

TRUTHS:

a new ESA Earth Watch mission for climatology and radiometric calibration from Space

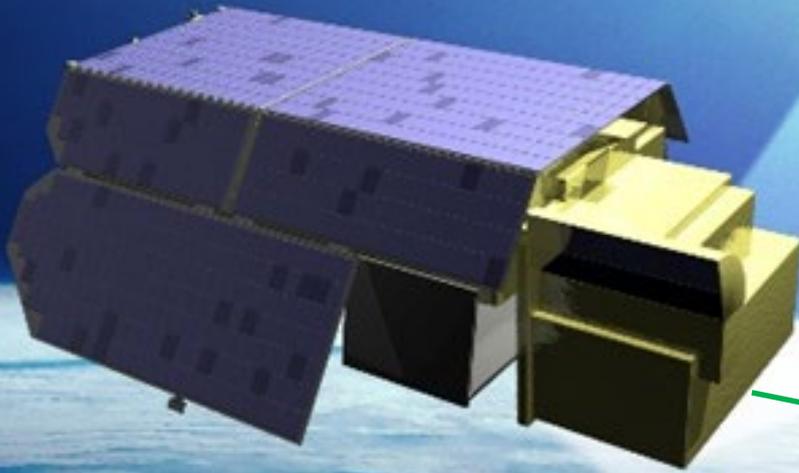
Czech Space Week - 09/11/2021

A.Marini/T.Fehr & TRUTHS ESA Team
ESA/ESTEC – Noordwijk, The Netherlands

'Traceable Radiometry Underpinning Terrestrial- and Helio-Studies'

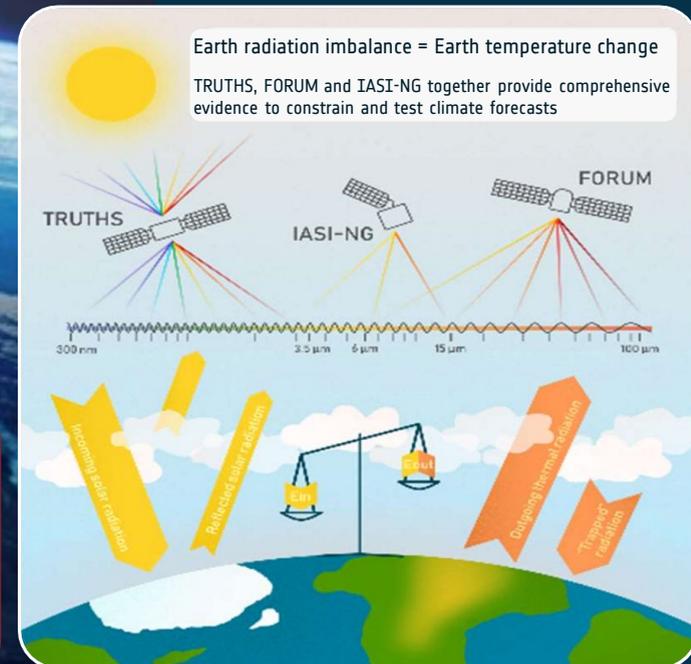
Optical mission for measuring incoming solar and outgoing reflected radiation

provide **SI-traceable measurements of the solar spectrum** to address direct science questions.



Satellites cross-calibration: Establish a 'metrology laboratory in space' to create a fiducial reference data set to cross-calibrate other sensors and improve the quality of their data

Climate benchmarking: enhance by an order-of-magnitude our ability to estimate the Earth Radiation Budget through direct measurements of incoming & outgoing energy



TRUTHS is an **operational climate mission**



- Platform recurrent from CRISTAL, flying at 609 km in polar non-sun-synchronous orbit,
 - 61 days revisit; 6 cycles per year to characterize the full diurnal cycle and seasonal variations over the whole globe
- Payload composed of three elements:
 - HIS (Hyperspectral Imaging Spectrometer) –UV to SWIR, single detector, 50 m resolution, 100 km swath
 - CSAR (Cryogenic Solar Absolute Radiometer) – operated at 60 K ,the “absolute radiometric reference”
 - OBCS (On-Board Calibration System) –) transferring the CSAR solar absolute measurement to the HIS
 - Absolute radiometric accuracy < 1% (Threshold), <0.3% (goal)
- Target launch end 2029

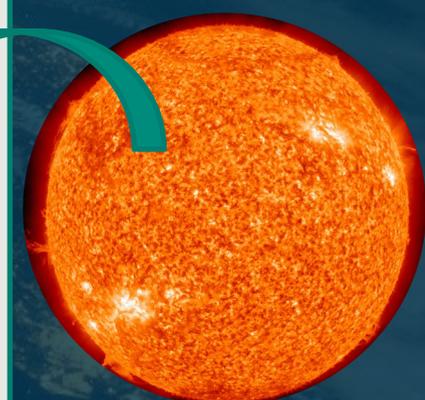
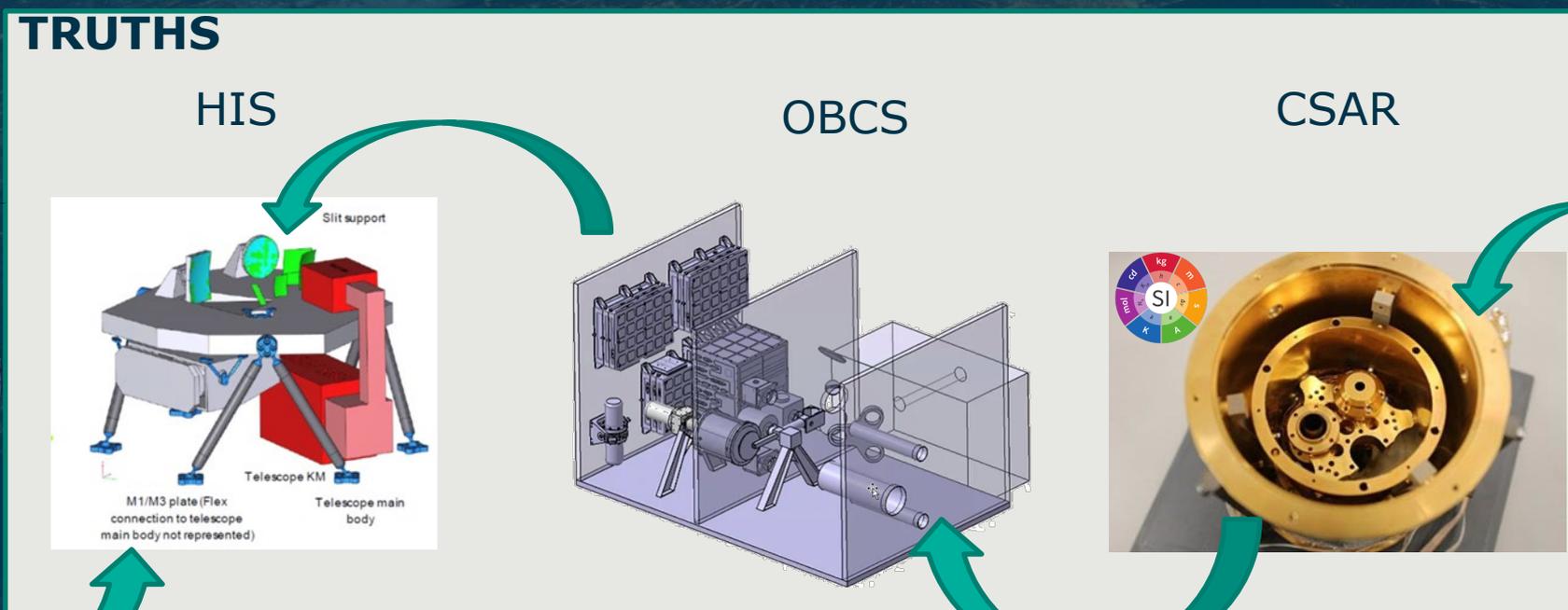
Mission/System Drivers:

- Climate application drives the stringent Radiometric accuracy (0.3% G ÷ 1% T) → *Payload & Calibration System design*
- Cross-calibration application leads to a non-SSO orbit → *Satellite design (thermal and solar power generation all year)*
- Solar/Earth samples in a large spectral range: *UV to SWIR (320-2400 nm), SSD 50 m , 100 km swath*



Calibration concept

- Measuring energy from the sun, providing the direct traceability to International Standards (CSAR)
- Observing the direct and Earth reflected sunlight at high spectral and spatial resolution (HIS)
- Novel onboard calibration system ensuring traceable to the absolute reference (OBCS)

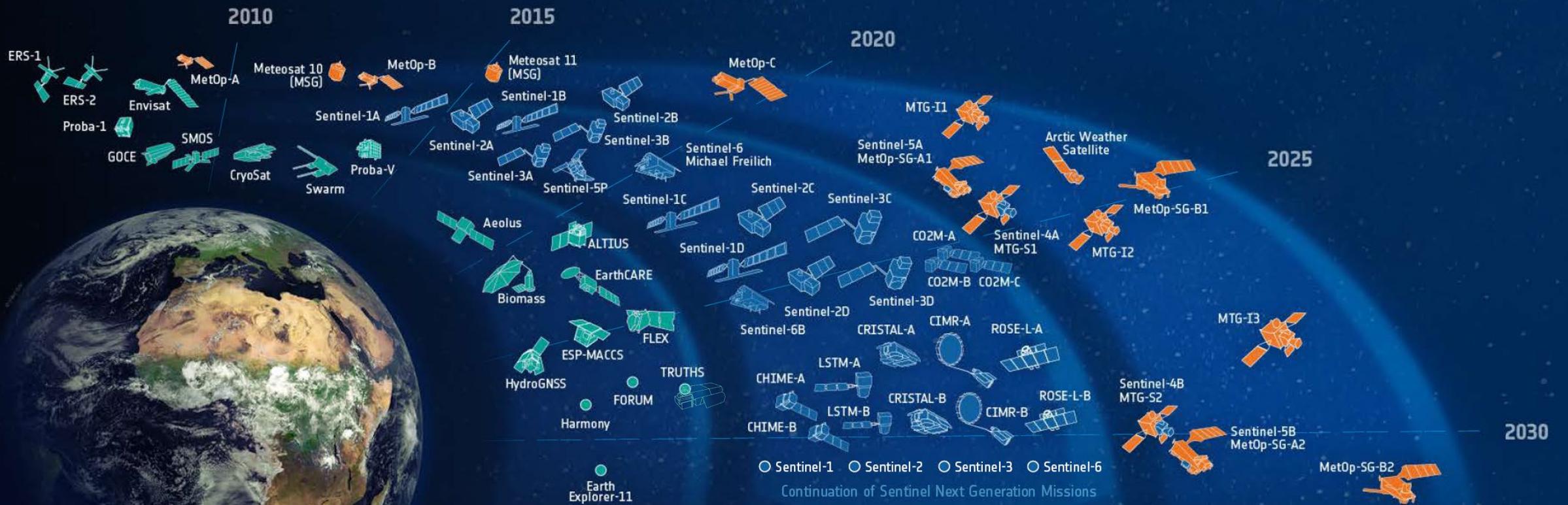


Gold Standard Reference for Satellites observing the Earth, Moon & Sun

- TRUTHS will be a 'Gold Standard Reference' with free and open data
- TRUTHS will transferring its accuracy to other satellites improving their performance
- TRUTHS will characterize special sites on Earth, the moon and the sun's radiation that are used by other spaceborne instruments to assess their data quality.
- TRUTHS will help harmonize and improve accuracy of data from the world's satellites both current, historic and future creating improved time series' of Essential Climate Variables.

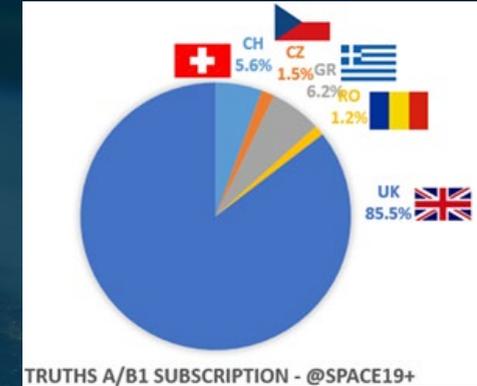


ESA-DEVELOPED EARTH OBSERVATION MISSIONS

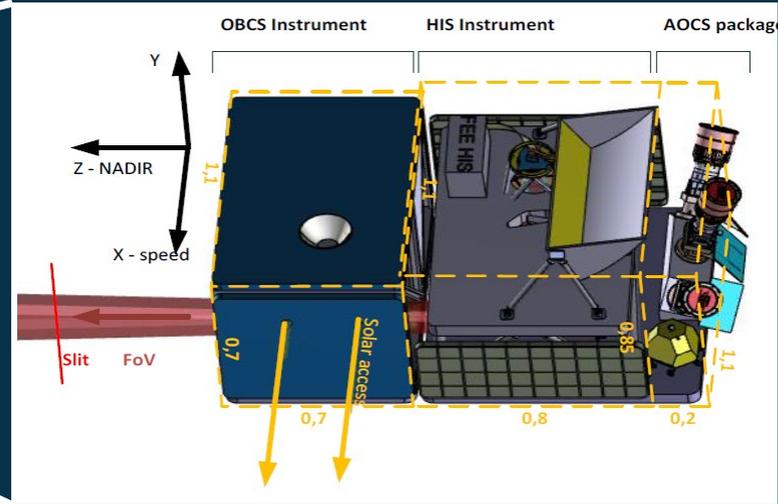
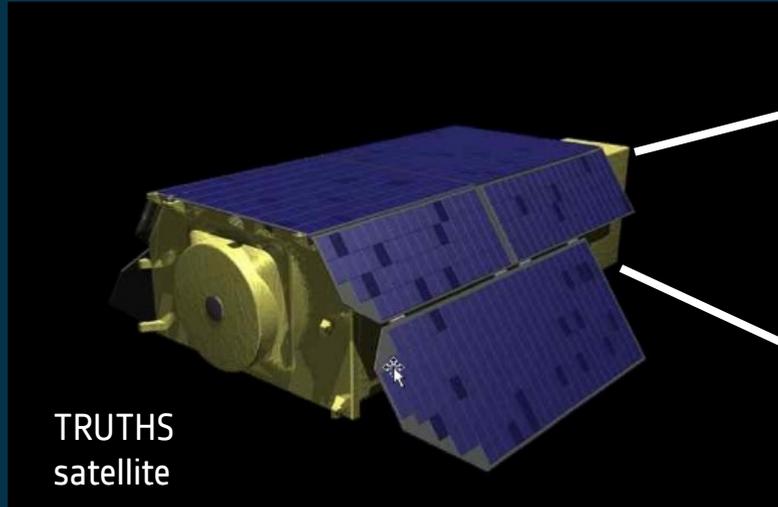


TRUTHS Program Status and outlook

- TRUTHS was proposed by UKSA in May 2019 as a new Earth Watch (EW) Element.
- TRUTHS Phase A/B1 has been fully subscribed at Space19+: by 5 Participating Countries:
- UK (85.5%), GR (6.2%), CH (5.6%), CZ (1.5%), RO (1.2%)
- Industrial Phase A/B1 system studies and technology predevelopments initiated in Oct-20.
 - Consortium led by Airbus UK Ltd. with partners from the Participating States
 - Supporting Science studies carried out in parallel and MAG established since Nov-2020
- Phase-A completed at end-July 2021
- Phase B1 on-going, to be completed in Q2-2022.
- Programmatic “Gate Review”: go/no-go decision, at latest in July-22, to submit program to CM-22
- Phase B2/C/D/E to be funded at CM-22/-25 -> Program plan being currently prepared



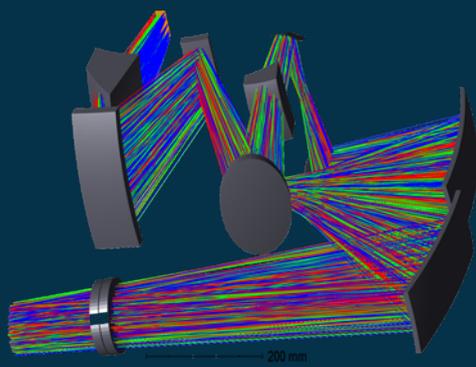
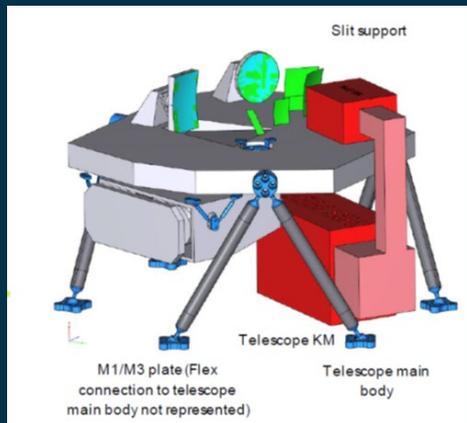
Phase A/B1 running to provide a matured concept



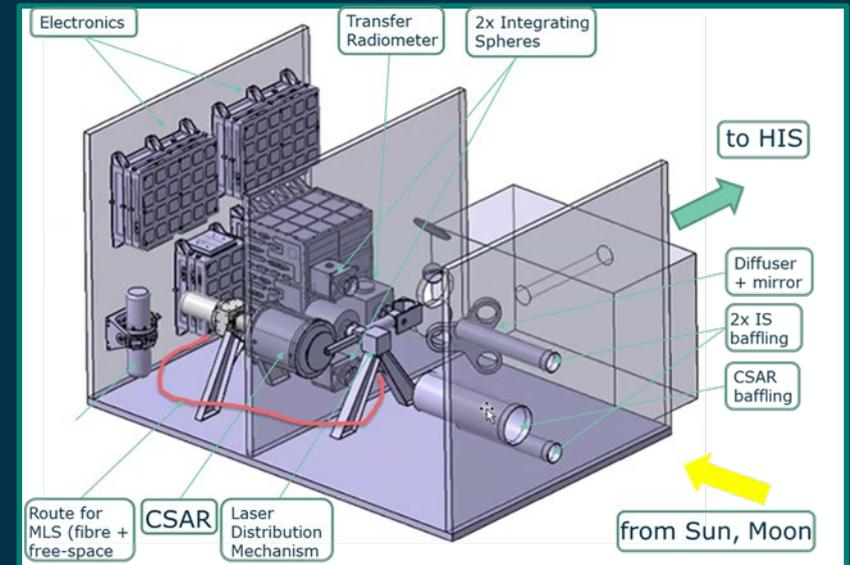
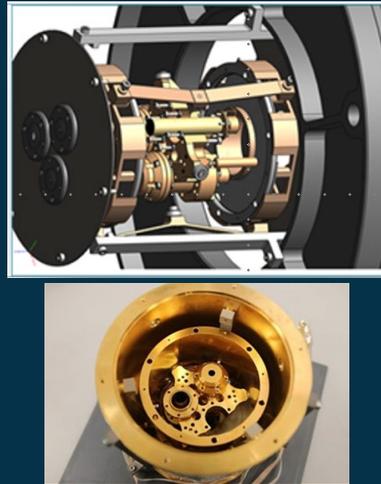
TRUTHS
Payload
Assembly

OBCS/CSAR

HIS

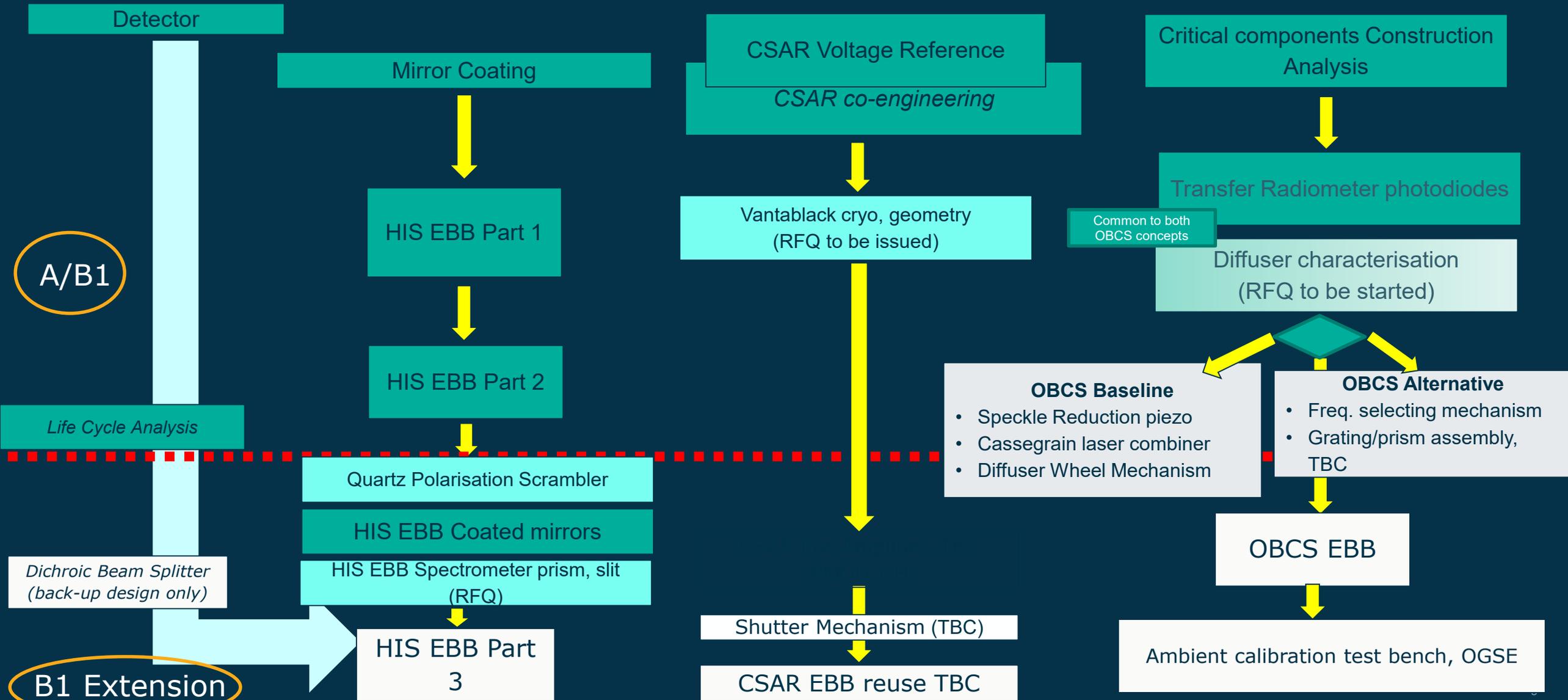


CSAR



All images courtesy of Airbus/NPL

Technology pre-developments



Industrial Consortium Phase A/B1

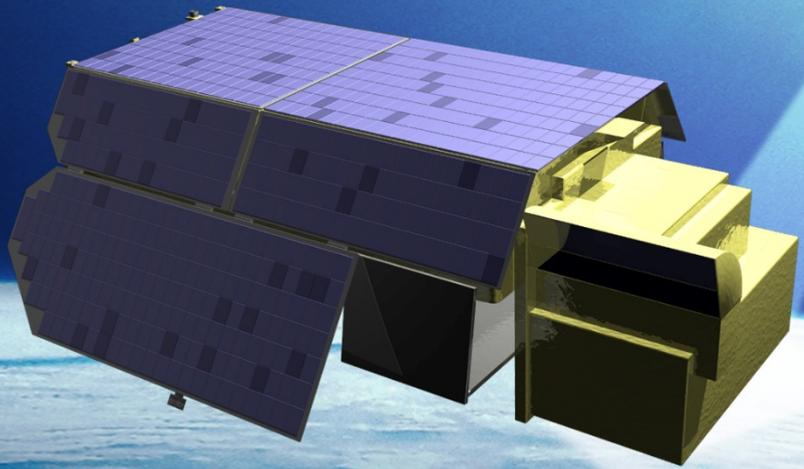


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TAKING THE PULSE
OF OUR PLANET
FROM SPACE





Thank you for your attention!