

# CHEOPS

Consortium for **H**all **E**ffect  
**O**rbital **P**ropulsion **S**ystem

—  
15/10/2018

Project Coordinator : Idris Habbassi  
Safran Aircraft Engines

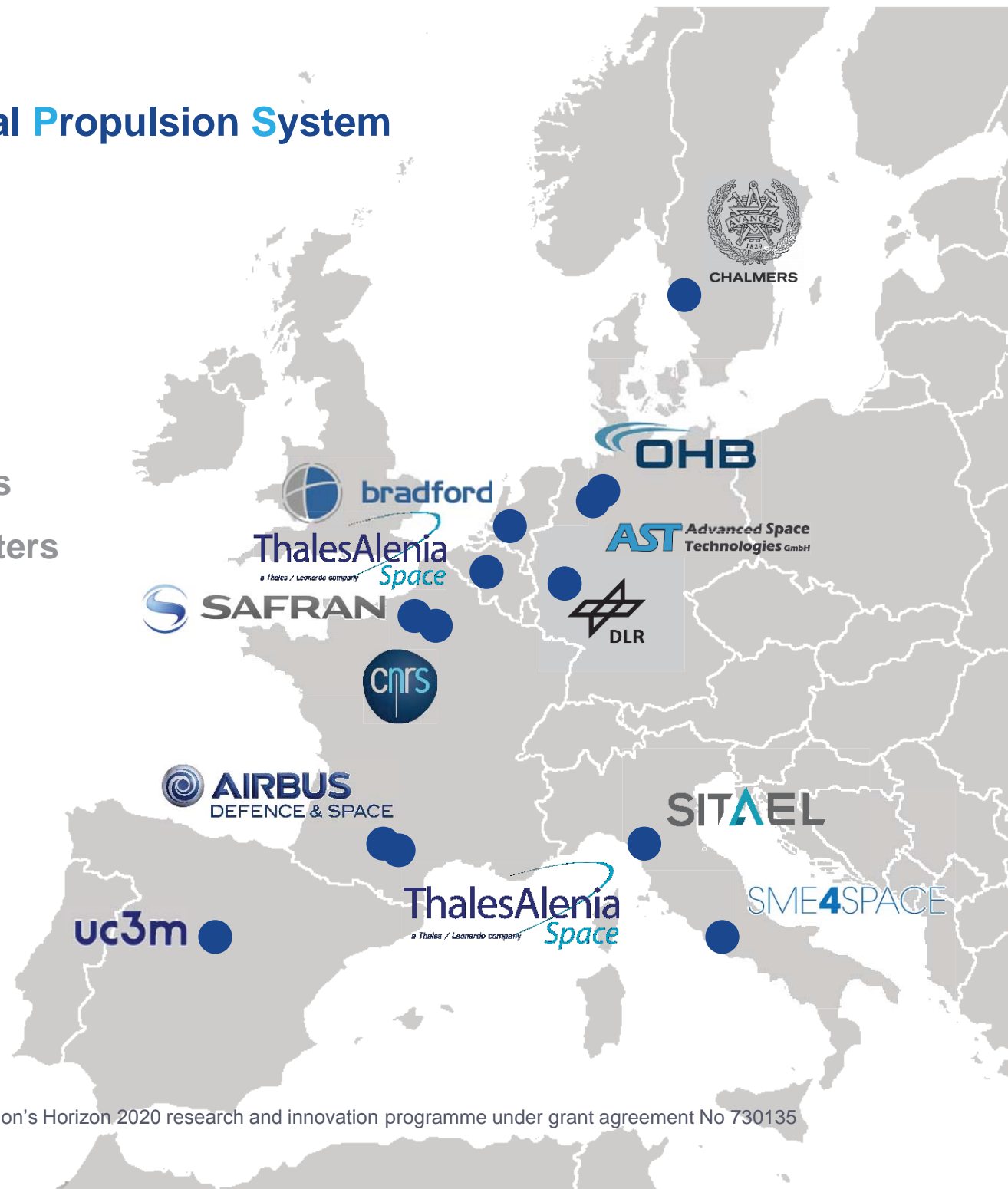


# Consortium for Hall Effect Orbital Propulsion System

## The Consortium

### 13 PARTNERS IN 7 COUNTRIES

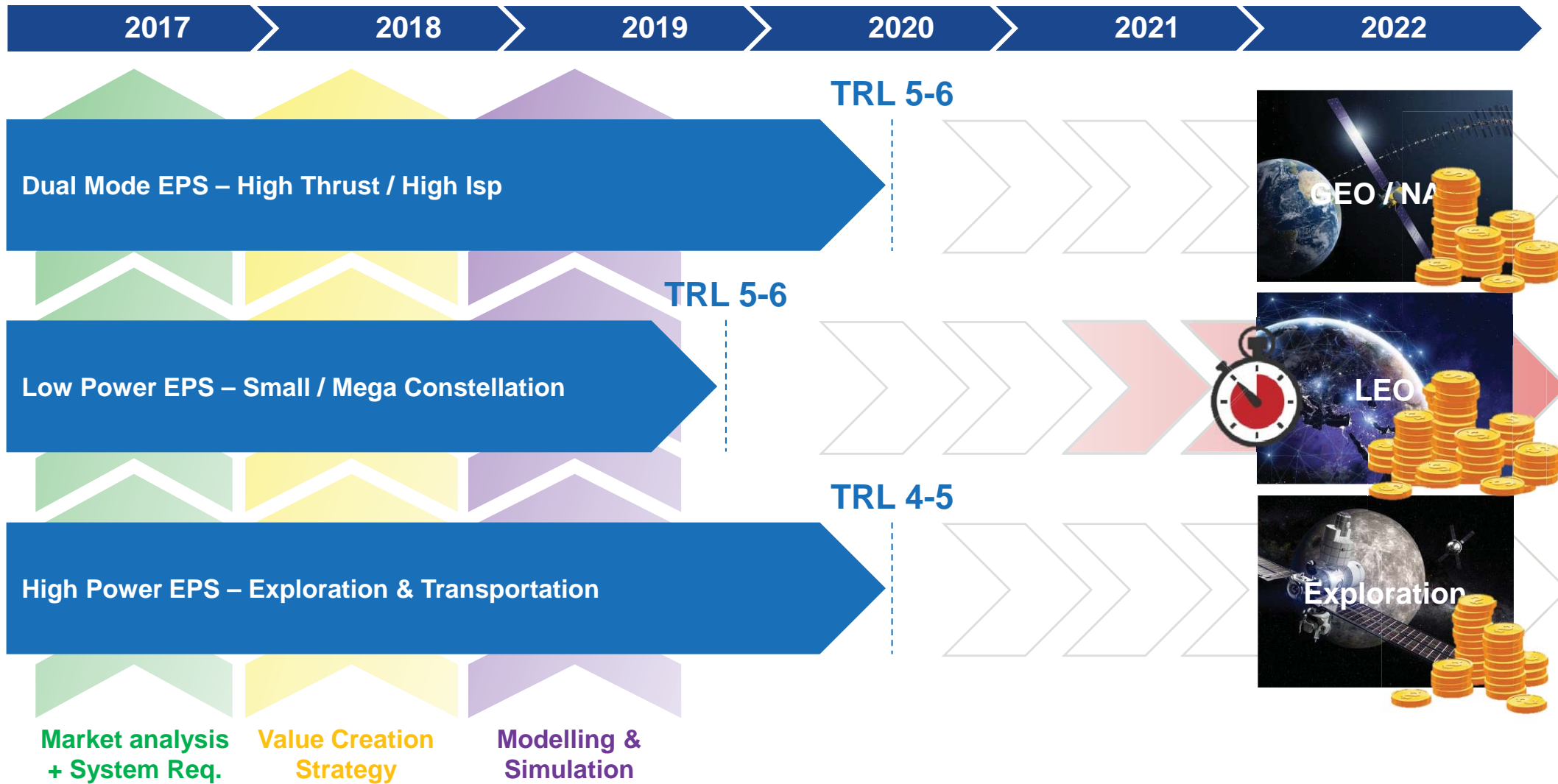
- The 3 European Primes
- 5 Syst. & Equip. manufacturers
- 4 Universities & Research centers
- 1 Space SME association



CHEOPS project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 730135

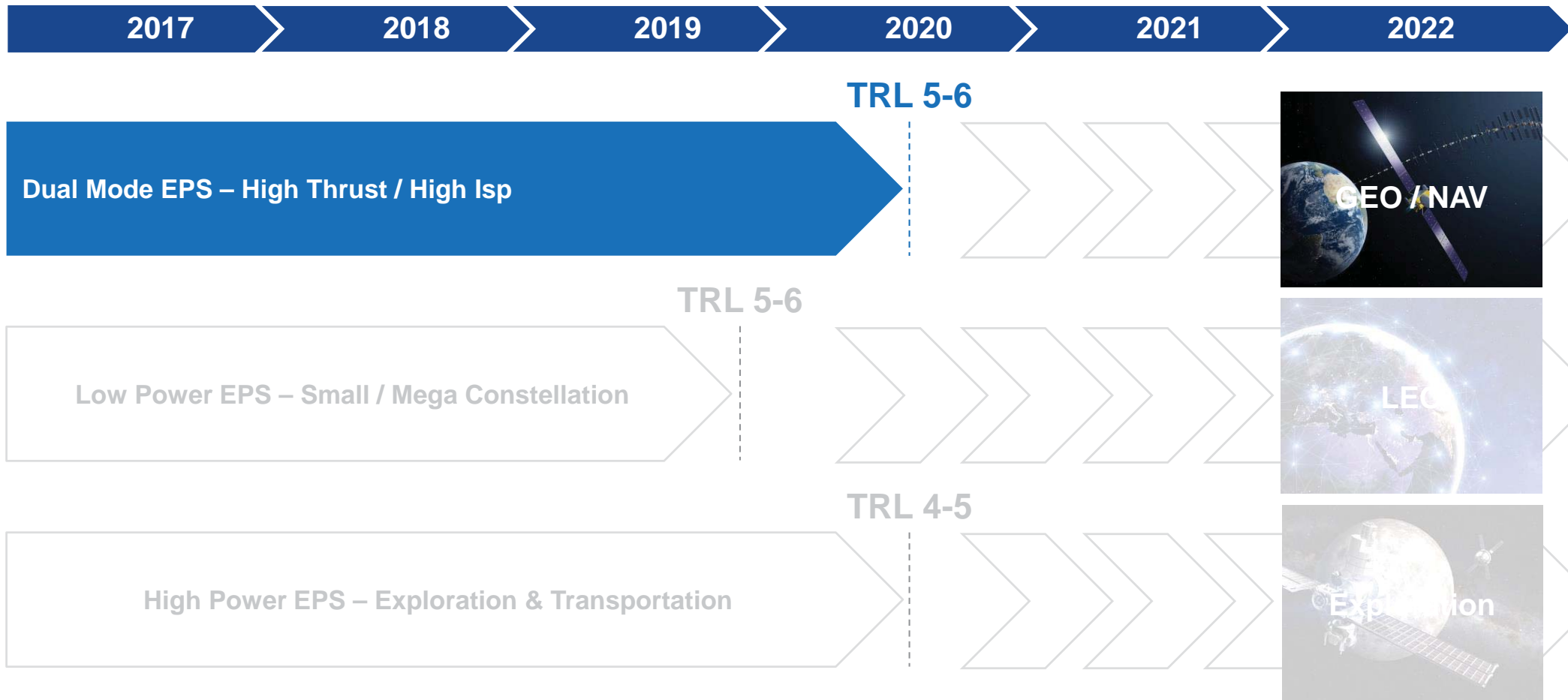
# Consortium for Hall Effect Orbital Propulsion System

## CHEOPS objectives



# Consortium for Hall Effect Orbital Propulsion System

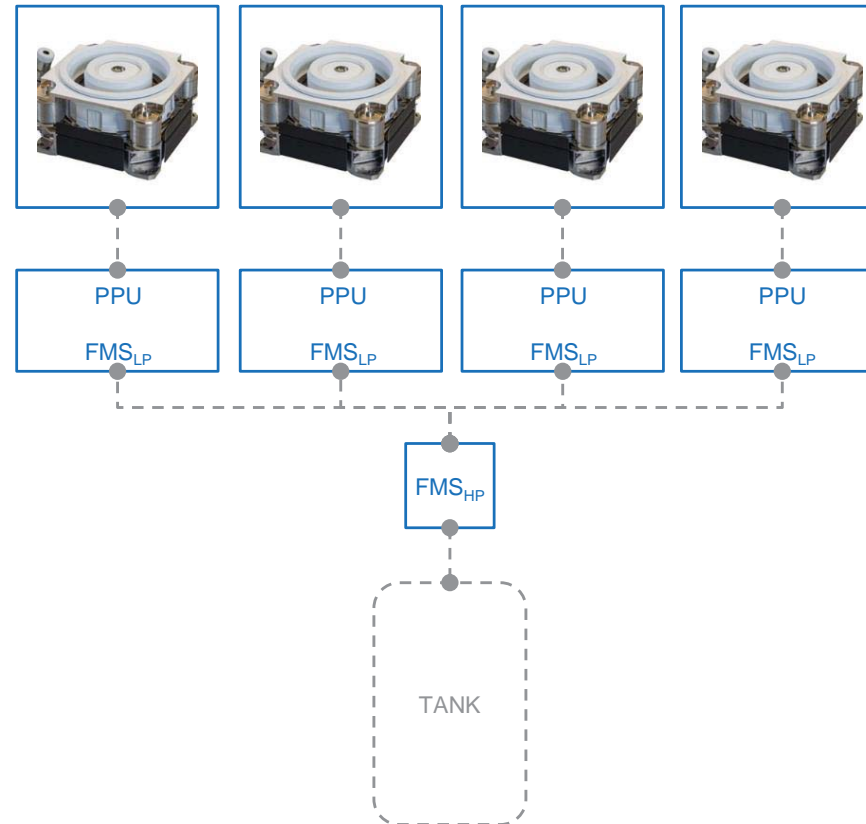
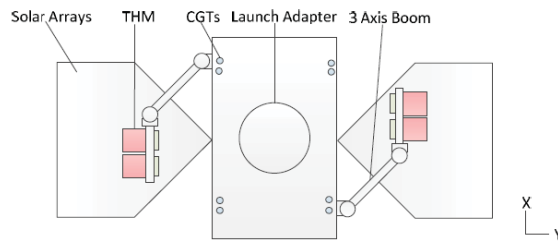
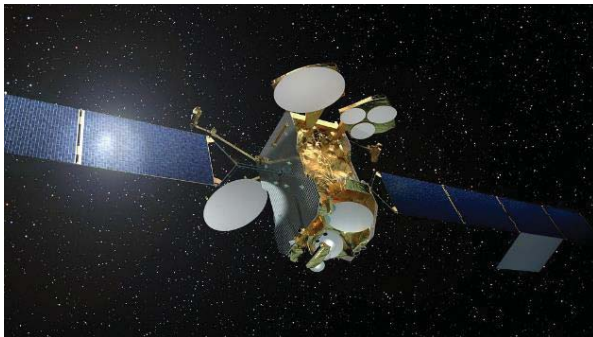
## CHEOPS objectives



# Consortium for Hall Effect Orbital Propulsion System

## Dual Mode EPS – High Thrust / High Isp

### BASELINE ARCHITECTURE : NEOSAT



### TARGETS

**COST**  
-30%

**ORBIT RAISING**  
7 kW  
HIGH T/P

**STATION KEEPING**  
3,5 kW  
HIGH ISP



# Consortium for Hall Effect Orbital Propulsion System

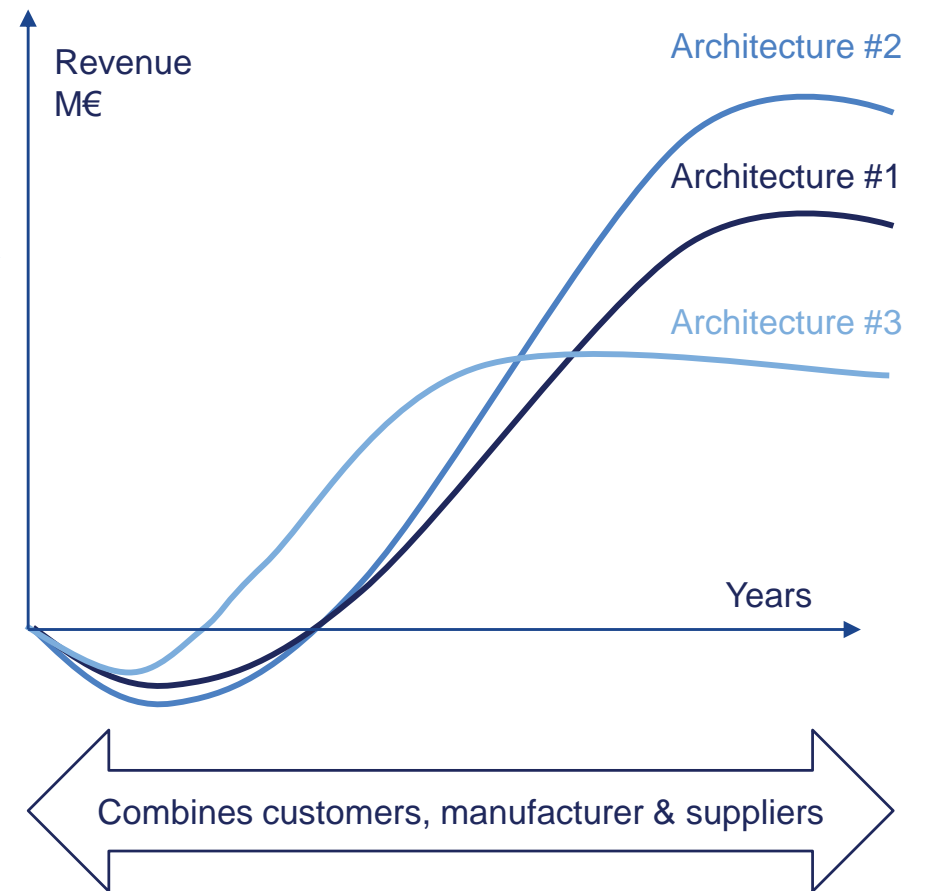
## Dual Mode EPS – High Thrust / High Isp



### VALUE CREATION STRATEGY

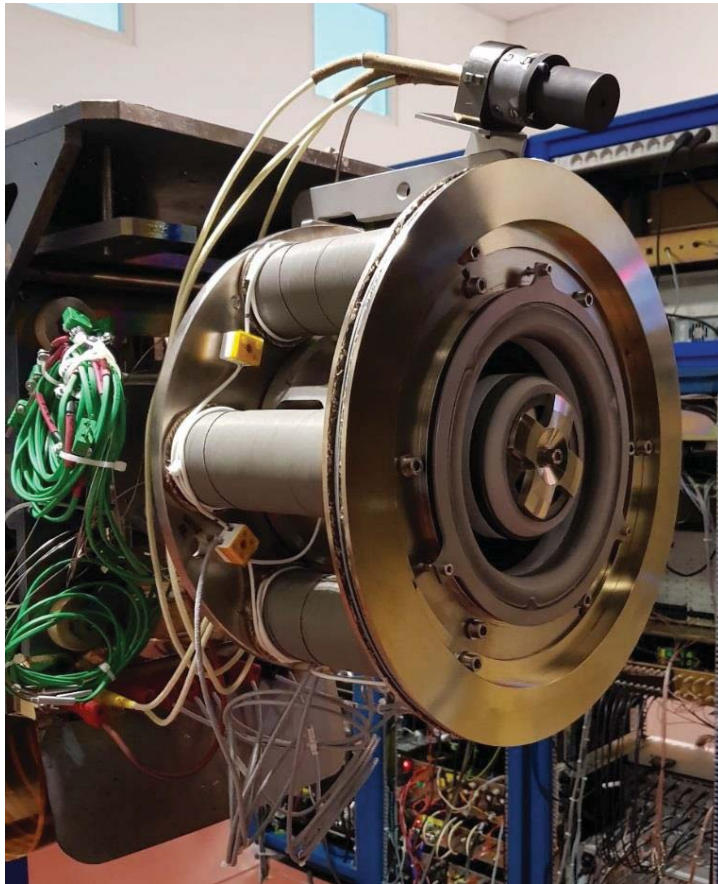
- How the customer makes revenue from the product?
- How the product causes the customer to incur costs?

### Surplus Value Model



# Consortium for Hall Effect Orbital Propulsion System

## Dual Mode EPS – High Thrust / High Isp

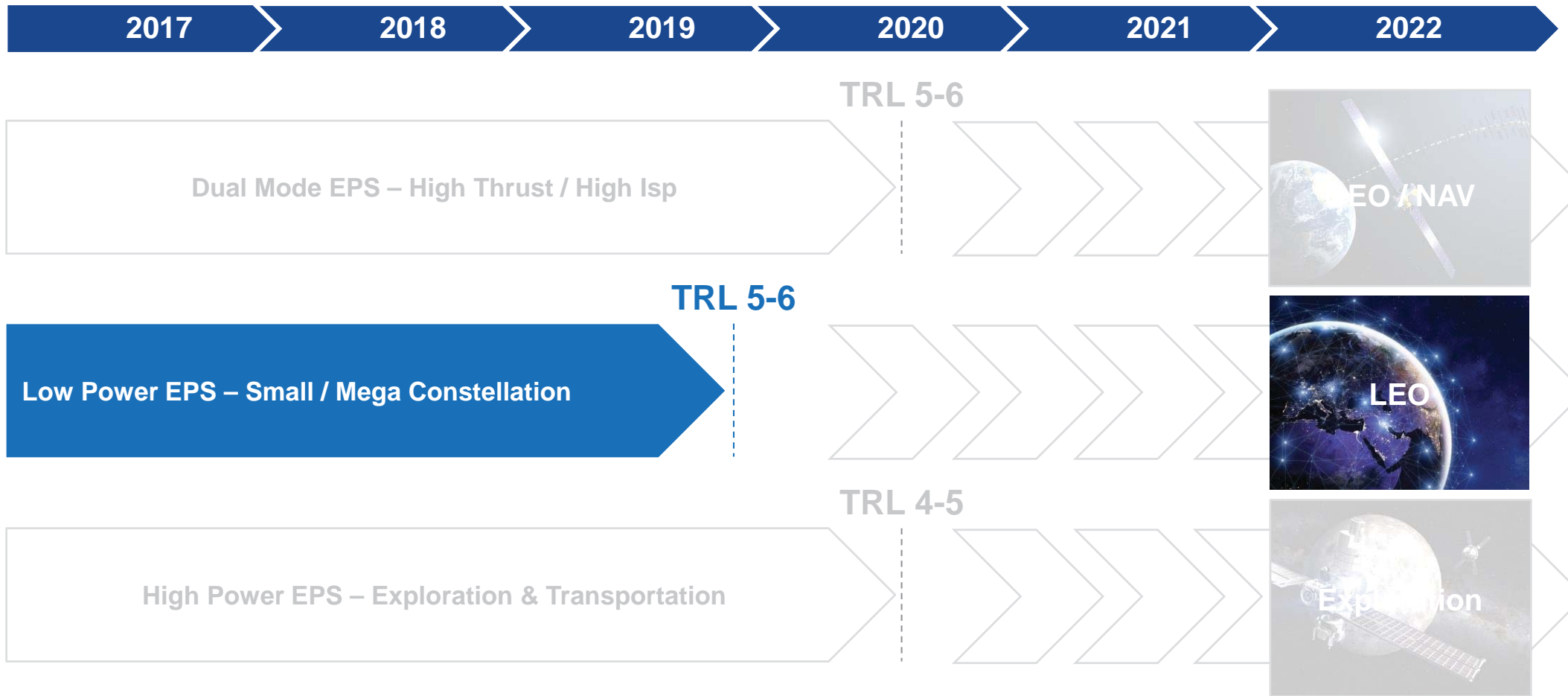


**Safran PPS@Dual-ML  
Lab. Model (2018)**



# Consortium for Hall Effect Orbital Propulsion System

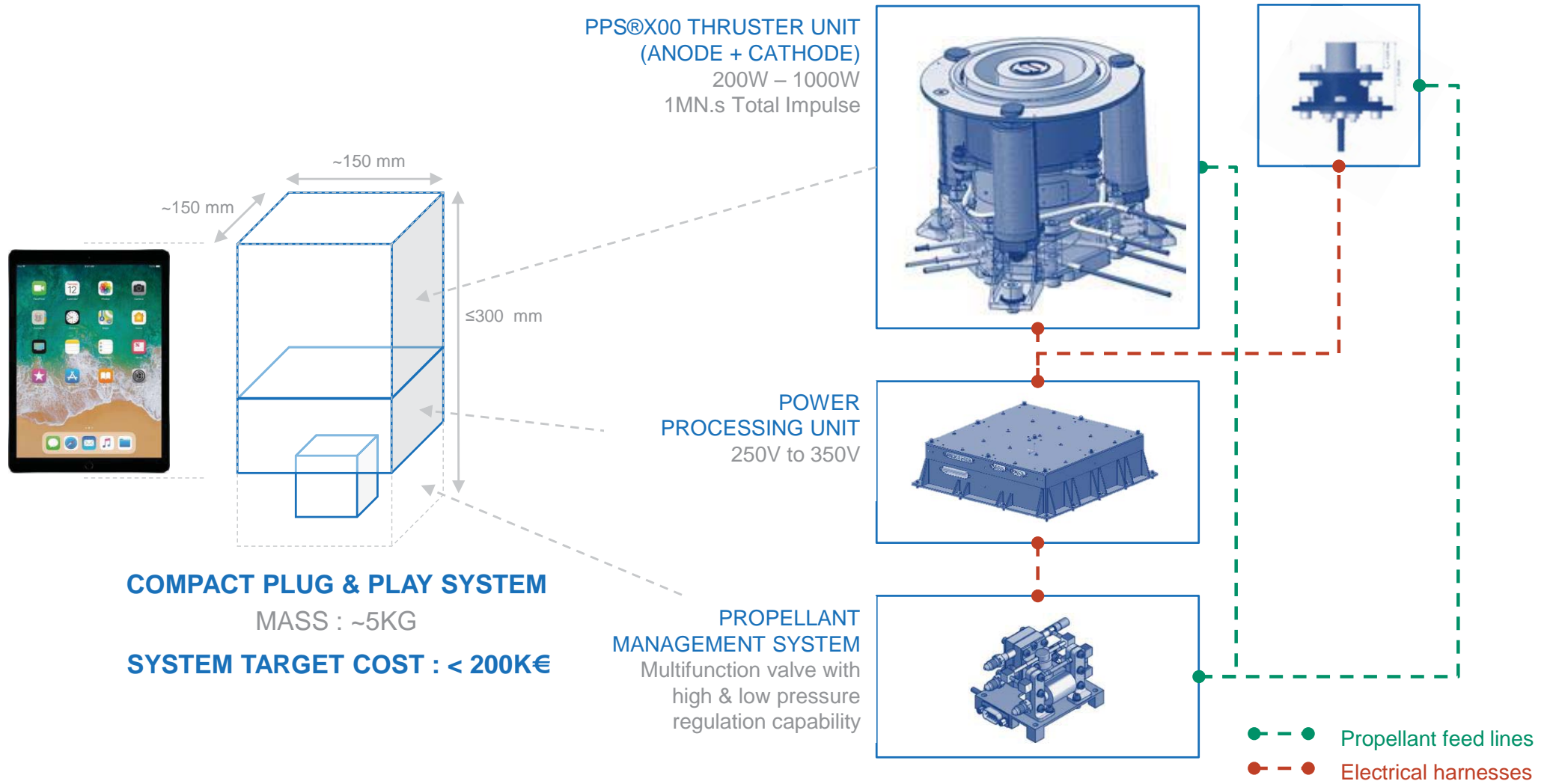
## CHEOPS objectives





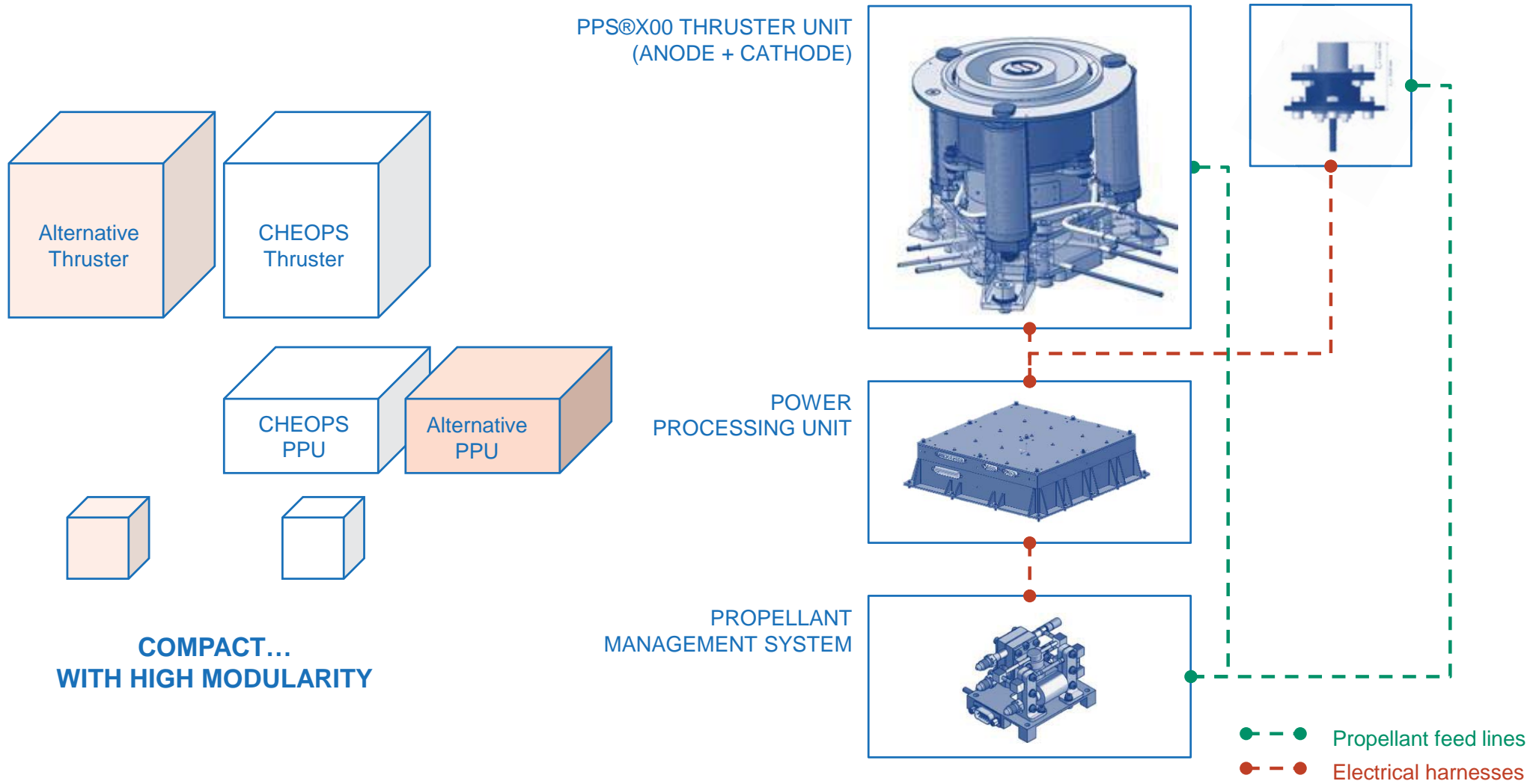
# Consortium for Hall Effect Orbital Propulsion System

## Low Power EPS – Small / Mega Constellation



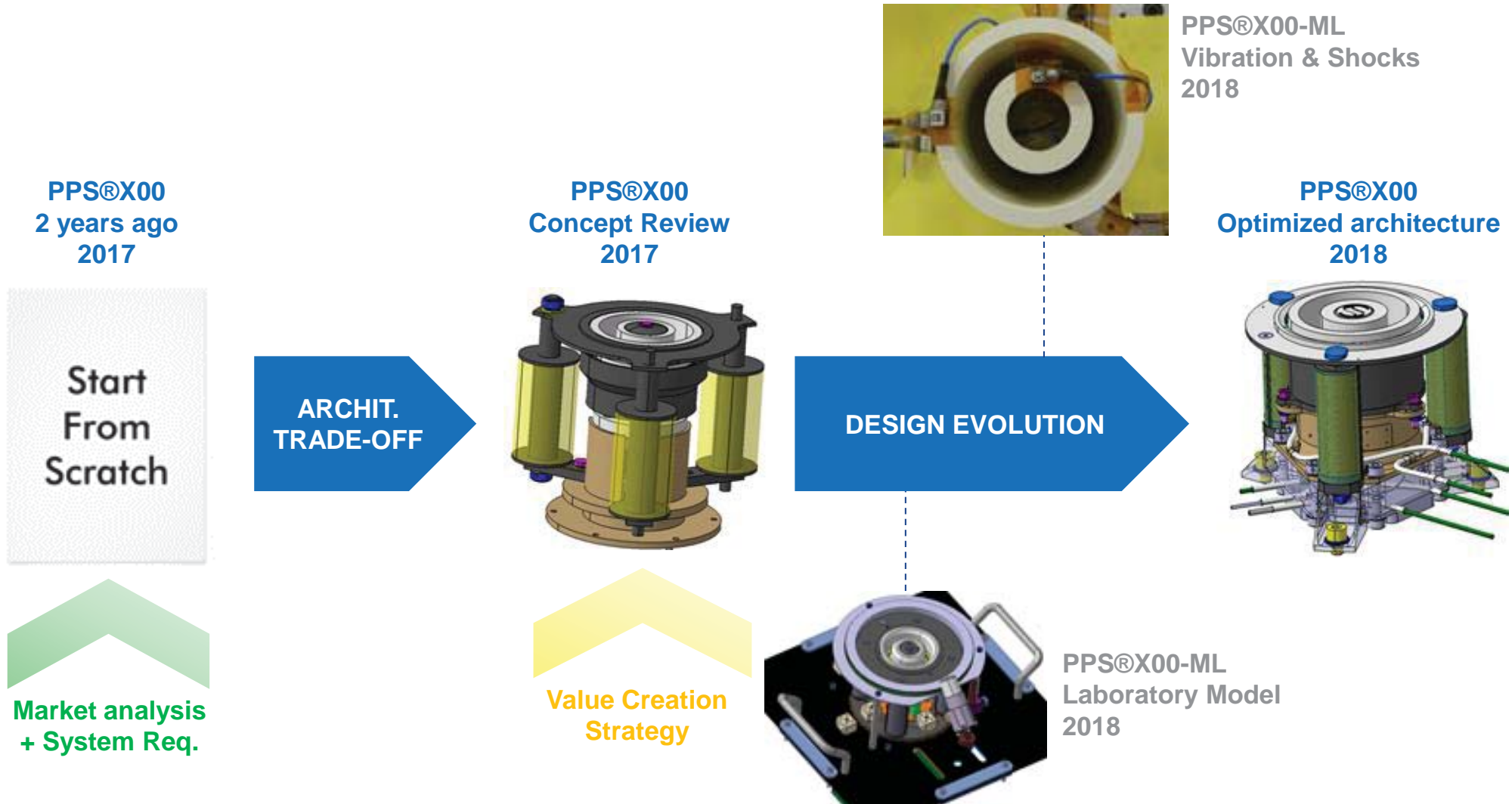
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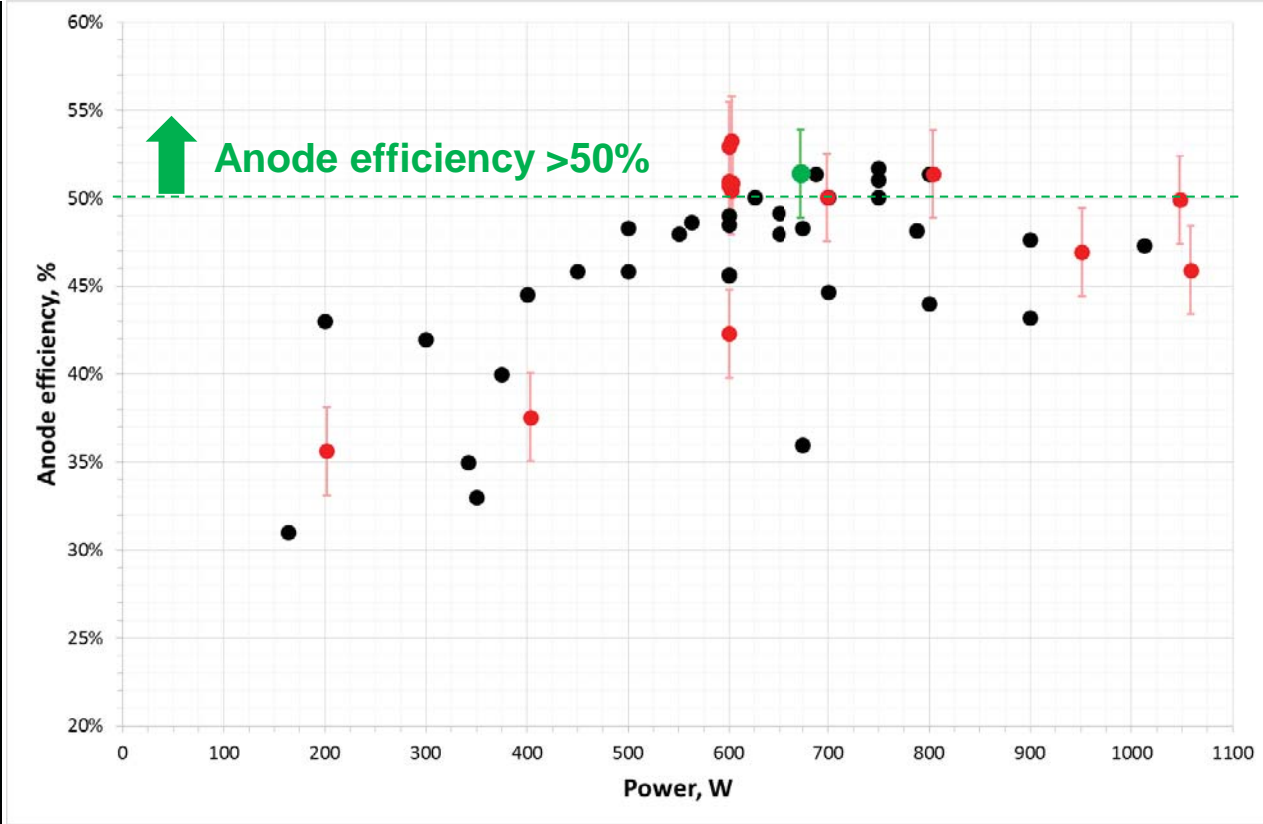
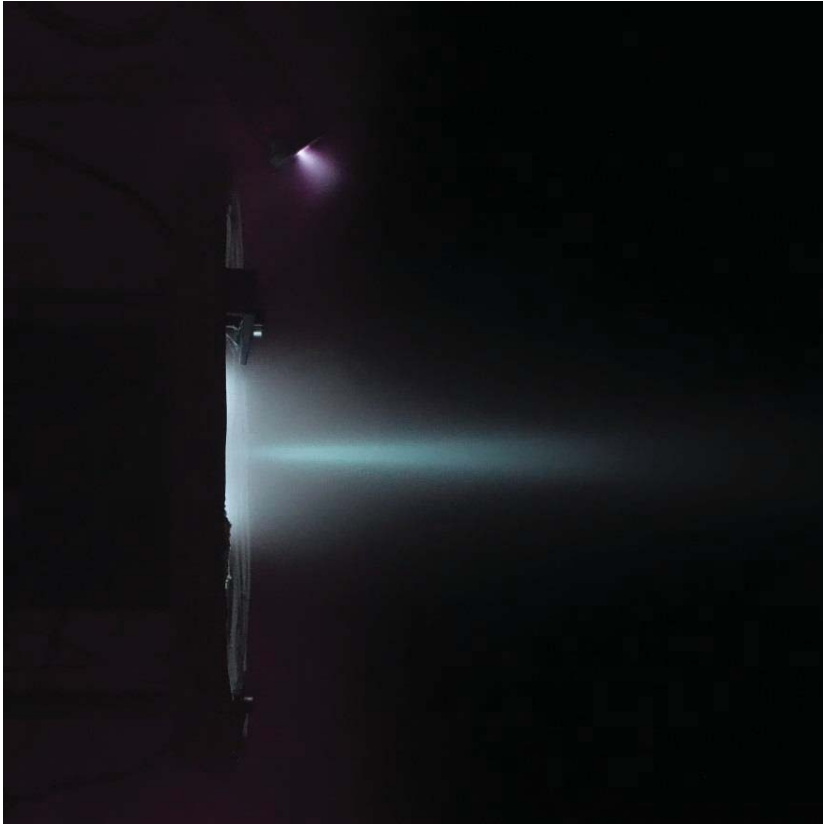
# Consortium for Hall Effect Orbital Propulsion System

## Low Power EPS – Small / Mega Constellation



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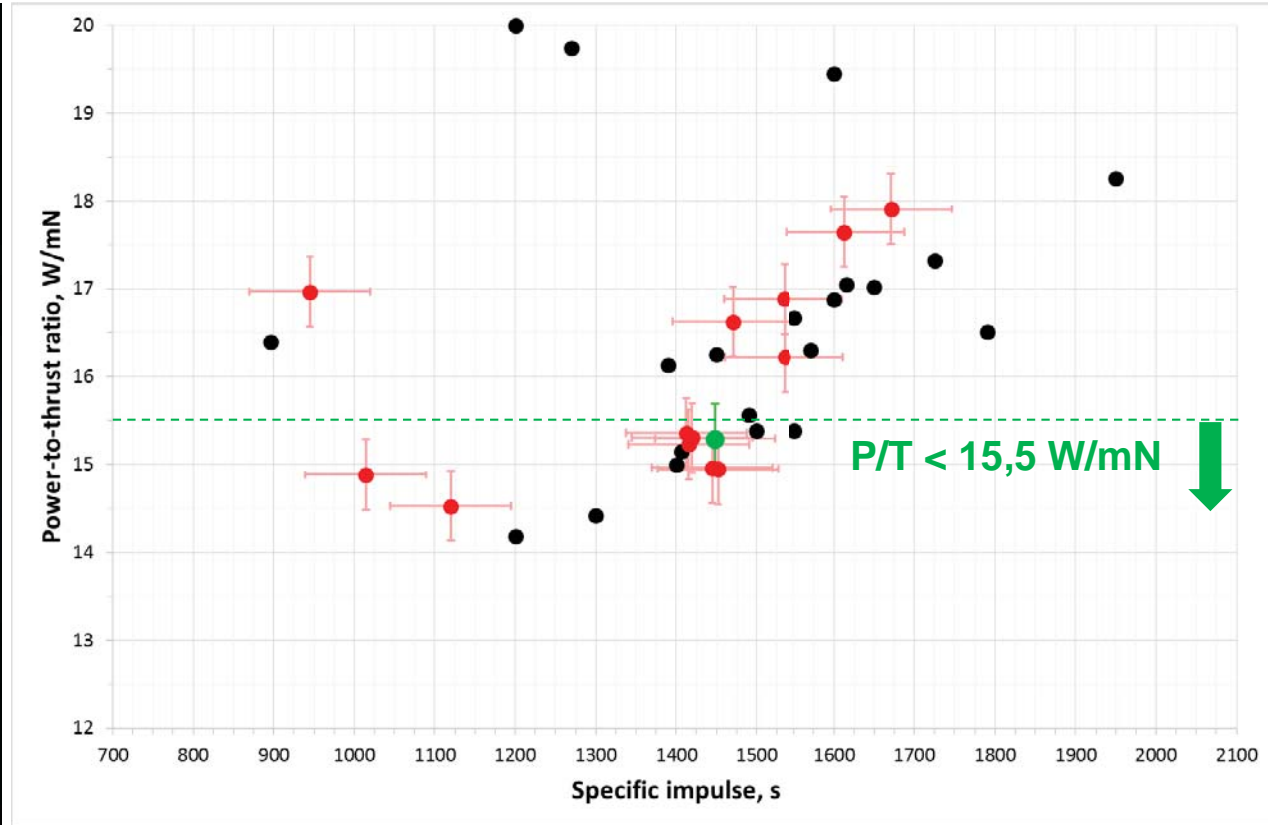


Full article :  
J. Vaudolon, V. Vial, N. Cornu, I. Habbassi, PPS@X00 Hall Thruster  
Development at Safran, IAC-18-C4.4.9x45869, 69th International  
Astronautical Congress (IAC), Bremen, Germany



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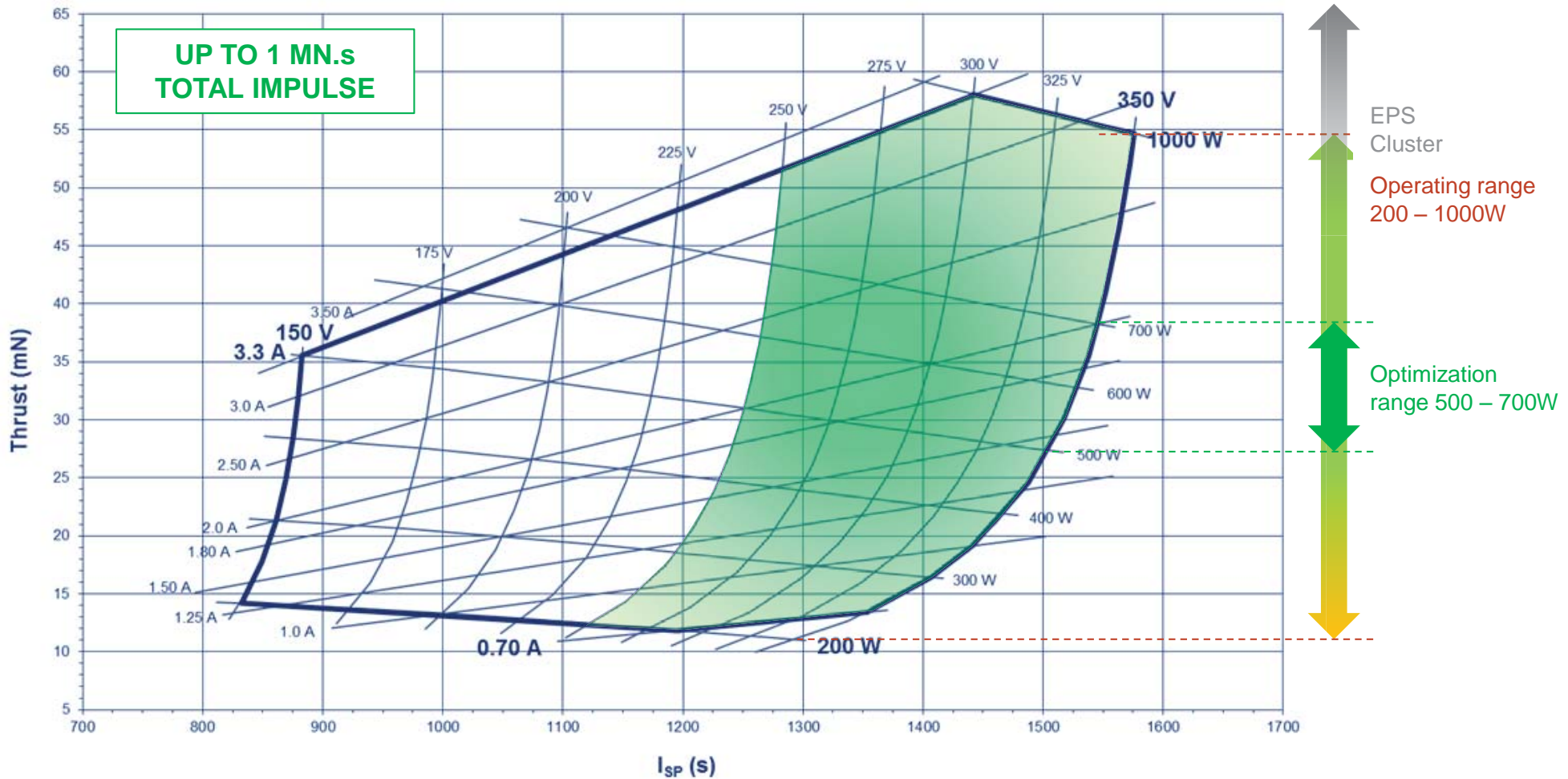


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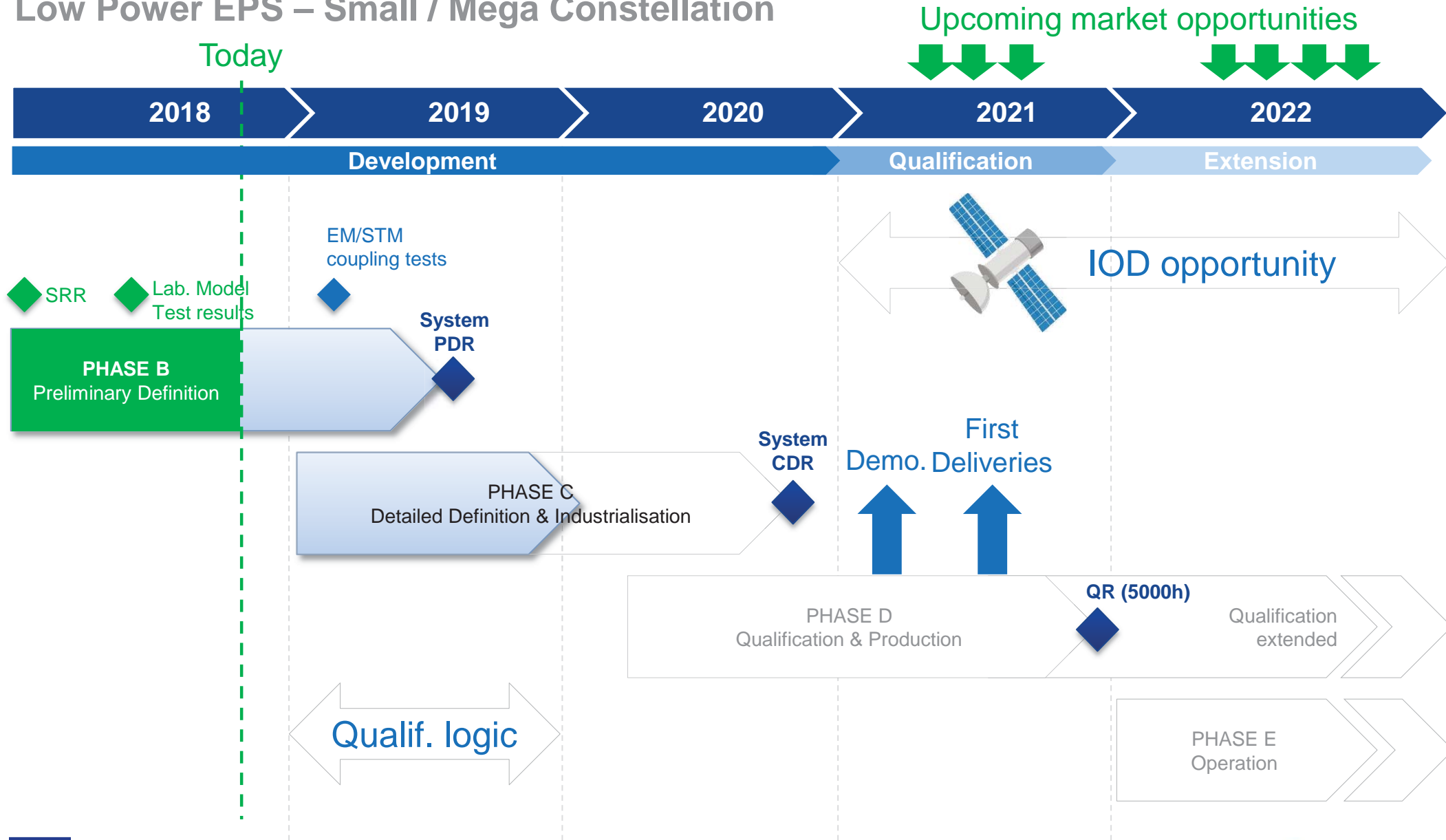
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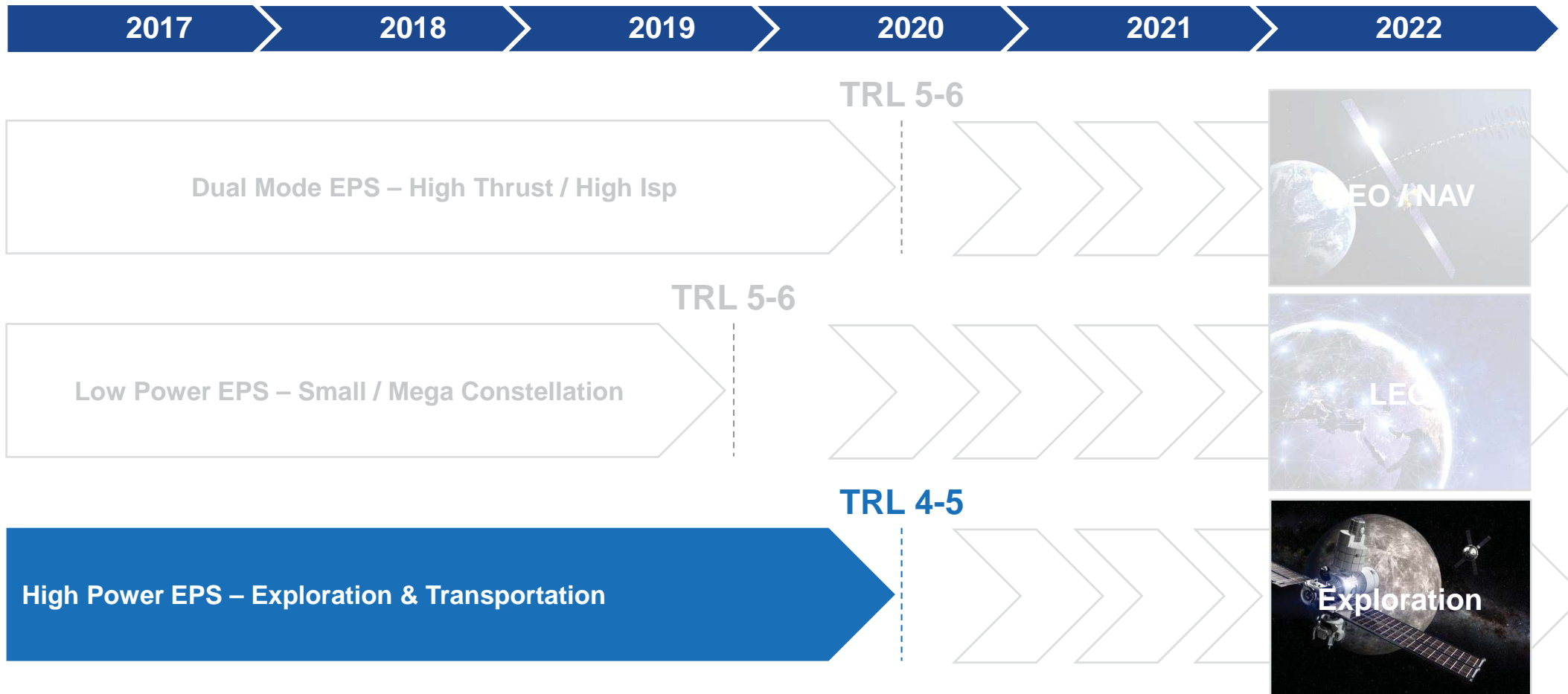
# Consortium for Hall Effect Orbital Propulsion System

## Low Power EPS – Small / Mega Constellation



# Consortium for Hall Effect Orbital Propulsion System

## CHEOPS objectives

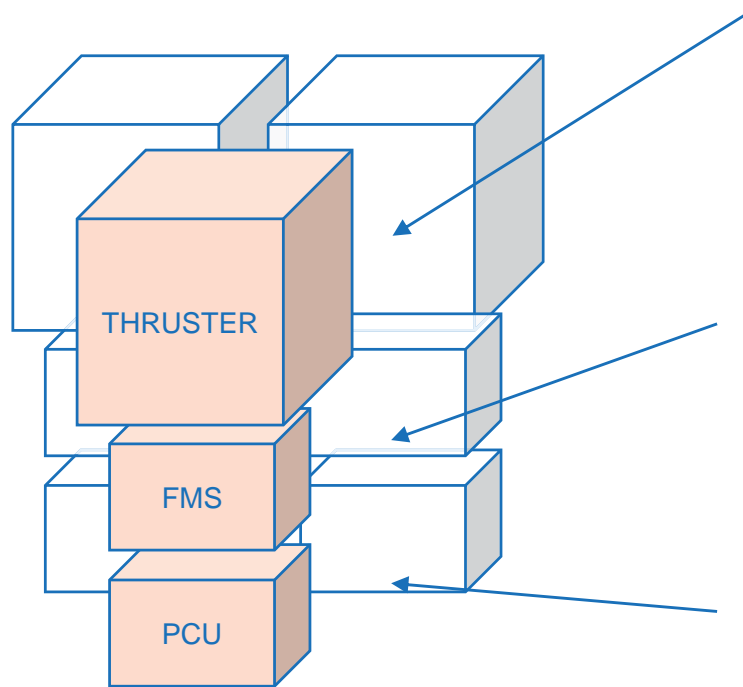




# Consortium for Hall Effect Orbital Propulsion System

## High Power EPS – Exploration & Transportation

Multiple Propulsion lines operation (Space Tug)



Single Branch Propulsion System

### High Power Thruster unit

- 15kW-25kW (Based on Sitael HT20k)
- Magnetic shielding
- Improved thermal performances

### Flow Management System

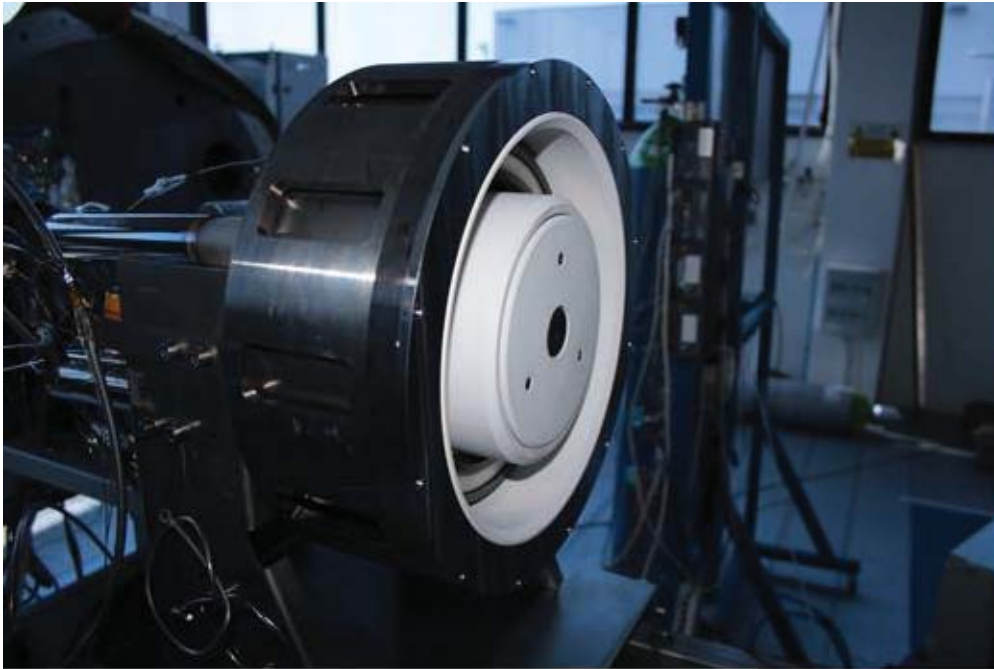
- High flow FMS with reduced mass, footprint and costs

### Direct Drive power control unit

- Directly thruster supply from a high voltage solar array, without PPU converters

# Consortium for Hall Effect Orbital Propulsion System

## High Power EPS – Exploration & Transportation



**Figure 1 - The magnetic-shielded version of the HT20k development model on the thrust stand, ready to be tested in the IV10 facility at SITAEL; testing of this development model was aimed at supporting the thruster unit PDR.**

SITAEL



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## High Power EPS – Exploration & Transportation

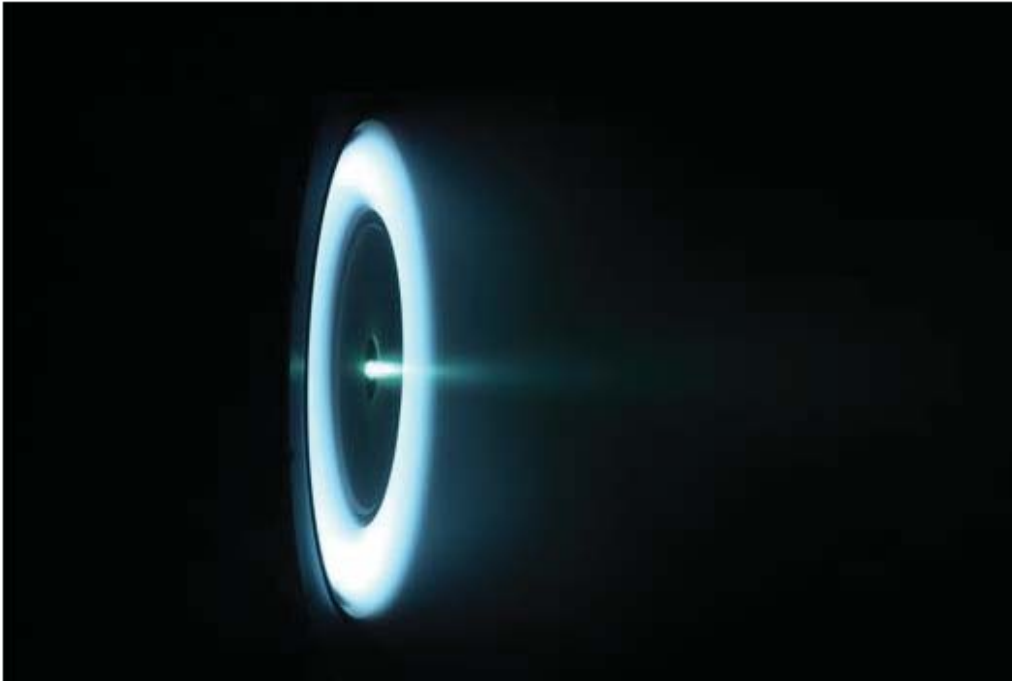
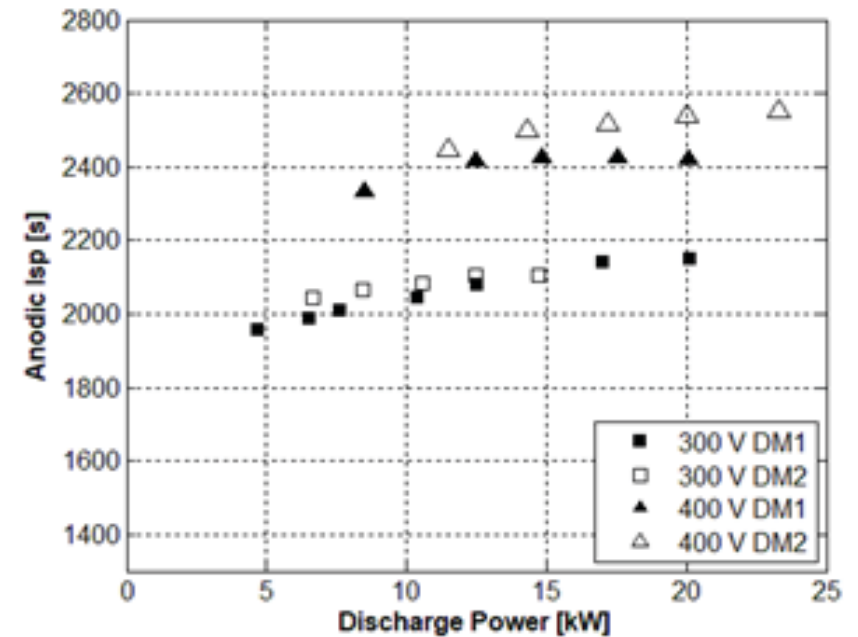


Figure 2 - The magnetic-shielded version of the HT20k development model in the IV10 facility at SITAEL during a preliminary test campaign in support of the thruster unit PDR.



# Consortium for Hall Effect Orbital Propulsion System

## Modelling and simulation activities

### On-going activities :

- 2D axisymmetric hybrid code development to simulate the plasma discharge in the Hall thruster
- Simulations of alternative propellants using both the Particle-In-Cell codes (axial-azimuthal and radial-azimuthal) and the 1D fluid code.
- Engineering tool development to monitor with higher resolution and accuracy not only the channel but also the pole erosion

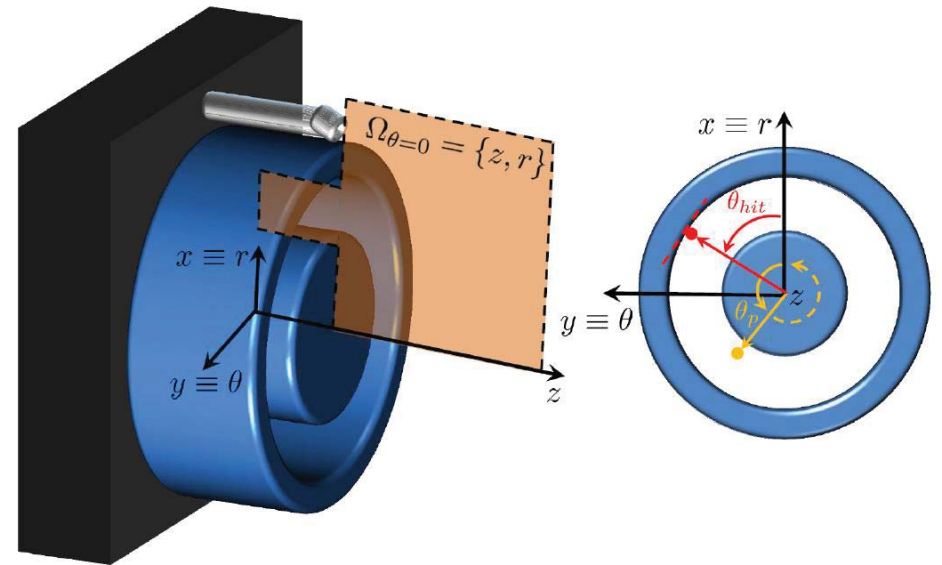


Figure 3: Figure of 3D physical domain to be simulated.

# Consortium for Hall Effect Orbital Propulsion System

What we need to achieve CHEOPS strategic objectives?

**CONTINUOUS INVOLVEMENT AND VISIBILITY  
FROM PARTNERS & CUSTOMERS**

**EUROPEAN STRATEGY FOR QUALIFICATION  
AND ENTRY INTO SERVICE (IOD)**

**FUNDINGS**





Consortium for **Hall Effect Orbital Propulsion System**

**THANK YOU**



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