JOANNEUM RESEARCH DIGITAL

AIRWATCH

Airborne data acquisition and processing technologies for improved situational awareness

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Bucharest, October 30th 2013

KIRAS Sicherheitsforschung

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Diamond AIRCRAFT

IFR

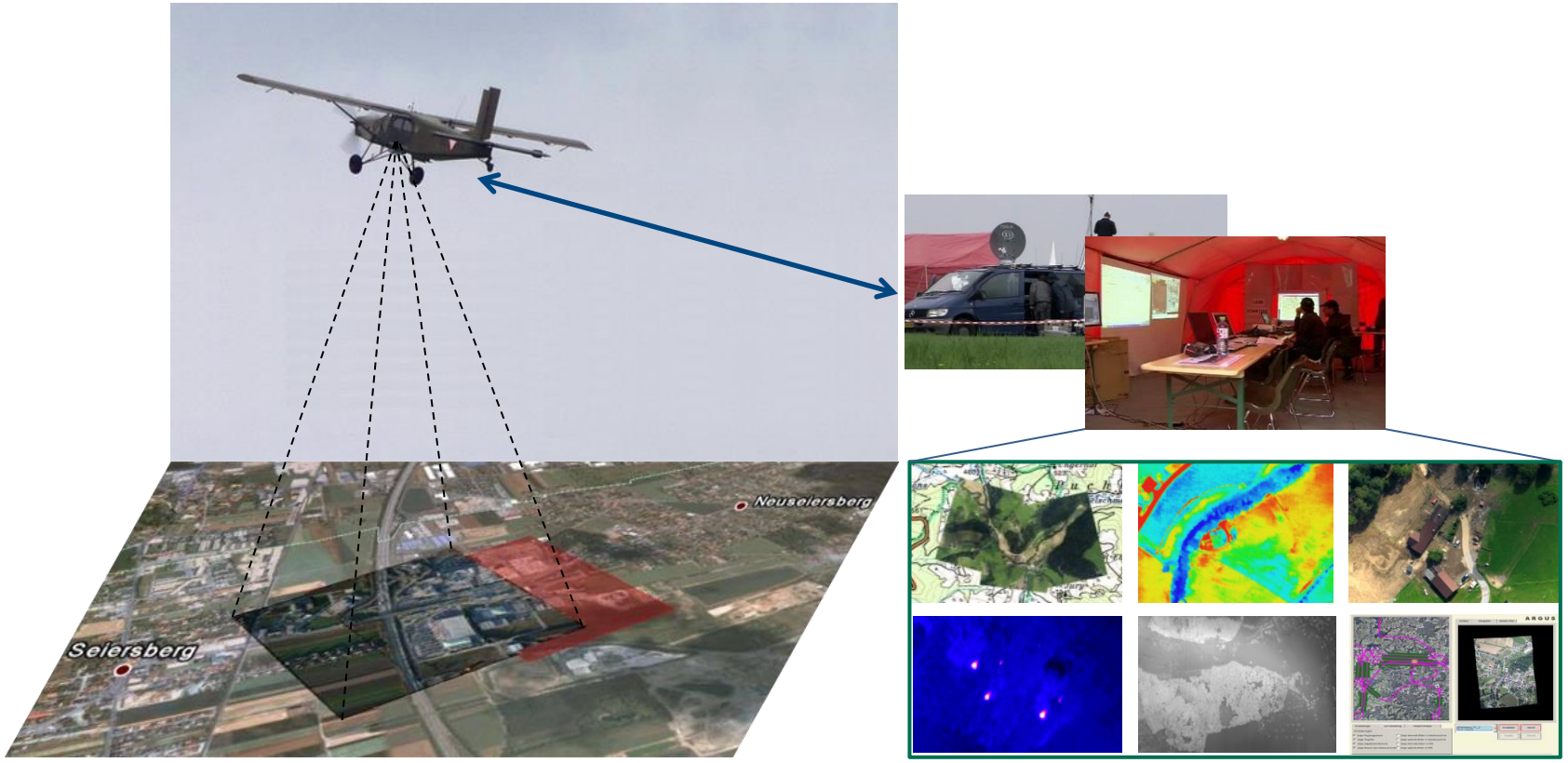
Das Land Steiermark

Topics

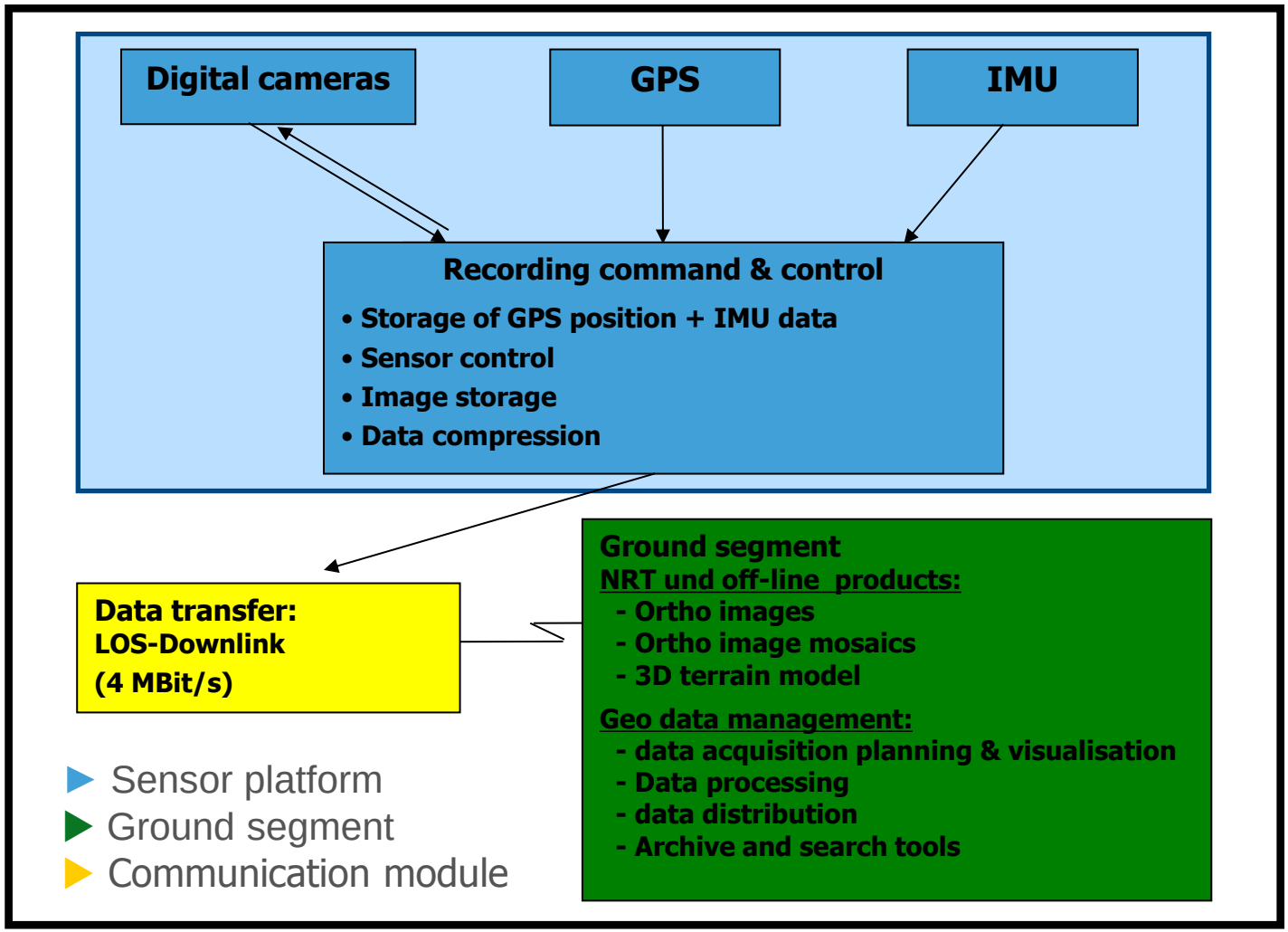
- System Overview
- Airborne Sensor Plattform
- Real-Time Communication
- Geodata Management
- Examples

Motivation - NRT Disaster Mapping

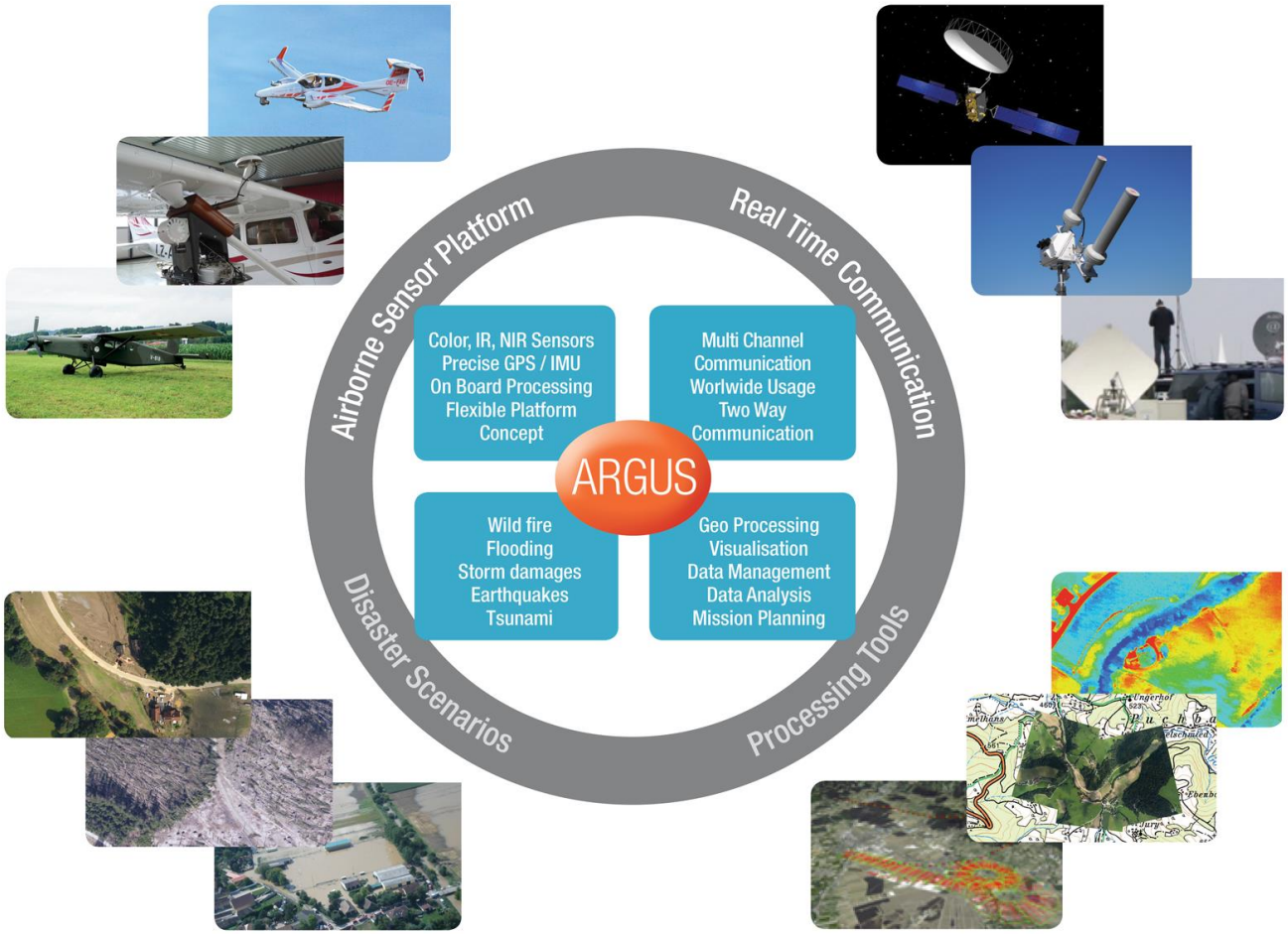
- Requirements to support crisis management of natural disasters



Flow Chart


Digital cameras
GPS
IMU
Recording command & control
• Storage of GPS position + IMU data
• Sensor control
• Image storage
• Data compression
Data transfer:
LOS-Downlink
(4 MBit/s)
Ground segment
NRT und off-line products:
- Ortho images
- Ortho image mosaics
- 3D terrain model
Geo data management:
- data acquisition planning & visualisation
- Data processing
- data distribution
- Archive and search tools
Sensor platform
Ground segment
Communication module

System Concept

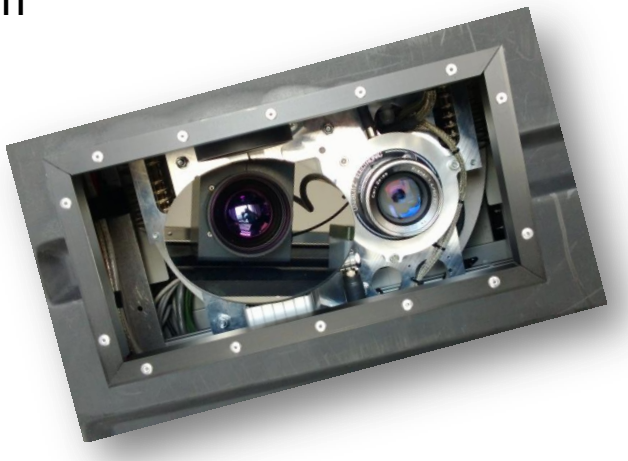


Airborne Sensor Platform

- Flexible multi-sensor sensor platform
  - Optical, thermal IR und optional near IR
- Precise position and orientation data for each image
  - GPS and IMU data
- Operation of multiple carriers
  - Pilatus PC6 (AA), DA42MPP, Cessna
- Data downlink and processing
  - LOS data link with tracking antenna
  - On board data processing

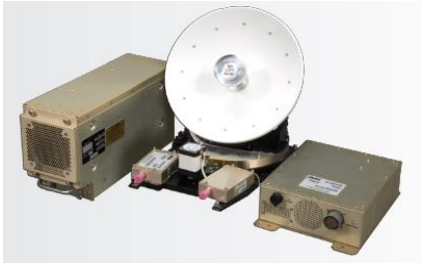
Airborne Sensor Platform

- Prosilica GE 4900C RGB (4872 x 3248 px- 16 MPx)
  - 15 cm @1000m AGL / coverage 720m @50mm
- Prosilica GC2450 CIR (2448 x 2050 - 5 MP)
  - 30 cm @1000m AGL / coverage 720m
- INFTRATEC Thermal IR camera
  640 x 512 + reflector
  - 50 cm @1000m AGL
    coverage 720m
- Geo referencing
  - Novatel GPS (L1/L2)
  - IMAR/FSAS IMU



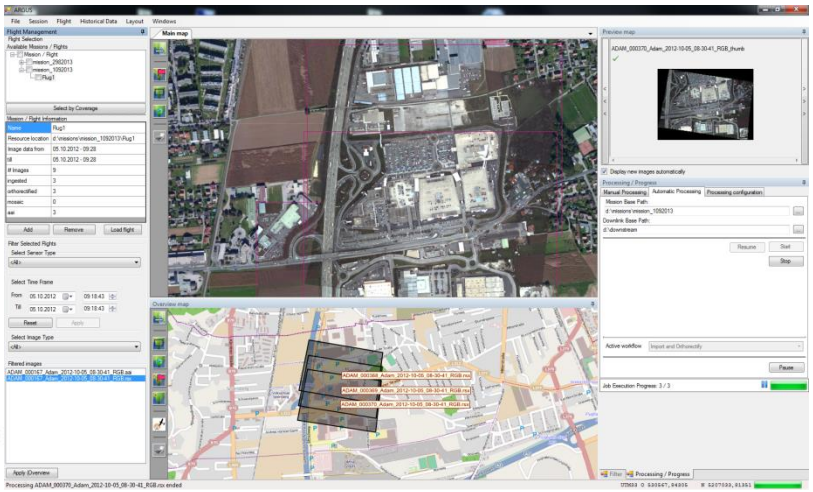
Real-Time Communication

- LOS data link
  - Broadband bi-directional IP connection
  - 4 Mbit/s down-stream, 1 Mbit/s up-stream
  - Line of Sight (LOS) up to 70km (auto-tracking directional antenna)
  - Supports different wave bands
- Satellite communication evaluated

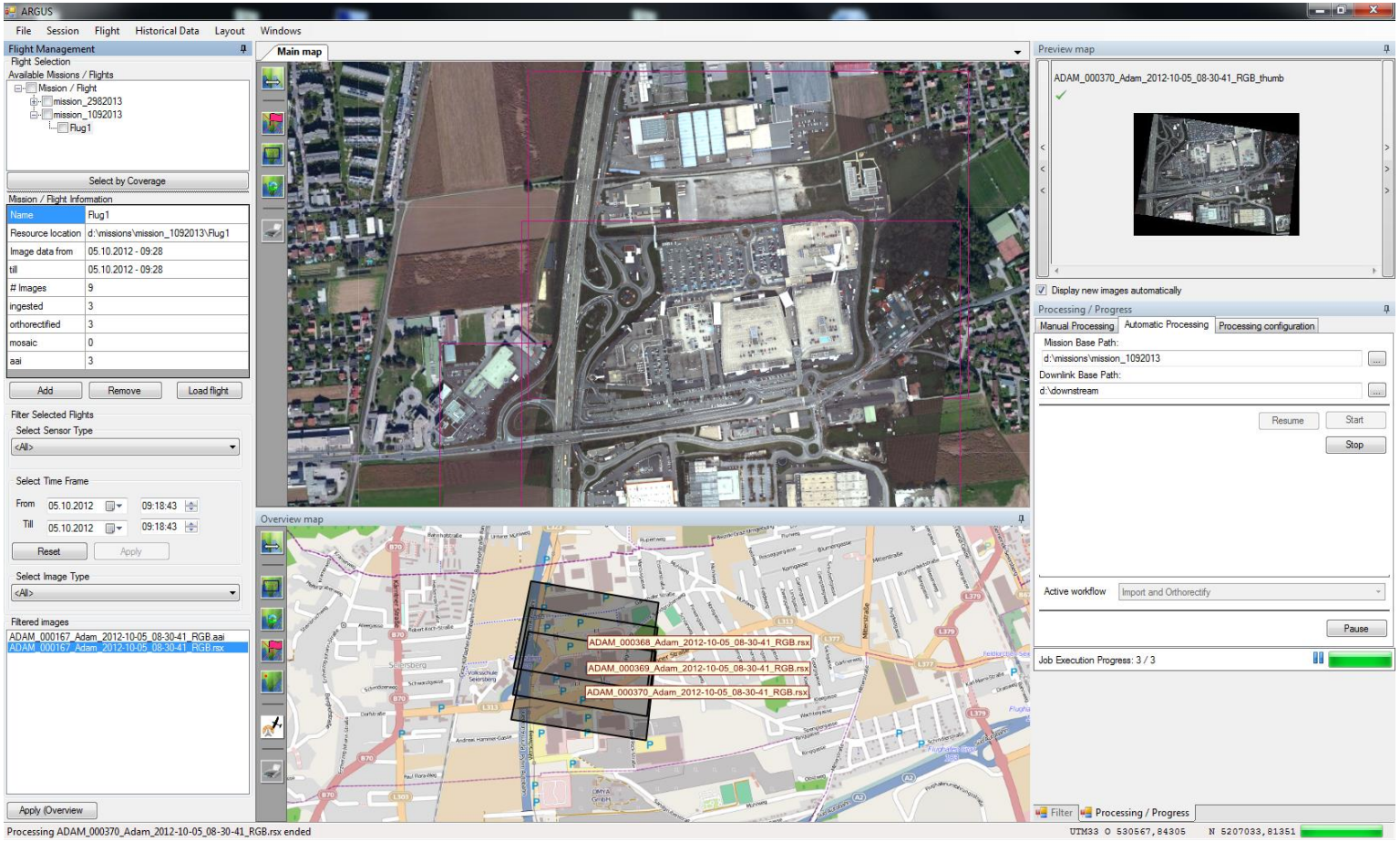


Geo Data Management

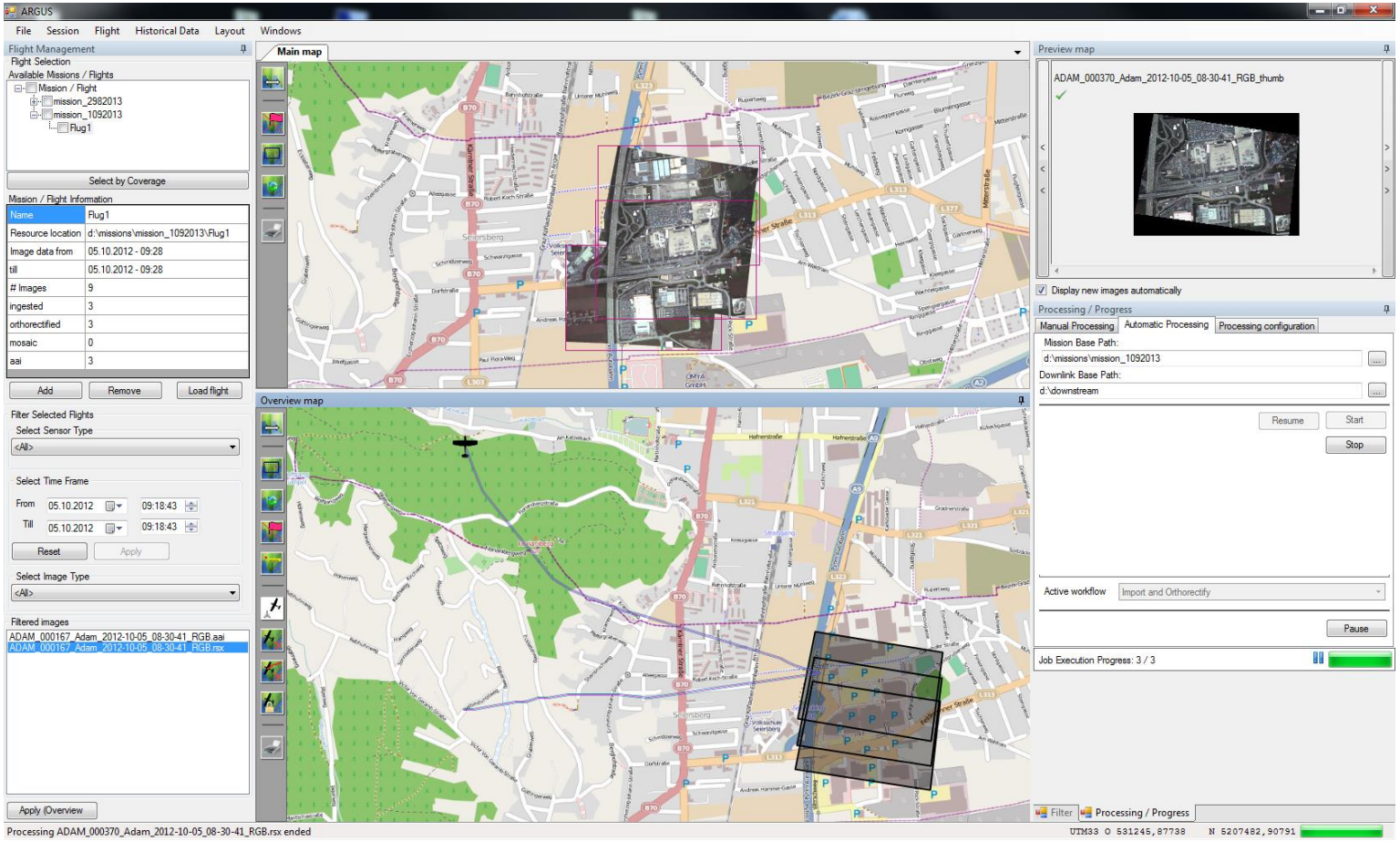
- Management of data acquisition planning and execution
- Data processing control
- Interactive data presentation and analysis
  - Basic maps + result product overlays
  - Data archive + search / -filter functionalities
  - Preview via thumbnails
  - Interactive annotations
  - Interactive measurements
- Export interfaces for geo data
  - Raster data (z.B. geo-tiff, png, jpg)
  - Vector data (z.B. shp, kml, gpx)



GUI Example 1



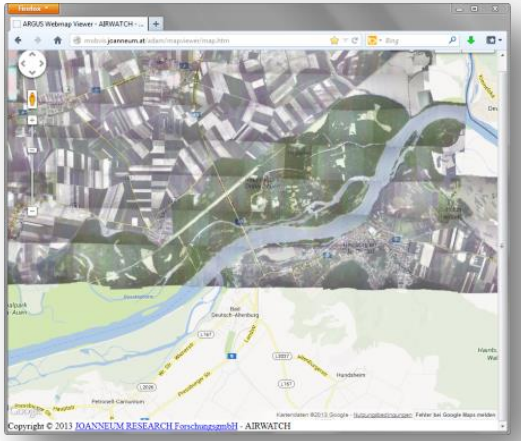
GUI Example 2



Geo-Data Management

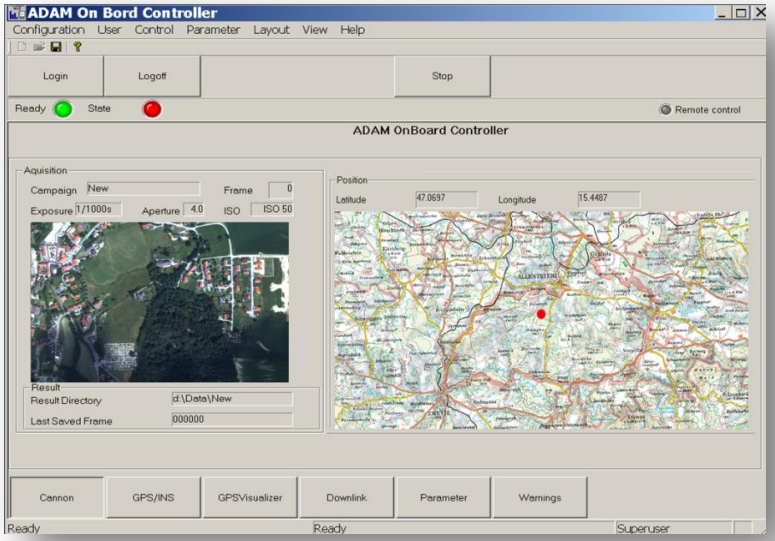
Role based data distribution

- Interfaces to crisis management centres
  - Data distribution to linked systems
  - Colaboration based on shared data sets
- Interfaces to mobile units
  - Visualization / feedback via apps
- Browser based data access
  - Information distribution via hyperlinks
  - Data distribution based on role based decision structures



➔ Google Maps

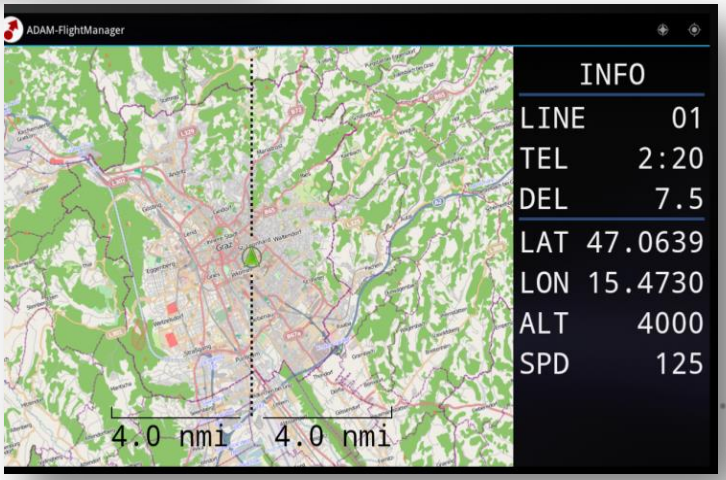
On Board Control Software



Operator

Sensor command & control

- Camera control
- GPS + IMU logging
- Trigger control
- Flight management
- Data storage

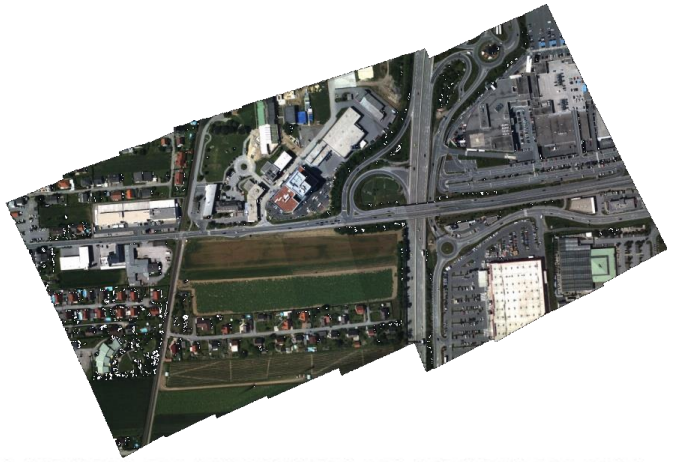


Pilot (tablet)

Product Generation (1)

Automatic and interactive data processing

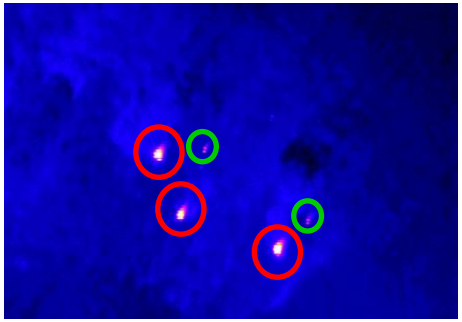
- Orthophotos (ortho-rectification)
  - „Near real-time / rapid mapping“ time optimized processing chains
  - „Enhanced mapping“
  - „Precision mapping“



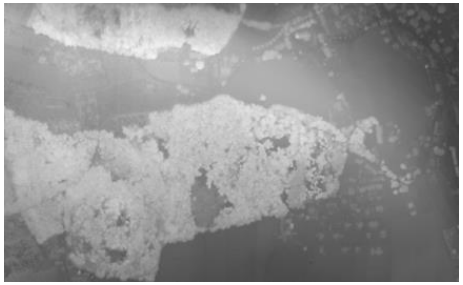
- Automatic generation of ortho-mosaics

Product Generation (2)

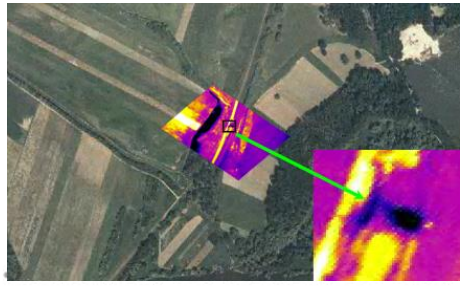
- Interactive / automatic data analysis and classification



- Automatic creation of digital terrain models



- Rapid generation of thematic overviews of the situation



Processing Workflows (1)

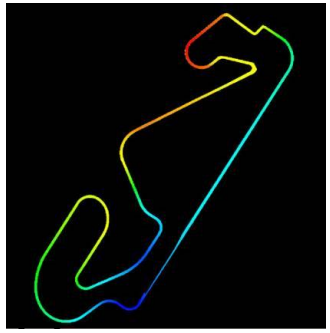
Processing scenarios

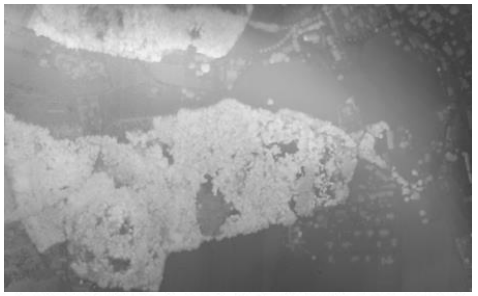
- Real-time mapping („online“)
  - Data downlink, direct, near real-time creation of ortho-images (ortho-rectification)

- Rapid Mapping („offline“)
  - Direct ortho-rectification after landing optional post-processing of GPS/IMU data

Processing Workflows (2)

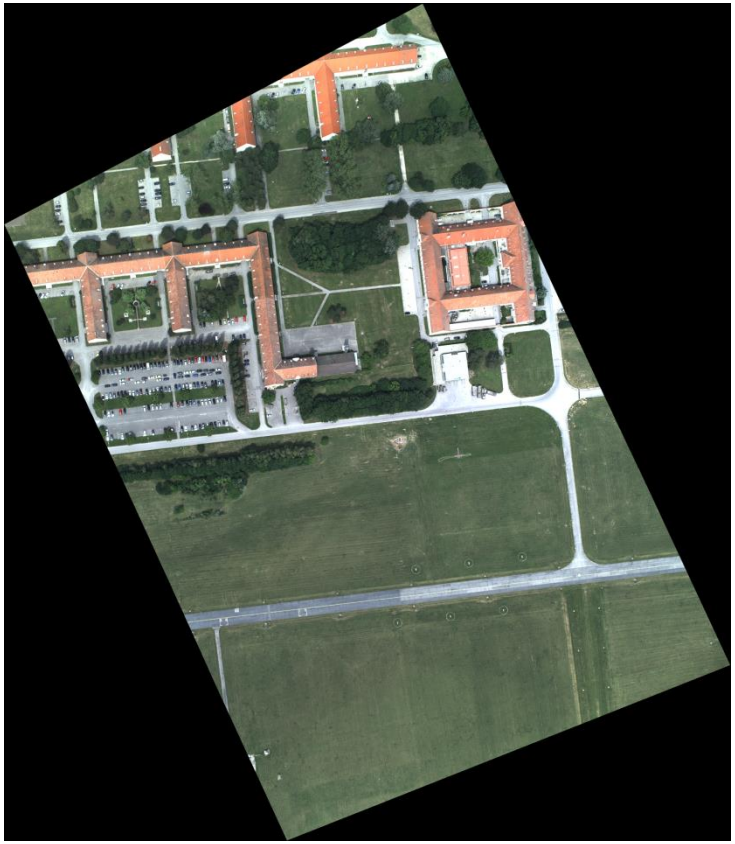
- „Enhanced Mapping“ (automatic tie points)
  - Enhanced relative position accuracy based on automatic found tie-points
- „Precision Mapping“ (interaktiv with GCP)
  - Enhanced absolute position accuracy based on ground control points and automatic found tie-Points (for smaller areas)
- Creation of 3D models
  - Generation of 3D models based on stereo images

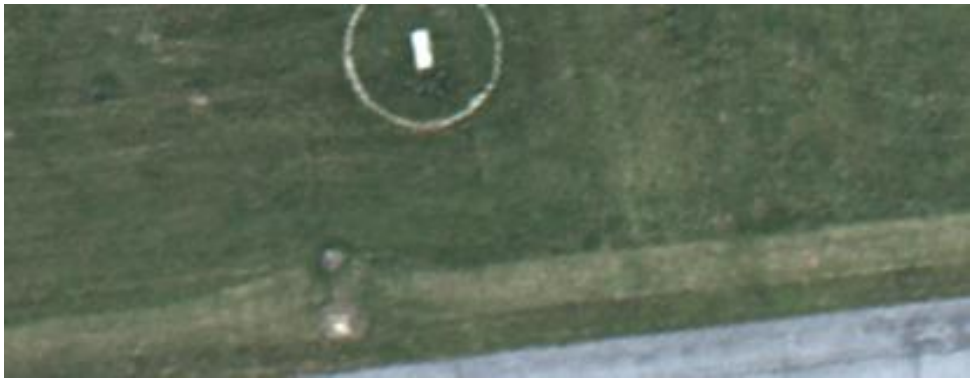




Examples (1)

- Example of an orthophoto - 10cm @ 760m AGL

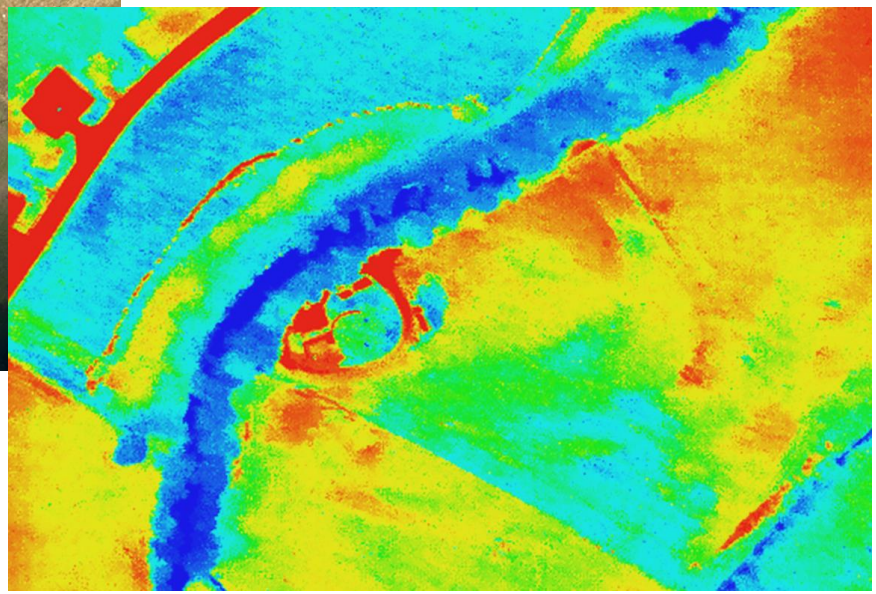




Examples (2)

- Comparison of RGB- und thermal IR

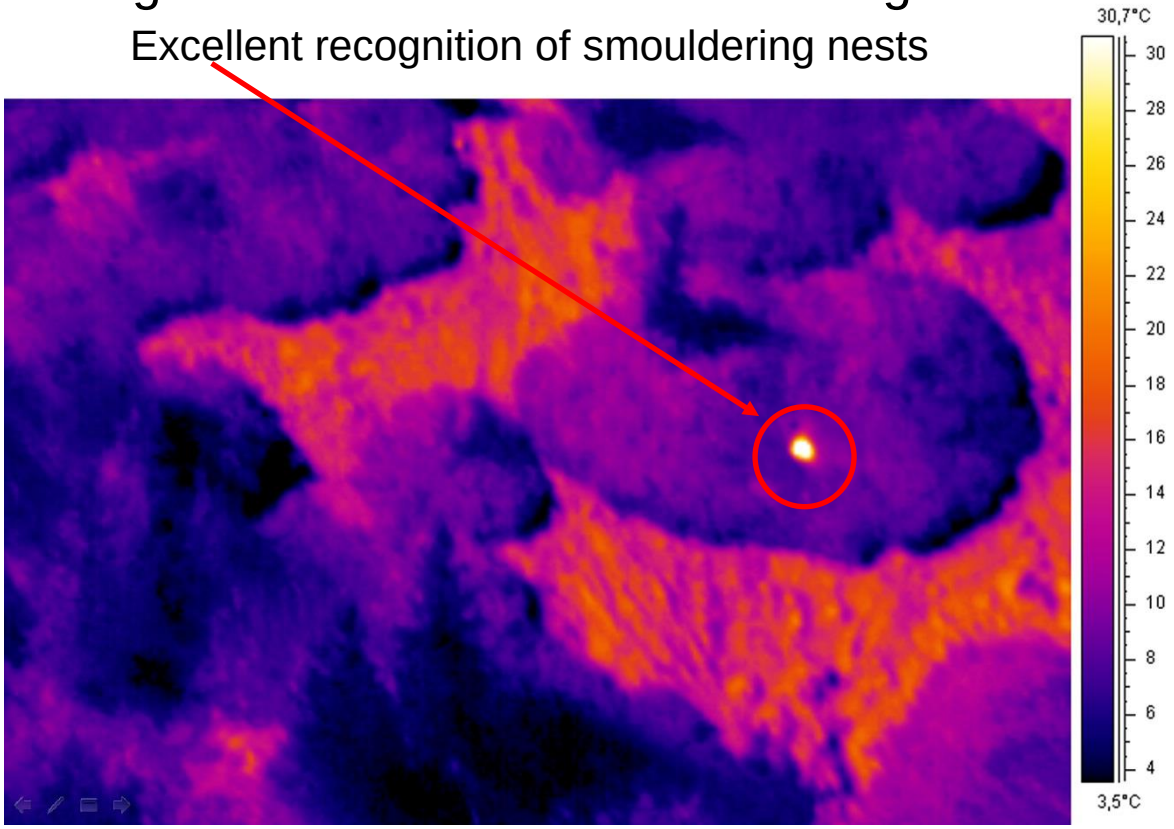
RGB image
ground resolution 15 cm



Thermal IR image
FLIR thermal camera
ground resolution 55 cm

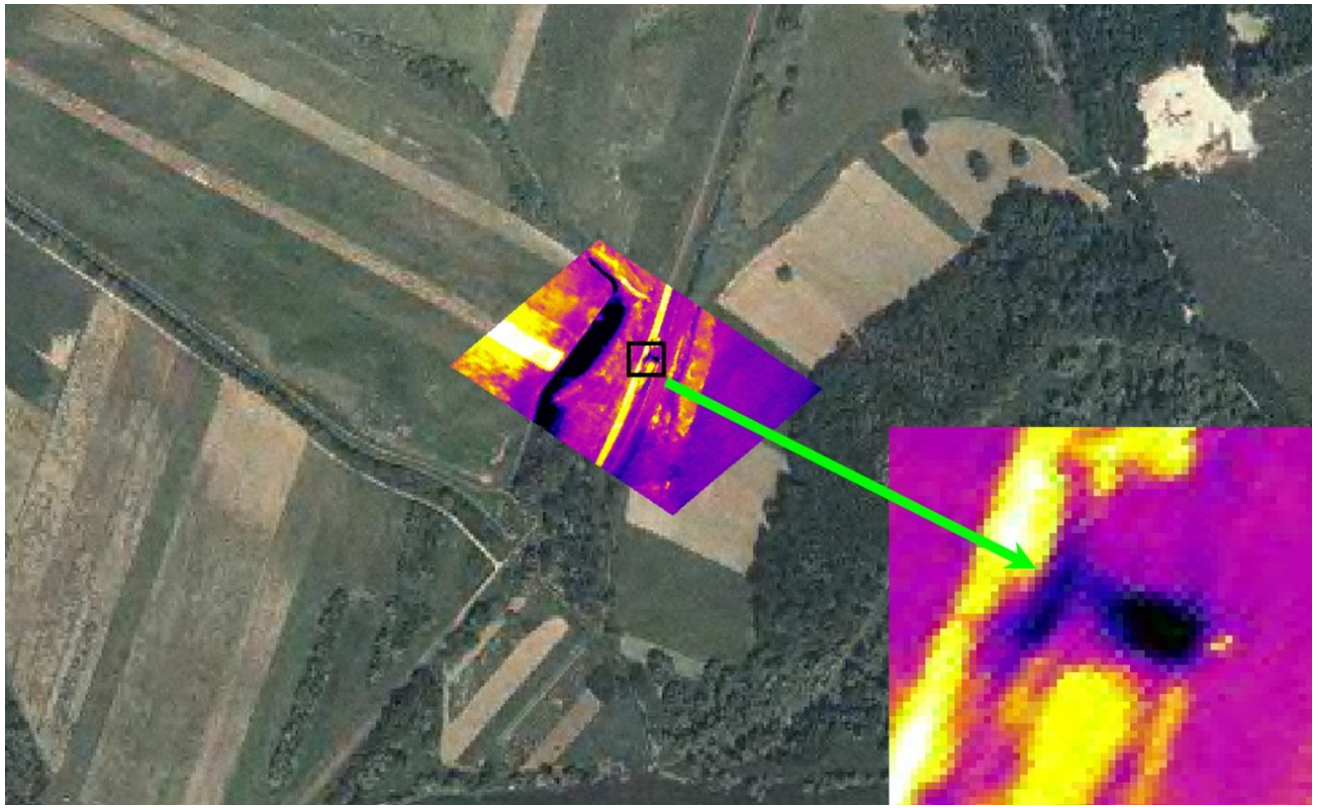
Examples (3)

- Thermal IR image – identification of smouldering nests

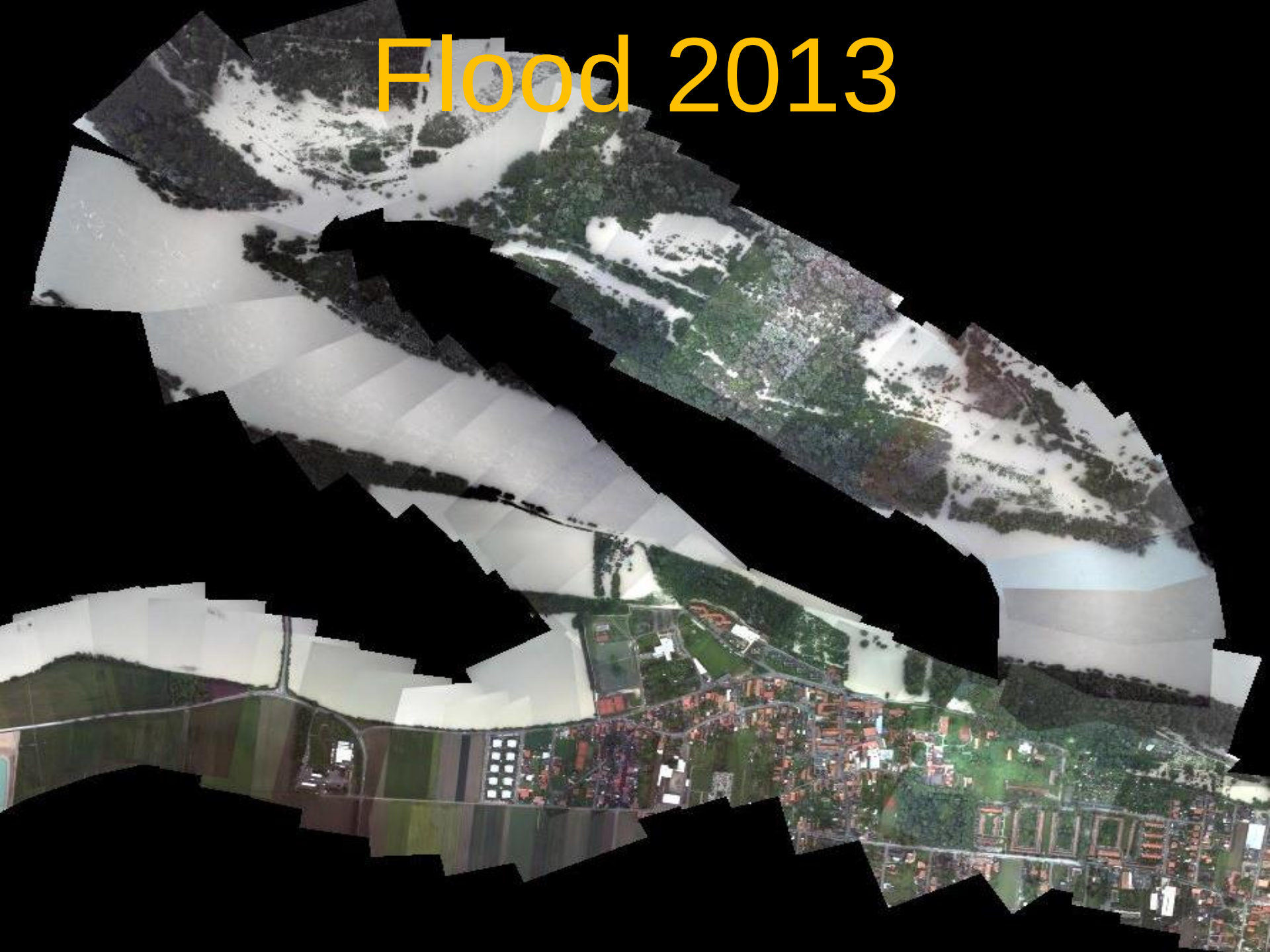


Examples (4)

- Thermal IR image – identification of a sodden embankment



Flood 2013




Flood 2013


Flood 2013

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