

Space Safety for Space19+

Space Safety - Cornerstones

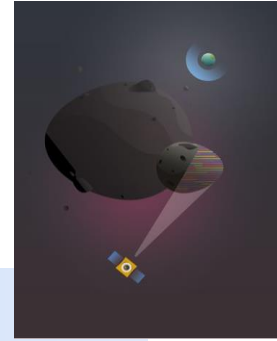
1 Core



2 Lagrange Mission



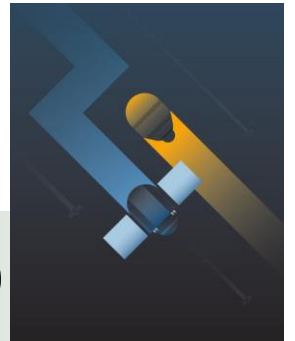
3 HERA



4 ADRIOS(Active Debris Removal/In-Orbit Servicing)



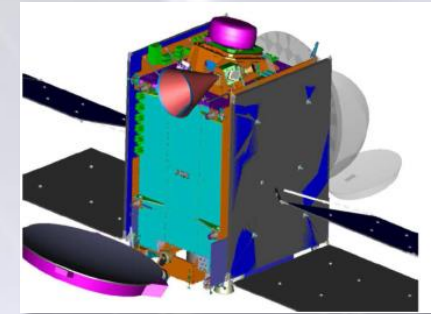
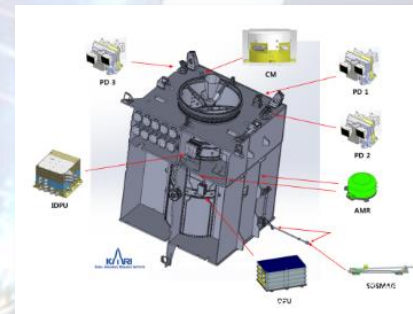
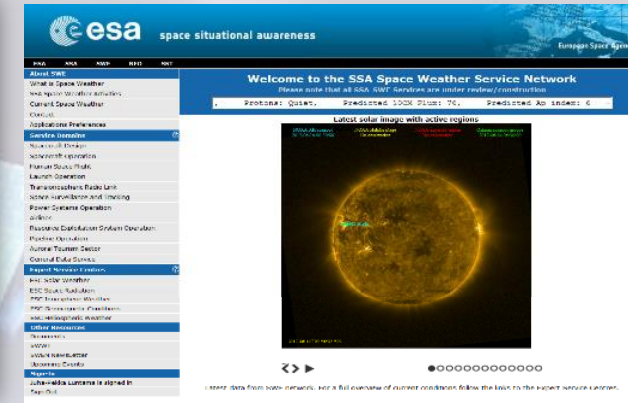
5 CREAM(Collision Risk Estimation & Automated Mitigation)



Core - ESA SSA Space Weather System Today



- 29 pre-operational services based on >200 products
- European Service Network of >40 Expert Groups
- > 1000 registered users
- > 700 000 hits on service portal monthly
- Hosted payload missions in progress
- Lagrange mission & D3S
- Coordinated Communication Protocol for Europe

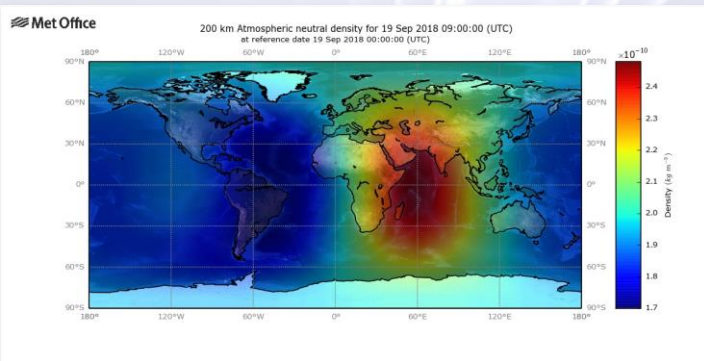
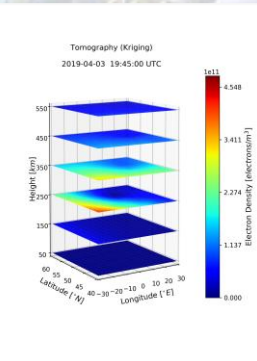
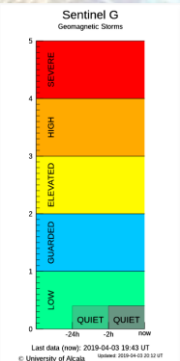
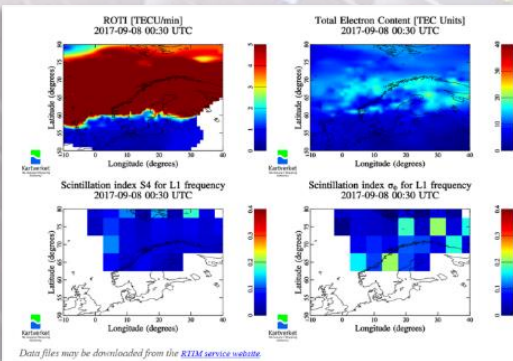
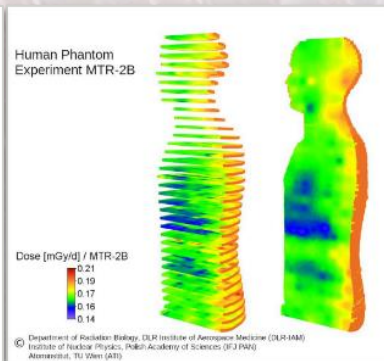


Satellite Risk Prediction and Radiation Forecasts

Risk Indicators	Environment	
	RAS - Radiation Belt Model Forecast	Met. Office - Relativistic Electron Forecast Model
GOES-15	4	1
GOES-14	4	1
GIOVE-A	4	1
Slot Region 8000 km	1	1

Acknowledgements

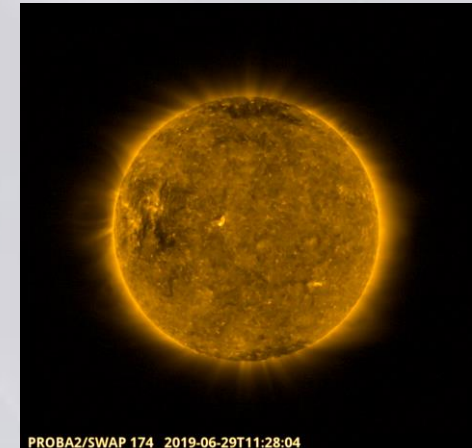
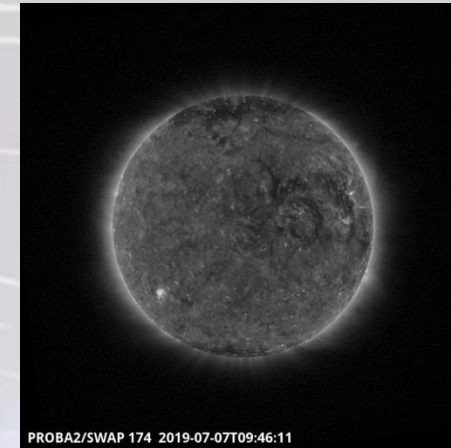
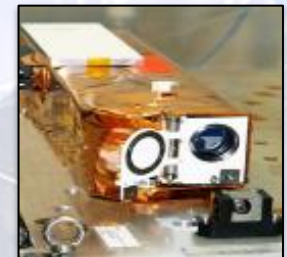
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Version: 6.02.001



BE SWE Activities & SSA Programme



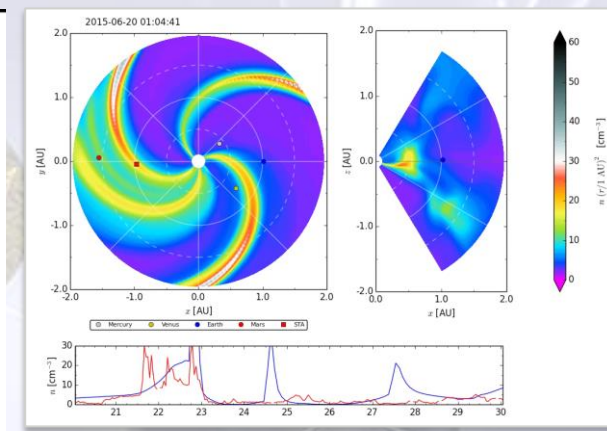
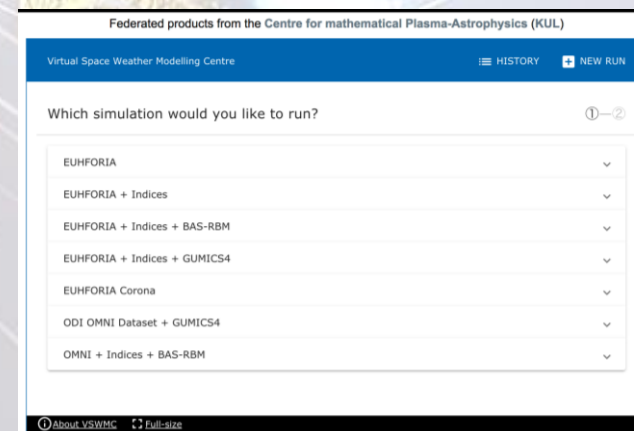
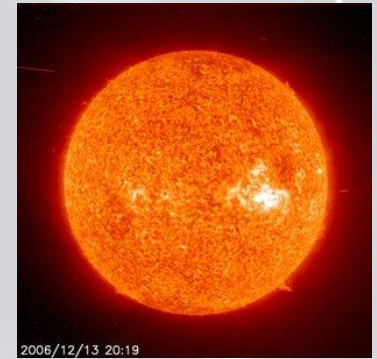
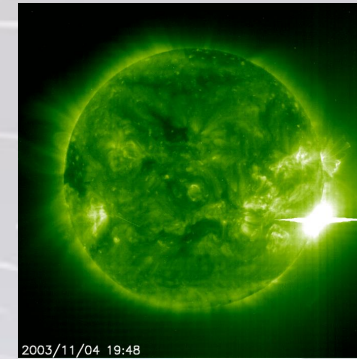
- Leadership in Solar Weather and Space Radiation ESCs
- SWE Service Coordination Centre (SSCC) in Space Pole
- Participation in Heliospheric Weather and Geomagnetic Conditions ESCs
- Lead in development of
 - Virtual Space Weather Modelling Centre (VSWMC)
 - EUHFORIA heliospheric model
 - SPENVIS space environment system
 - COMESEP, SEPEM, SPM and many other SWE tools and applications
- SWE Data Centre in ESEC
- Proba-2 mission extension
- EUVI and SCOPE developments for Lagrange mission
- New SWE instruments (e.g. 3DEES)

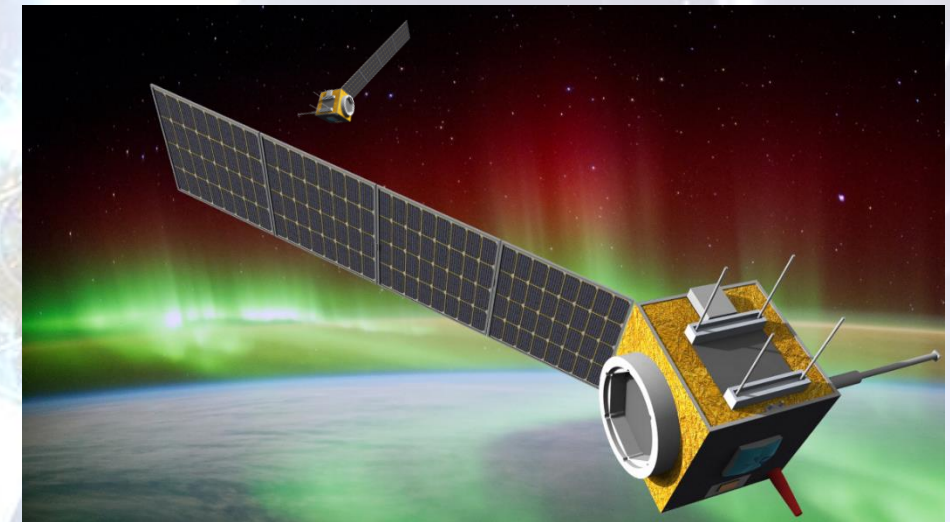
Core - SWE Developments in S2P Period 1



- Operation and enhancement of SSCC & ESCs
 - Maintenance and enhancement of existing assets (e.g. SPENVIS, COMESEP, ...)
- Enhancement of Space Weather Data System
- Physics based and empirical forecasting models
 - Solar, heliospheric and space radiation models
 - Utilisation of joint L5 and Sun-Earth line data
 - End to end modelling and coupled models
=> VSWMC enhancement
- Applications and tools tailored to user needs
- Machine learning, virtual research environment, cloud computing



- Hosted payloads (e.g. mini-EPT, 3DEES, mini-EUV imager, ...)
- Miniaturised/platform sensors and their utilization in mega-constellations
- Dedicated nanosatellite missions and constellations
- SmallSat platforms
- Extension of Proba-2 mission
- Utilisation of data from all European SWE sensors
- Ground based observations
 - Solar imaging
 - Solar radio emissions
 - GNSS sensor networks for ionosphere

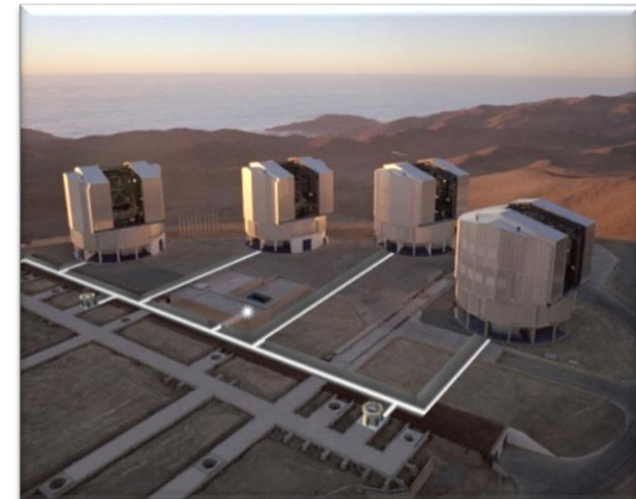




Core – Planetary Defense



Observations





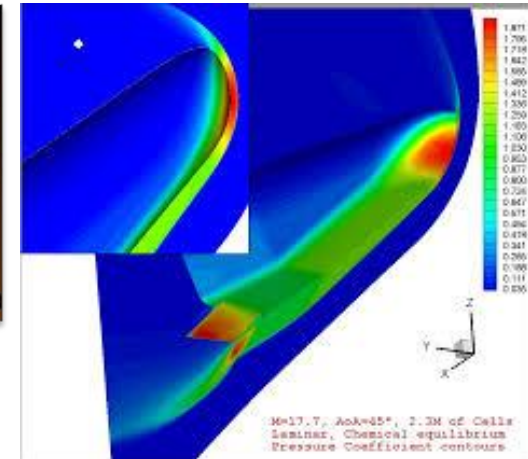
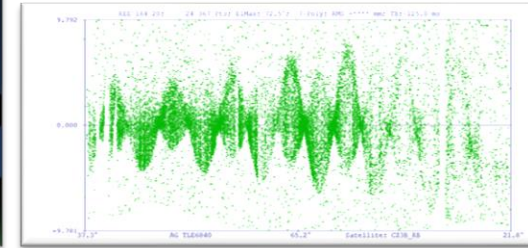
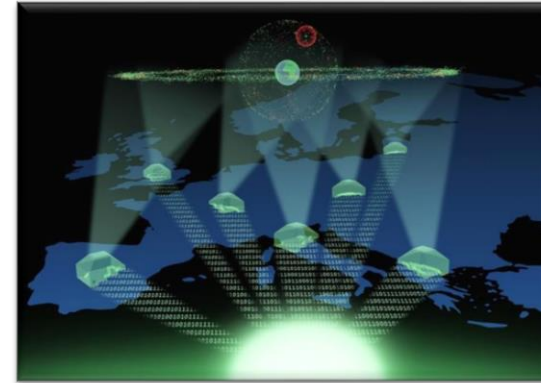
Information provision

Object Name	Size [m]	Date/Time	IP max	PS max
2017RH16	30*	2026-08-31 21:26	1/689	-2.36
2010RF12	9*	2095-09-05 23:50	1/16	-3.26
1979XB	900*	2113-12-14 18:07	1/1.84E6	-3.28
2000SG344	50*	2071-09-16 00:26	1/2096	-3.63
99942 Apophis	375	2068-04-12 15:13	1/531914	-3.67
2009JF1	16*	2022-05-06 08:12	1/4464	-3.75
2006QV89	40*	2019-09-09 07:03	1/11428	-3.79
2008UB7	70*	2060-10-31 18:26	1/36101	-3.83
2006JY26	9*	2074-05-03 01:00	1/86	-3.91
2008JL3	40*	2027-05-01 09:07	1/13280	-3.95

Latest Updates on neo.ssa.esa.int

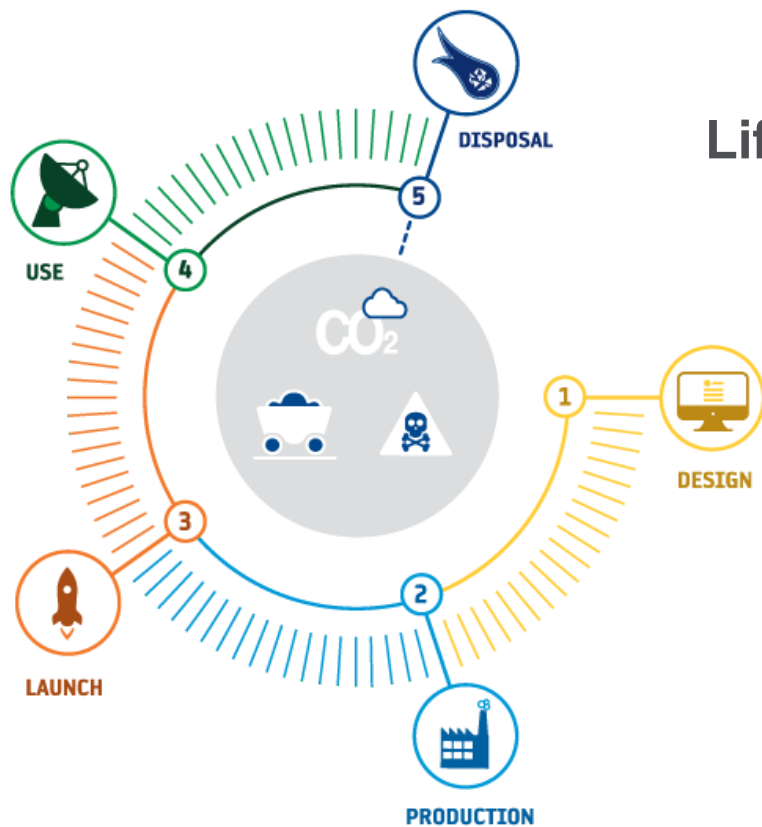
Core – Space Debris

- Technology development for space and ground based sensors
- Community Approach towards SST Core Software
 - Shared **development** and **maintenance** efforts
 - Ensure interoperability among **multiple European systems**
- Risk models and concepts

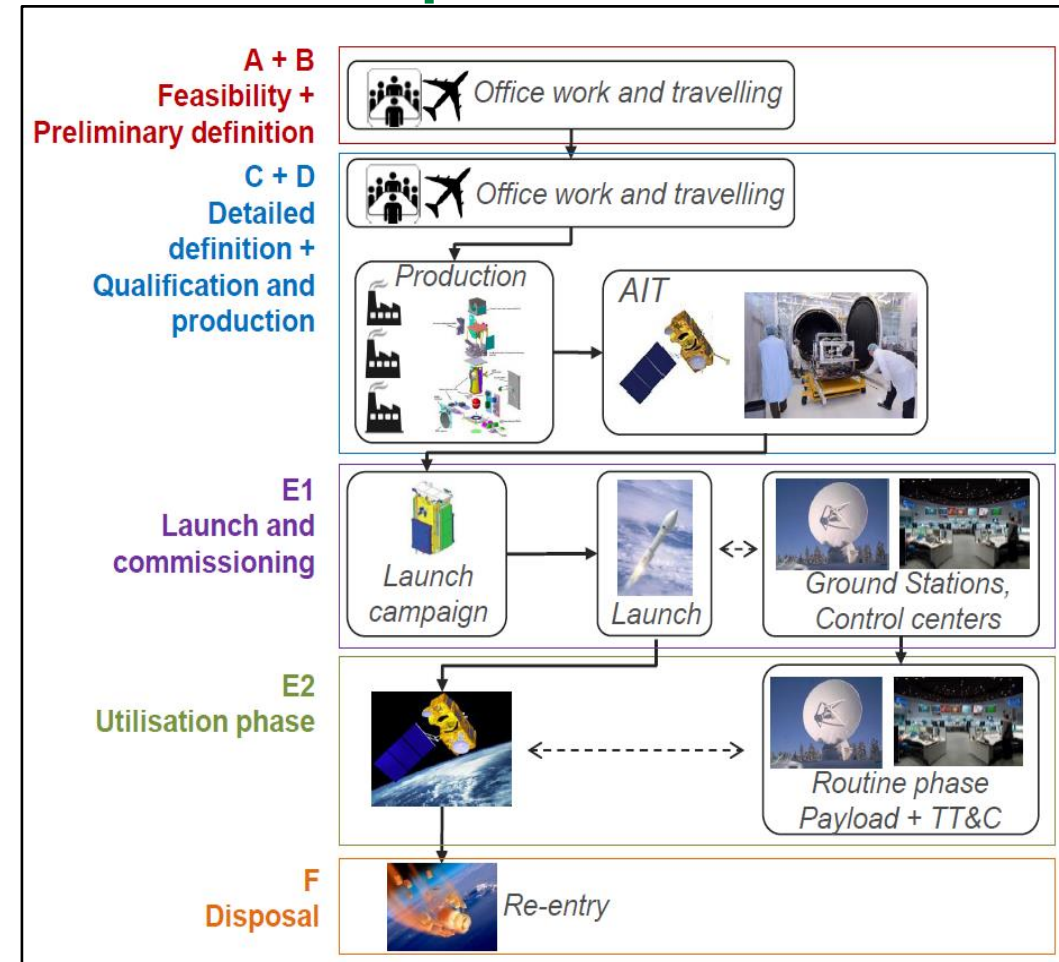




EcoDesign: Understand how much space activities pollute and identify alternatives to reduce the environmental impacts



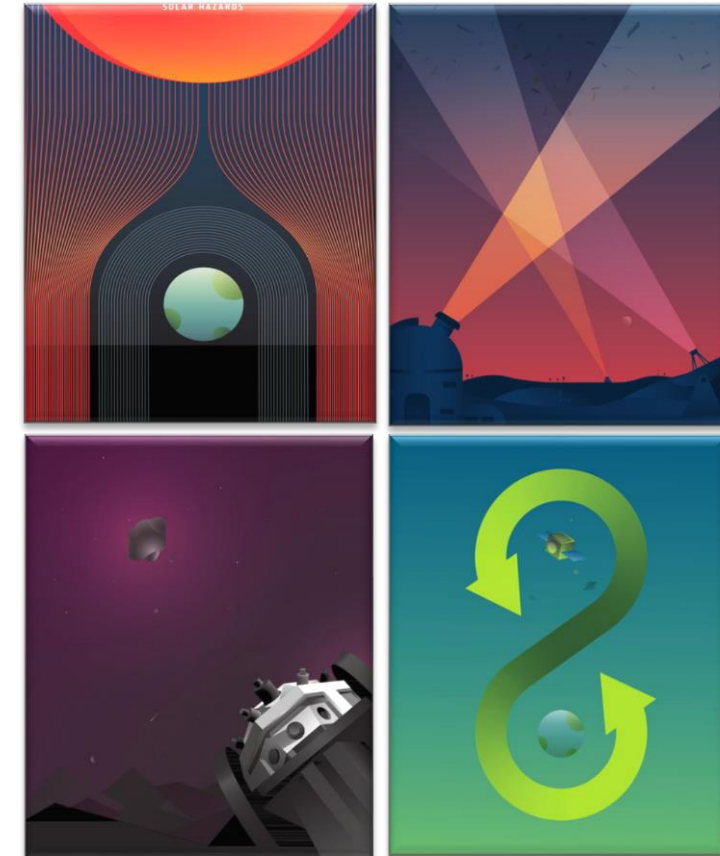
Life Cycle Assessment (LCA)



1 Core - Summary

- Fundamental activities in the areas of Space Weather, Planetary Defense, Space Debris and Cleanspace
- Addresses the technical dimension of STM
- Sensors, services, hosted payloads
- Continuous efforts on comparable level also in future periods

CaC	Space19+ (Period 1)
N/A	135M€



Measurements:

- Solar disk magnetic field
- EUV imaging
- Solar X-ray flux
- Solar wind characteristics
- Interplanetary magnetic field
- Solar proton, electron and ion flux

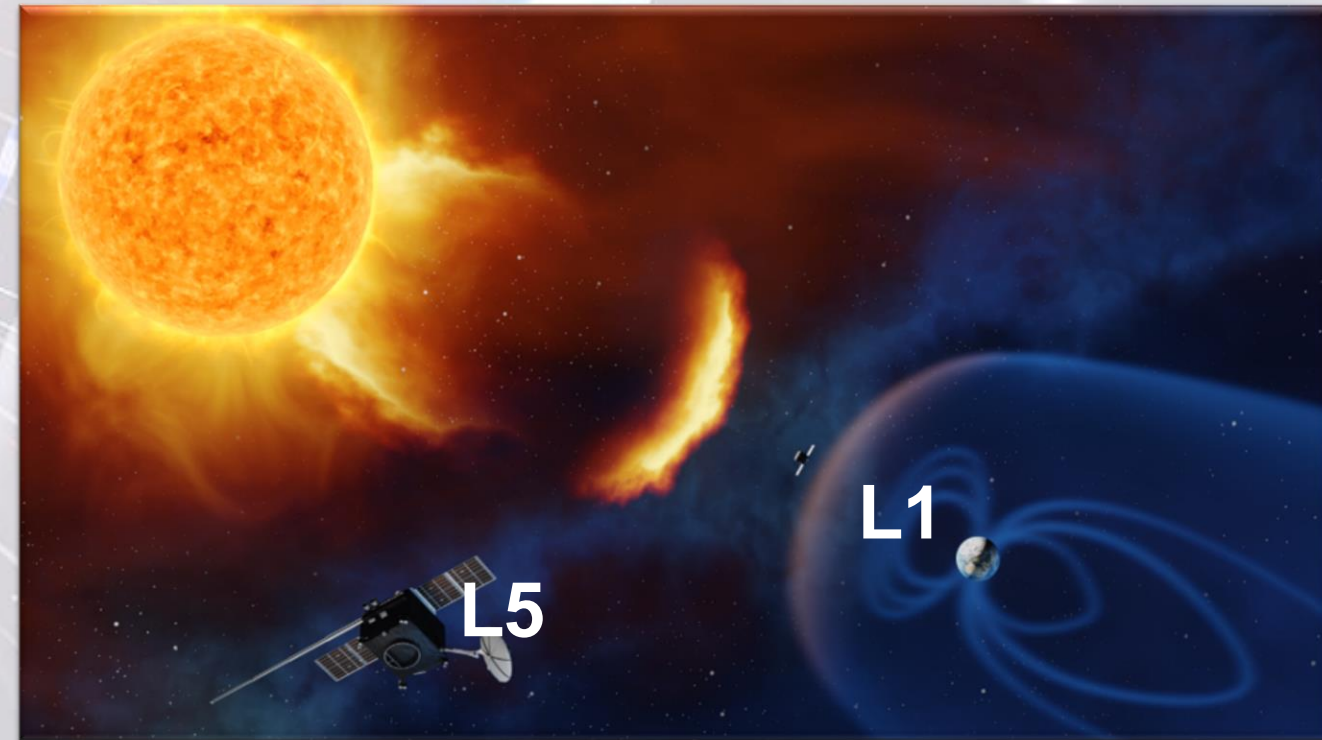
Heliospheric imaging

Wide-angle coronagraphy

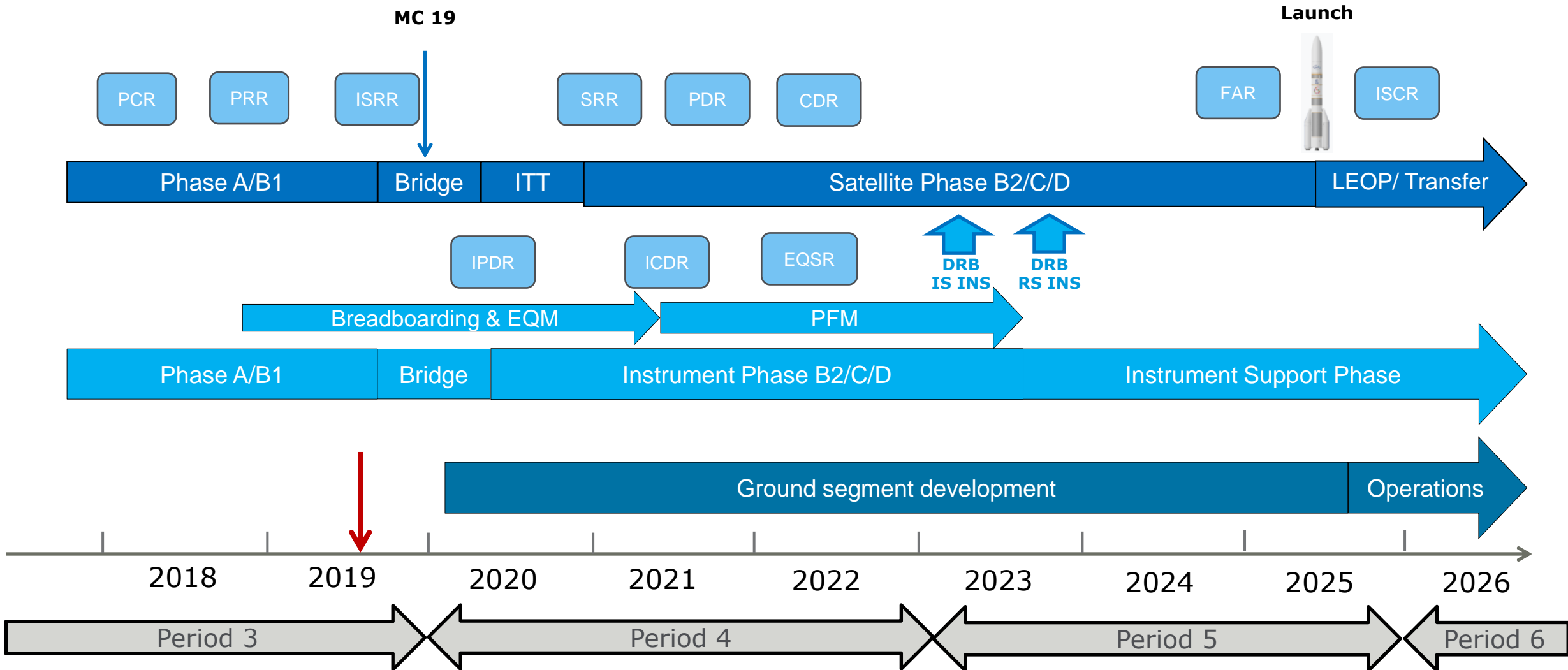
2 Lagrange Mission

- Currently in phase A/B1
- Joint Understandings for cooperation
 - NOAA being signed
 - NASA in preparation
- Launch in 2025

CaC	Space19+ (Period 1)
500M€	230M€



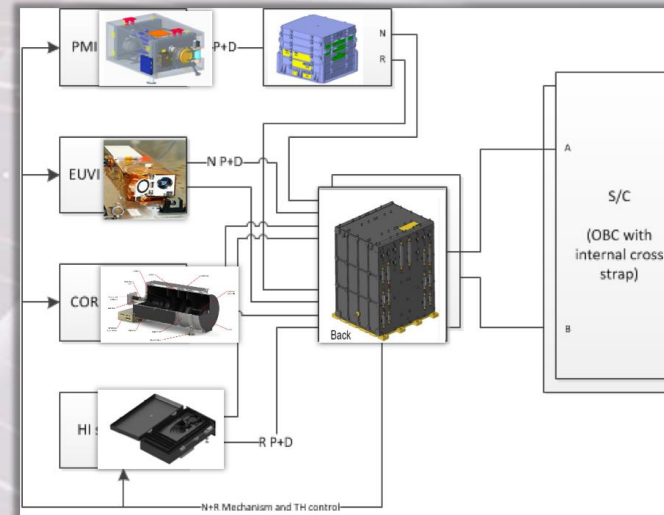
Lagrange Mission Timeline



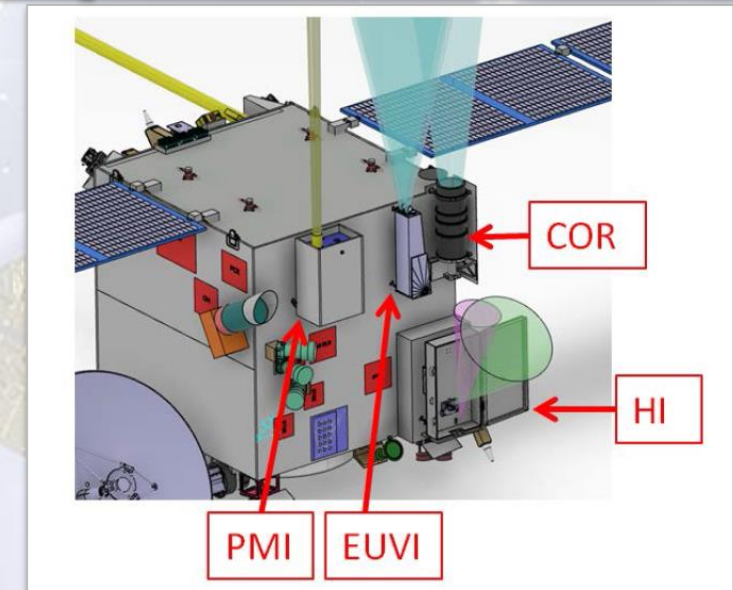
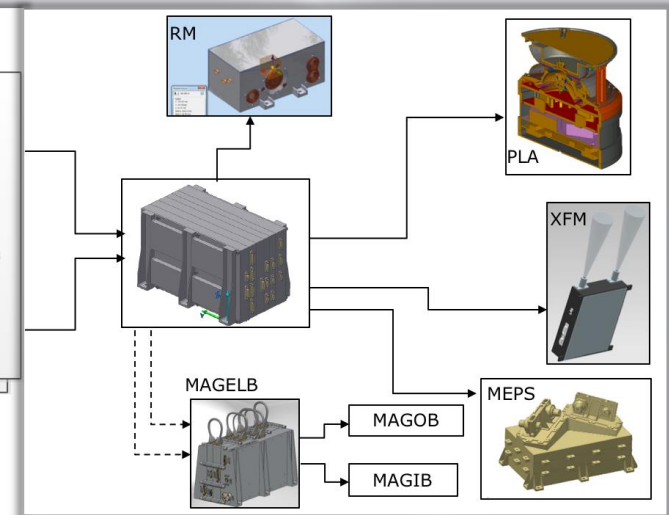
Opportunities in Lagrange Mission

- Instruments for Lagrange
 - Lead of Extreme Ultraviolet Imager (EUVI)
- Lagrange spacecraft system development
 - X-band TWTA,
 - communication system,
 - platform structure,
 - RTU,
 - PCDU

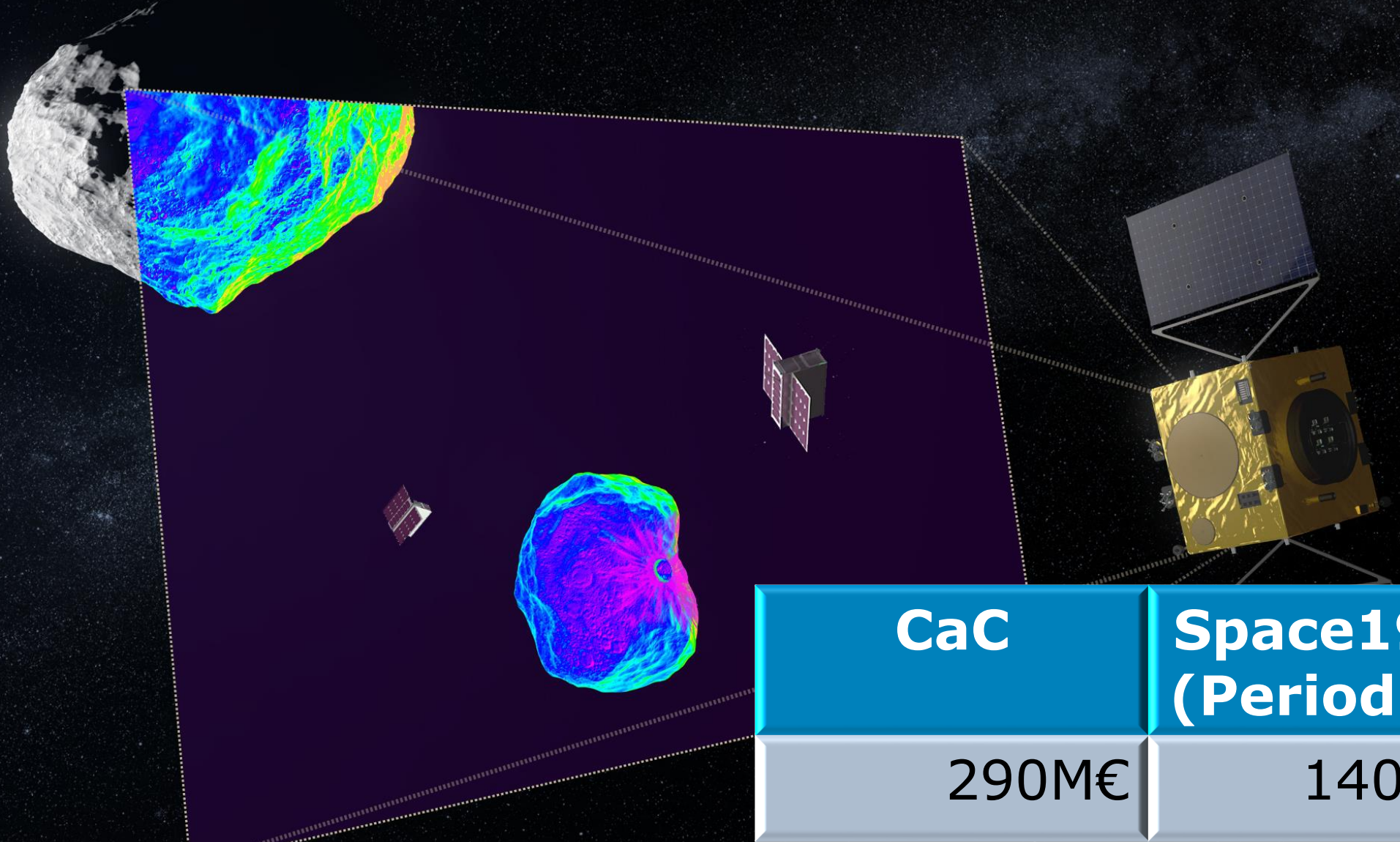
Optical instruments



In-situ instruments



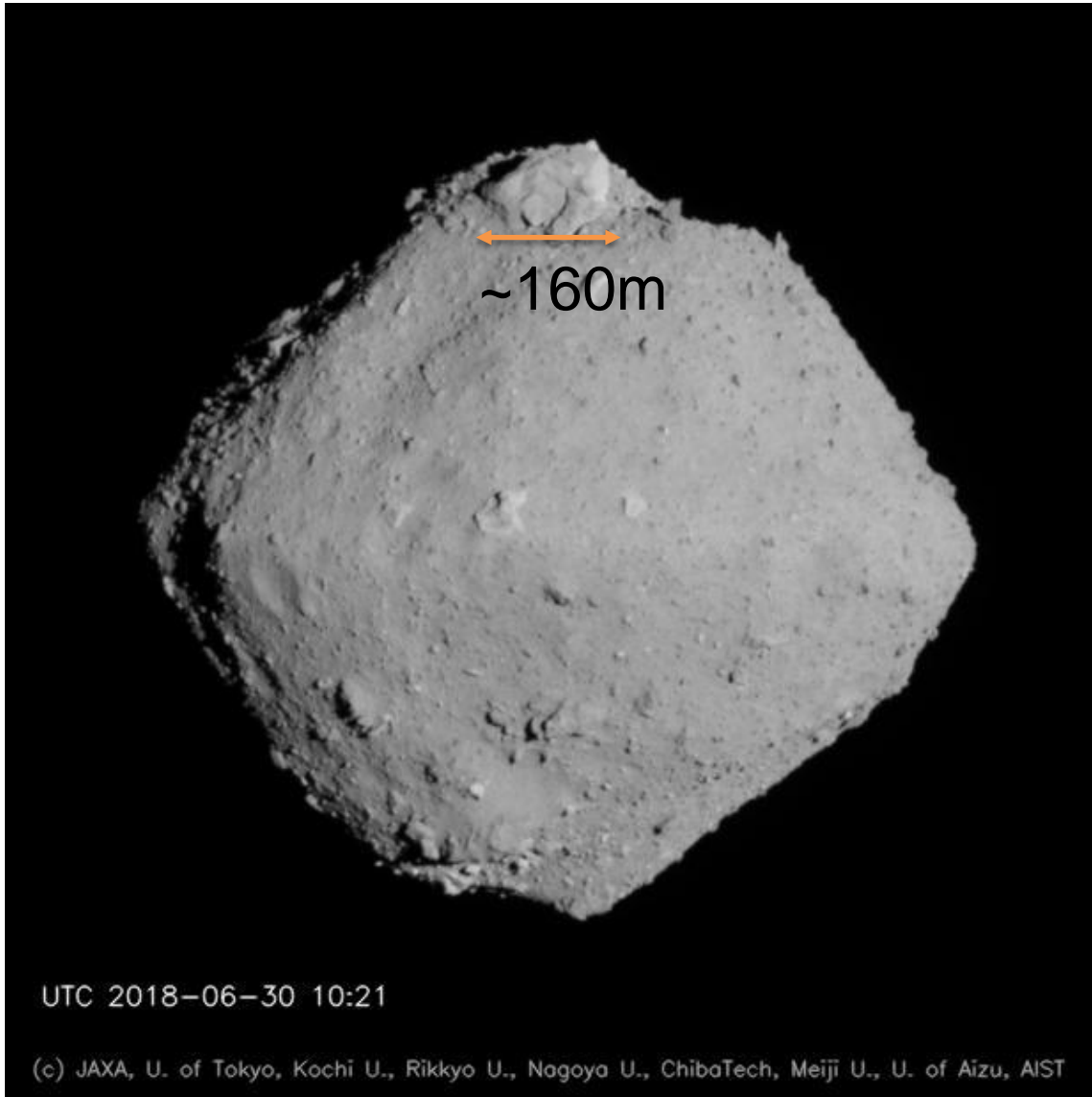
HERA



CaC	Space19+ (Period 1)
290M€	140M€



Didymos vs Ryugu



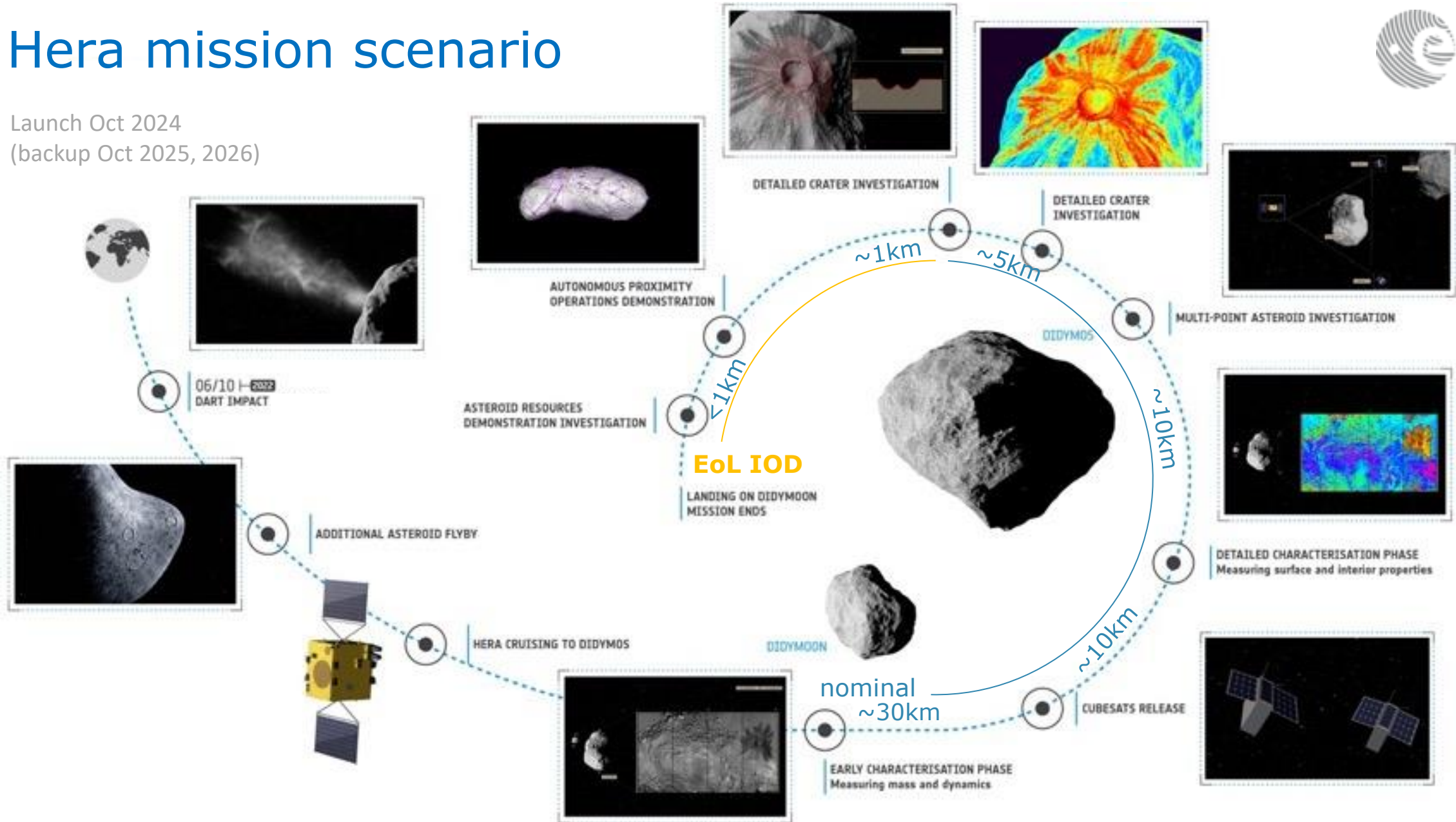
Hera mission firsts

- First mission to **binary asteroid**
- **Smallest asteroid** ever studied
- First full scale **cratering physics experiment**
- First **radar tomography of an asteroid**

Hera mission scenario

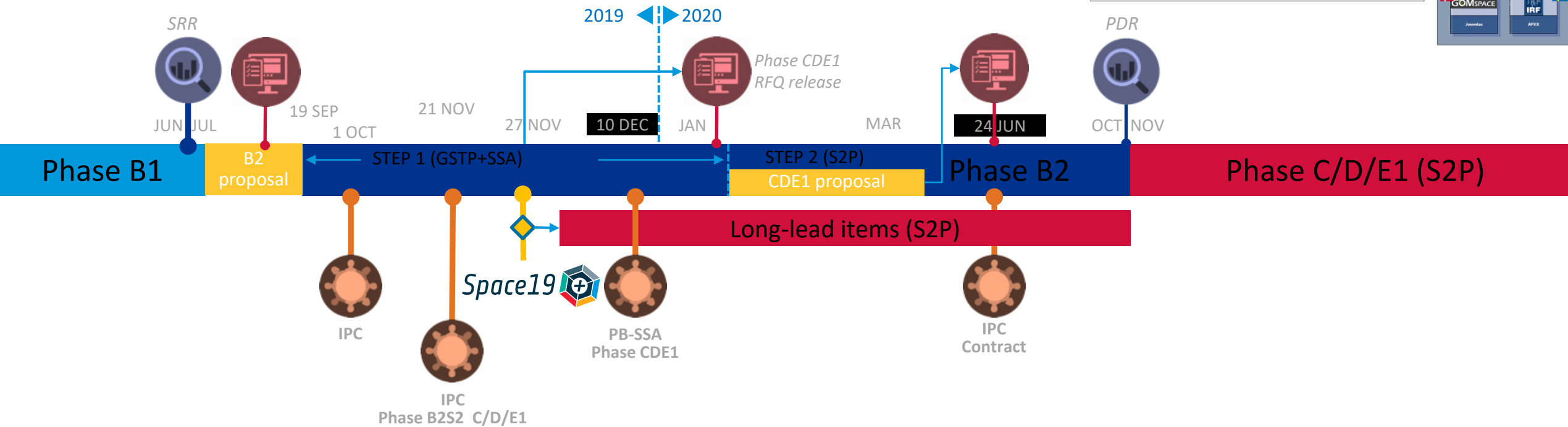
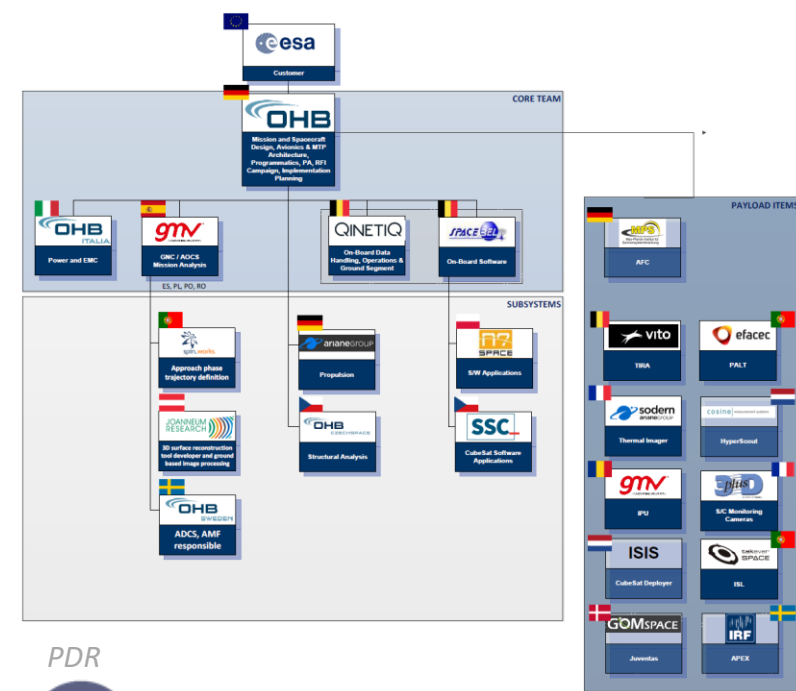


Launch Oct 2024
(backup Oct 2025, 2026)

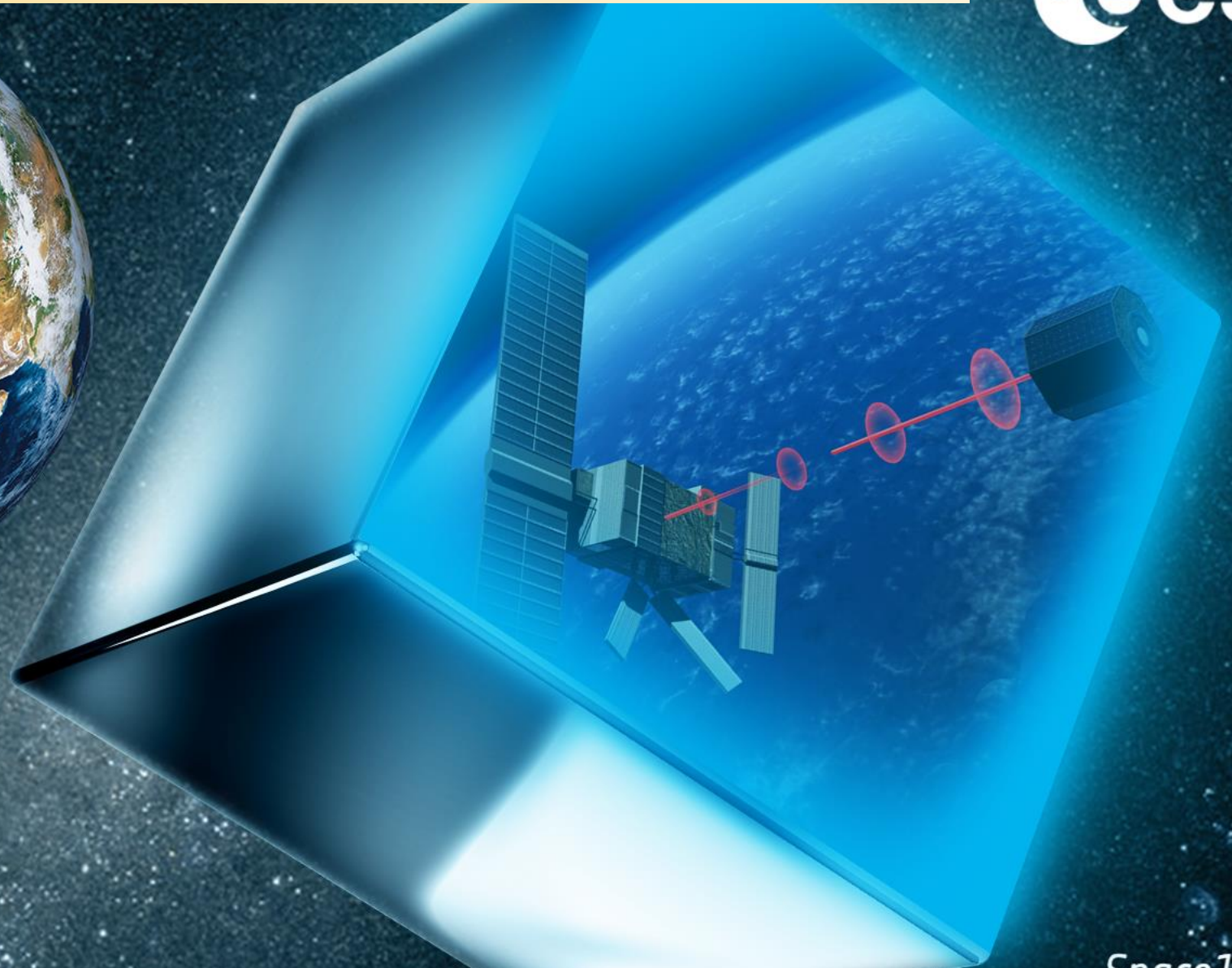


Hera procurement approach (GSTP→S2P)

- Successful SRR on 17 July 2019
- **Phase B2 kick-off on 30 September 2019**
- CubeSats PDR in November 2019
- All developments proceeding nominally



In-Orbit Servicing/Removal Mission



4 ADRIOS (Active Debris Removal/In-Orbit Servicing)

- Removal target: VESPA adapter (100kg, launched with PROBA-V), first ever active removal!
- Selected industrial proposal in clarification process
- Some freedom in consortium participants

CaC	Space19+ (Period 1)
106.6M€	75M€

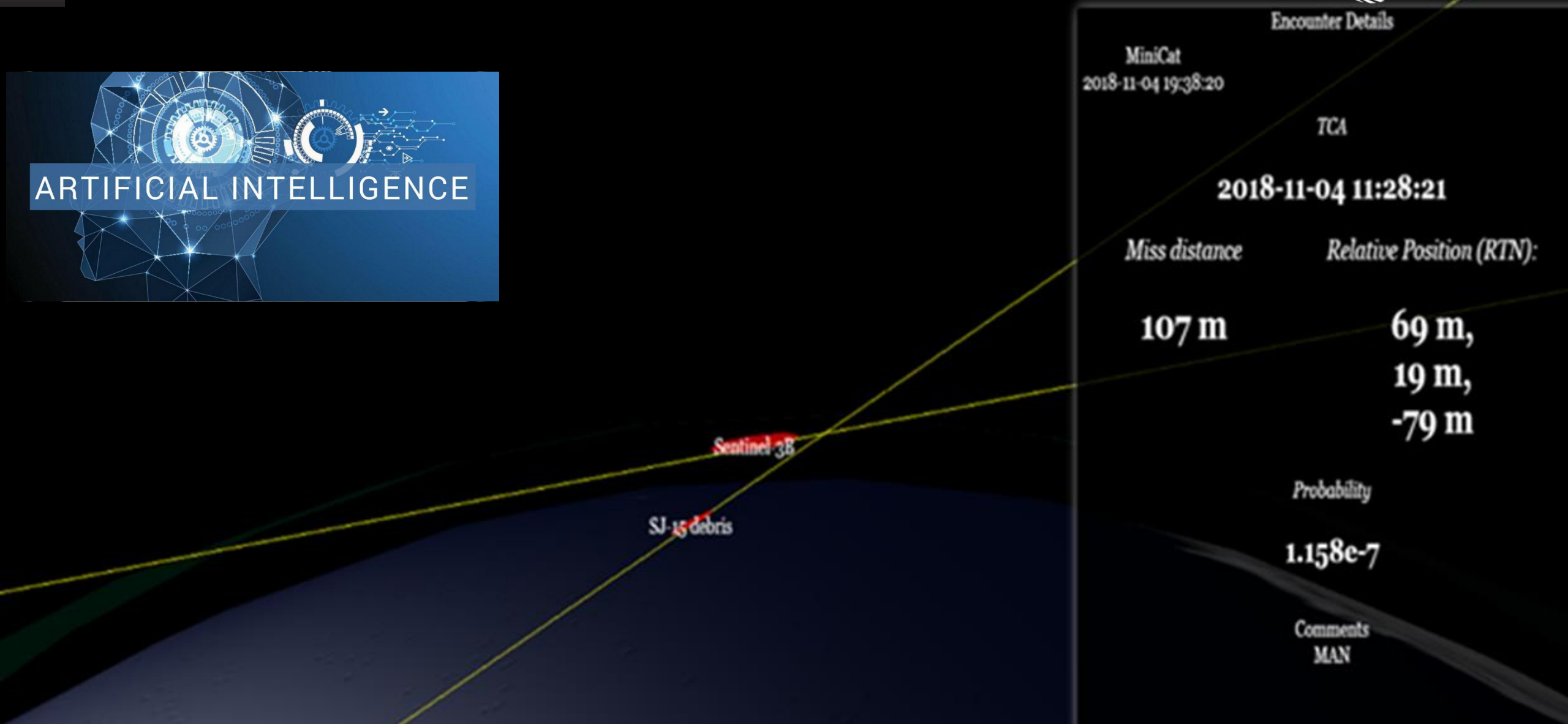
VESPA
Adapter



CREAM-Collision Risk Estimation & Automated Mitigation



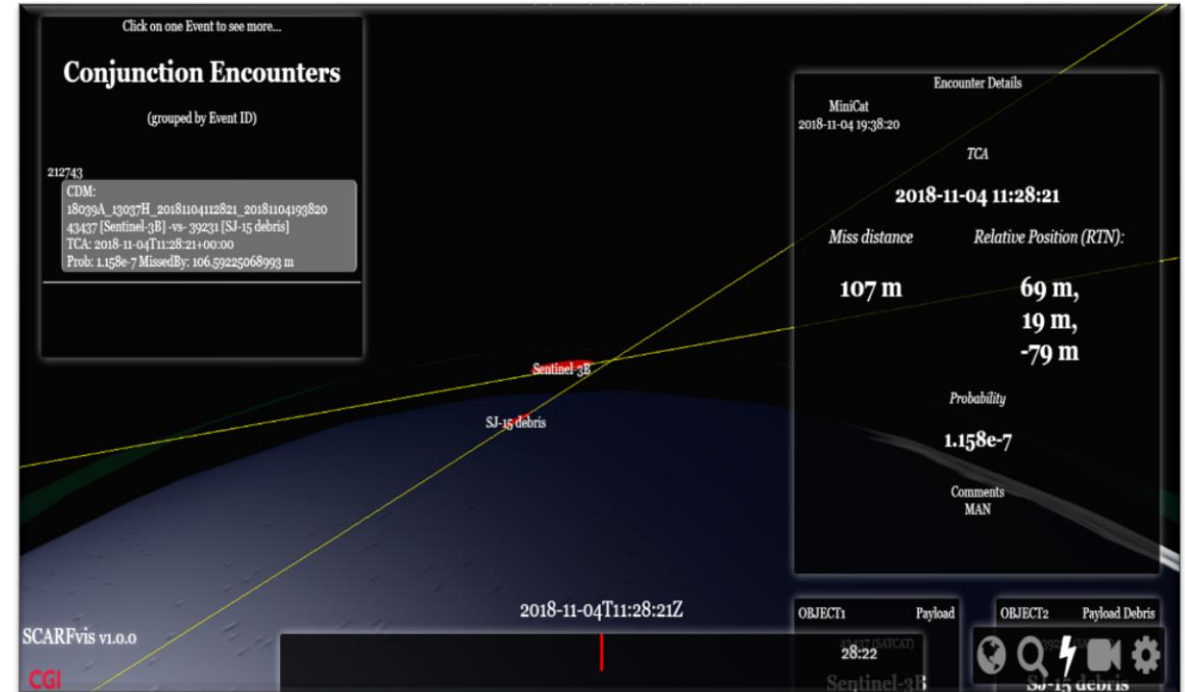
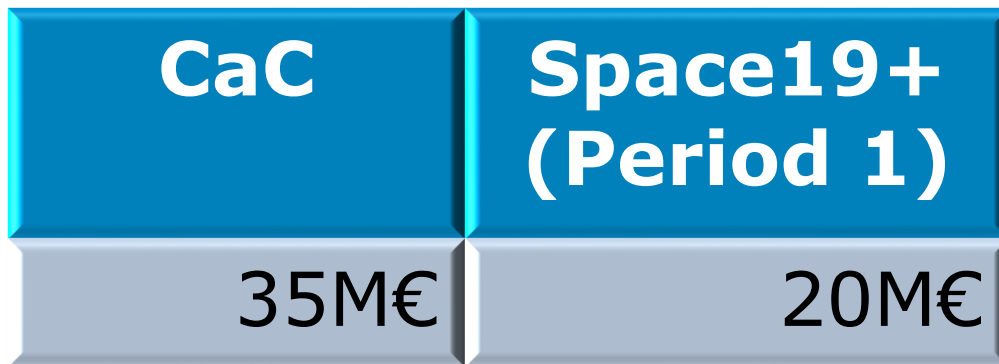
ARTIFICIAL INTELLIGENCE



5 CREAM-Collision Risk Estimation & Automated Mitigation



- Target first demonstration of automated collision avoidance by 2023
- Machine learning competition 2019





THANK YOU

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