



Space Technology at Spin.Works - H2020 Space Workshop

Lisbon, Portugal

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Company Profile

Spin.Works, S.A.

- Based in Lisbon, Portugal
- Founded in 2006
- Aerospace and Defence Company
- Space
 - Optical Instruments & Machine Vision
 - Guidance, Navigation and Control
 - Avionics
- Unmanned Systems
 - End-to-End Vehicle and System Design
 - Avionics and Flight Control Systems
 - Imaging and Data Services



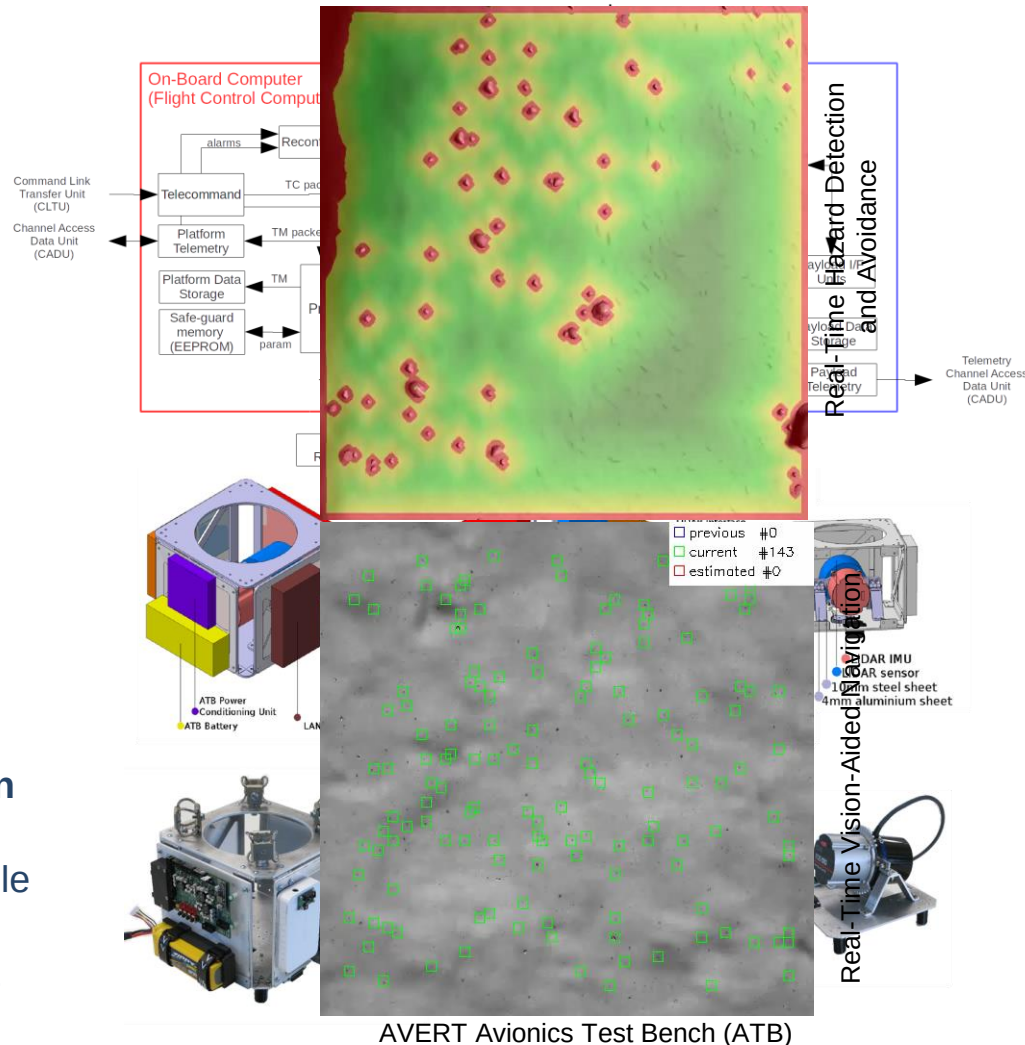
AVERT (AVoidance Algorithms development and Extended Testing)

-Project Overview

- Data Fusion Processor development and in-flight demonstration (up to TRL 5/6)
- ESA MREP-2 Activity (2015-2018)
- Spin.Works is prime contractor

-Technology Development Activities

- Processor-in-the-loop and Hardware-in-the-loop testing (based on own avionics lab)
- Hardware-acceleration of **Vision-aided Navigation** and **Hybrid Hazard Avoidance**
- Real sensors (Camera, Lidar) and space-compatible hardware (PLDPU – ESA CFI)
- Flight Tests over representative terrain (lab + Mars Analog) with enforced real-time constraints



Development and Testing Environment

- Avionics Test Bench & Lab Testing

- Vision-based Navigation + HDA HW implementation

- Flight-representative LEON-2 + FPGA using RTEMS OS
- SpW + CAN interfaces
- Real sensors (IMU, Altimeter, Camera, Imaging Lidar)

- Model/Processor/Hardware-in-the-loop Capabilities

- Avionics laboratory

- Calibration, testing and integration with real sensors

- Flight Testing

- StarTiger Dropter

- Large multi-copter (37kg MTOW) carrying sensor suite
- Landing with embedded CPU-based VBN+HDA (visual)
- Multiple flights

- AVERT - ongoing Spin.Works-led activity

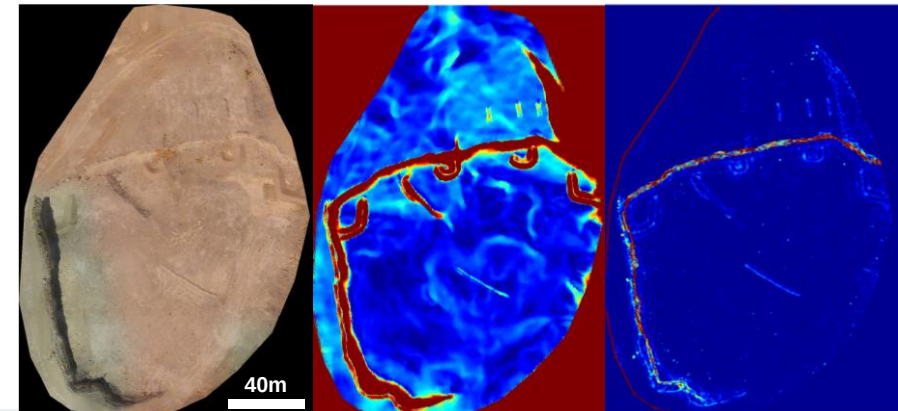
- Large multi-copter (21kg MTOW) carrying sensor suite
- Real-time HW-accelerated VBN/HDA & GNC (LEON-2+FPGA)
- 100s of flights over Mars representative terrain



Camera Image

Slope Map [deg]

Roughness Map [m]



AOCS/INR Co-Design for GEO-HR

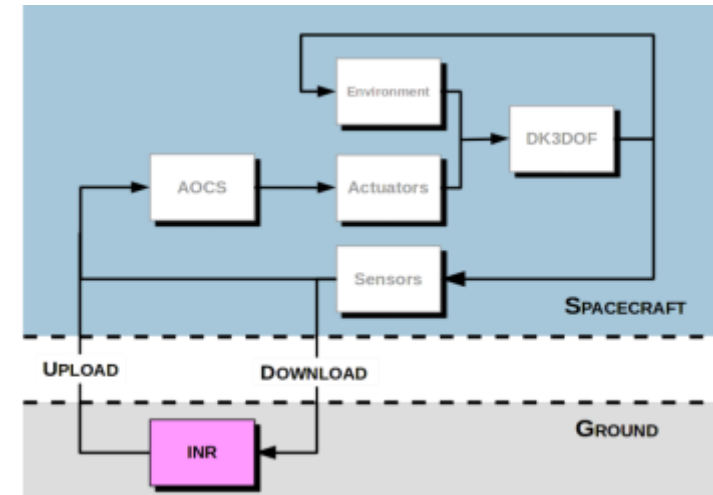
-Project Overview

- Co-design of AOCS/INR for Geostationary High-Resolution mission (disaster management and maritime security/surveillance)
- ESA contract (TRP, 2014-present)
- Spin.Works as prime contractor (Airbus D&S as sub-co.)

-Technology Development Activities

- Simulation tool development
- Covariance and Pointing Analysis Tool
- Attitude and Orbit Control System (AOCS) design
- Image-based Navigation and Registration function:
 - Very high pointing accuracy requirements ($\sim 10^{-8}$ rad)
 - Identification of coastline and ground features for INR
 - Selection + trade-off between ground/onboard processing solutions

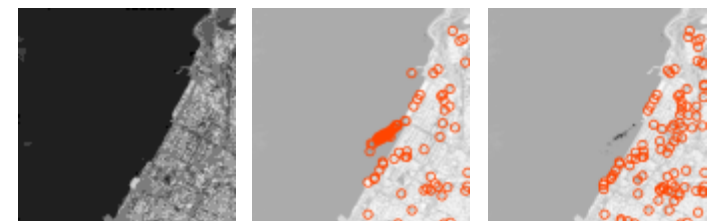
AOCS + INR Simulation Architecture



coastline detection



feature-based INR



INFANTE MultiSpectral Imager

Multispectral Camera Overview

- “Mini-telescope” concept (Maksutov-Cassegrain, 8m/pixel)
- Single sensor, 4MP, area scanner

Strategic Goals

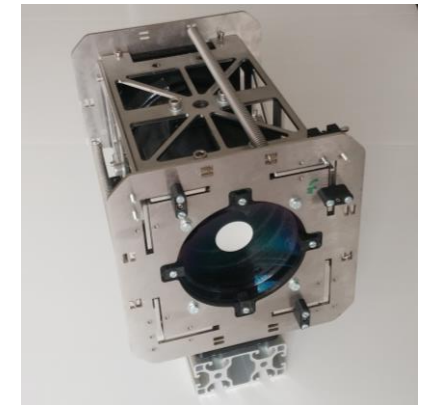
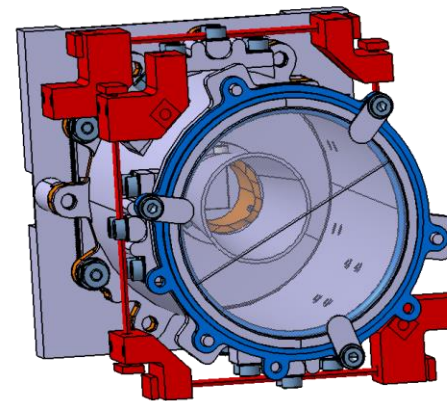
- Technology spin-in Demo from UAVs to Space
- Sat-based EO imaging system prototype
- Aiming at high TRL, base for future vision processing algorithms (space+UAV applications)

Technical Goals - HW

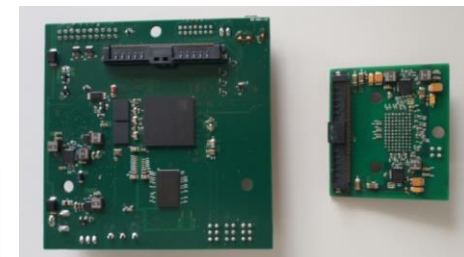
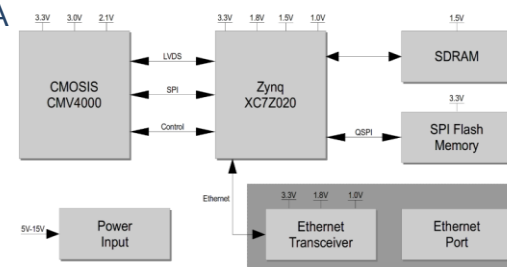
- Implementation of COTS-based OBC with CPU+FPGA
- FPGA-based digital I/F with all sensors
- Implementation of Memory, Network, External I/F

Specs - SW

- Sensors configuration and control
- Image acquisition, processing, compression, storage
- Interaction with INFANTE OBC (TM/TC + data)
- In-space demo (TRL9) of real-time compression algorithms



MS Camera design and mechanical breadboard



MS Camera Electronics

Unmanned Systems

S20 Micro Drone

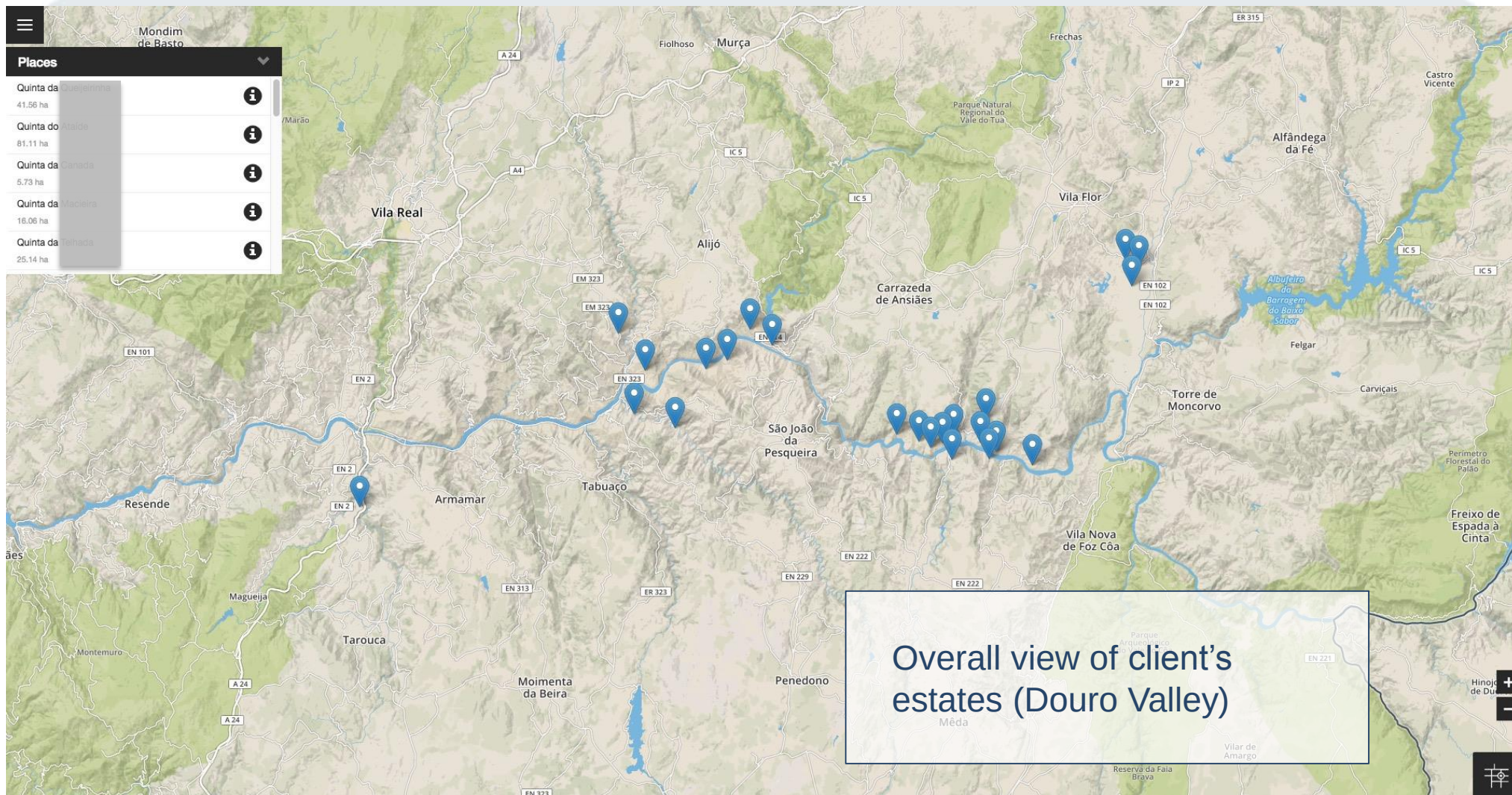
- Weight: 2kg
- Wingspan: 1.7m
- Endurance: 2h
- Range: 20km

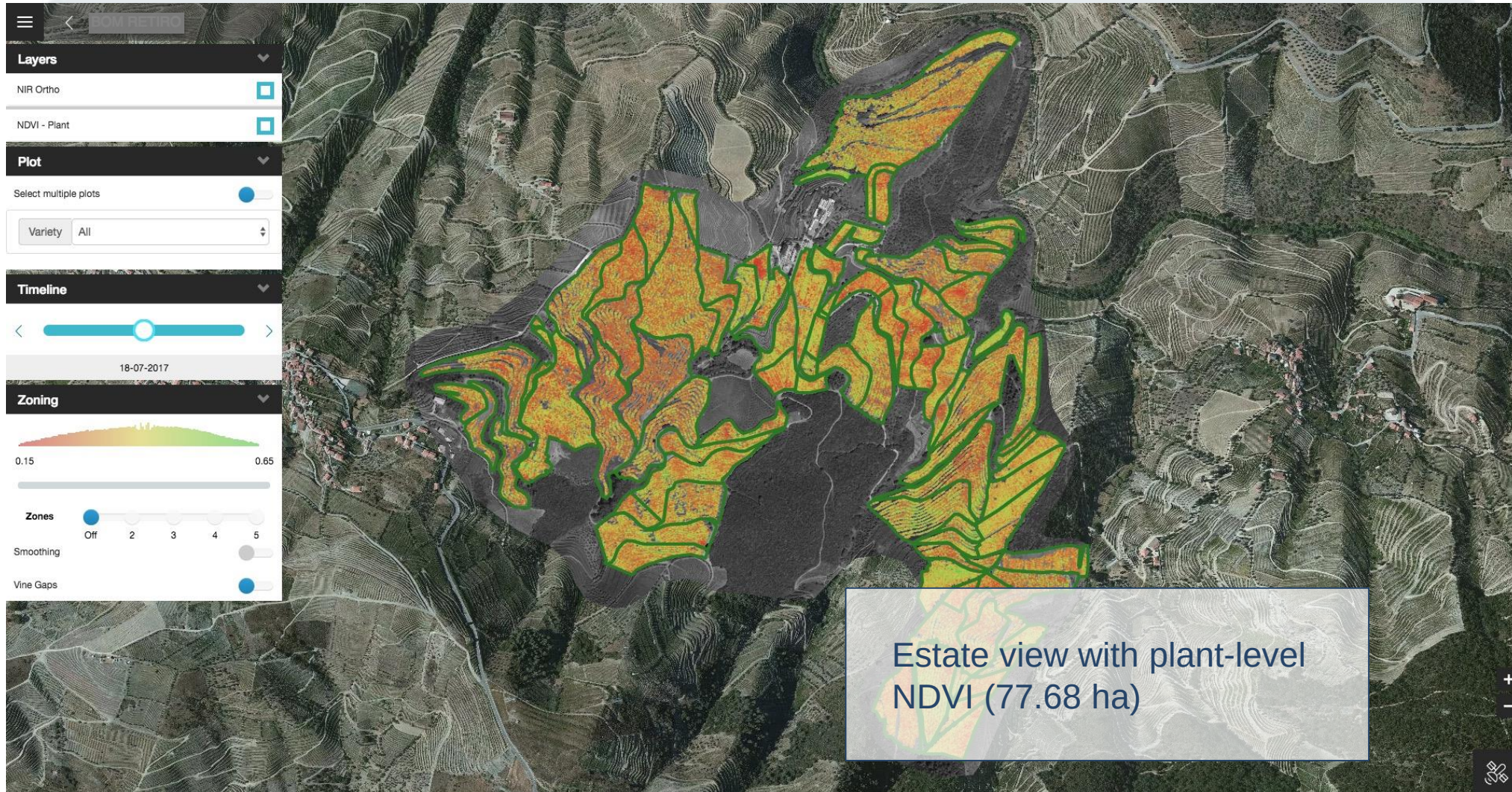
Imaging & Data Services

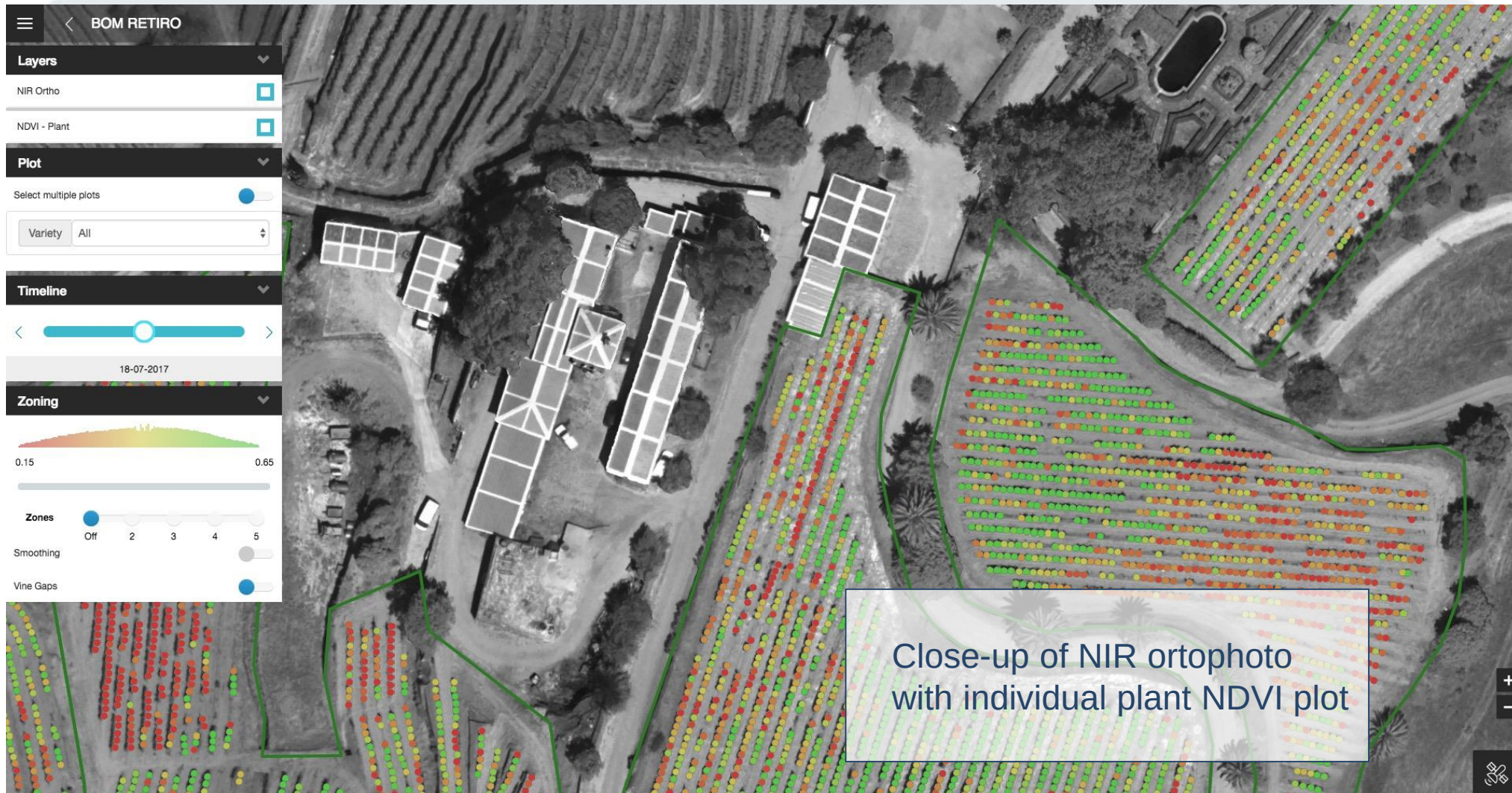
- High-resolution imaging
- Real-time video













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