



Advances in remotely piloted airborne imaging concepts

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VITO, Vision on TechnOlogy

- » a leading European independent research and consultancy centre;
- » in the areas of cleantech and sustainable development;
- » elaborating solutions for the large societal challenges of today and tomorrow.



Energy



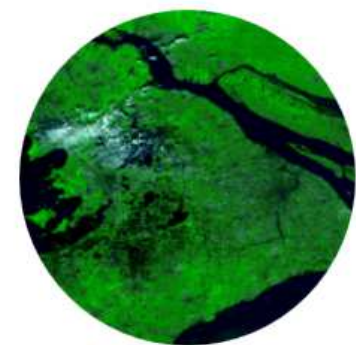
Materials



Chemistry

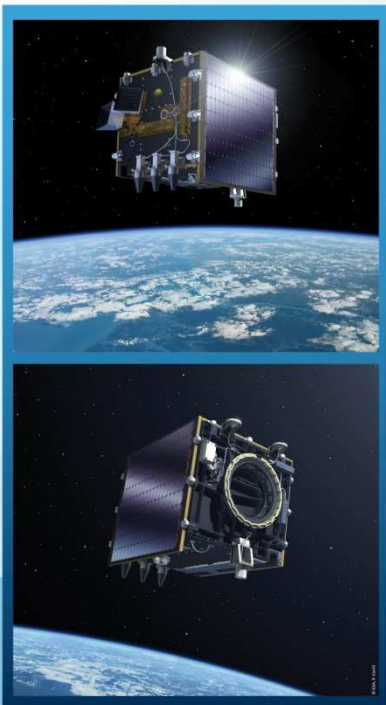


Health



Land use

MISSION DESIGN



FROM USER REQUIREMENTS TO TECHNOLOGY

- >> Space- & Airborne Systems
- >> Principal Investigator
- >> Mission & User Requirements
- >> Sensor Design
- >> Hyperspectral Technology



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IMAGE PROCESSING



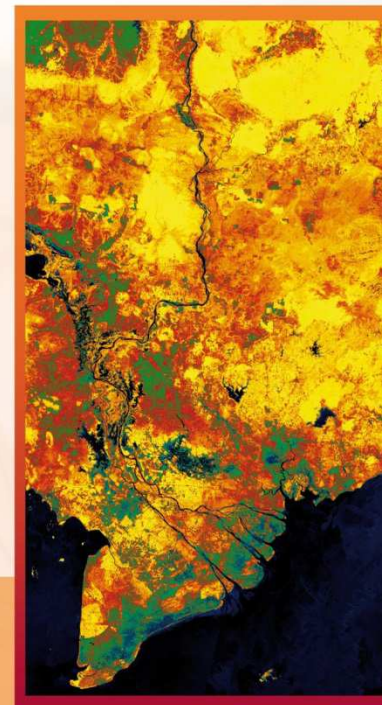
FROM RAW DATA TO END-USER PRODUCTS

- >> Space- & Airborne Imagery
- >> User Segment Development
- >> Processing & Archiving Centre
- >> On-Demand Processing
- >> Data Dissemination



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LAND USE SERVICES



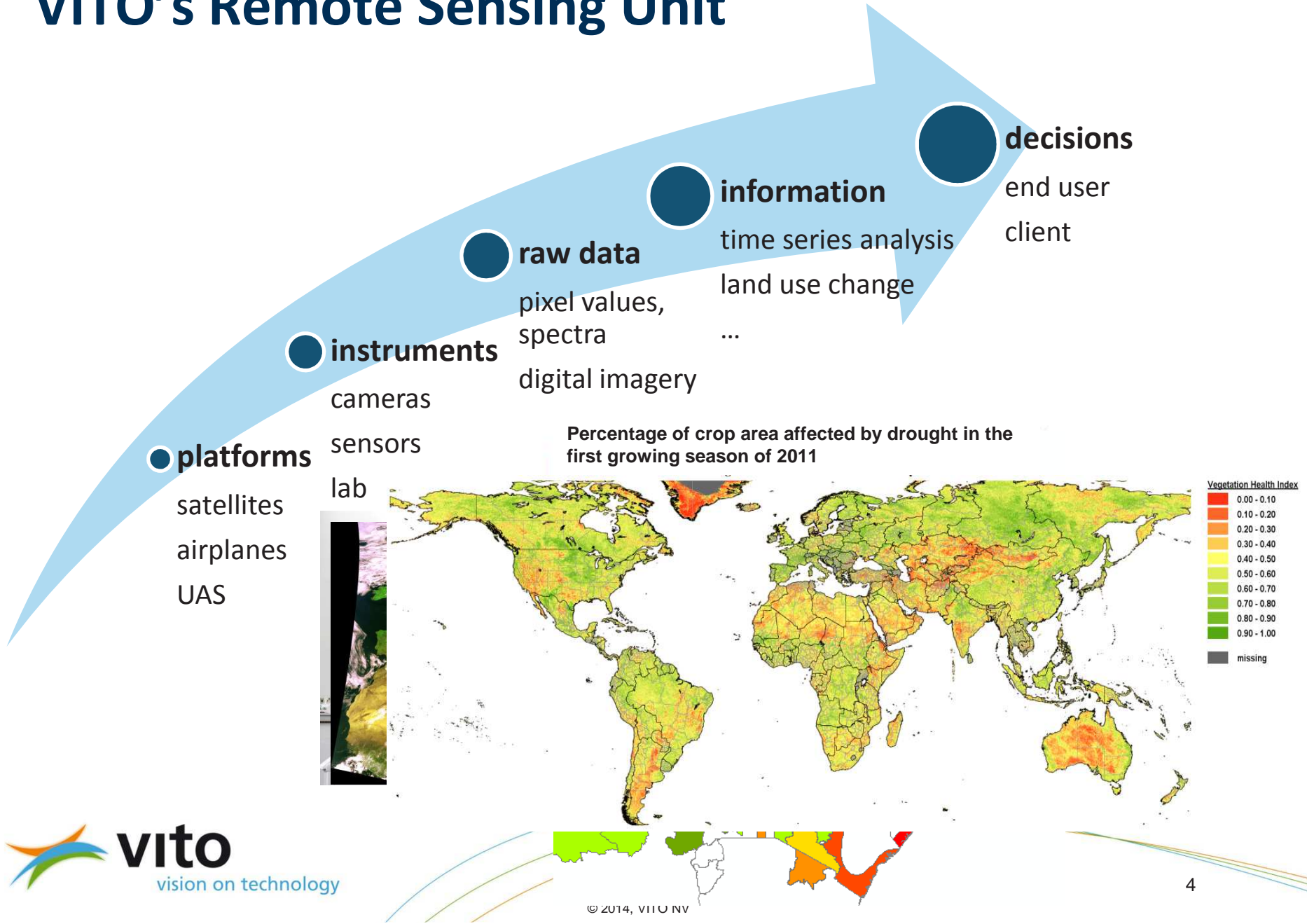
FROM QUALITY IMAGES TO INFORMATION

- >> Copernicus Global Land
- >> Global Agriculture Monitoring
- >> Local Environment Monitoring
- >> Capacity Building
- >> Application Software Development



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VITO's Remote Sensing Unit



Zephyr-7: endurance world record

- » Solar-powered, 14 day mission in stratosphere
- » Qinetiq Zephyr assets recently transferred to EADS-Astrium (Airbus)





The HALE UAV camera MEDUSA

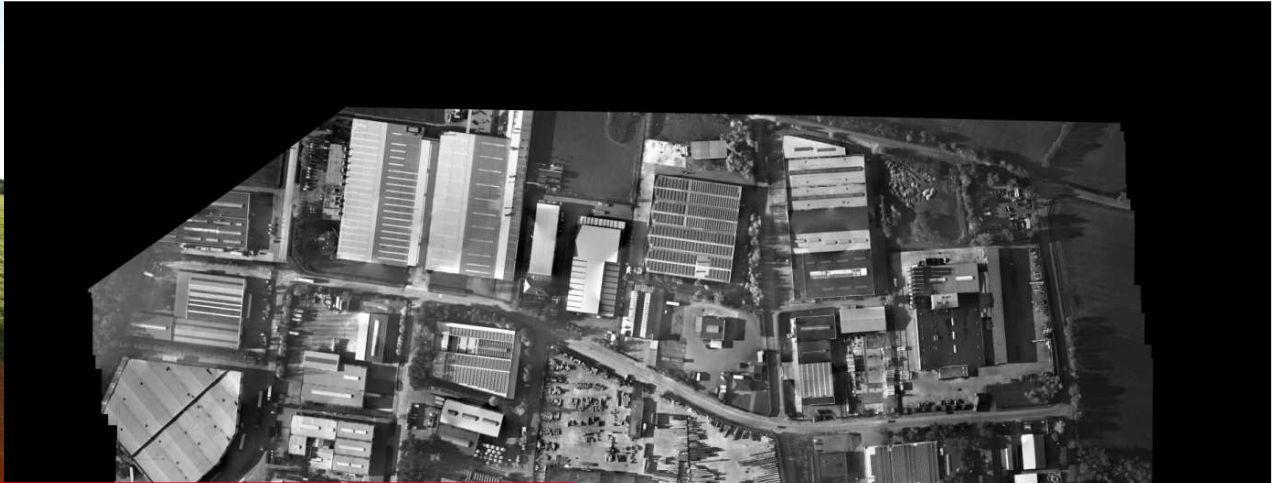
Top level specifications

Focal length	330 mm
Mass	2,6 kg
Power consumption	< 40 W
Operational altitude	15 -18 km
Swath (@18 km)	3 km
Ground sampling distance @18 km	30 cm
Spectral range	400-650 nm
Spectral channels	PAN COLOUR (RGB)
Image collection rate	0.7 fps
Realtime data downlink (S-band)	20 Mbps
Direct georeferencing functionality	Hardware synchronised INS
Image compression	JPEG2000
Focal plane size	10000 x 1200 (2 times)



**Fully operational processing chain for geometrically corrected orthorectified products, ready for added value services:
e.g. change detection (AGIV BVK)**



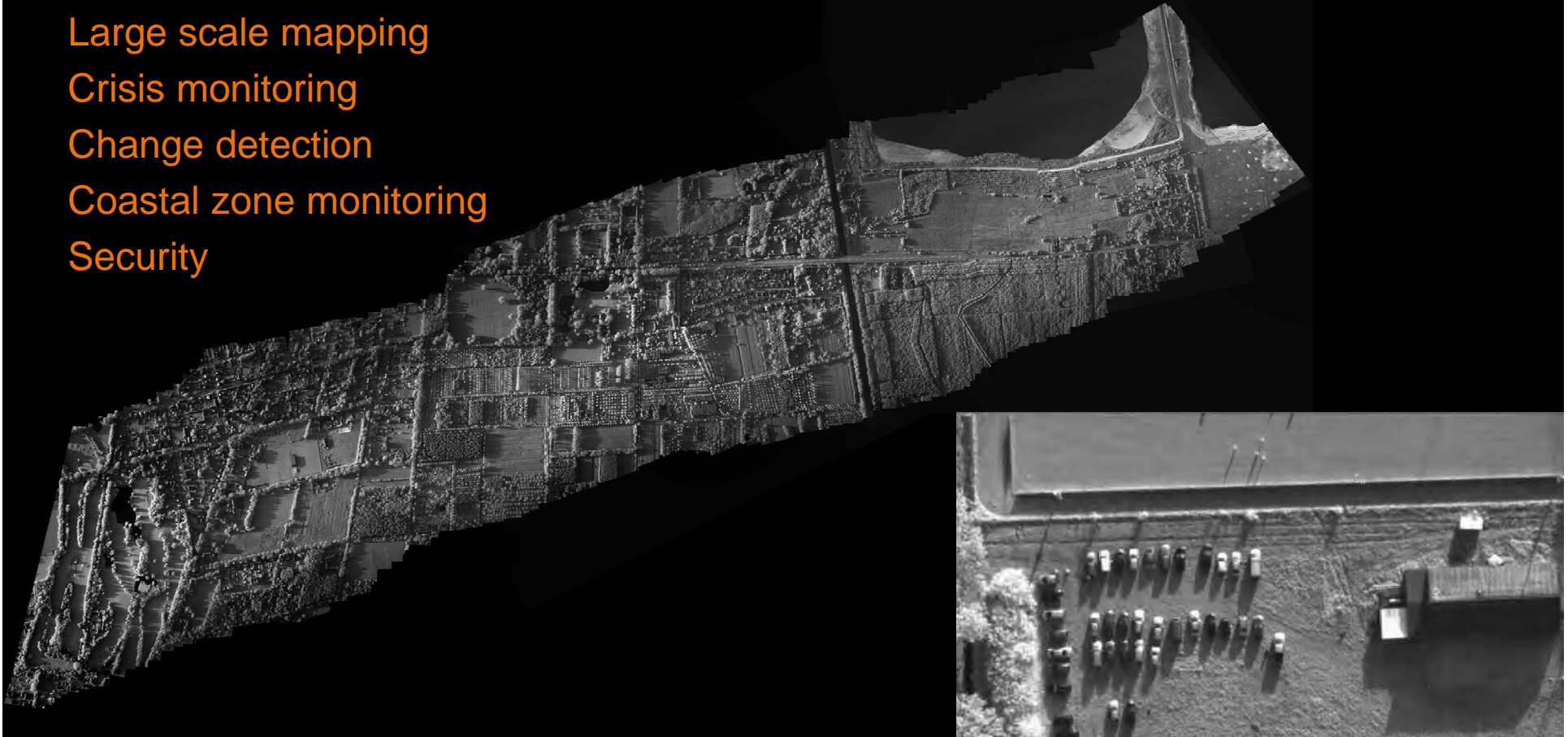


MEDUSA EM image
10000x1200 pixels
<10 cm GSD



Real-time downlink and image stitching
For situational awareness

Large scale mapping
Crisis monitoring
Change detection
Coastal zone monitoring
Security



RPAS based Situational awareness



LUMEN



Flood monitoring Flanders

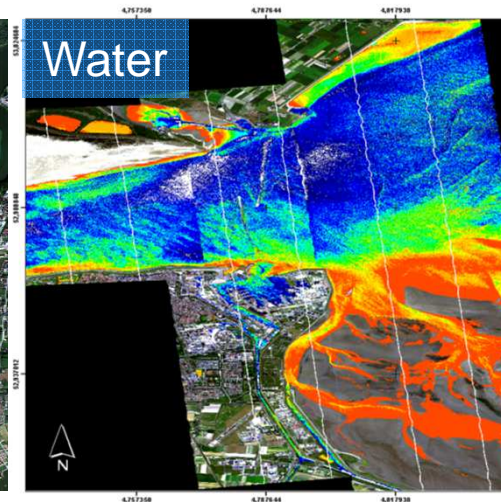
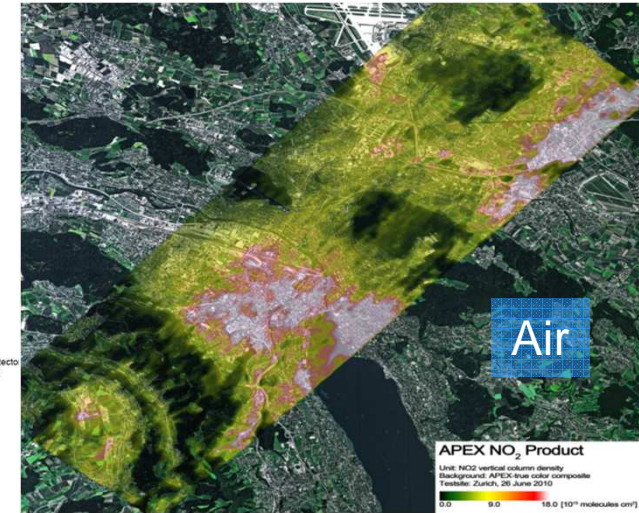
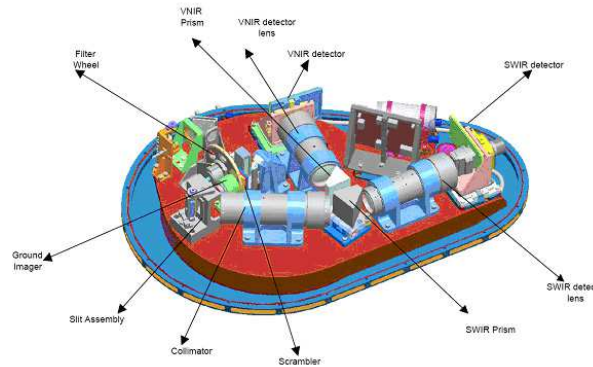
Maritime monitoring North Sea



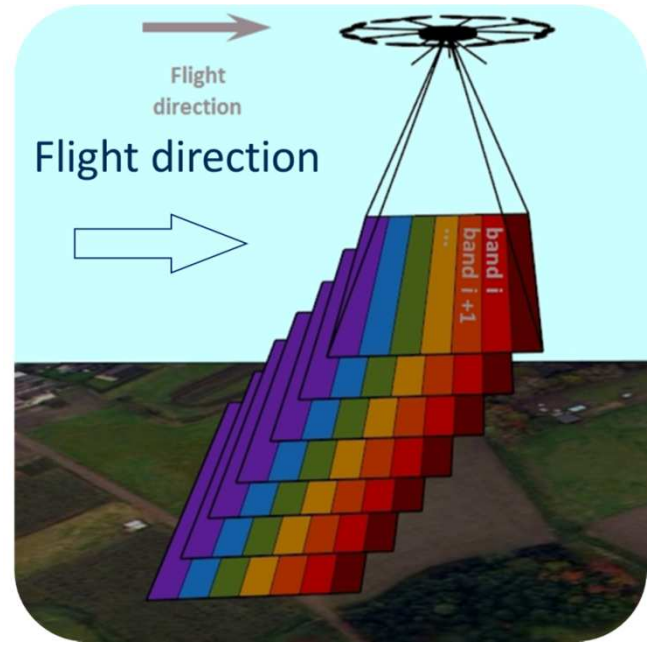
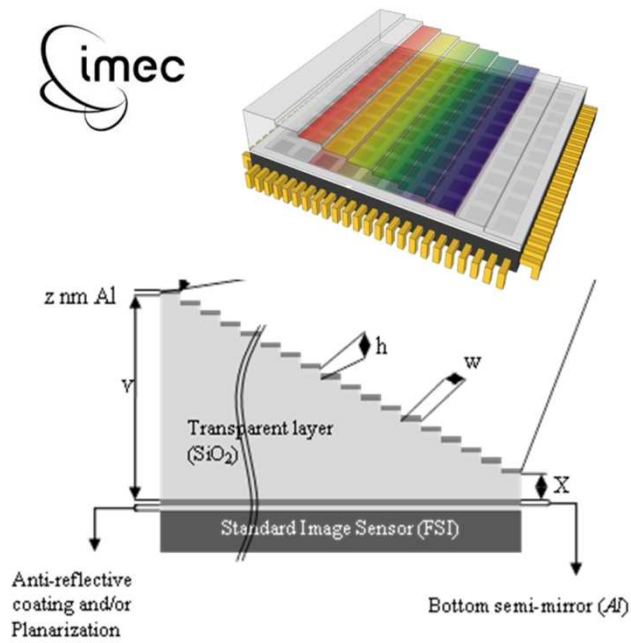
Hyperspectral: APEX (Airborne PRISM Experiment)



- » 10+ years of experience in hyperspectral remote sensing technology, processing and applications
- » Co-PI for **Airborne imaging spectrometer (APEX)**
- » Operational since 2011, flight campaigns for European Clients & universities



What if a hyperspectral camera would have the size of a digital colour camera?



- » Compact
- » Lightweight
- » Potentially cheap

Prototype Hyperspectral Payload

Spectral camera

- » 2048 x 1088 pixels
- » 18.5 mm lens
- » GSD @60m: 2.5cm
- » Swath @60m AGL: 30m
- » Spectral range: 600-900nm
- » Spectral resolution (FWHM): 7nm
- » Number of bands: 100

Resolution:
High spectral
High spatial
High temporal

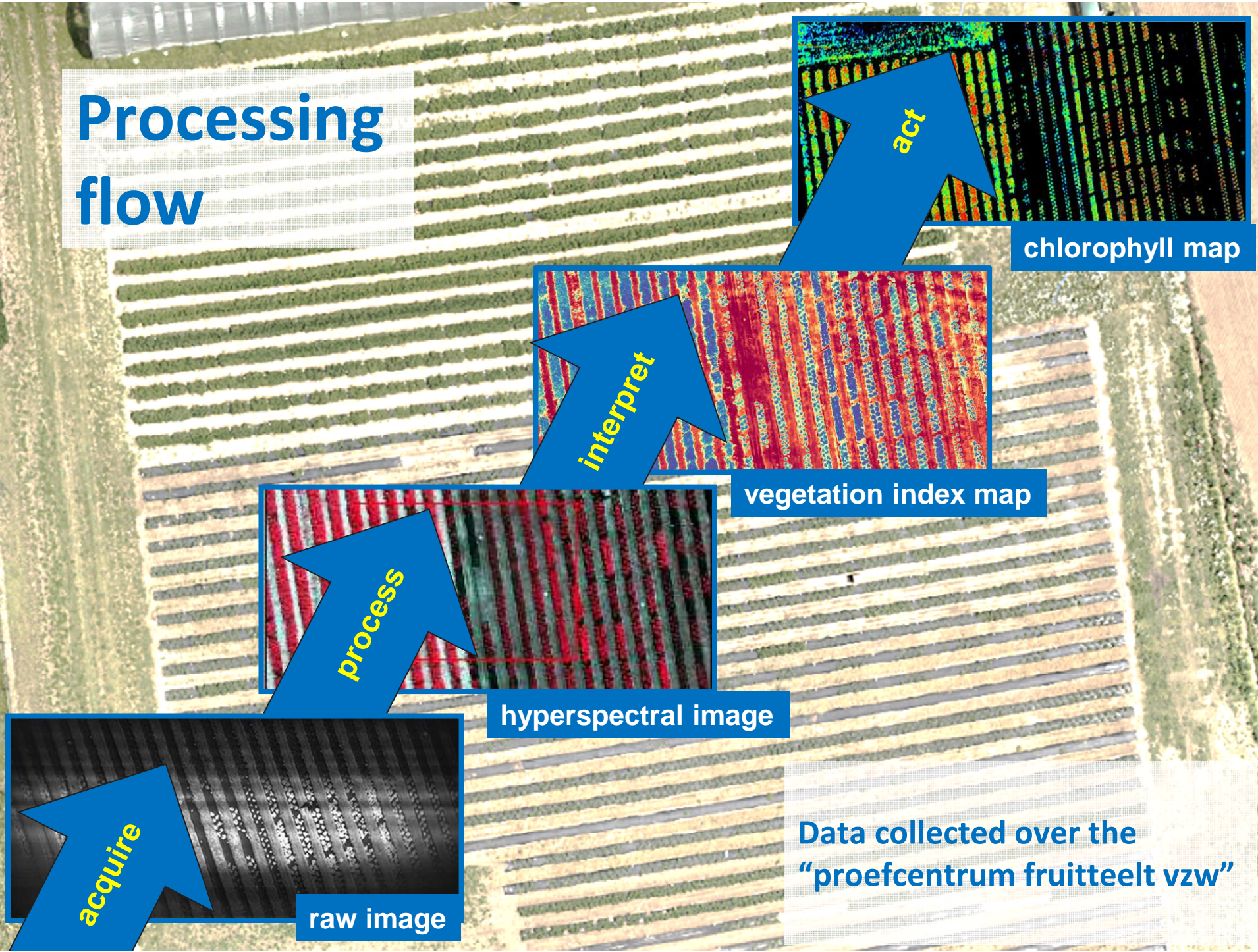
Panchromatic camera

- » 2048 x 2048 pixels
- » 16.0 mm lens
- » Size: 15x14x8cm

Total weight < 1kg



Processing flow



acquire

raw image

process

hyperspectral image

interpret

vegetation index map

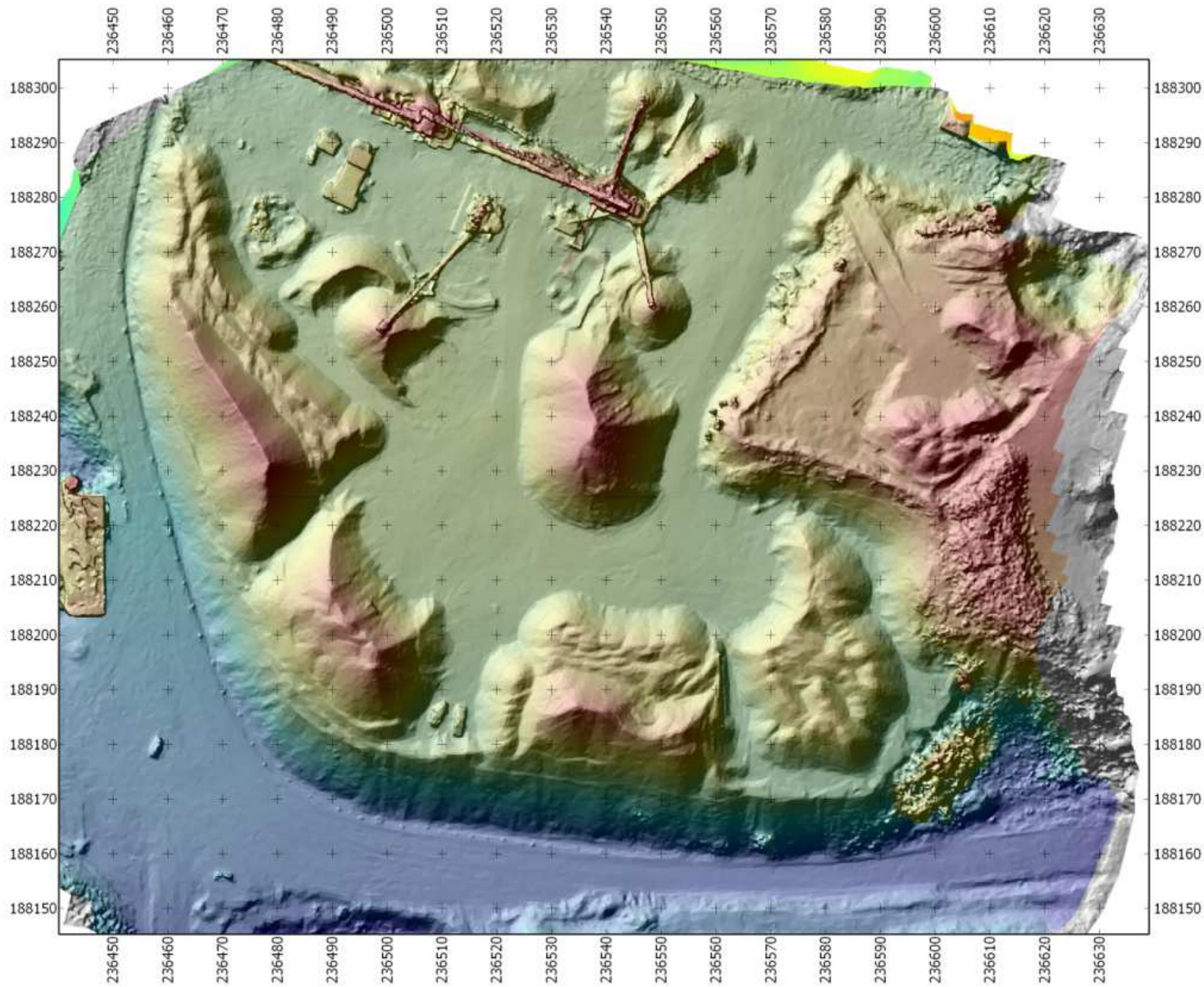
act

chlorophyll map

Data collected over the
"proefcentrum fruitteelt vzw"

Land surveying applications





Legende



0 10 m



Air quality monitoring: real-time black carbon measurements with AE-51 Aethalometer

The image is a composite of three parts. The top-left part shows a drone flying over a field, emitting a large plume of white smoke. The bottom-left part is a color-coded map of a region, with a legend for NO2 concentration in $\mu\text{g}/\text{m}^3$. The legend ranges from 11-16 (lightest) to 71-102 (darkest). The map shows higher concentrations in urban areas and along roads. The right part is a close-up of the drone's payload, showing a yellow battery, a black box labeled 'VITO', and various antennas. Labels with green lines point to the 'GPS antenna', 'Processing' unit, 'GPRS antenna', and 'Black Carbon' sensor.

NO2 basis ($\mu\text{g}/\text{m}^3$)

11-16
17-18
19-20
21-22
23-24
25-26
27-28
29-30
31
32
33
34
35
36
37
38
39
40
41-43
44-47
48-50
51-55
56-60
61-70
71-102

GPS antenna

Processing

GPRS antenna

Black Carbon

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13

17



Thank you

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