



The Limitless Possibilities of Rotary UAS: Inspection to Inventory, Mapping to Movies

GeoSmart Asia 2015

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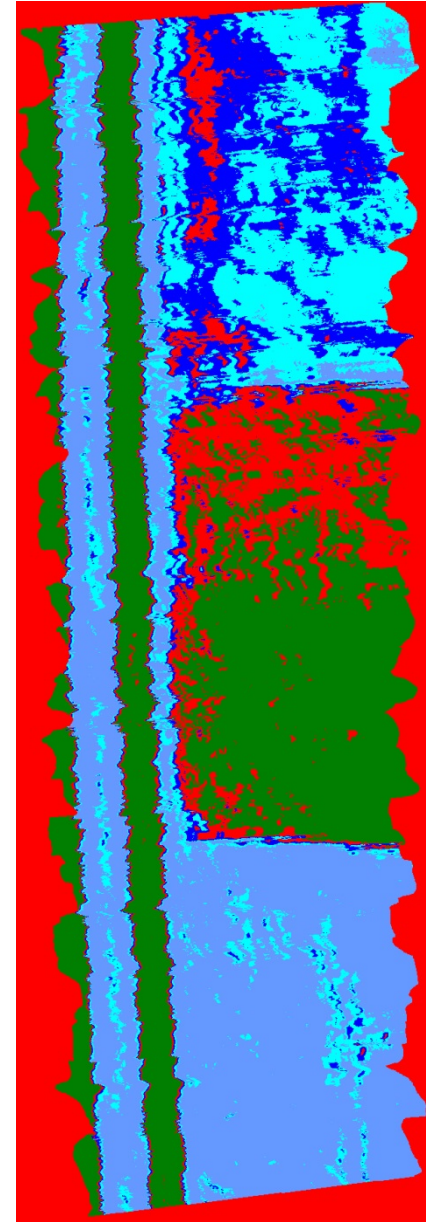
Leica Geosystems AG



Rotary UAS Possibilities

Content

- **Where are the current Commercial Opportunities**
- **New Opportunities for Commercial Operations**
 - New and Varied Sensor Payloads
 - High Accuracy Solutions
- **Resulting New, or more accurate Applications**
 - In Inspection, Inventory, Mapping, and others...
- **Future of the UAS**



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UAS Market Forecast

Commercial UAS Sector Offers Great Opportunities

“The current global market value of commercial and civil UAVs ... is expected to continue its growth to €612.9m in 2015”

Inea Consulting, 2014

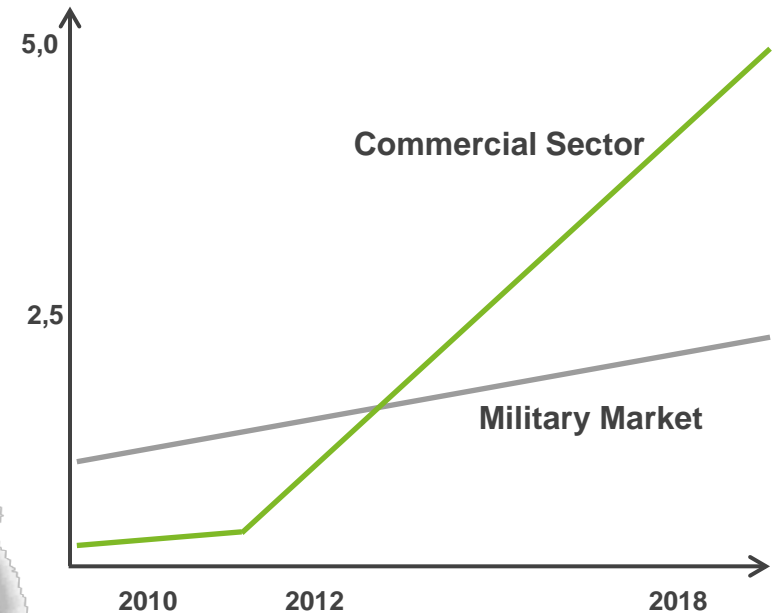
“The monitoring of civil infrastructure is a fast growing multibillion Dollar business”

Frost&Sullivan, 2013

“By 2019 the Commercial sector will dominate the overall sUAS market with revenues exceeding US\$5.1 billion, roughly 5x larger than the Prosumer/Hobby market, and 2.3x greater than the Military/Civil market segment.”

ABlresearch, 2015

Revenue in billion dollars



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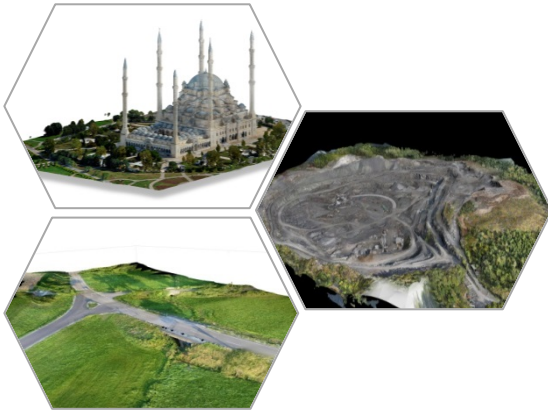
Commercial Opportunities

Professional Applications

Current Main Fields of Application

Mapping/GIS

- 3D models
- Point clouds
- Orthophotos



Inspections

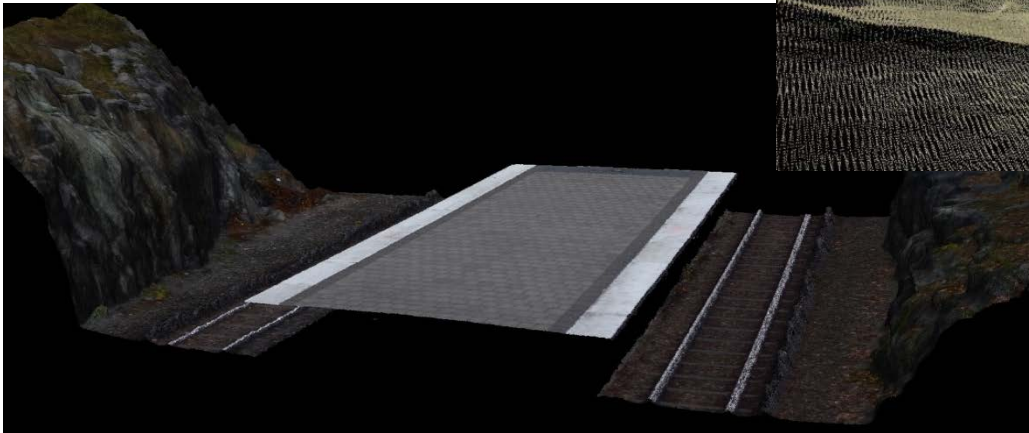
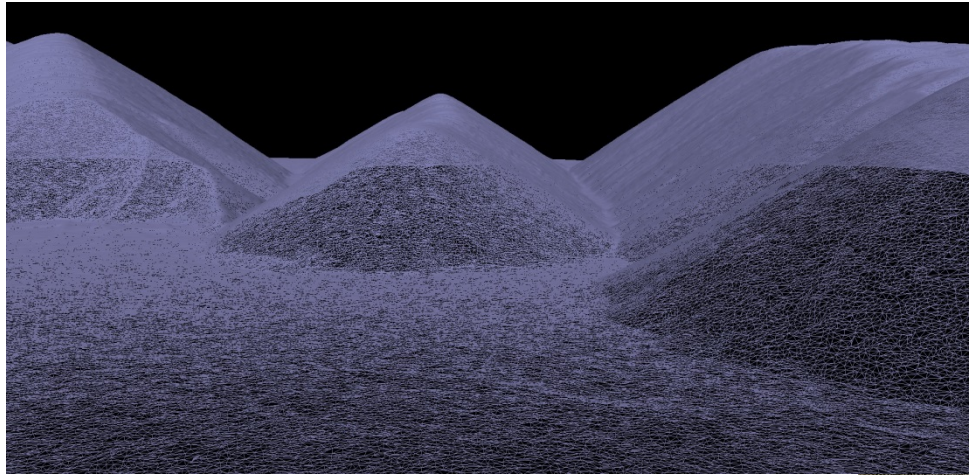
- Power lines
- Bridges, dams
- Buildings



Mapping 3D Terrain Models



Mapping Point Clouds



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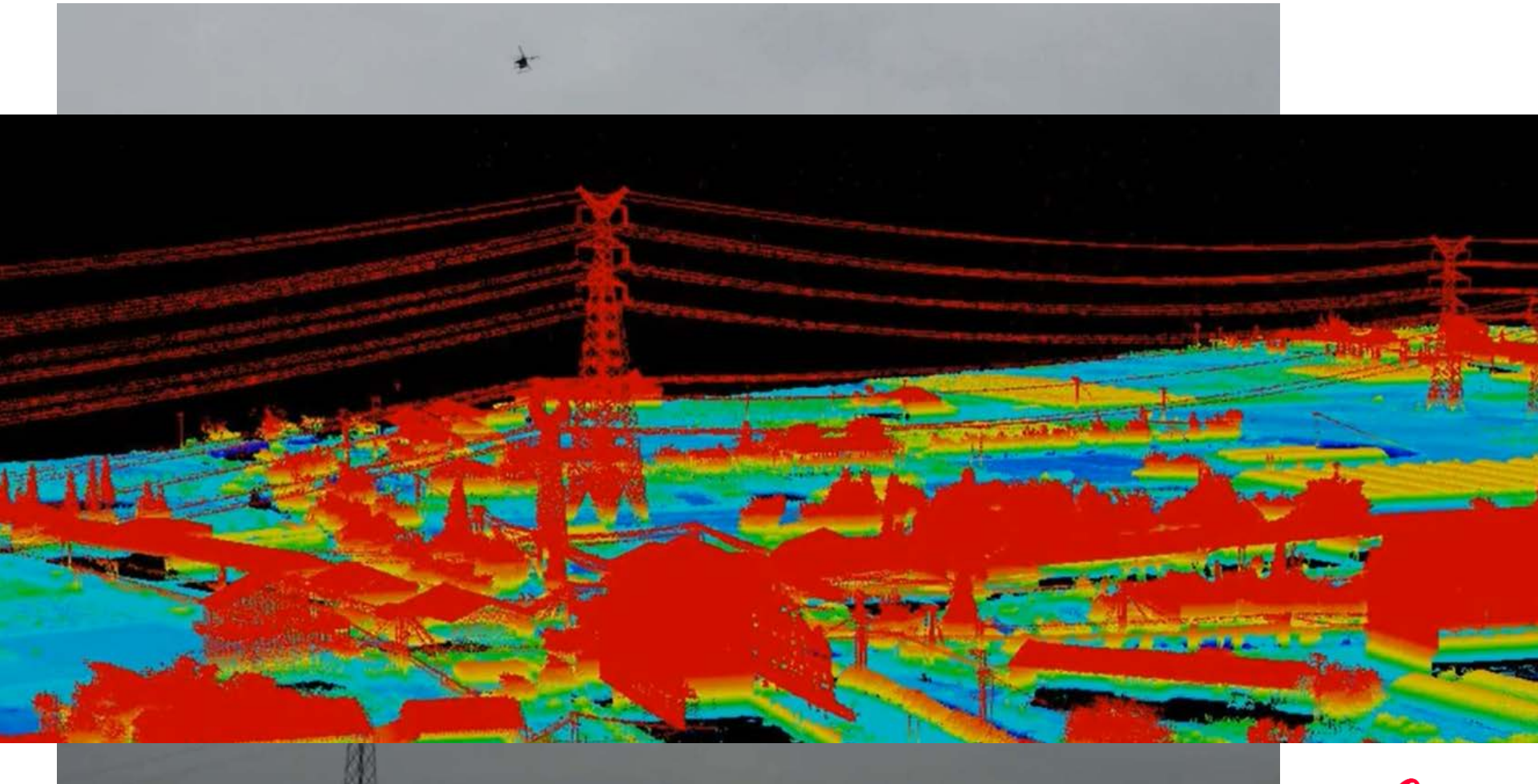
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Mapping Orthophotos



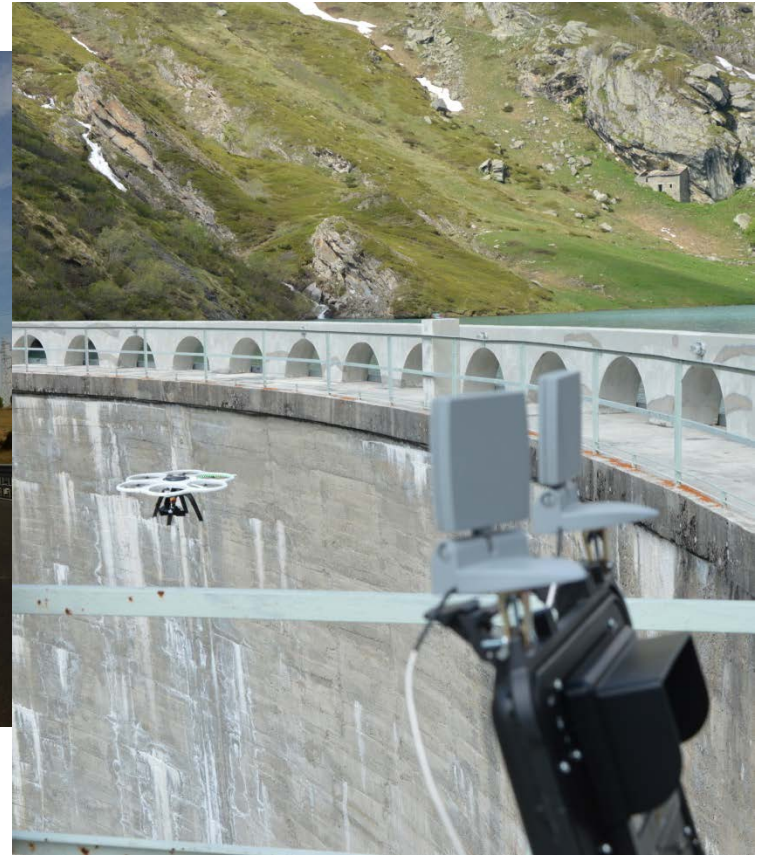
Inspections

Power Lines



Inspections

Bridges, Dams



Inspections Buildings



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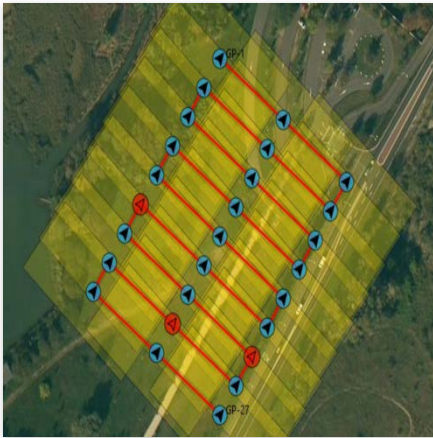
New Opportunities for Commercial UAS Ops. Variety of Sensors - not just Cameras...



New Opportunities for Commercial UAS Ops.

Thermal Cameras

Photovoltaic Panel Inspections



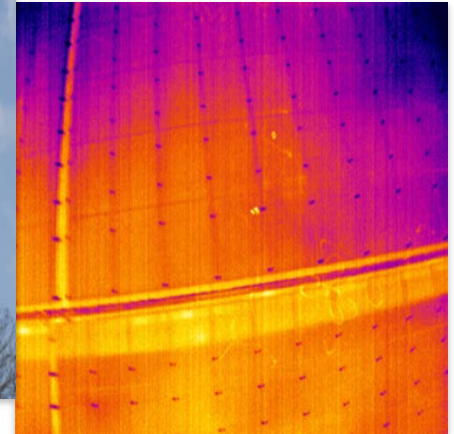
Plan



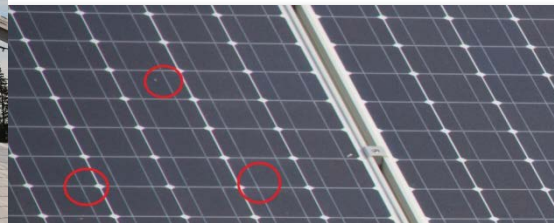
Prepare



Auto Flight



Post Process

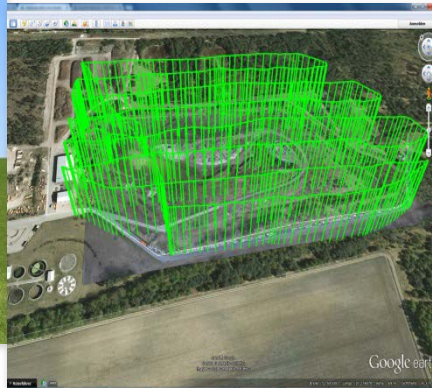


New Opportunities for Commercial UAS Ops. Hyperspectral Camera

Plant Species Surveys / Counting



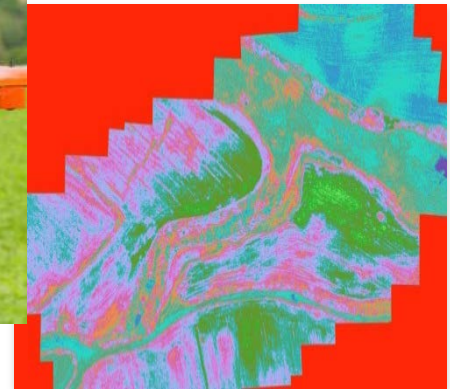
Species Spectral
Signature



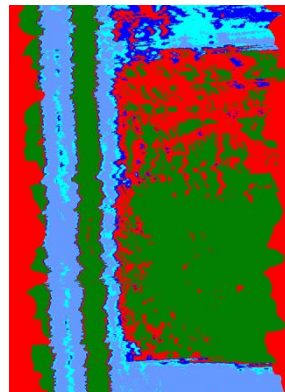
Plan



Auto Flight



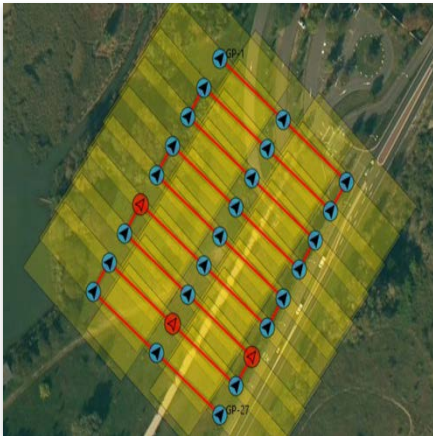
Post Process



New Opportunities for Commercial UAS Ops.

Lidar

Airborne Lidar Data Capture



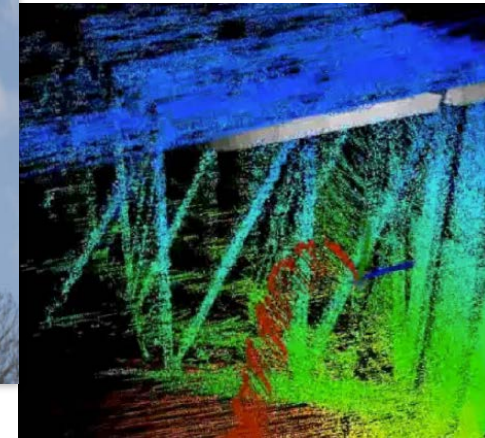
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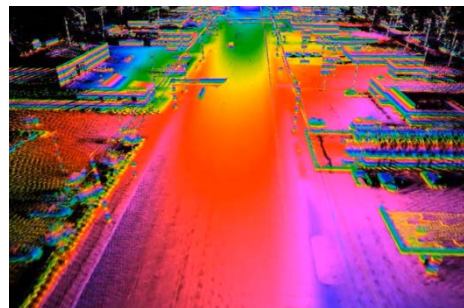
Prepare Lidar



Auto Flight

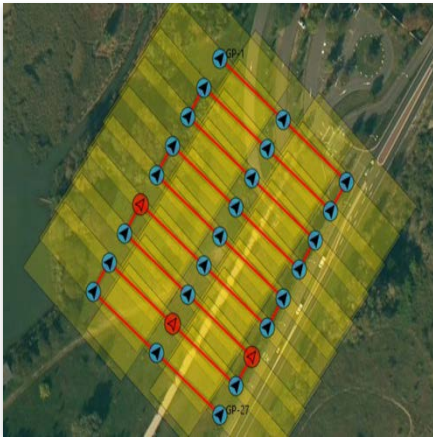


Point Cloud



New Opportunities for Commercial UAS Ops. Ground Penetrating Radar

UAS Inspection by GPR



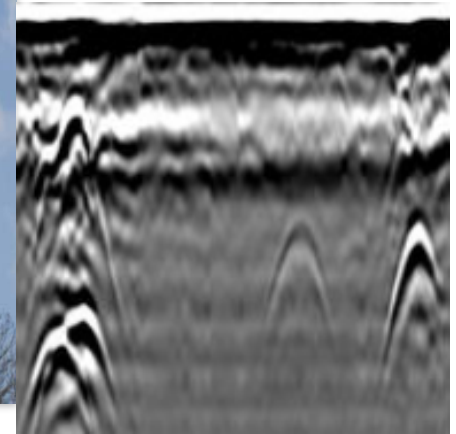
Plan



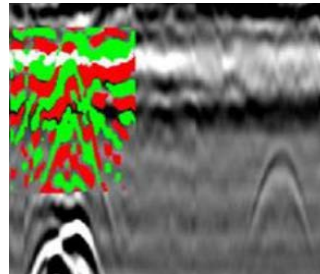
GPR



Auto Flight



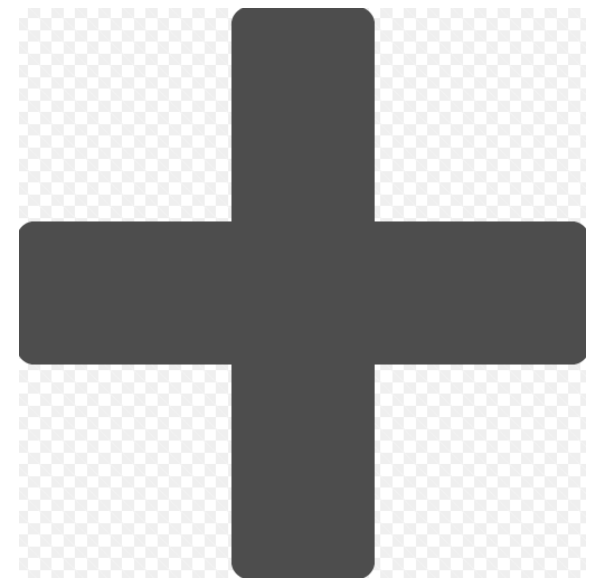
Analyse Radar
Data



New Opportunities for Commercial UAS Ops.

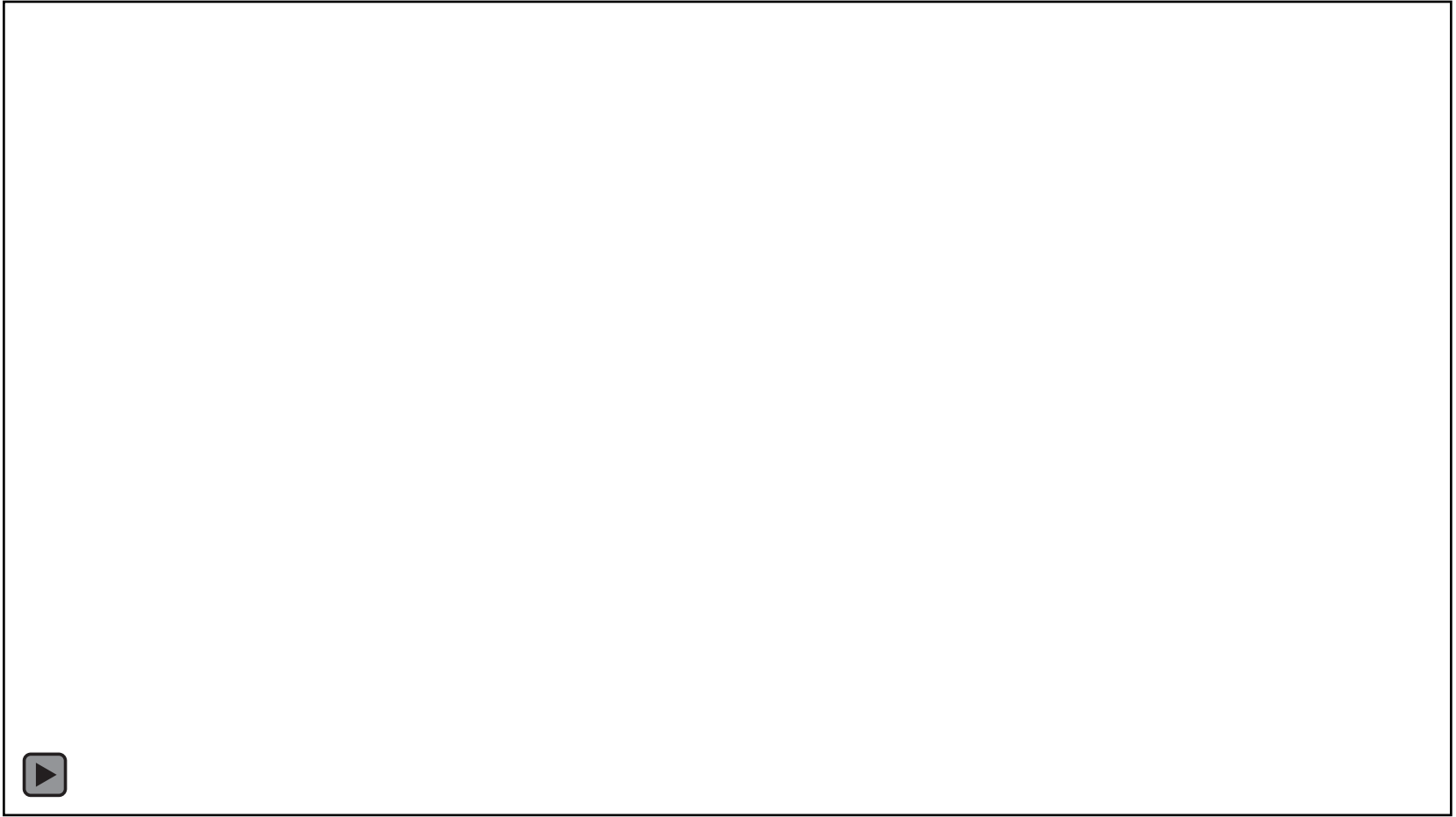
High Accuracy Positioning

To extend Commercial Operations into some new applications requires higher accuracy than GNSS, or other, 'navigation' solution



New Opportunities for Commercial UAS Ops.

High Accuracy Positioning



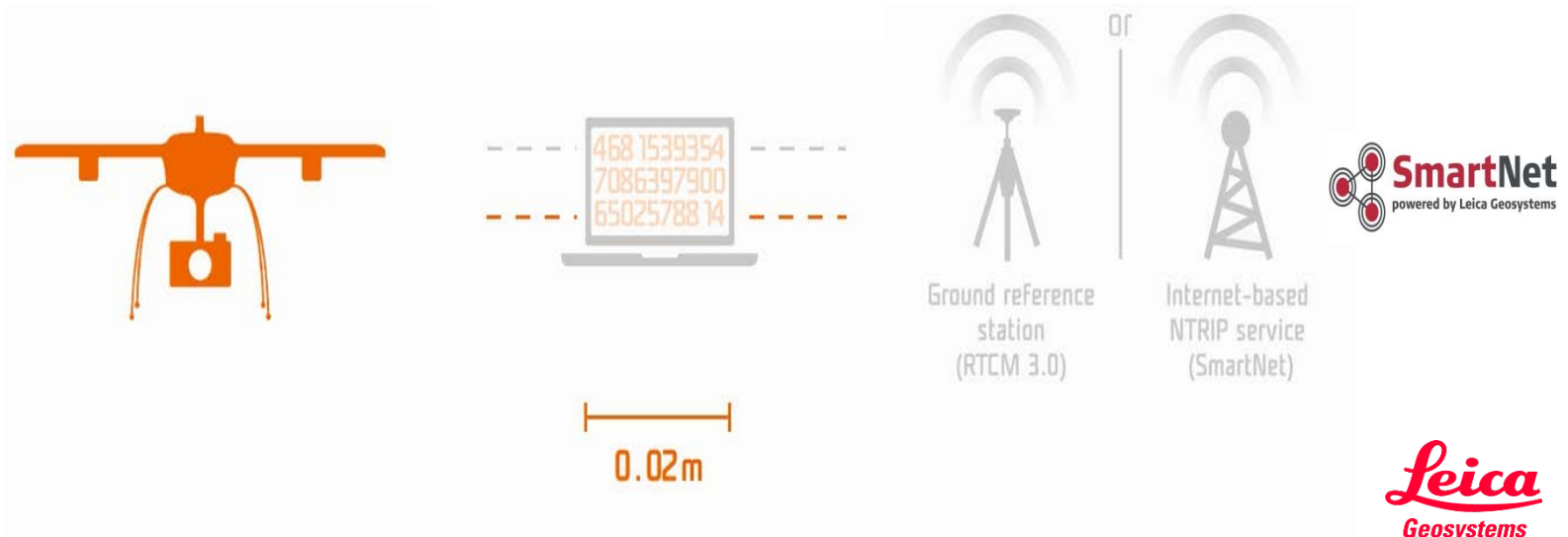
New Opportunities for Commercial UAS Ops. High Accuracy Positioning – via GNSS

The Technical Solution

- Survey grade **RTK GNSS** receiver and antenna
- **Dual frequency**, L1/L2 GPS & GLONASS
- Highly accurate **offset calibration** algorithms

Compatible Real-Time Correction

- **VRS/NTRIP** via Internet
- **Base reference station** via radio modem (RTCM 3.0/3.1)



New Opportunities for Commercial UAS Ops. High Accuracy Positioning – via TPS

The Technical Solution

- Exact tracking of UAV with prism via TPS
- Wireless link
 - Transfer of positioning data from TPS to UAV
- Flight execution based on high precision TPS-data
- Lost connection procedure
 - Automatic Position and Altitude Hold (vision-based)
 - Resuming of waypoint flight after connection recovery



New Opportunities for Commercial UAS Ops.
Varied Sensors and High Accuracy leads to...

New or more accurate...

...segments...

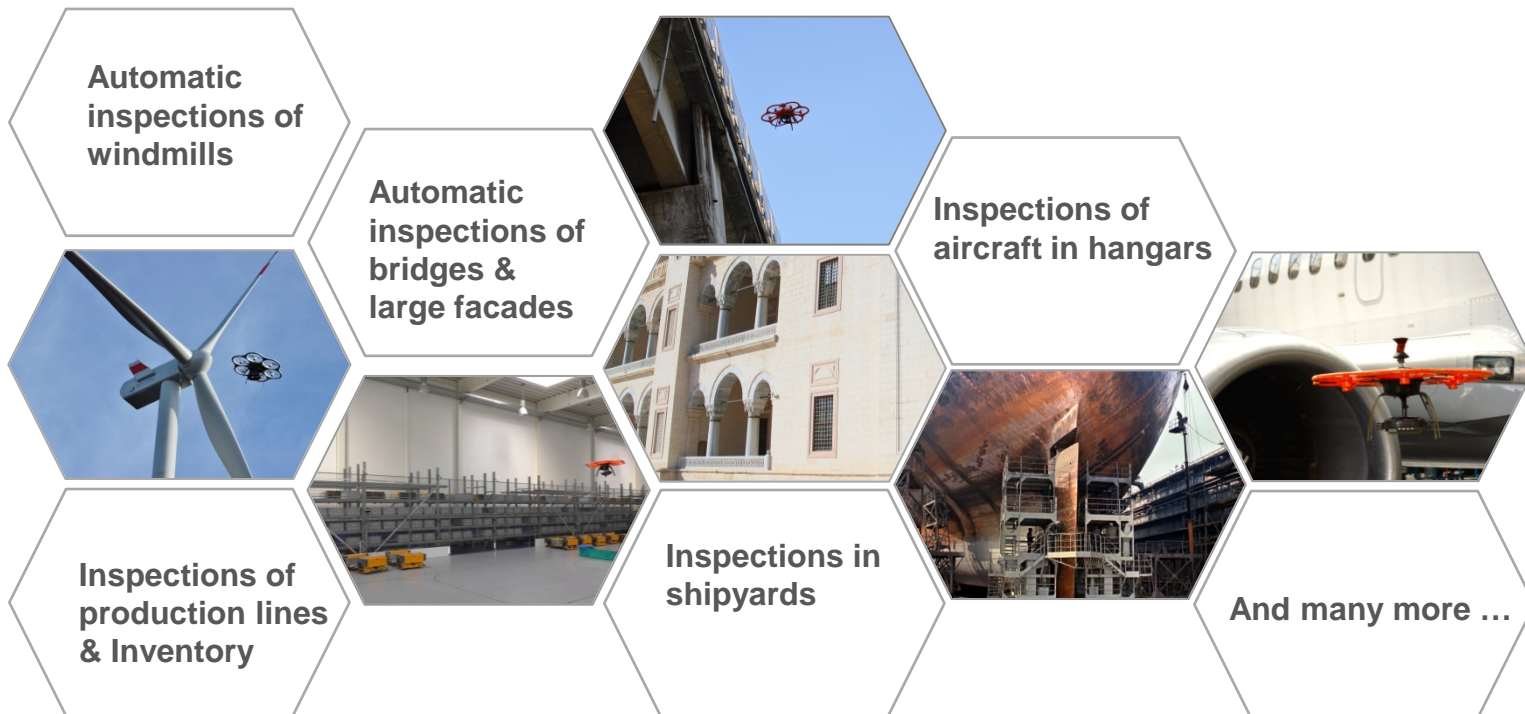
...applications...

...opportunities...



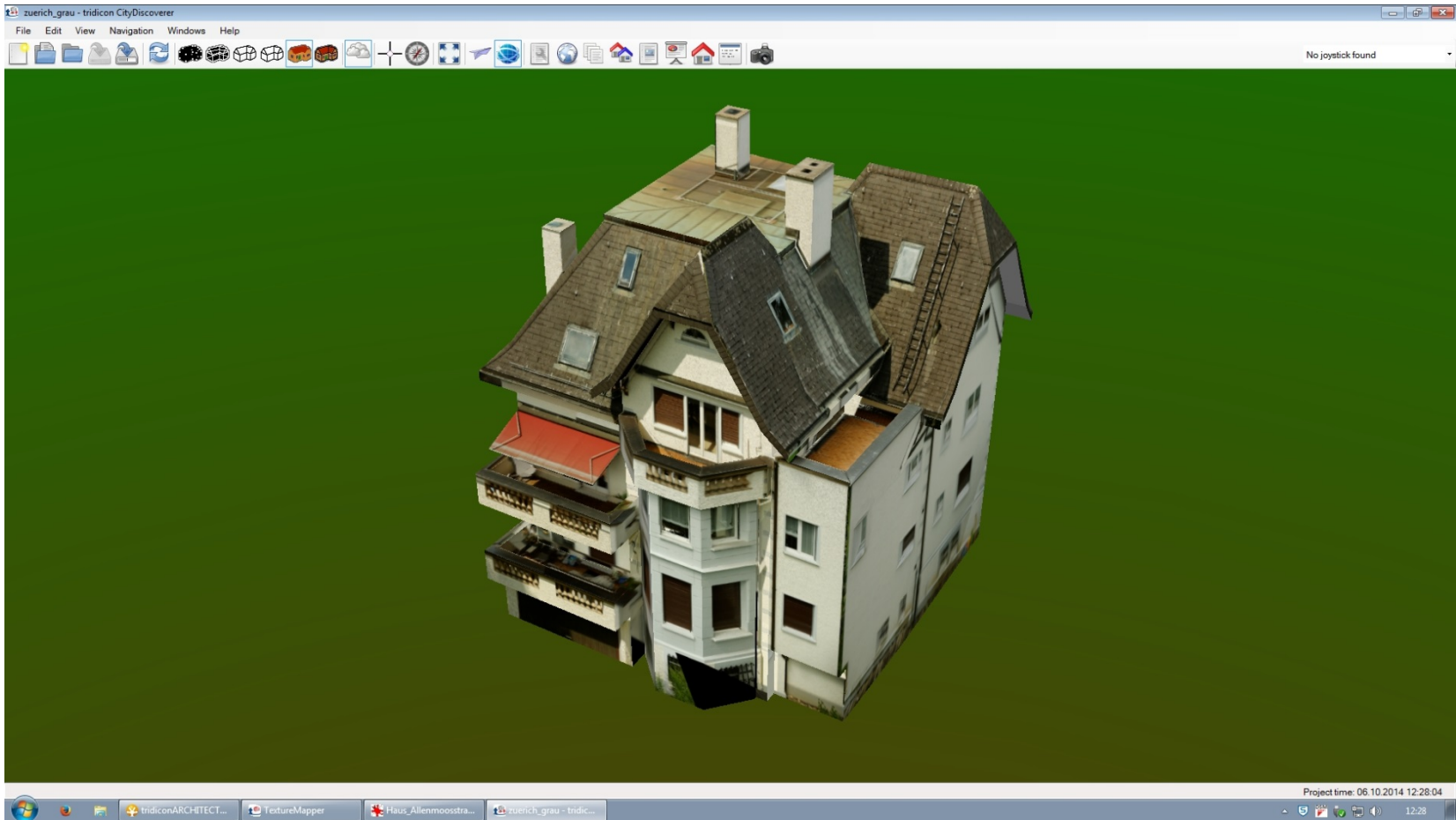
New Opportunities for Commercial UAS Ops. Professional Applications

New Solutions and Workflow



Mapping / Modelling

Outdoor Mapping and 3D modelling of buildings



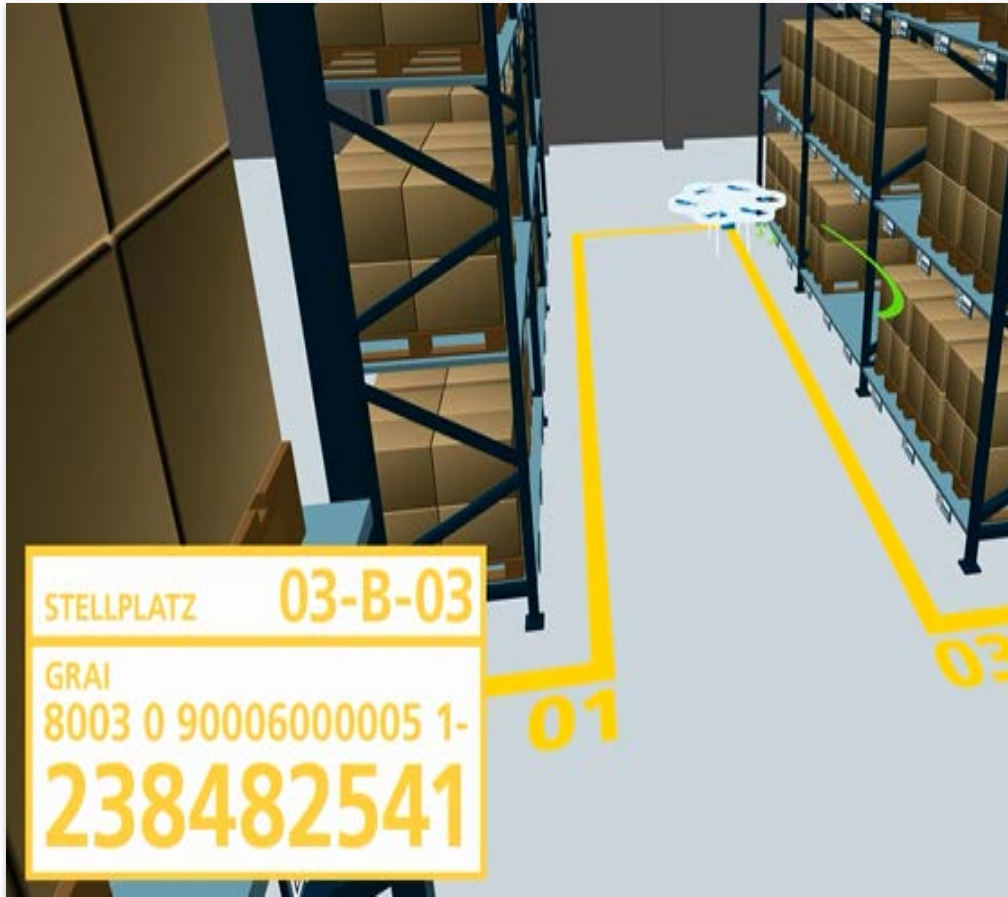
Mapping / Modelling

Indoor Mapping of Building



Inspection

Automatic Inventory Control



use
→
Sensor to UAV
↓
Inventory
→



Inspection

High Precision Automated Inspection

Automatic Wind Turbine Inspection

- TPS measures actual position of wind turbine blades
- Route is generated by UAV
- TPS tracks UAV
- High precision positioning and close up inspection possible



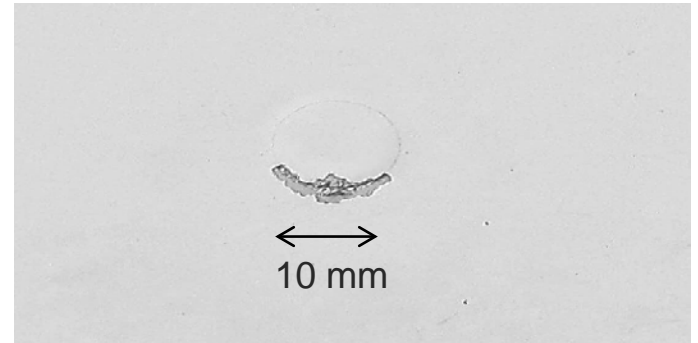
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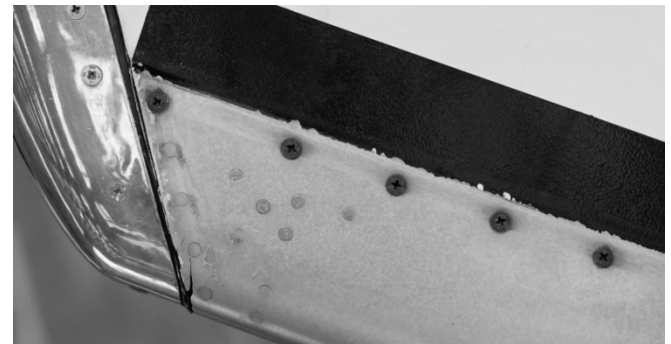
Inspection

Inspection of High Value Assets

Indoor Inspections of Aircraft for Lightning Strike Damage



Captured lightning strike

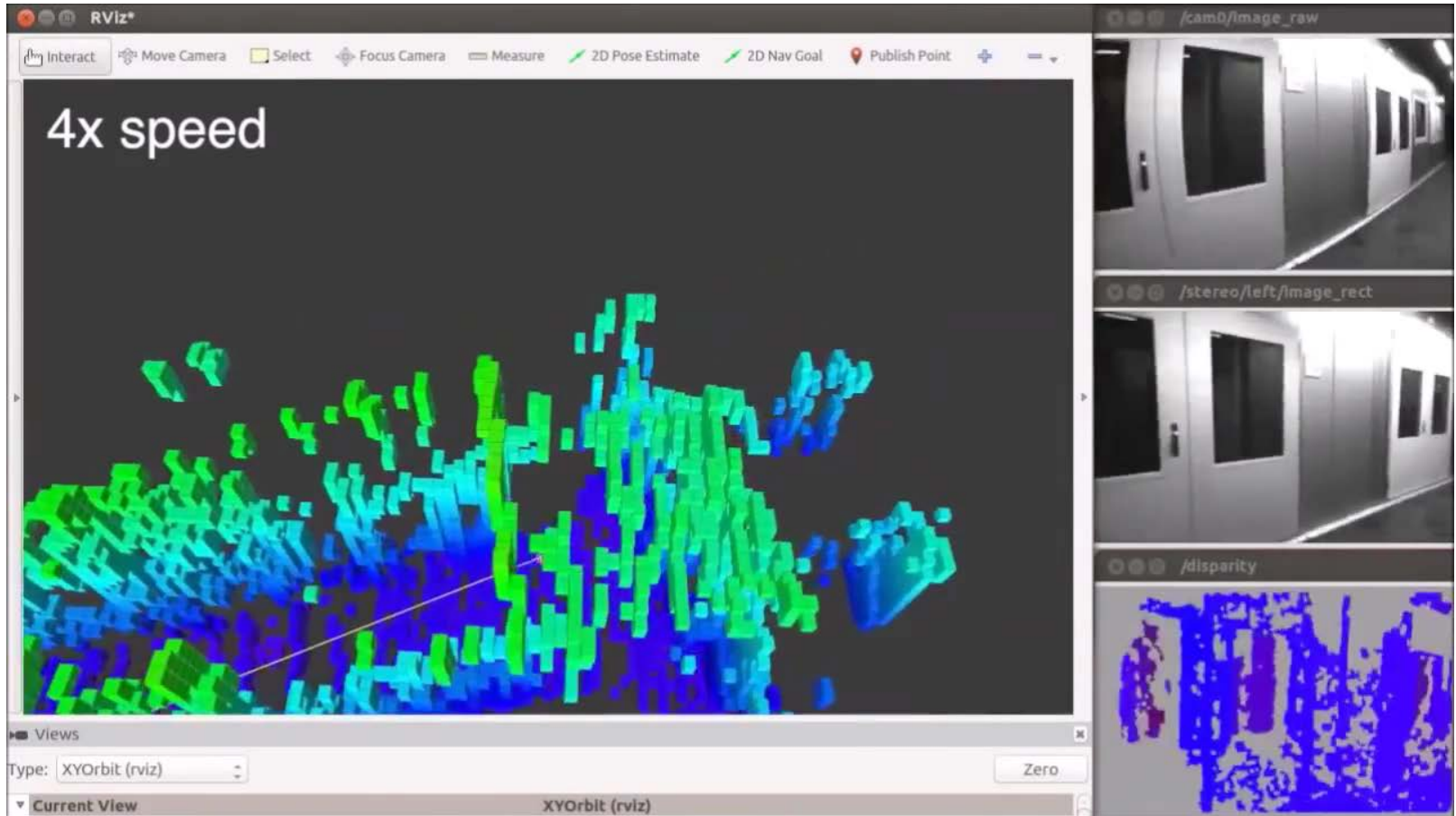


Detail of the tail rudder



Future of UAS?

Indoor 3D model building



Future of UAS?

“Prometheus” (*Ridley Scott, 2012*)



Thank you!

Any Questions?



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