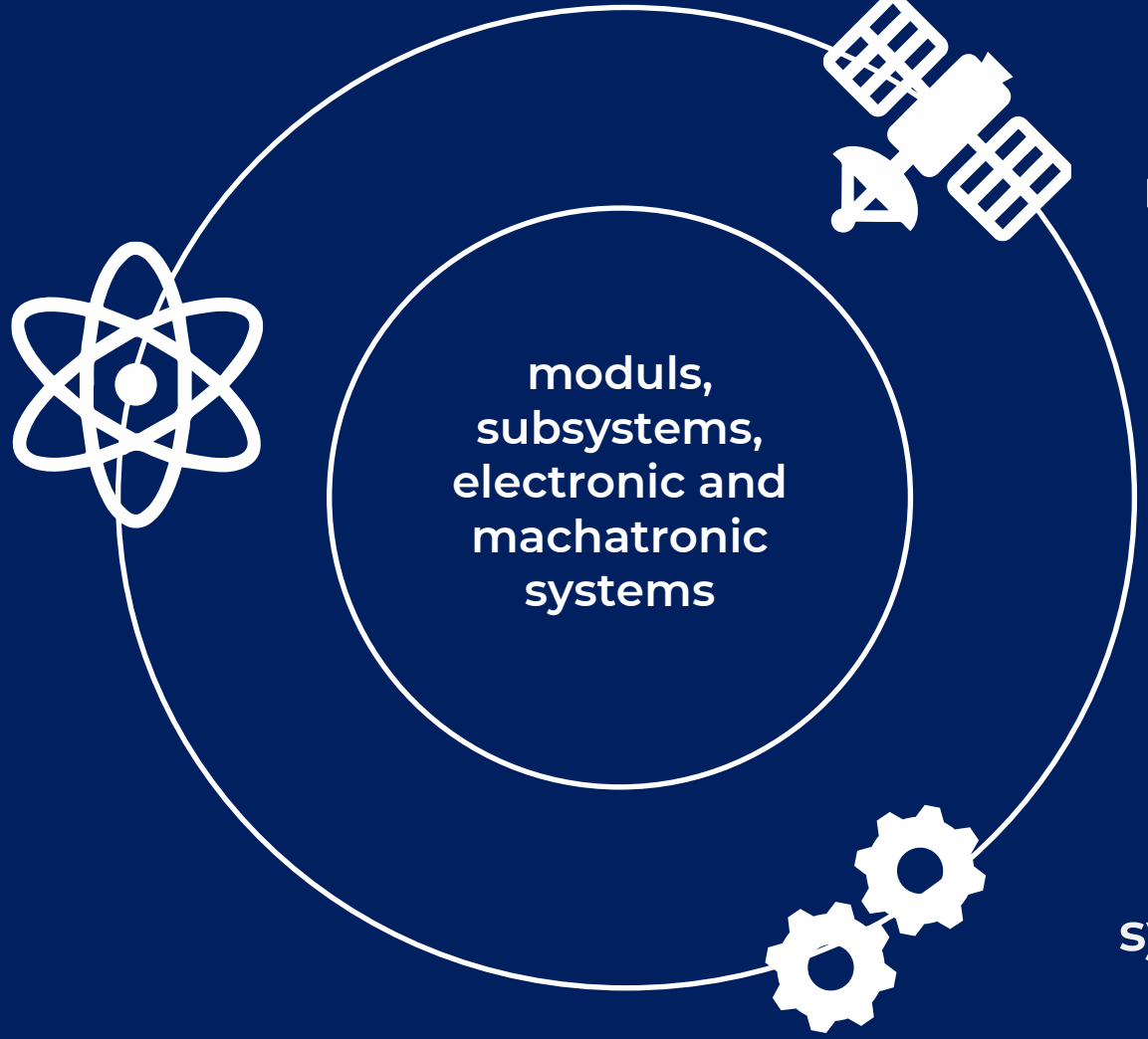
Jacek Kosiec

San Sebastian, 17-21.07.2023



CREOTECH INSTRUMENTS MISSION

Science:
Hard Real Time Systems, e.g. quantum computers, QKD



Space:
HyperSat microsatellite platform, EO missions, ESA projects

Industry:
WhiteRabbit time synchronisation technology

QUANTUM AND TIME SYNCHRONISATION SYSTEMS

SEGMENT SCIENCE

Together with the CERN laboratory, we are implementing the White Rabbit standard for sub-nanosecond time synchronisation - currently in demand in research centres, but the first deployments in telecommunications and energy systems are underway.

Together with Oxford University we are working on the Sinara standard. It allows to assemble control and measurement systems from simple electronic "building blocks", e.g. for quantum computers. Currently, we have implemented into production >30 electronic systems in the Sinara standard.

Estimated CAGR (2017-25): 29.5%
(Persistence)

QUANTUM COMPUTER – EU & PL

SEGMENT SCIENCE

- Creotech is taking part in the Millenion project for the 1000-qbit quantum computer for the EU. The project is executed by the international consortium under the leadership of Innsbruck University and is financed by Horizon Europe Quantum Flagship programme:
  - Phase I (2022-2026) budget is €20 million
  - Phase II (2026-2029) budget is €1 bilion

- Antoher project in this area realised by Creotech is EuroHPC with a total budget of €100 milion for 6 countries.

EAGLEEYE

SEGMENT SPACE

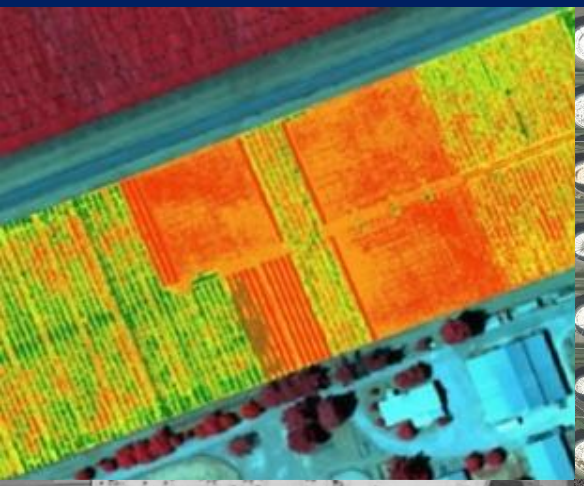
- EagleEye product line parameters :

• Flight heritage:	mid 2024	
• Satellite mass	25-100kg	
• Maximum payload mass	50kg	
• Available envelope for payload	350x350x400mm	
• Design lifetime at LEO	5 years	
• Power generation (EOL OAP) (Baseline / Extended)	70W / 200W	
• Power available to Payload (EOL OAP)	20W / 150W	
• Pointing accuracy	APE	<0.11° (3-sigma)
•	AKE	<0.014° (3-sigma)
•	RPE (10s window)	<0.005° (3σ)
• Slew rate	Up to 2°/sec	
• Propulsion	Electric or Chemical propulsion	
• Energy storage	Up to 500Wh	

EXAMPLES OF SATELLITE (AND UAV) DATA APPLICATIONS

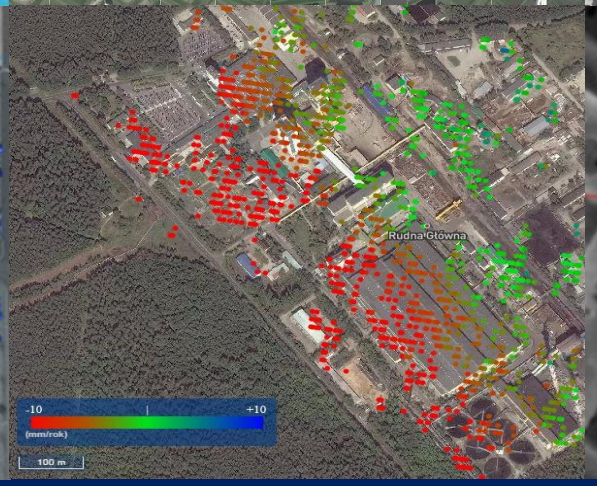
SEGMENT SPACE

Agricultural market



Oil reserves

Airports



Car park Monitoring

Mining damages

Activity monitoring

Resolution

Nanosatelite

10m

Mikrosatelite

0,5m

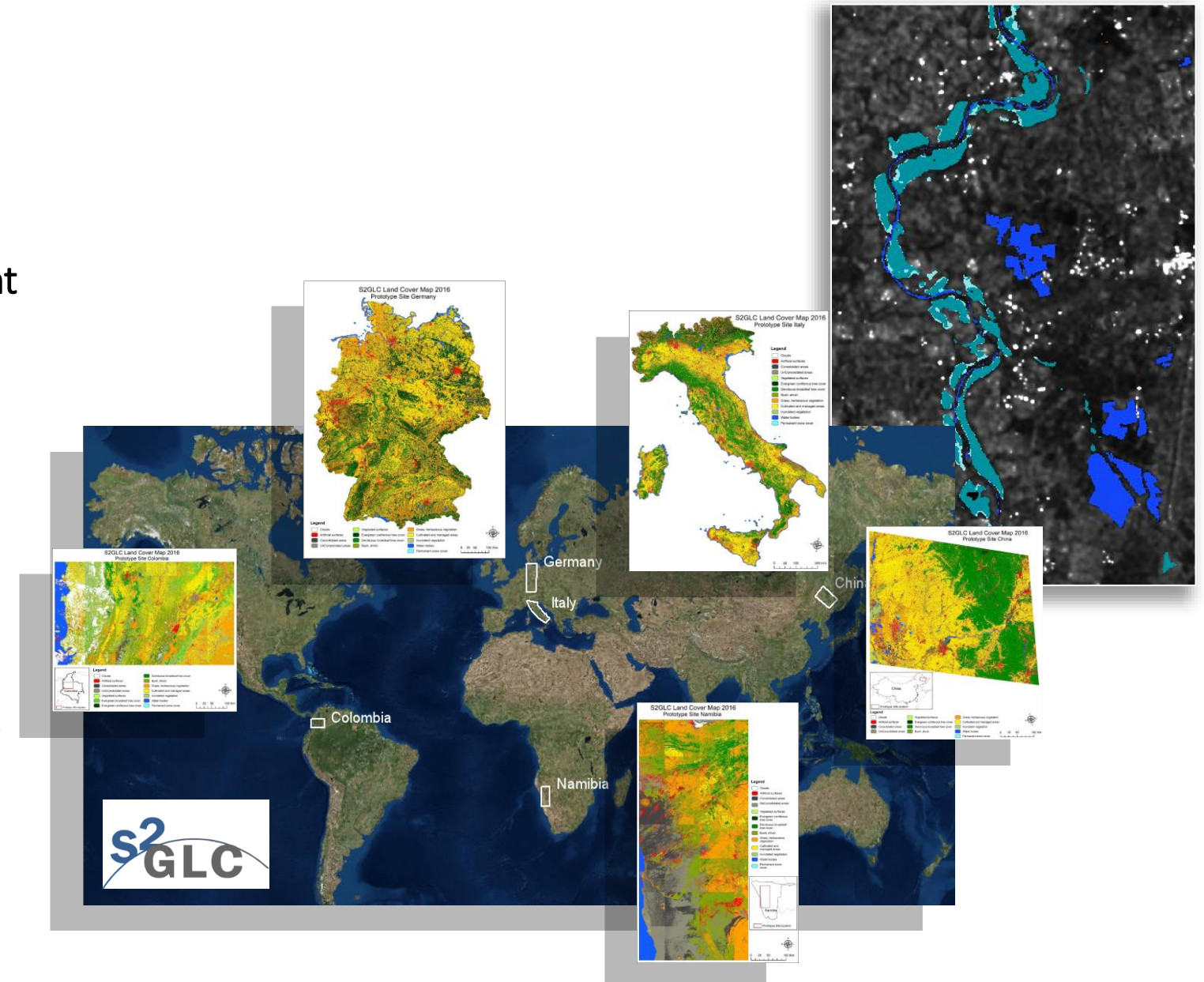
Makrosatelite

0,1m

MORE EXAMPLES OF SATELLITE (AND UAV) DATA APPLICATIONS

SEGMENT SPACE

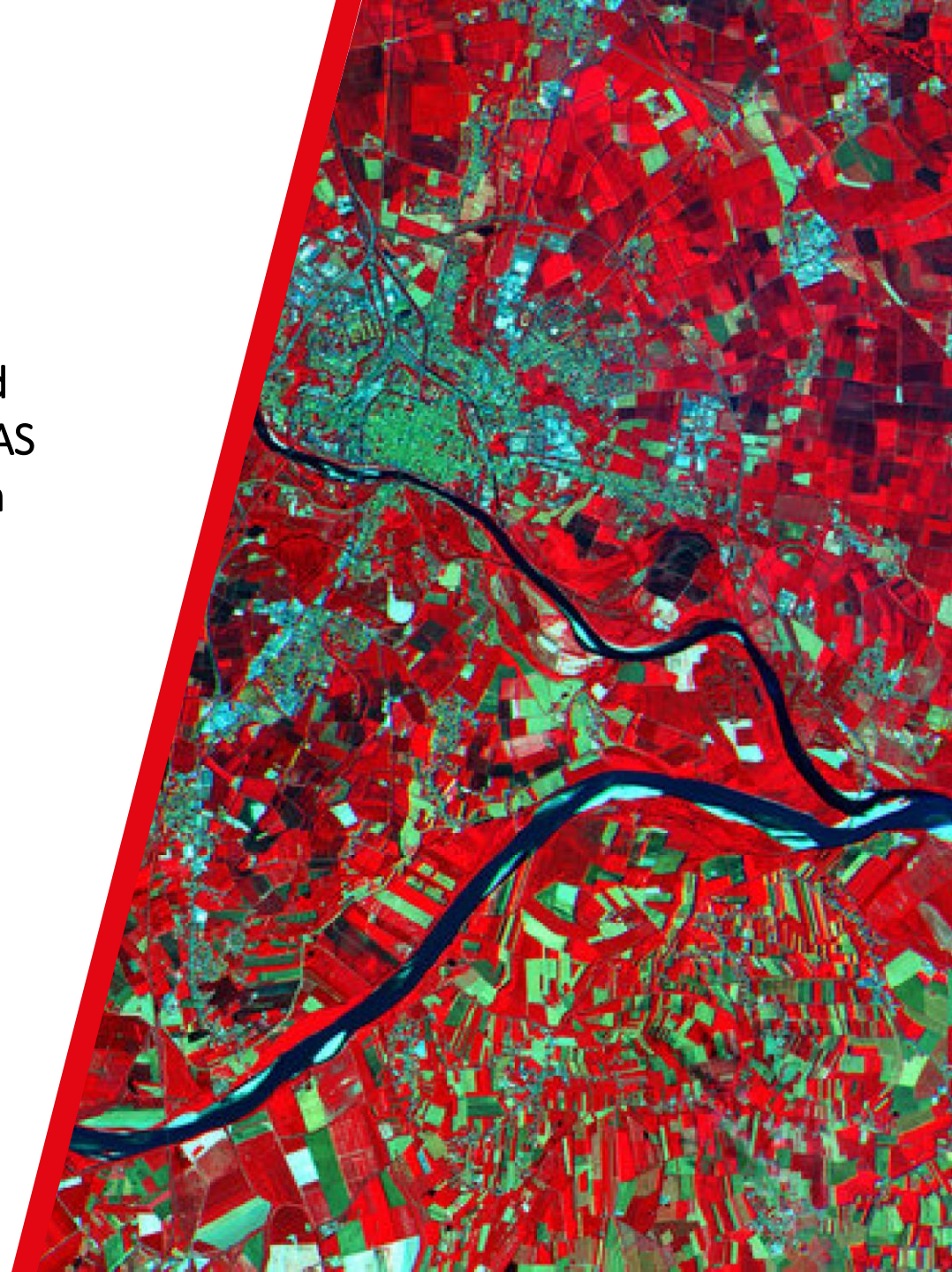
- Flood monitoring
- Land coverage and biomass assessment
- Soil moisture
- Landslides/vertical ground shifts
- Haze monitoring/fire detection
- Sea pollution monitoring
- AIS / VDES ship monitoring
- Telecommunication towers monitoring
- Terrain profile




CREODIAS

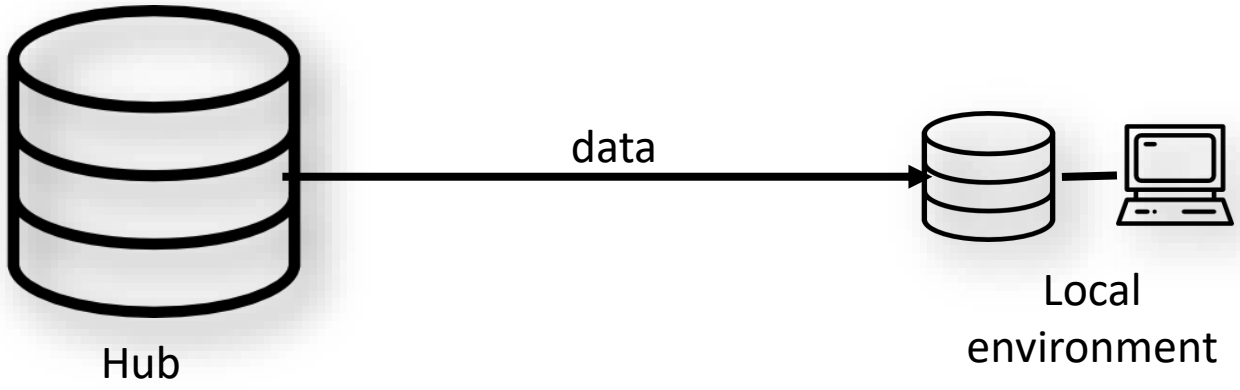
Data and Information Access Services – Copernicus DIAS

- In 2017 consortium led by Creotech Instruments was selected by European Space Agency (ESA) as one of the Copernicus DIAS providers. CREODIAS platform has been put into operations in June 2018

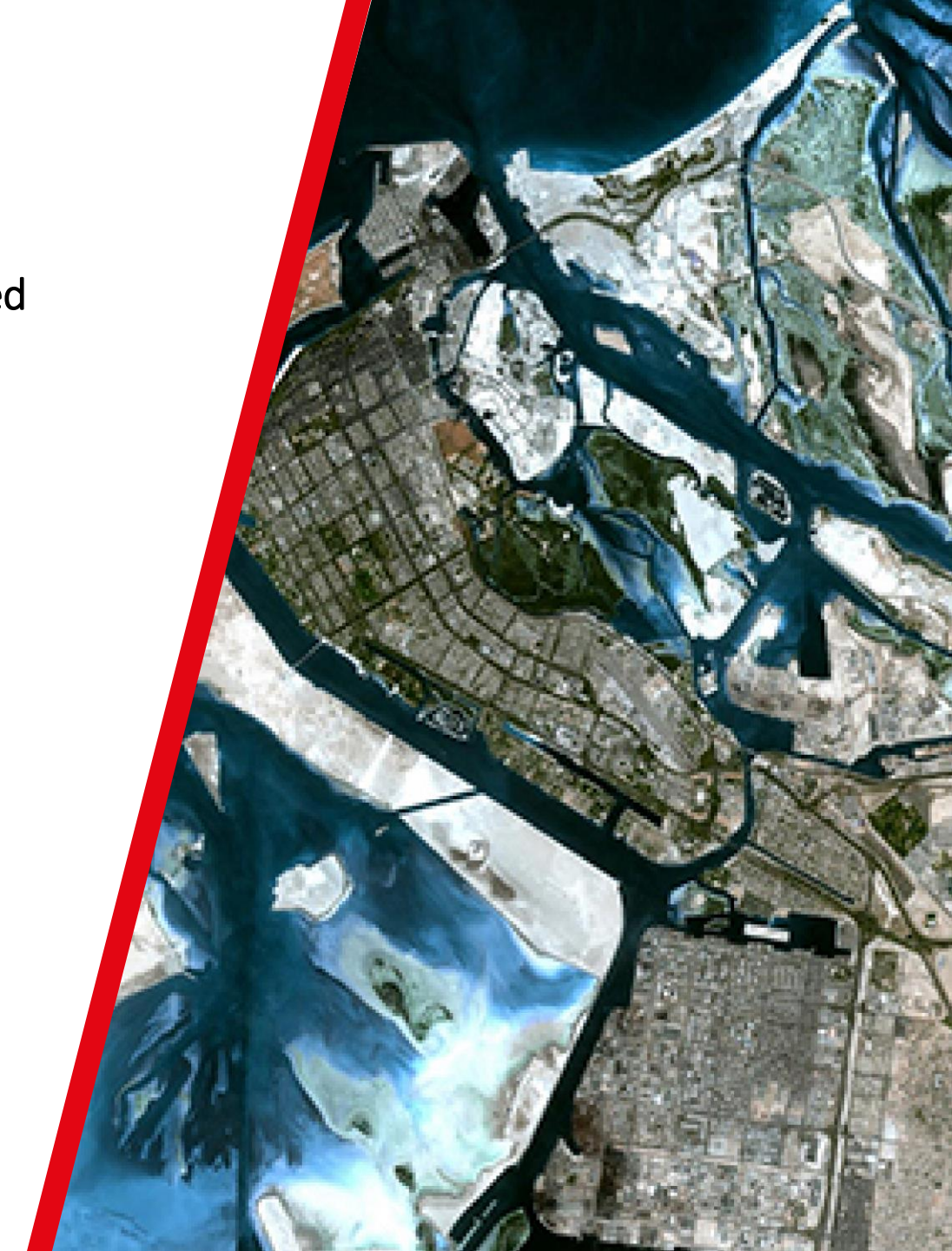


DIAS Concept

- Standard model of satellite data processing – data downloaded and then processed locally

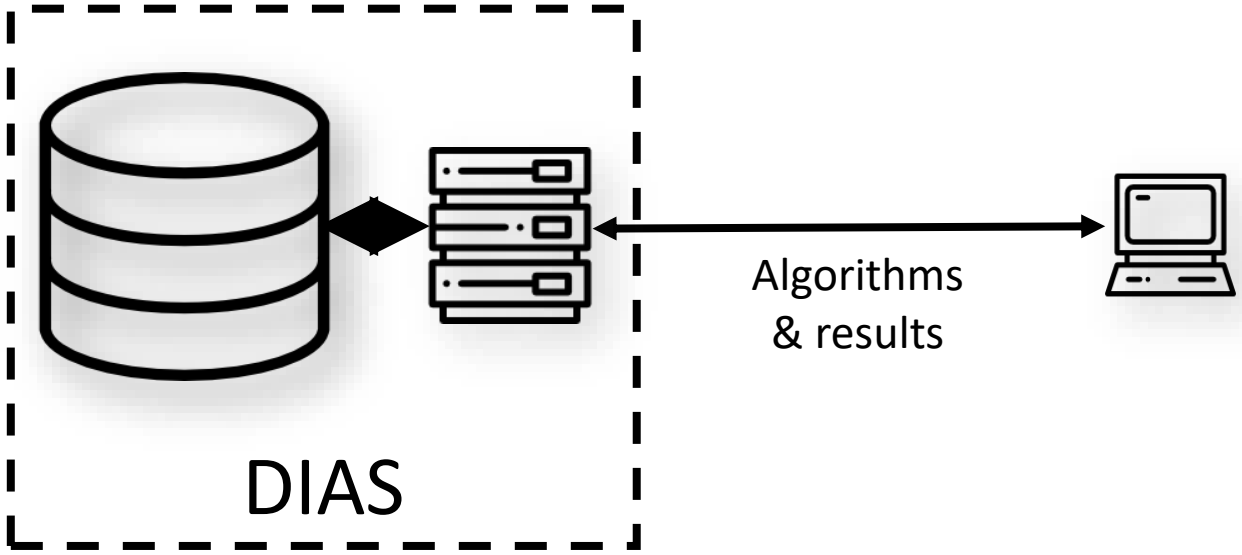


CREODIAS



DIAS Concept

- Processing brought close to locally stored data



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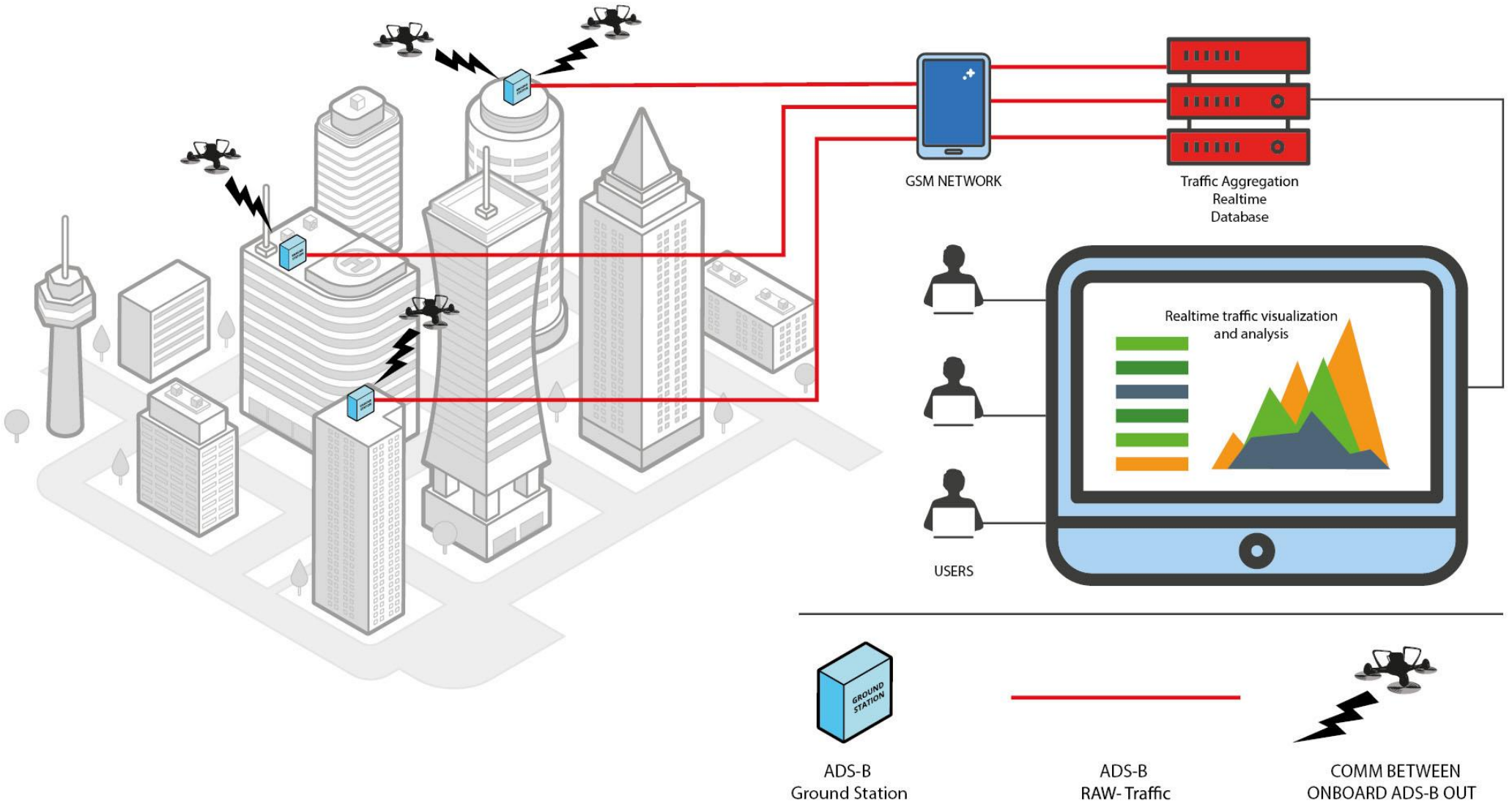
UAV (drone) Technologies

FMS (Flight Management System)- basic concept

Operating drones transmit their coordinates via trackers to the system providing real-time visulisation and analysis

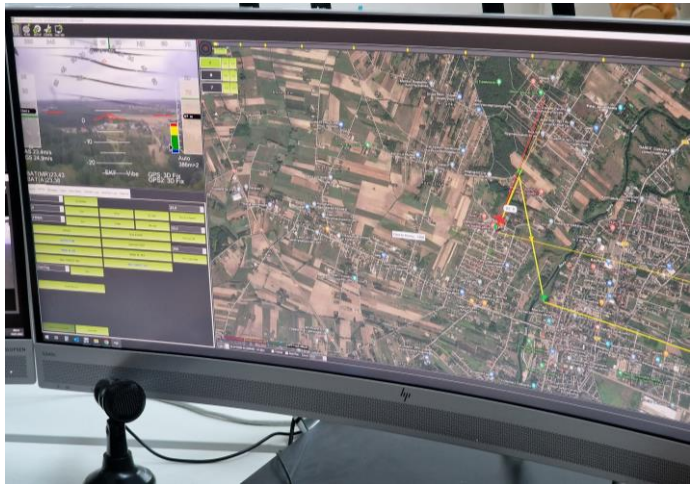


ADS-B Groundstation – sample use

ADS-B tracking is one of the possible options, along with GSM/Lte based tracking in urban areas

FMS – Flight Management System

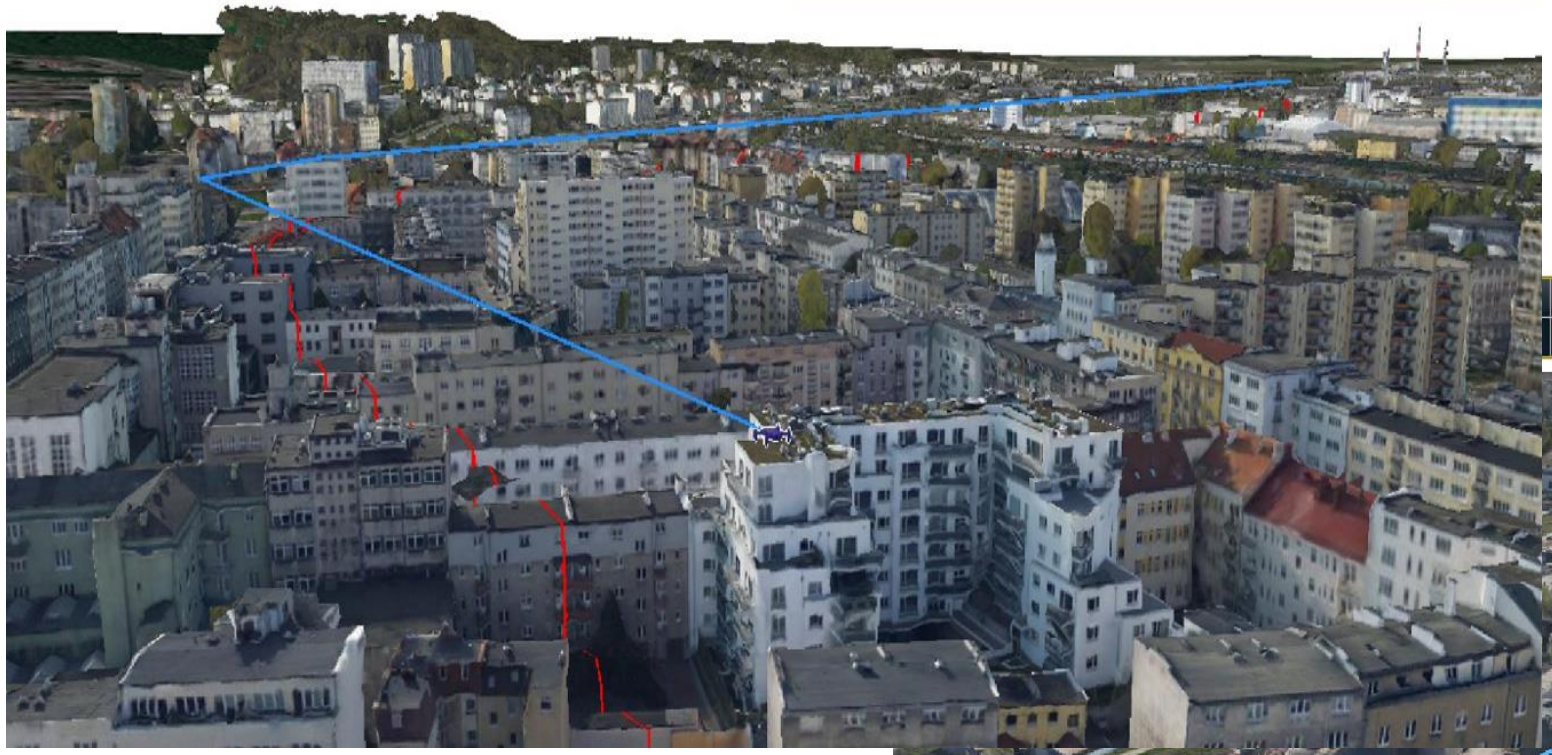
The system allows for real-time operations monitoring of a fleet of drones and other equipment (e.g. rescue vehicles) equipped with selected trackers (ADS-B and/or GSM/Lte). It can be integrated with UAV flight control systems



FMS

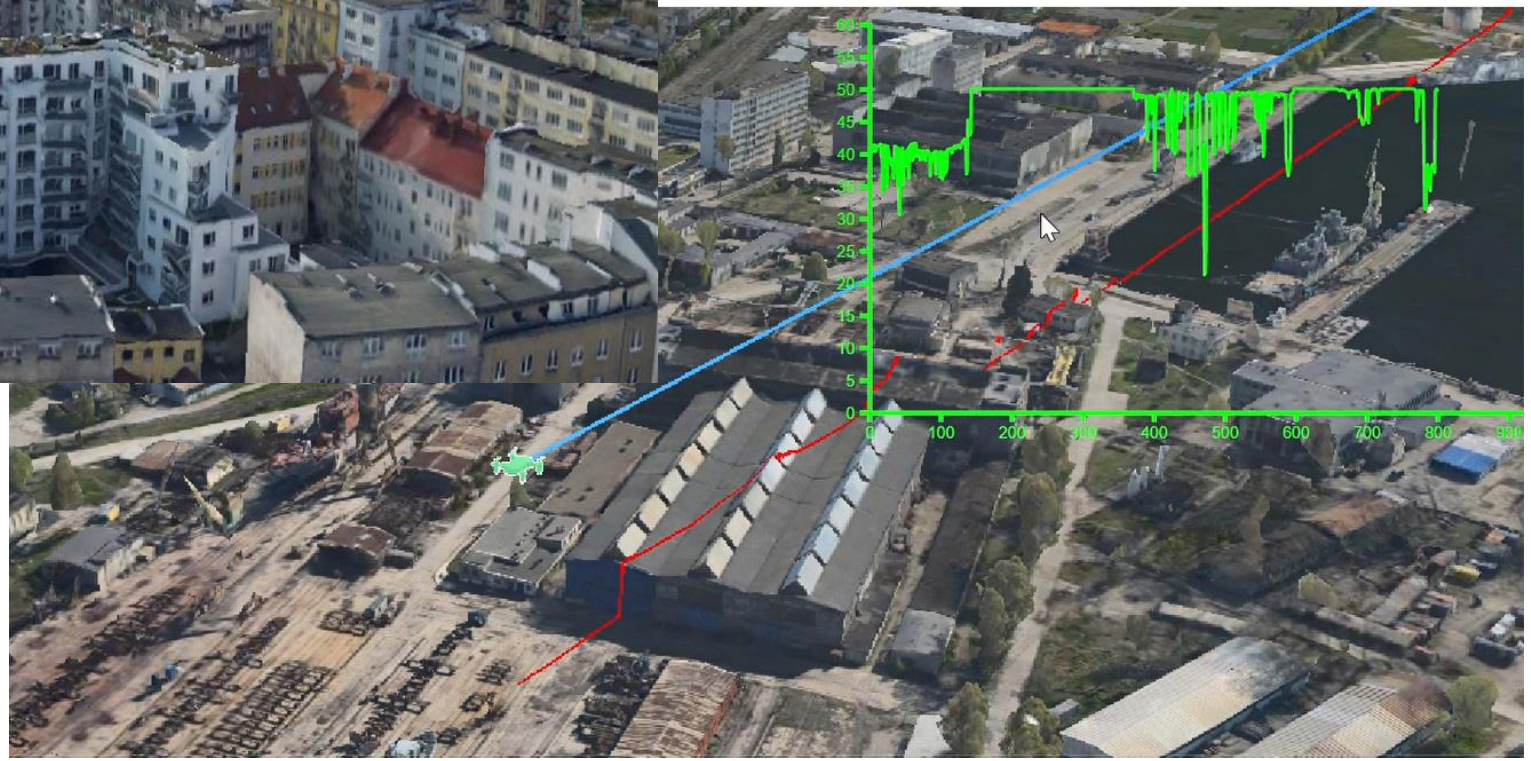
View

Call	ICAO	Coordinates	Altitude	Speed	HOT
Dron_1	48F002	[18.54137°, 54.52038°]	40.00 m	10 kn	31.56 m



The system allows for real-time operations monitoring of a fleet of drones and other equipment (e.g. resuce vehicles) equipped with selected trackers (ADS-B and/or GSM/Lte)

ICAO	Coordinates	Altitude	Speed	HOO
48FF94	[18.52996°, 54.54094°]	50.00 m	15 kn	49.75 m



DRONE RAPID MAPPING - DRM

PORTABLE RUGGED SERVER – ready to be used directly on site, in the field

Up to three displays, optimised for outdoor use in sunlight

Possible to be carried by one person – powerful processing server of suitcase size

Rugged design or the server casing – allowing use in field conditions, directly on emergency incident site

No need to connect to Internet or fixed power supply (possible use of petrol generator or car battery)

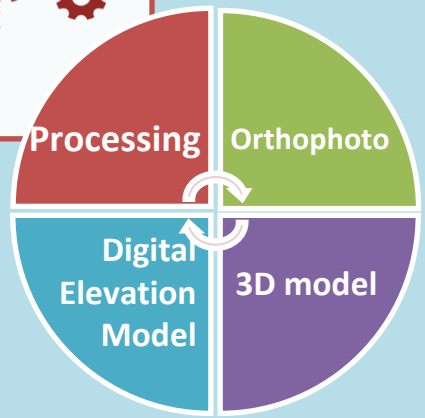
Fast mulitiprocessor server with GPU processing suport, Solid State Disks, memory cards reader and WiFi router allowing wired or wireless connection with other terminals

DRM principle of operation

Drone flight

Images

Processing environment



Outputs

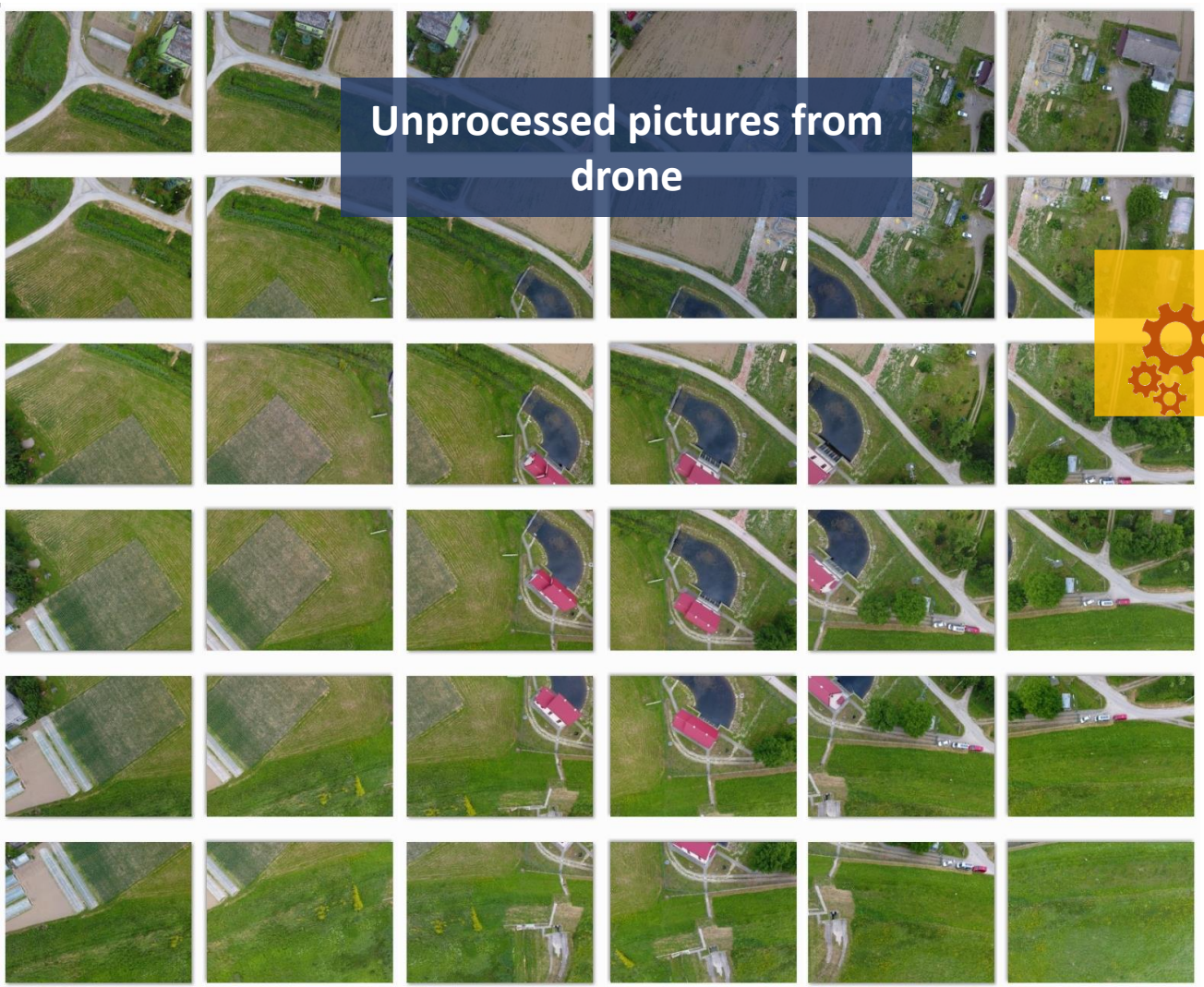
Ortophotomaps

3D Models

Full processing automation

DATA PROCESSING AND PRODUCTS:

Results are available shortly after drone data download to the rugged on-site system, orthophotomaps and then 3D models (as needed)



3D MODELS:

The textured 3D models allow for better situational awareness and can easily be shared with rescue team members, other teams or supervisors (also on mobile devices)

MEASUREMENTS:

The field system allows for a set of customised measurements and automated analysis scenarios

GREy

Geomatic Remote EYe

2021

www.grey.aero

GREY services – current status

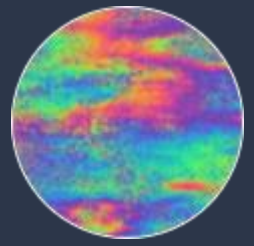
Terrain height for the selected point

Terrain height statisticts within the selected rectangle

Terrain profile for the selected route (fractional line)

Risk map

Topgraphic objects data/map

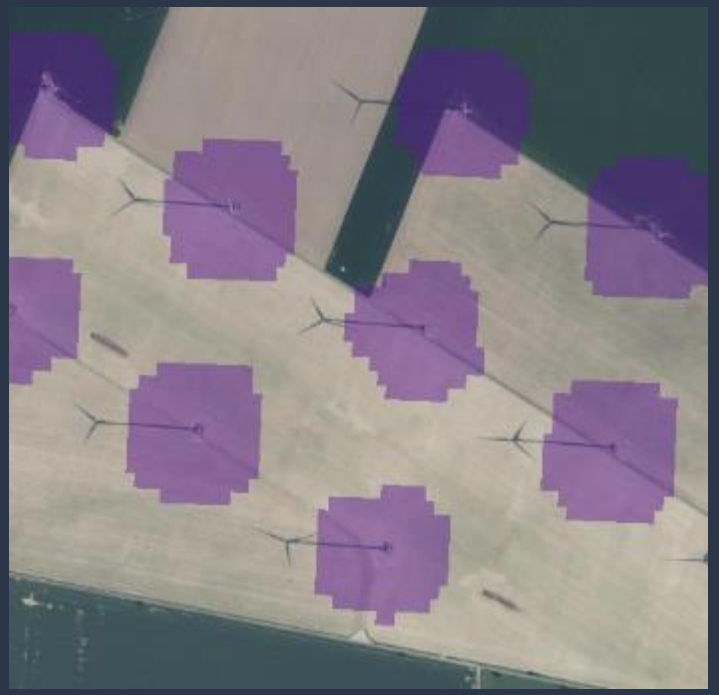


Satellite interferometry based monitoring of terrain changes in the selected areas

GREy

Analyses examples

Terrain height for the selected point

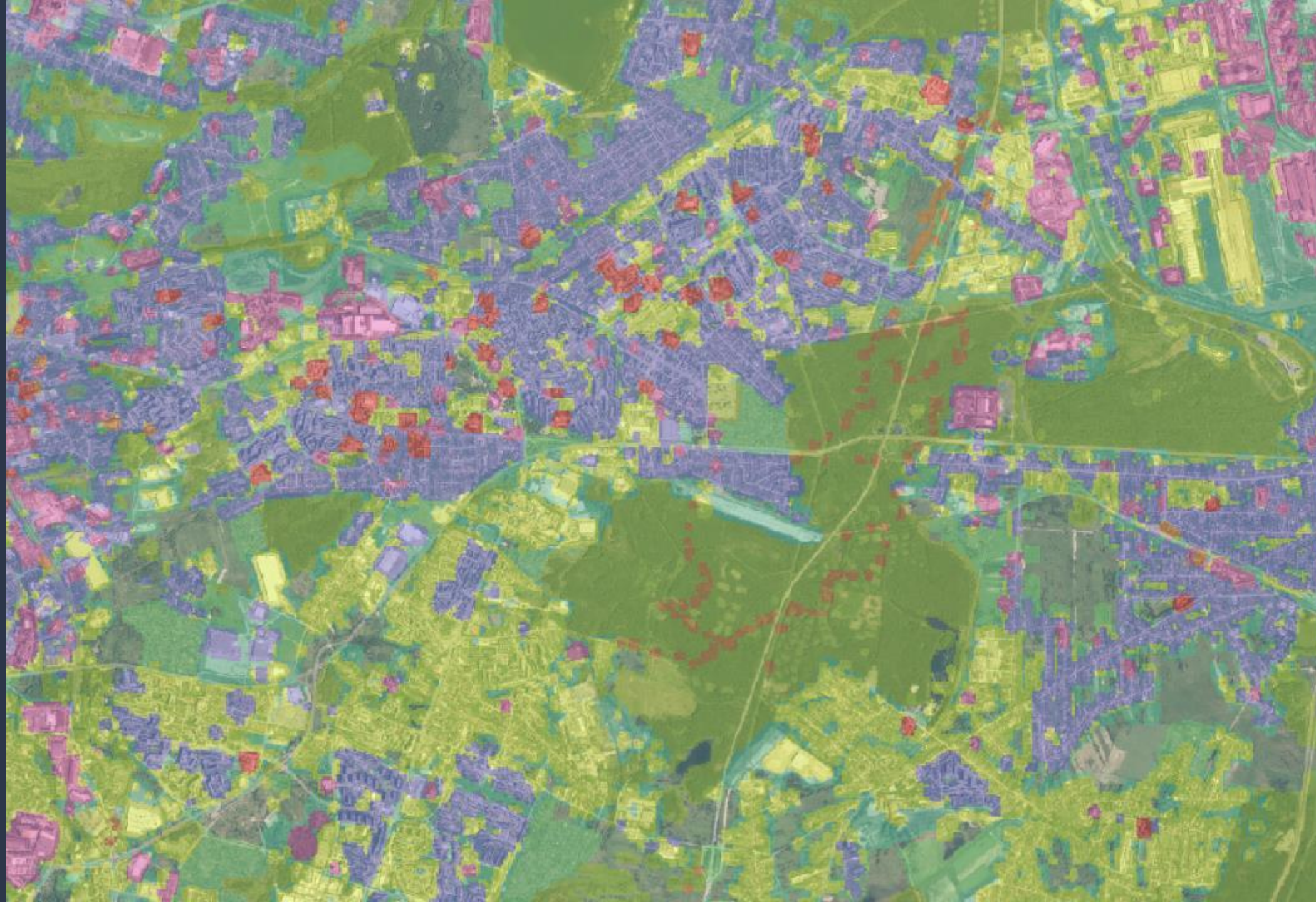


Slender objects map

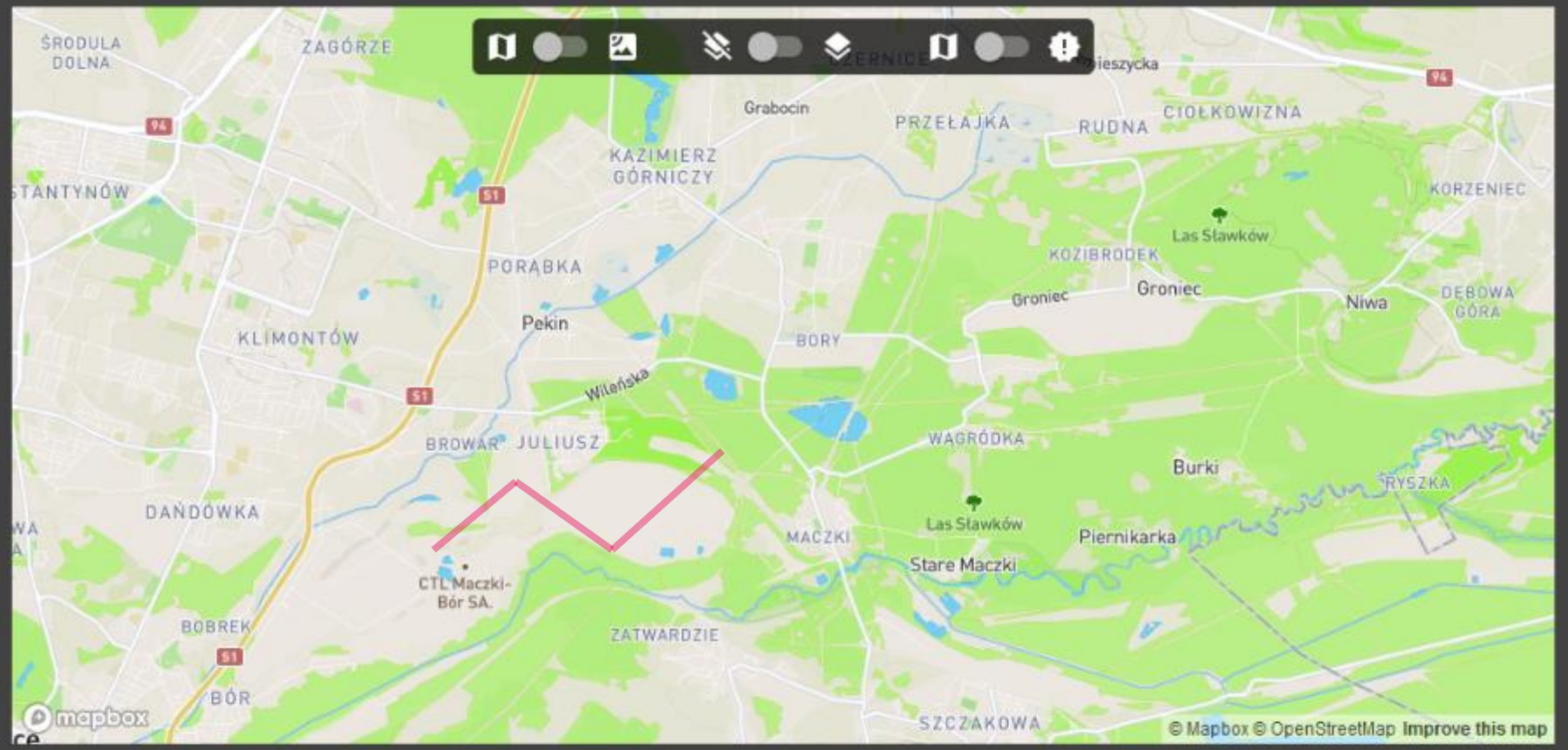
Risk map

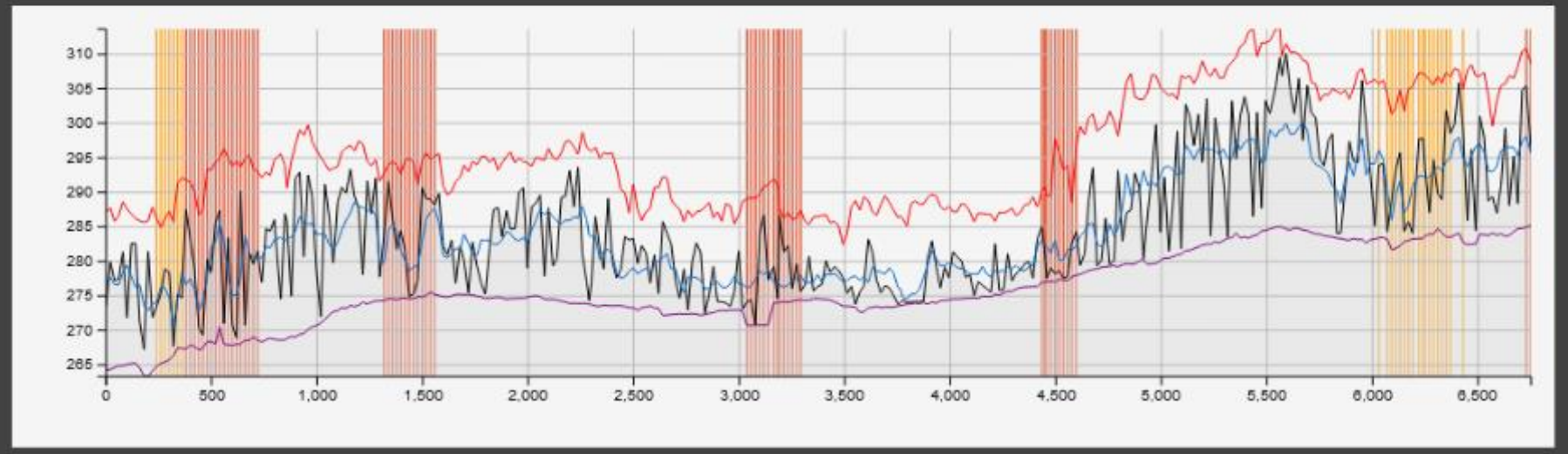
GREy

Risk map



Extended terrain profile (with graph including information on possible presence of any pre-selected known topographic objects)



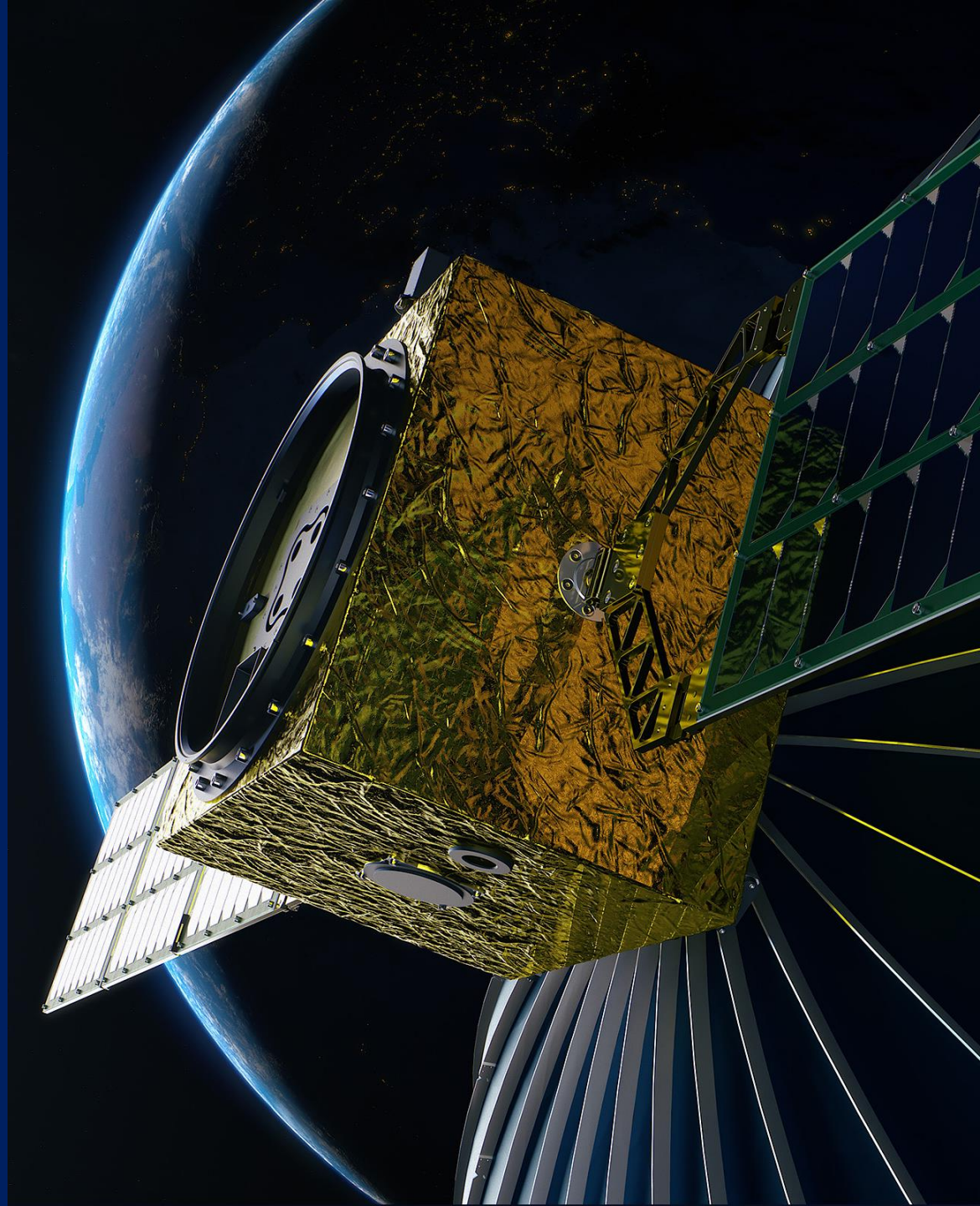


SAMPLE

System for Automated Air Obstacles Detection & Monitoring

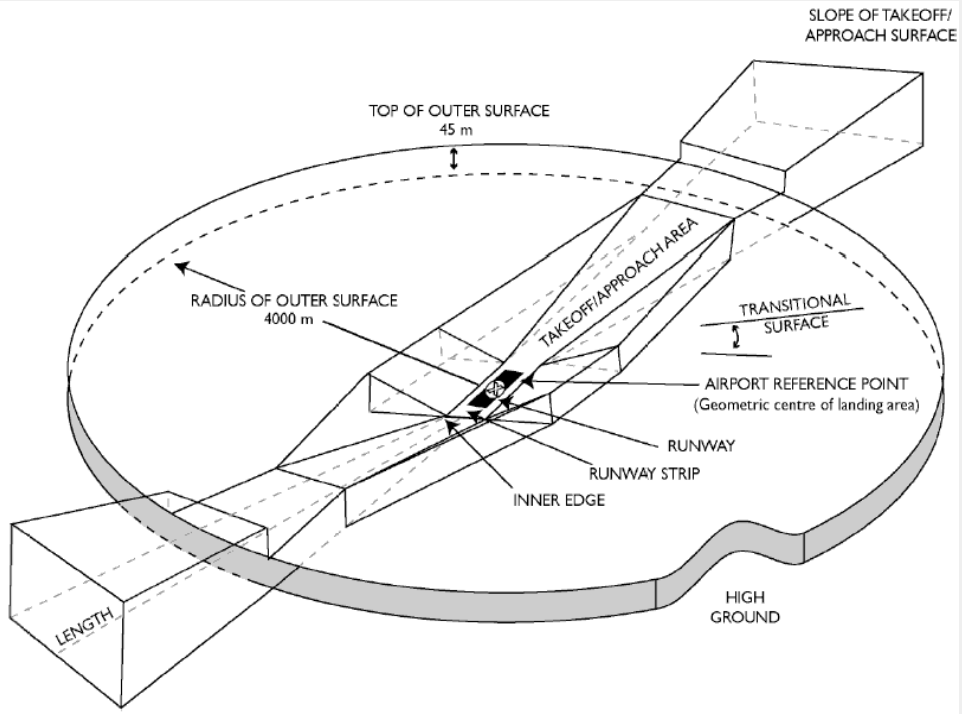
Introduction

Innovative system for automated detection and monitoring of air obstacles with advanced functions of visualization, risk analysis, reporting and automatic notifications.



Problems to solve

- Air obstacles create serious and obvious threats to air operations safety, especially in the vicinity of airports and have to be monitored very closely
- Airpors and air authorities have to meet numerous regulations regarding obstacle management (eg. ICAO Annexes 14 & 15)
- Rapid growth of cities (resulting in emerging skyscrapers, cranes and pylons) determine dynamic changes in their skylines - too fast to be accurately monitored by relevant authorities using standard methods
- Number of UAV (Unmanned Aerial Vehicle) operations grows rapidly worldwide, what creates clear need for tools allowing to plan safe flight routes
- More and more different activities require access to reliable Digital Terrain Model source



Obstacles limitation surfaces (ICAO annex 14)

Breakthrough technology

- Analysis done using variuos sources of Earth Observation data
- The basic set of Input data: **satellite imagine**, **SAR**, **Point Clouds** (LiDAR), direct **UAV** measurements, video surveilance
- Output data: **digital terrain model** providing information regarding all objects with the source data resolution
- **Database** provides comprehensive information in numerous formats providing data source for **aviation, telecommunication, construction, agriculture**
- **Machine Learning** and **Artificial Intelligence** used to detect, measure and classify objects

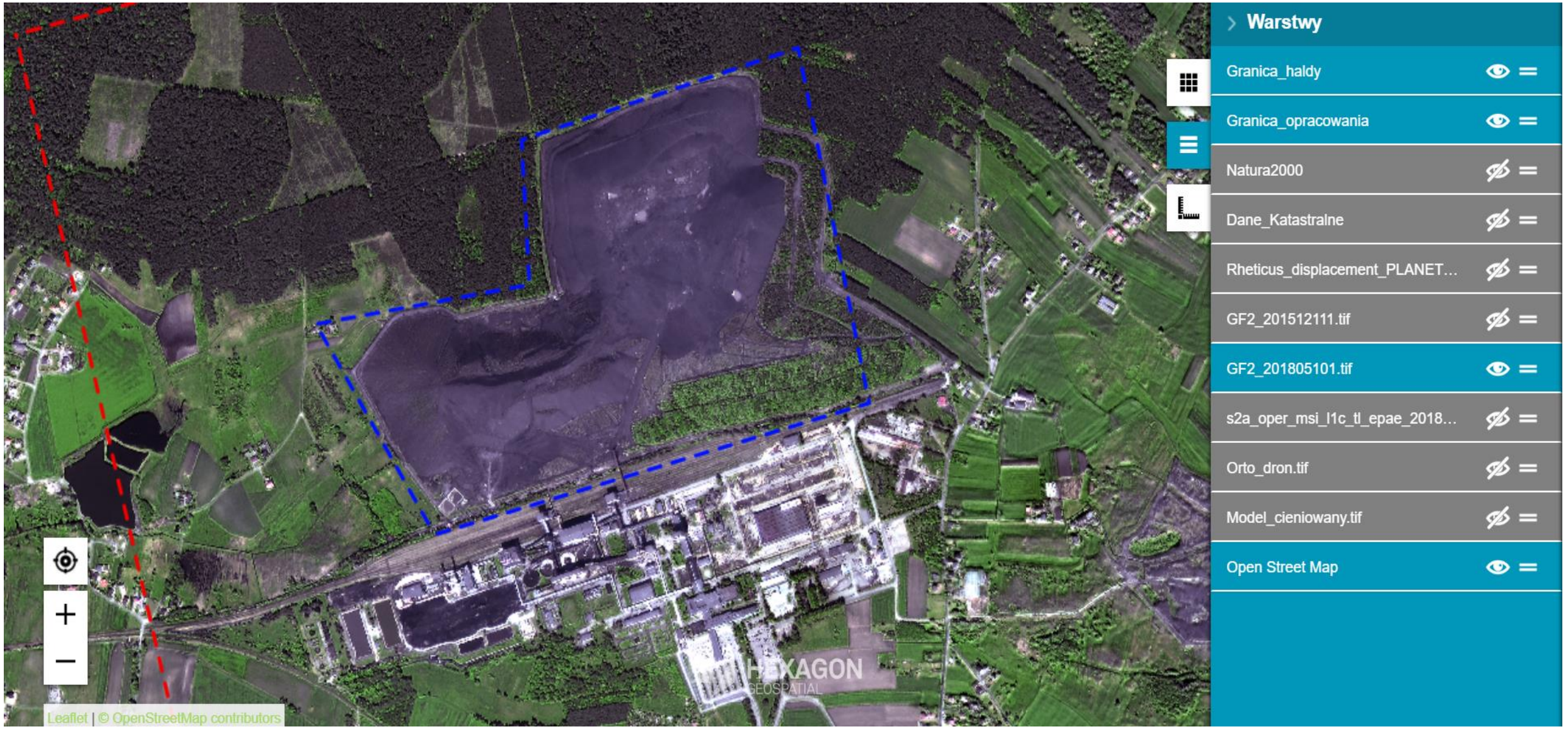
Main scope of SAMPLE

- Accurate, automately derived information on obstacles in the airfield proximity
- Rapid access to fully reliable data
- Easy obstacle database management
- Low cost data acquisition
- 24/7 availability
- Fully customizable output
- Operational readiness - confirmed by national Air Navigation Service Provider

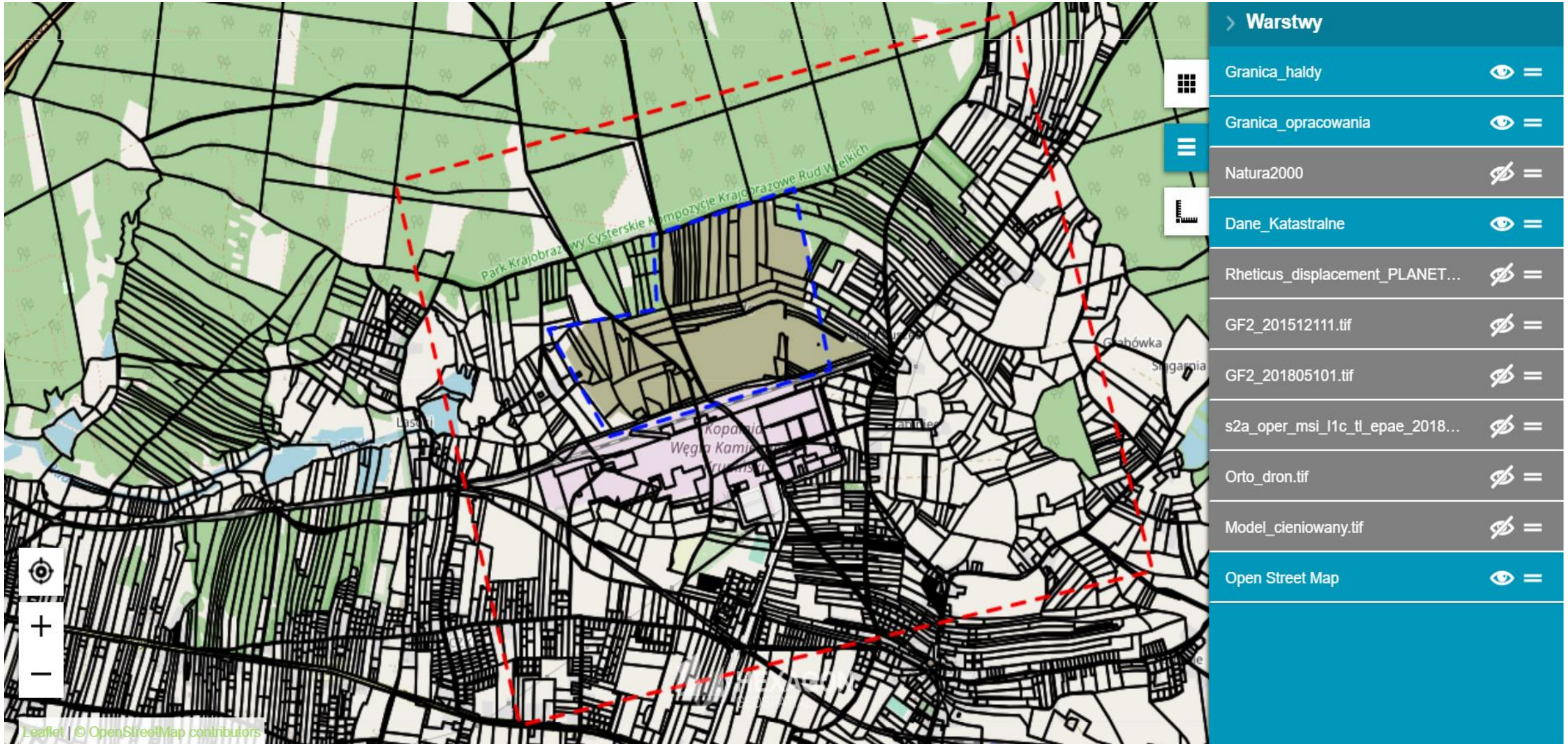
Obstacles in the airfield proximity

Spatial Portals

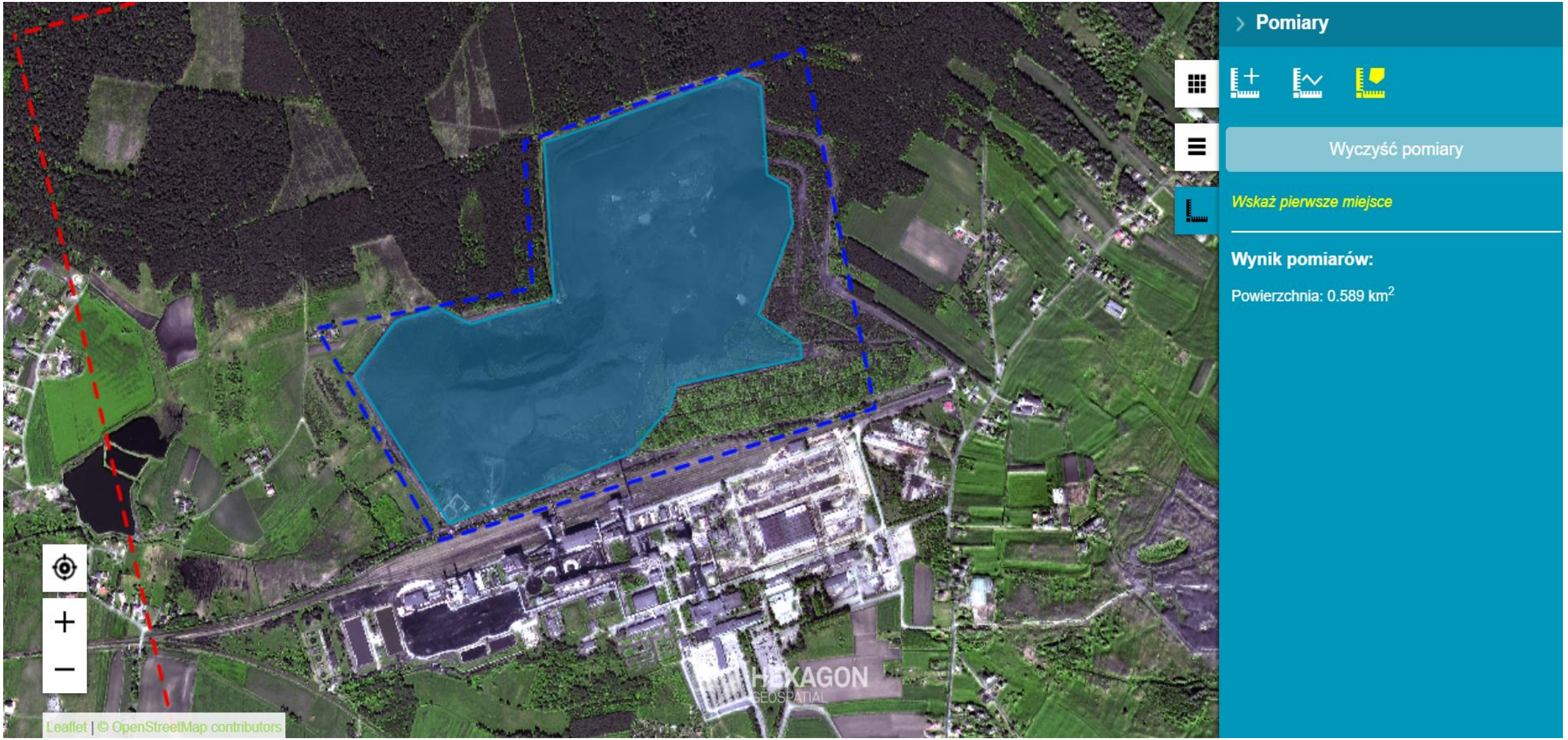
High resolution satellite imagery



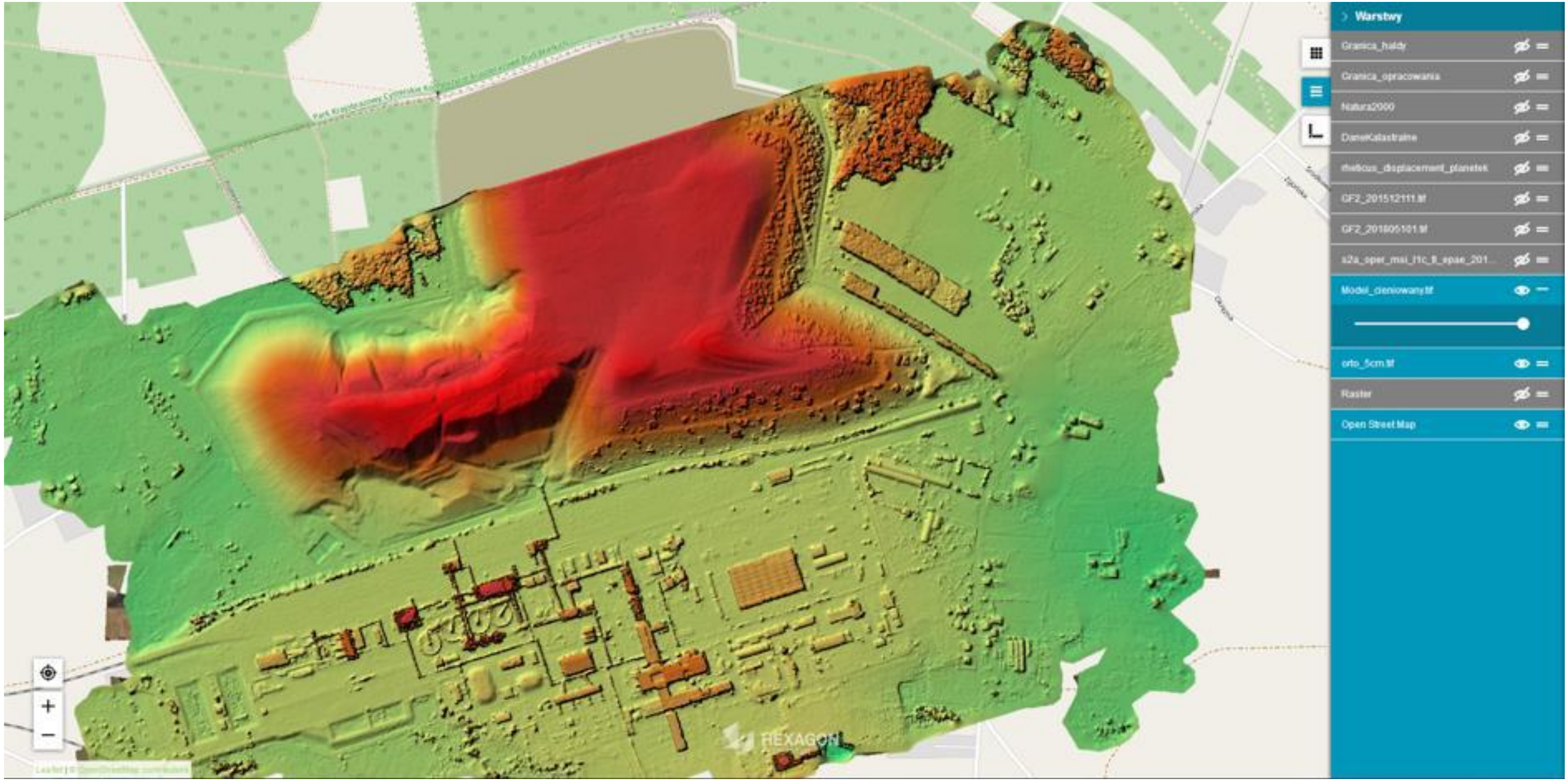
Cadastral data



Spatial measurements



Model 3D – heap volume calculation



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Thank You

July 2023