Smallsat missions/instruments for future EO in the ESA landscape

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(*Aurora Technology B.V for ESA)

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EO Technology vision: as part of ESA's Technology Strategy

Higher performance / cost ratio

- **New Measurements/instruments** (enabler)
  - **Higher spatial, temporal, radiometric** resolution
- Lower recurring **cost**
  - **Platform Standardisation** & multi source suppliers
  - **Spin-in** techno: e.g. COTS
  - Lifetime & flexibility (FPGAs)
- **Big Data** (AI enabler) & Data continuity

Miniaturisation and Constellations

- More **autonomous** platform & operations & synchronisation
- **Distributed** Ground Segment

ESA EO Satellites

Science + Copernicus + Meteo
16 in operation
38 under development
14 under preparation

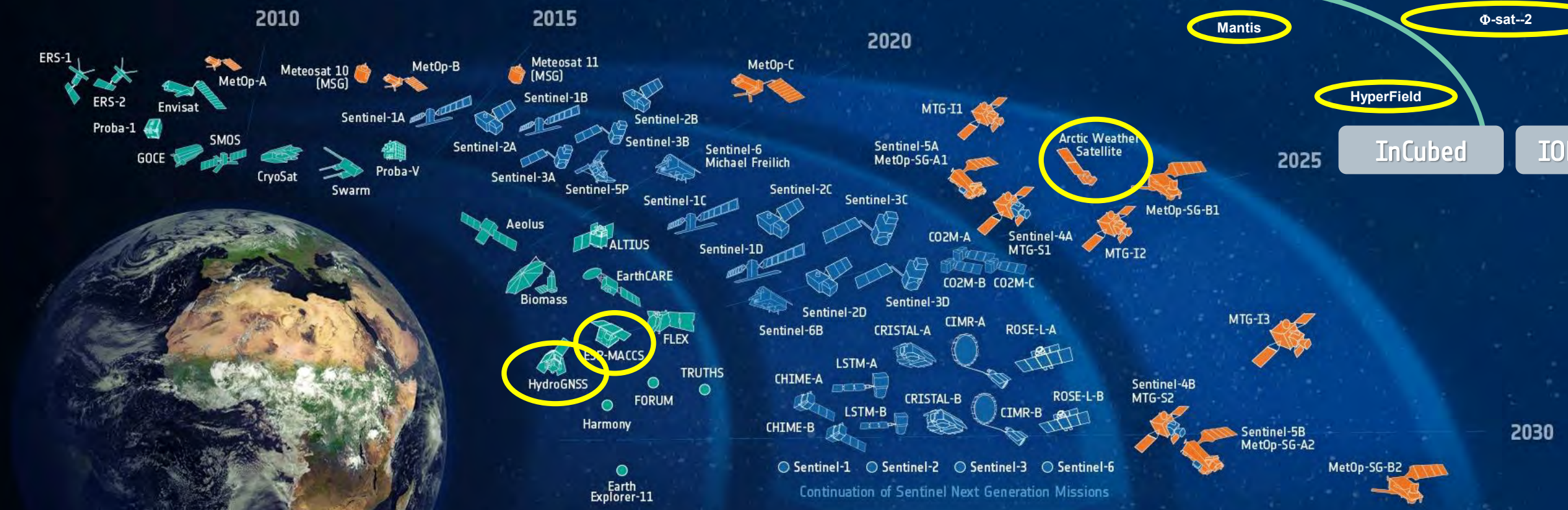
esa

Living Planet Programme (user driven)

Research Missions
EE, Scouts

Earth Watch Missions
Copernicus, Meteo, CustomisedEO (InCubed, National-driven)

Many in D/TEC
FSScat – Φ-sat-1
Φ-sat--2
Mantis
HyperField
InCubed
IOD



Science esa | Copernicus | Meteorology EUMETSAT

→ THE EUROPEAN SPACE AGENCY

Small satellites and ESA EOP lines

Fast development cycle | **Affordable Constellations** | **Miniaturisation**

Scout missions: 30 M€ range

- demonstrate novel Earth Observation techniques in Earth science and related non-commercial applications (open data policy);
- Mission selection through competitive ITT – then consolidation + implementation phases

InCubed (Investing in Industrial Innovation) **Programme & missions**:

- to invest in European industrial competitiveness → commercial driven
- **co-funded scheme** with 3 clear procurement steps
- wide scope : development of (sat, ground system) and also end-to-end missions
  - see https://incubed.phi.esa.int

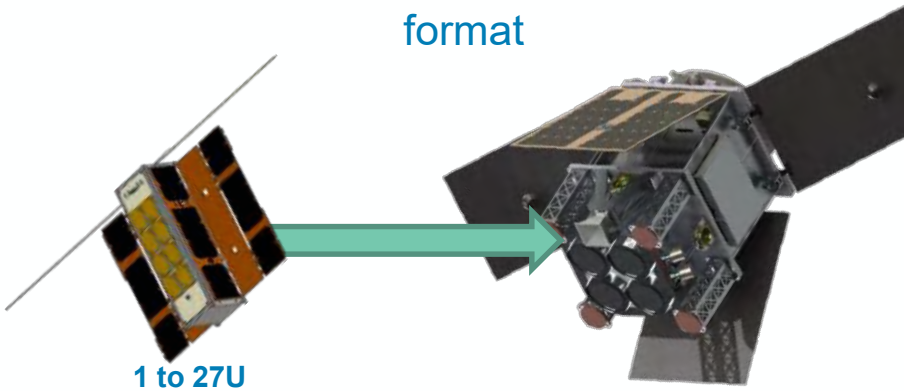
Φ-sat missions: 2-3 M€ range

- to develop missions for fast demonstration of EO new techniques
- to showcase innovative/disruptive technologies such as on-board AI
- open data policy
- Mission selection through Calls or competitive ITT
  - then consolidation + implementation phases

Technology:

- FutureEO and Corporate programme (TDE, GSTP) funding
  → objective is to enable candidates for new Calls

No specific requirement on size or format



ESA EO requirements driven by functionality and performance within cost limit

SCOUT – First Missions

Status of **Scout-1**:

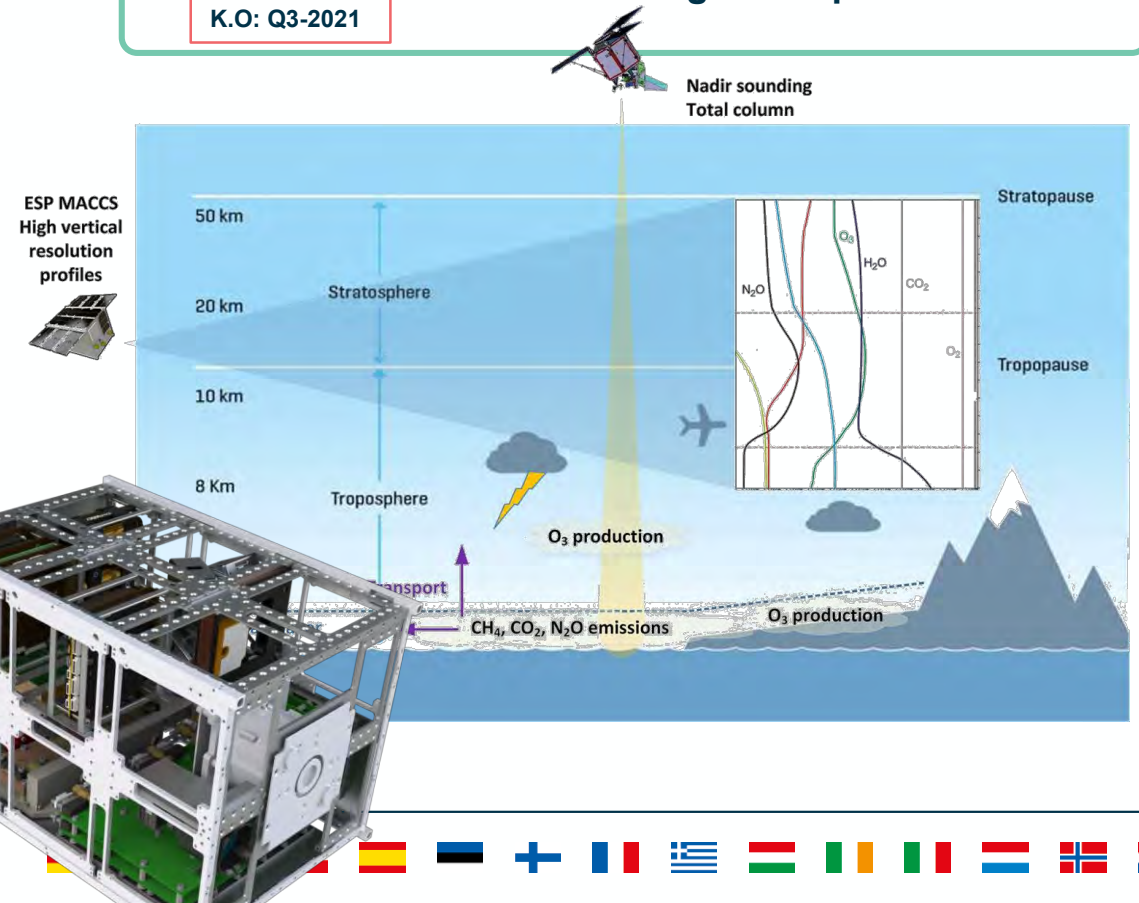
- 2x Mission Implementation (3 yrs development + Launch in 2024 + commissioning)

Earlier ESA contracts with SSTL, NOC, and other scientists for precursors: TDS-1, DoT-1

ESP-MACCS

K.O: Q3-2021

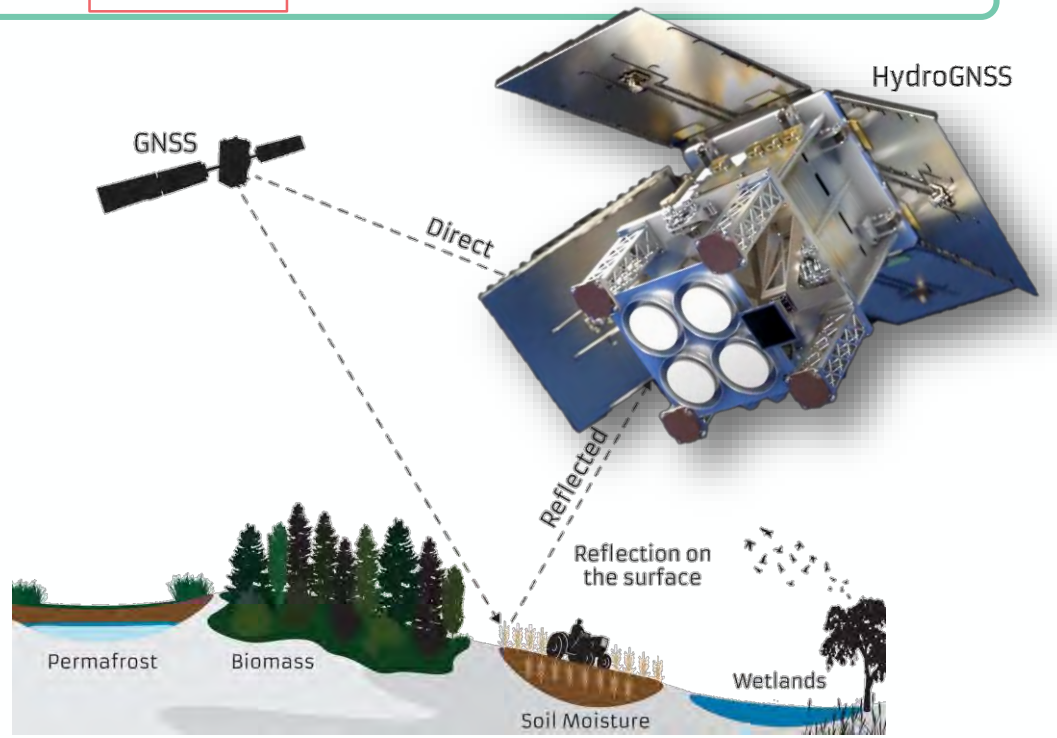
3 x 12U Cubesats
Monitoring Atmospheric Processes



HydroGNSS

K.O: Q4-2021

1 x 40 kg Sat with GNSS-R
Biomass, Soil Moisture, Ice



SCOUT – RR Activities from Scout-1

Scout-1 (missions not to be implemented):

- 2x Risk Retirement (RR) activities **To be initiated in Q4-2021**

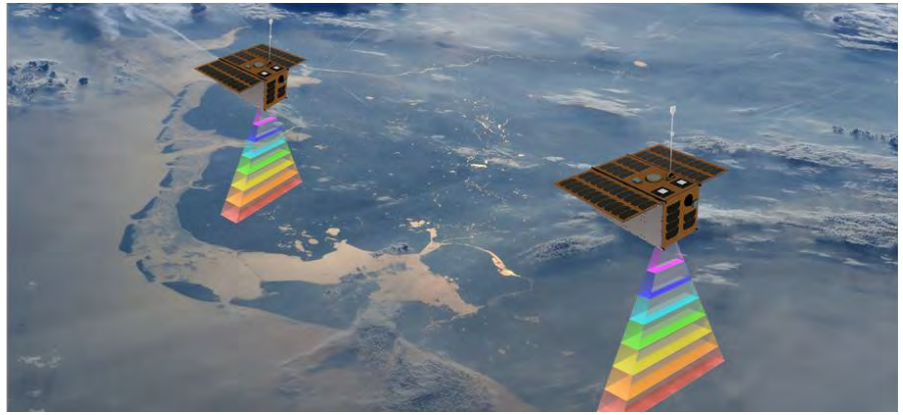
TANGO

2 x 16U Cubesat

Anthropogenic Greenhouse

Activities list:

- Customized MCT type detector
- Performance testing detector candidates and gratings
- Spectrometer test-bench Breadboard



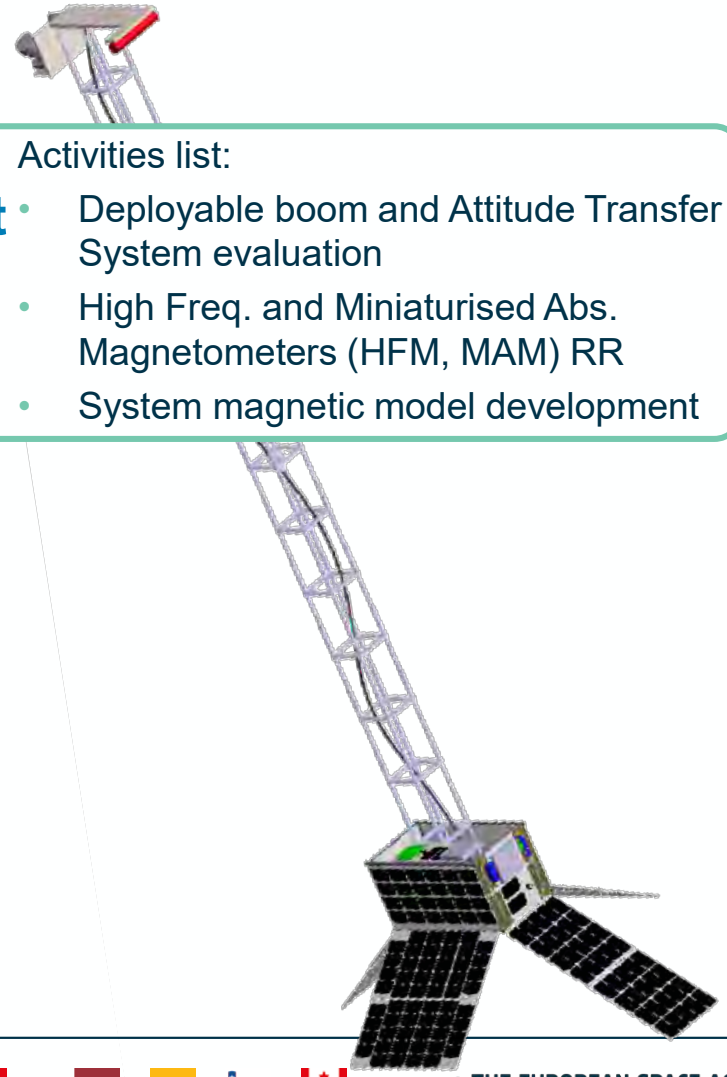
NanoMagSat

3 x 16U Cubesat

Magnetic Field, Plasma, GNSS Reflectometry

Activities list:

- Deployable boom and Attitude Transfer System evaluation
- High Freq. and Miniaturised Abs. Magnetometers (HFM, MAM) RR
- System magnetic model development



There will be a Scout-2 Call

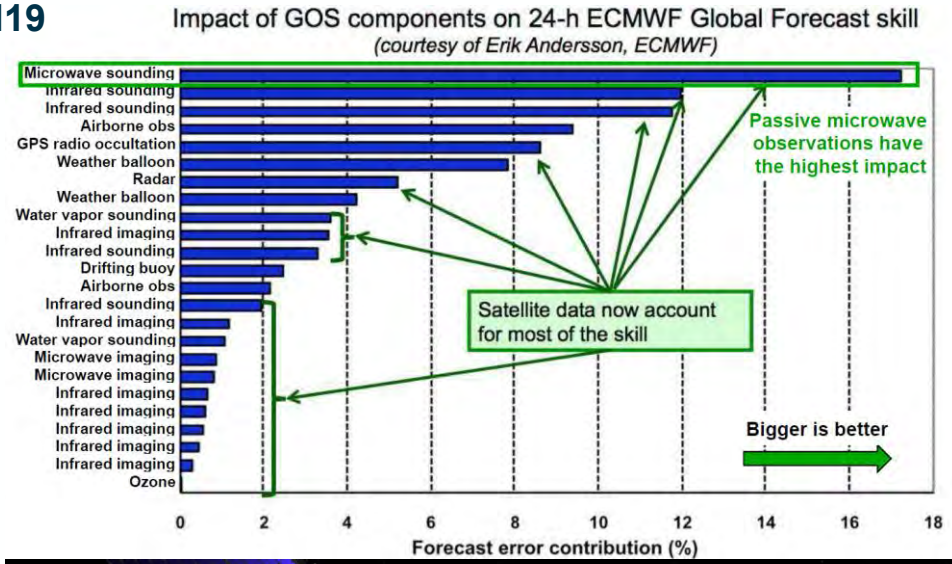
AWS PFM - (Artic Weather Satellite , Protoflight Model)

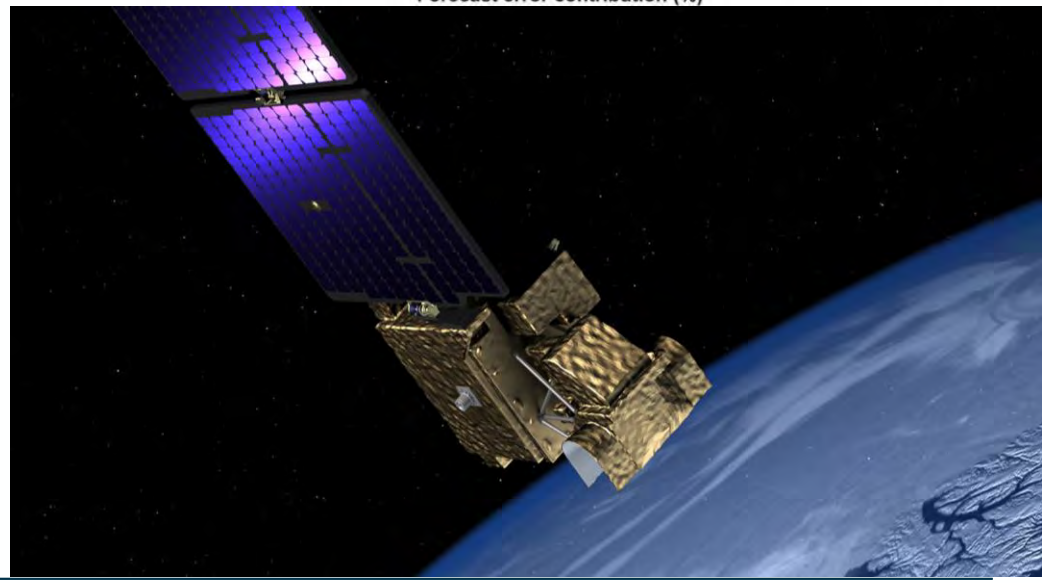
- **AWS PFM Part of Earth Watch Programme: 12 countries subscribed in ESA CMIN19**
  - Ph. B/C/D/E KO in 2021: incl. development, launch, ≥ 1 year operations
  - OHB Sweden Satellite Prime, Omnisys Instruments Payload Prime, TAS Ground Segment Prime
  - First AWS PFM : Launch in 2024

- **AWS PFM conceived**:
  - As a prototype satellite providing all-weather microwave sounding of the global atmosphere
  - for a future Constellation, to be implemented in cooperation with EUMETSAT, to complement MetOp, MetOp-SG and JPSS satellites

- **Microwave sounding is the top contributor to NWP**

- **PFM:**
  - Final orbit depends on launch opportunities. Likely launched into 600 km SSO.
  - ~120 kg, ~120 W, 1.1 x 0.7 x 0.8 m.
  - Electric propulsion, provides collision avoidance and orbit maintenance capability
  - 19 channels, total power microwave radiometer.
  - 50 GHz – 325 GHz using four sets of feedhorns:

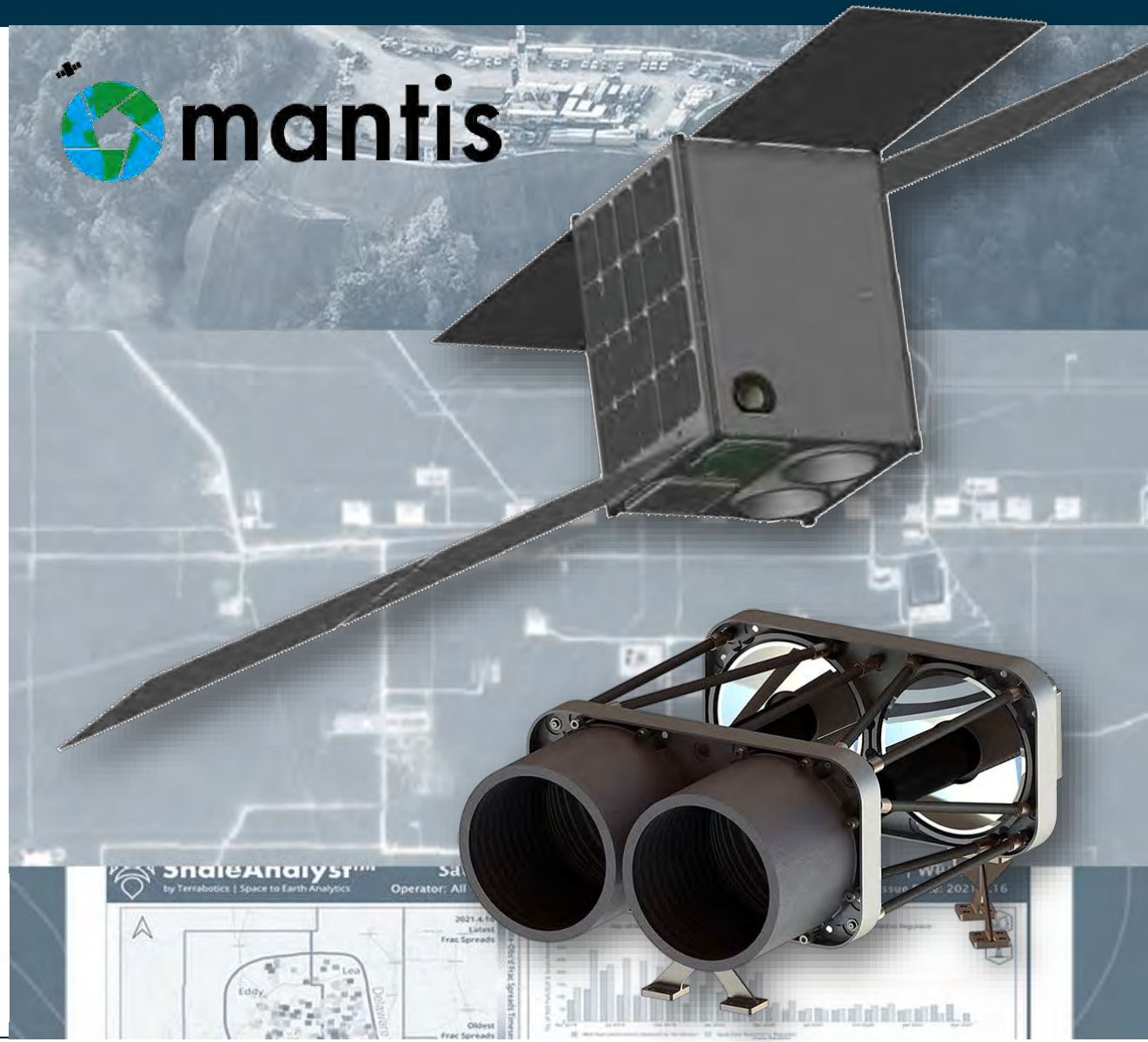




InCubed - mantis

Mission and Agile Nanosatellite for Terrestrial Imagery Services

- Specific focus on energy sector
- 3m GSD (SR)
- 12U Cubesat with VIS-NIR Push broom Multispectral 4 bands Dual Telescope
- Onboard Super Resolution
- Onboard Cloud Detection
- **Launch in 2022**



incubed.phi.esa.int/portfolio/mantis

OPEN COSMOS

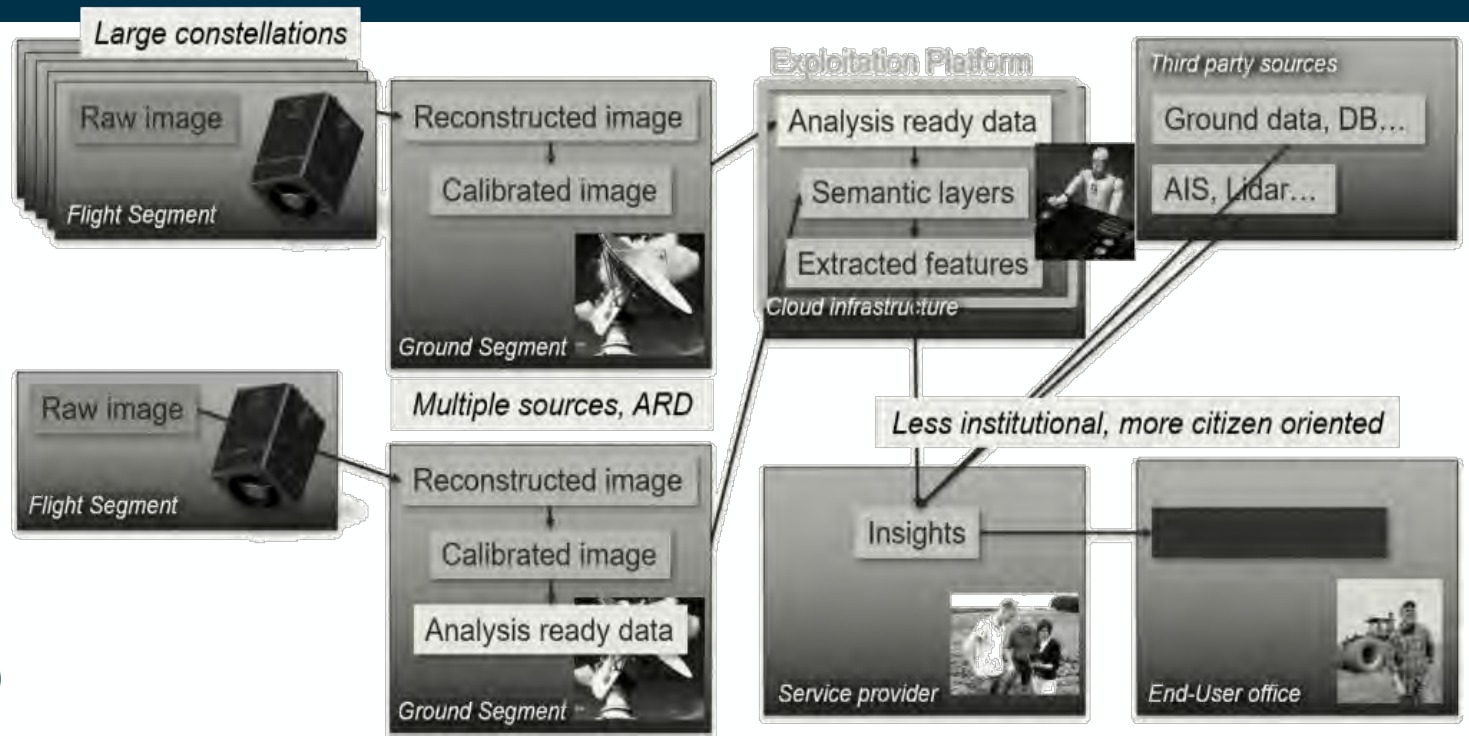
SATLANTIS

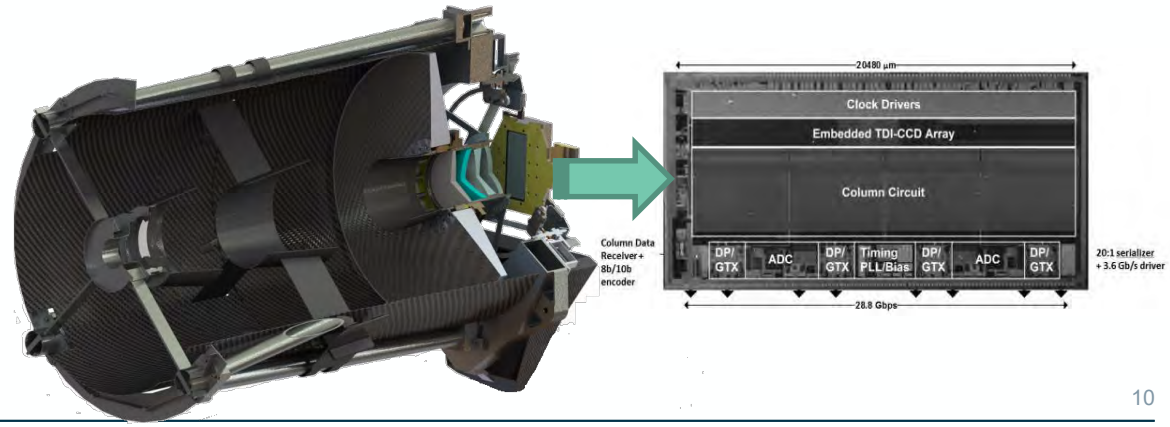
Terrabotics
Terrain Intelligence

InCubed – SAT4EO CE

SAT4EO
Critical Elements

- Development of a 100-200 Kg S/C AOCS Suite for state of art EO Small Satellites
- Development of a compact VIS-NIR VHR Telescope (***SSTL PRECISION***)
  - Use of the TE2V CIS 125 (developed under **CEOI** funding)
  - 0.6 m native GSD @ 500 Km
  - Super Resolution capabilities (up to 0.3 m GSD)
- Integrated Exploitation Platform (already operative)





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SURREY

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