omnidea

Plasma Focus Thruster

Final Presentation

ESA Contract n°.: 4000129618

30/07/2021

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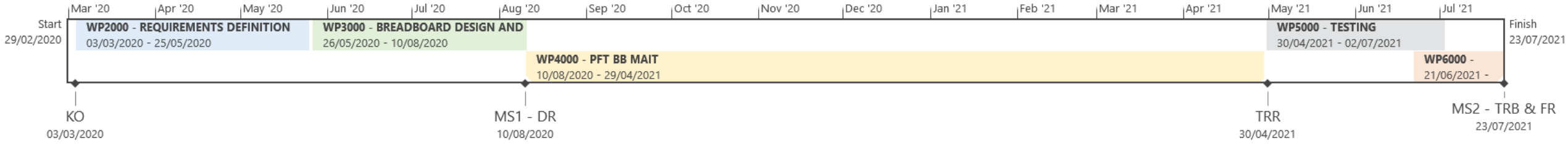
PFT – Objective & Schedule

Plasma Focus Thruster is a de-risking activity ESA GSTP. The main objective of this activity was to demonstrate the feasibility of a novel pulsed plasma thruster with augmented impulse enhanced by a magnetic pinch effect.



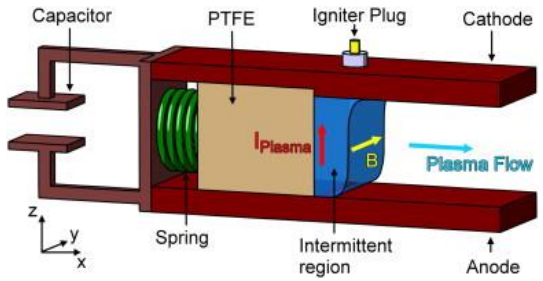
- **Duration:** 18 months
- **Total budget:** 200k€
- **TRL:** 3

PFT – Current Technologies

- First flow EPS;
- Long flight heritage;
- Two configurations;
- Main characteristics of PE-PPT:
  - Simplicity
  - Reduce size
  - Low efficiency

Pulsed Plasma Thrusters

Plate Electrodes



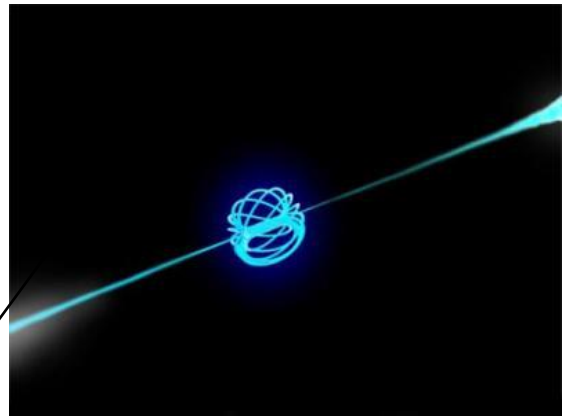
Coaxial

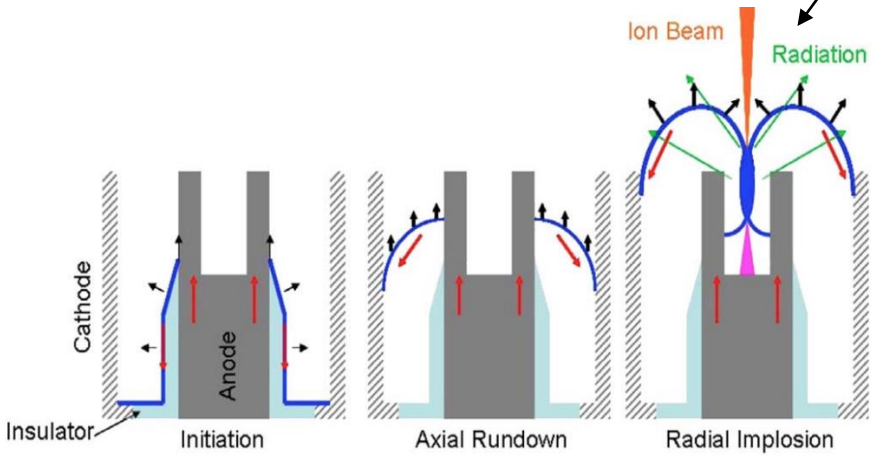
- Reference propulsive parameters:

Thruster	Impulse bit (mNs)	Specific Impulse (s)	Dimensions (cm)	Weight (kg)
PPTCUP	0.04	655.00	10x10x3.3	0.28
NanoPPT	0.09	640.00	11x3x4.5	0.35
BmP-220	0.02 (impulse bit)	N/A	8.65x8x5.4 (375 cm3)	0.50
Petrus	0.082 (impulse bit)	844.00	2.6(diameter) *5	0.60

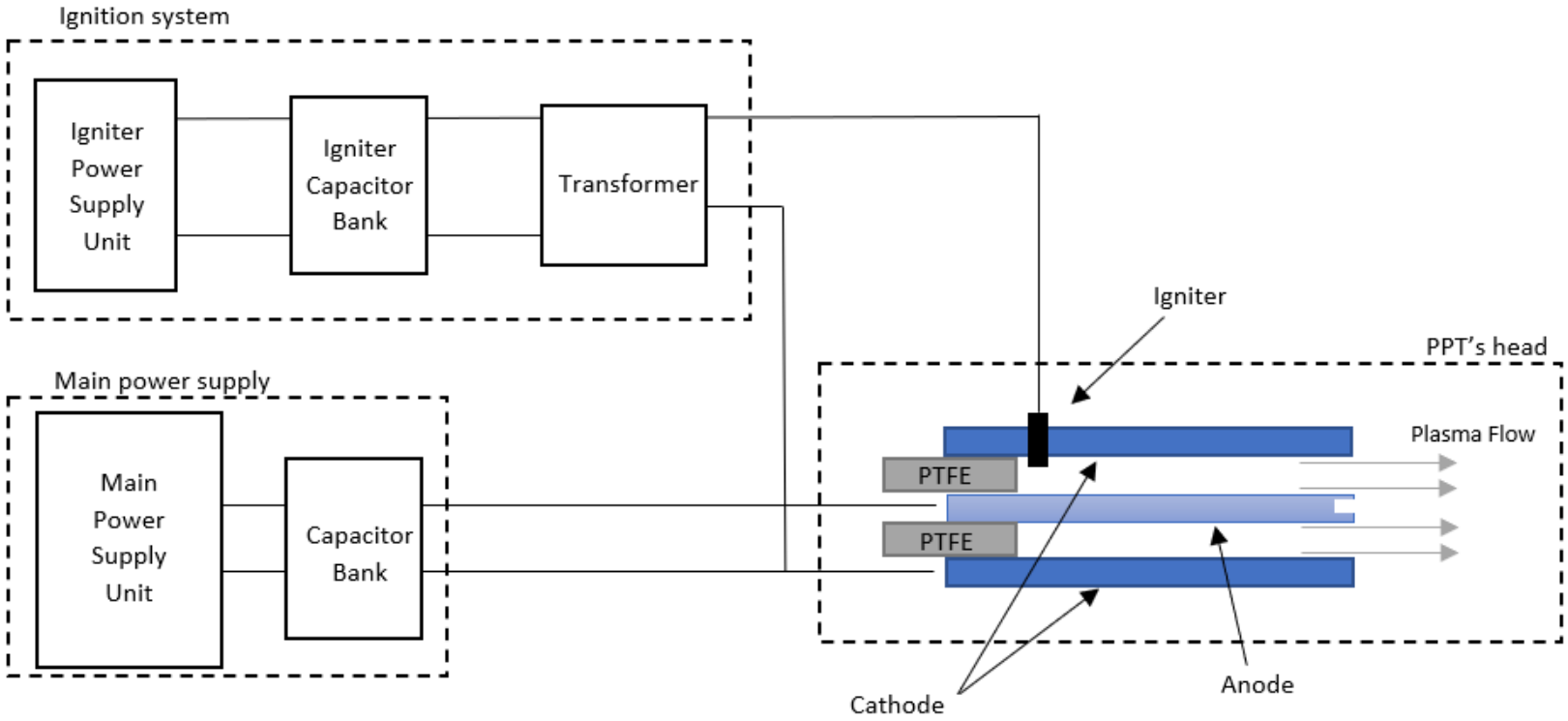
PFT – Current Technologies

- The DPF technology is based on a magnetic pinch.
- The working principle of this technology can be divided in 3 stages:
  - The initiation (A)
  - The axial rundown (B)
  - Radial implosion (C,D,E)



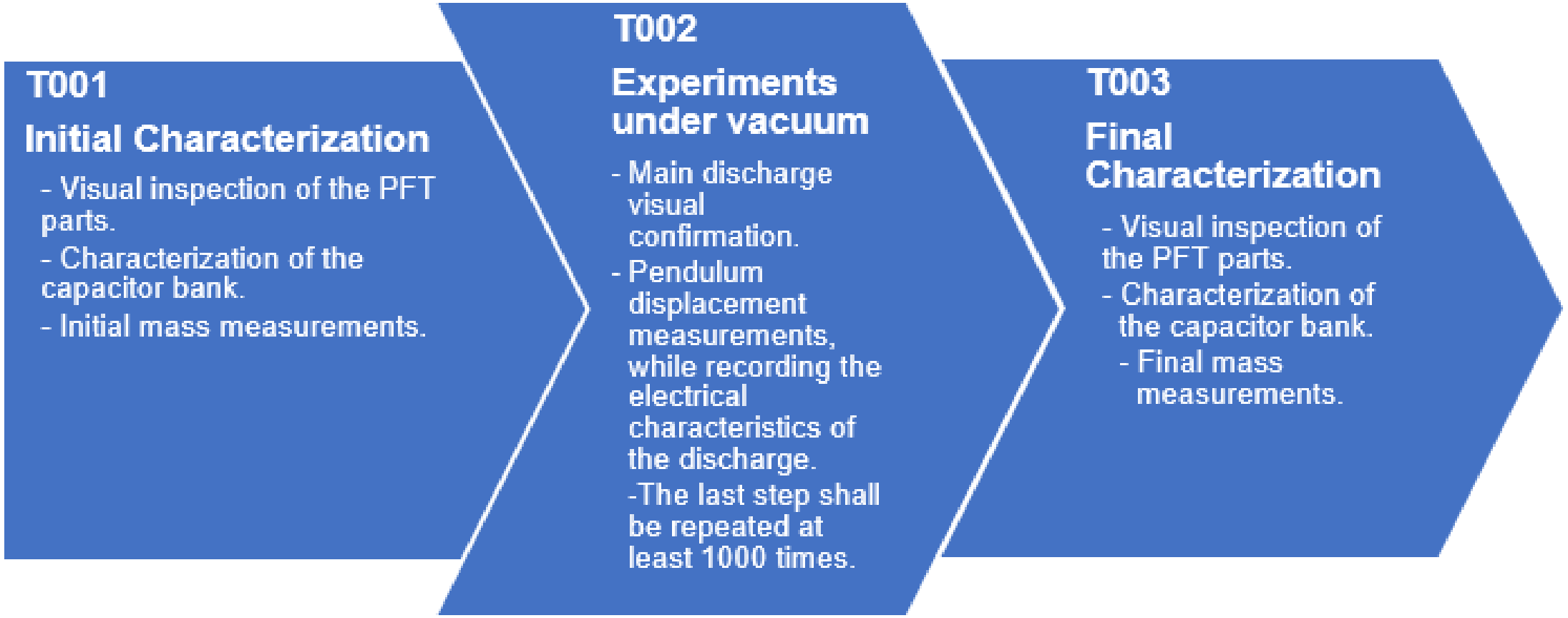


PFT – Design Solution



Parameter	PFT
Design	Coaxial
Volume	<1U
Propellant	(solid) PTFE
Capacitance	5 μF
Charge Voltage	<1.5 kV
Energy	<5.7 J
Electrodes	Copper/Tungsten alloy

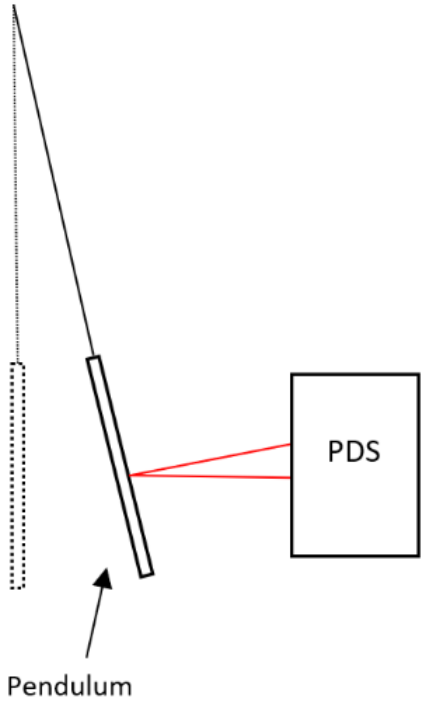
PFT – Test Plan



Test Setup

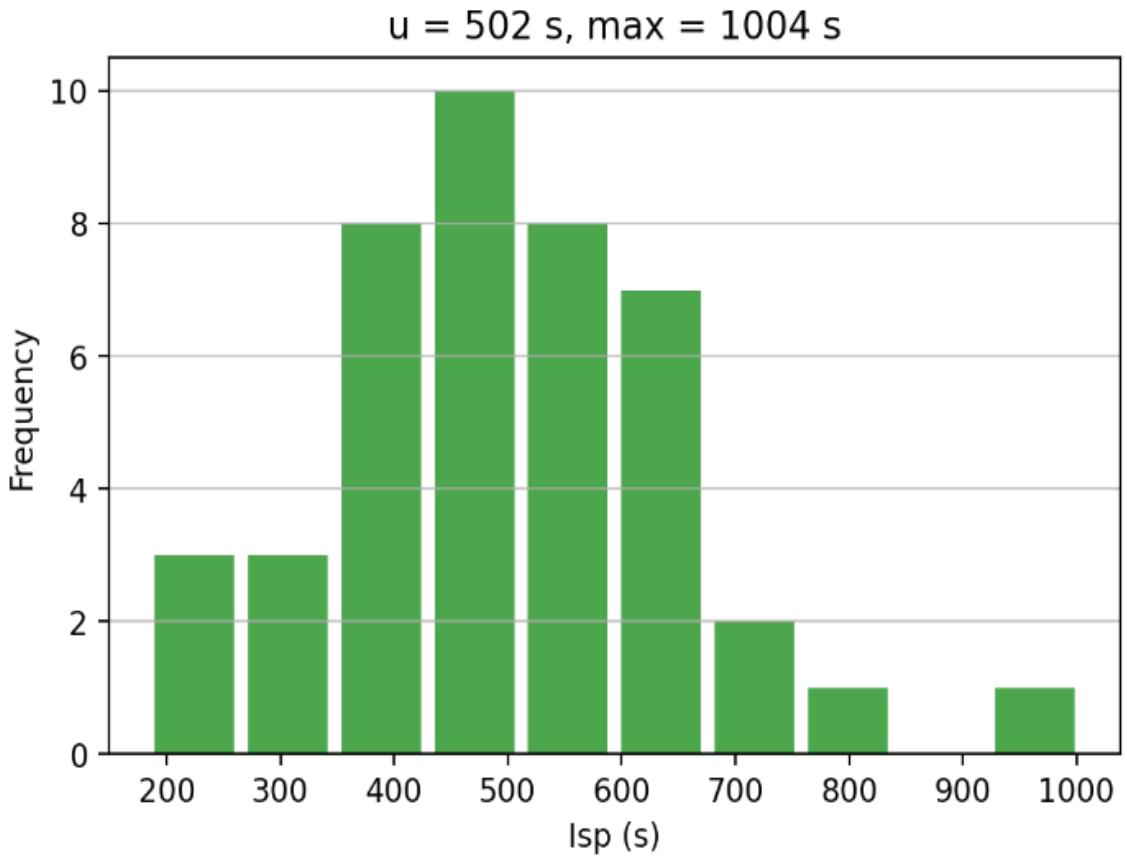
- Ballistic pendulum setup:

- Rigid pendulum target;
- Position Detection;
- Sensor;



PFT – Main Results

	Average	Maximum	Reference
I_{SP} (s)	502	1004	800
I_{BIT} (μNs)	2.3	4.6	100
η	0.3%	1.0%	5.0%



PFT – Issues to be Address

- Multiple Sparkplugs;
- Geometry variations;
- Available energy.

PFT –Summary & Conclusions

- The main objective of this activity was to demonstrate the feasibility of a novel pulsed plasma thruster with augmented impulse enhanced by a magnetic pinch effect.

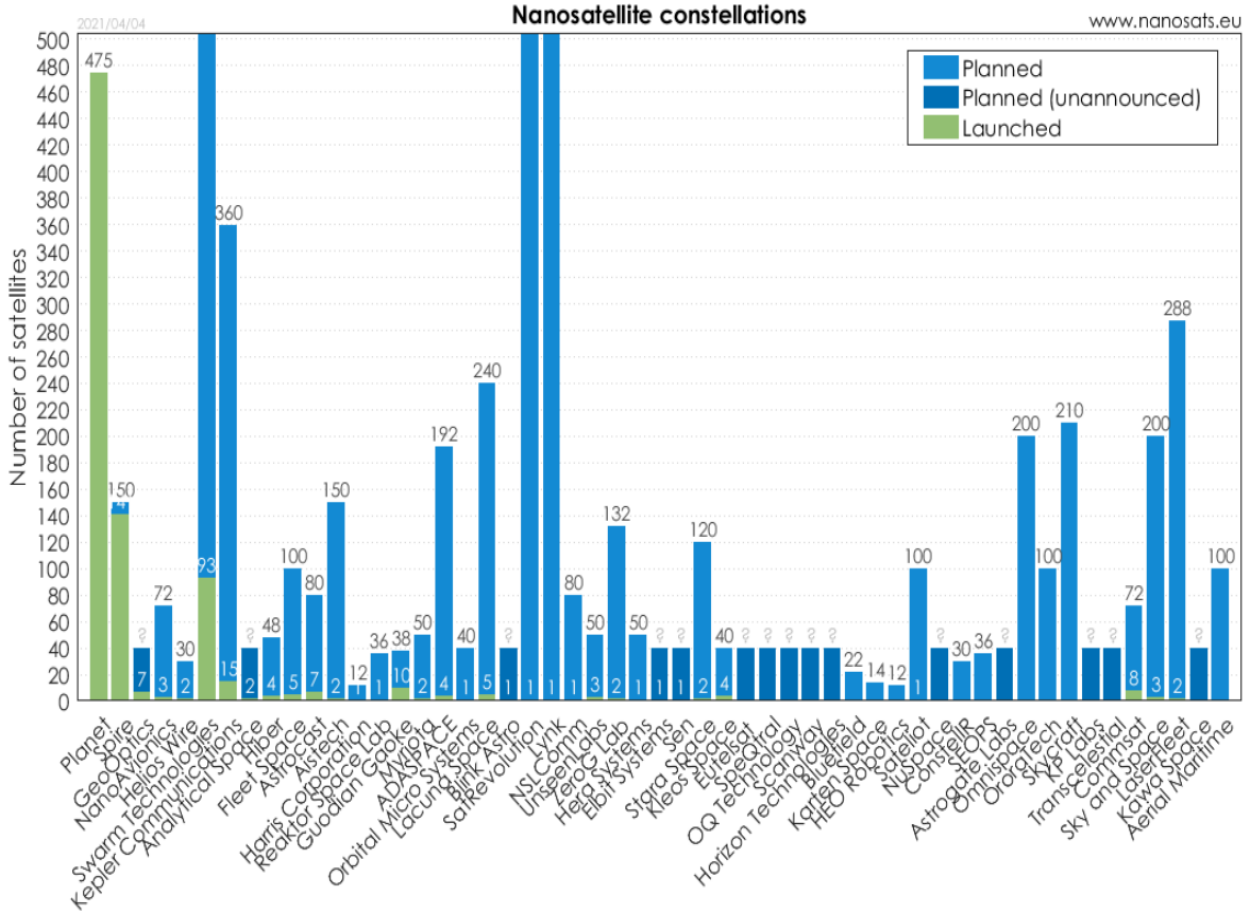
- Due to the successful results obtained during the project, Omnidea Ltd. proposed a follow-on activity with 2 years duration. The goals of this activity are to built and test an EM.

PFT – Follow-on Activity Development Plan

- Goal is to develop **Plasma Focus Thruster EM**:
  - Preliminary activities: implement modifications to current breadboard and verify performance;
  - Update market approach and define requirements;
  - Design EM;
  - MAIT of EM.

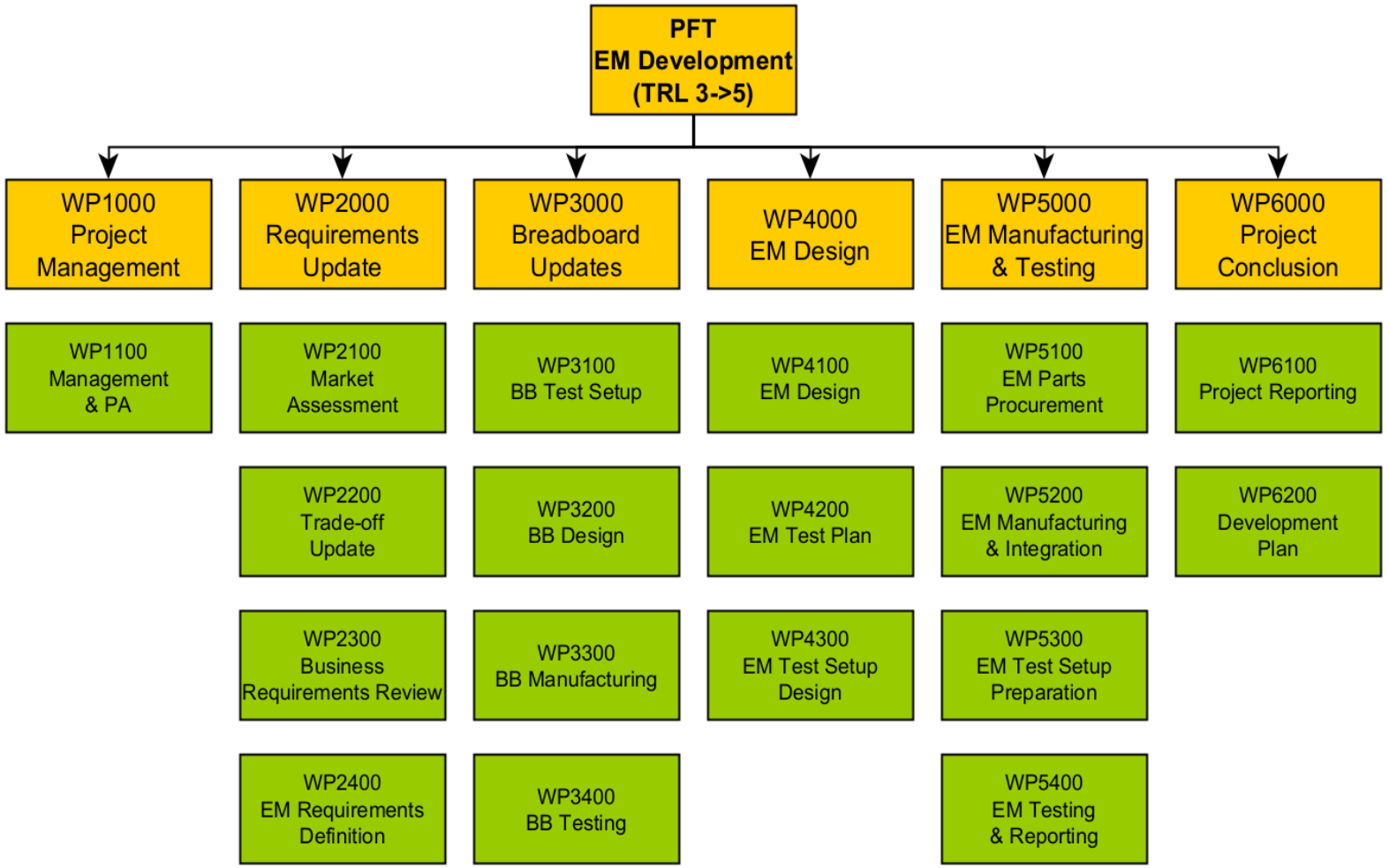
PFT - Commercial Evaluation of the Product/Technology

- The immediate market targeted for the PFT will be CubeSats.



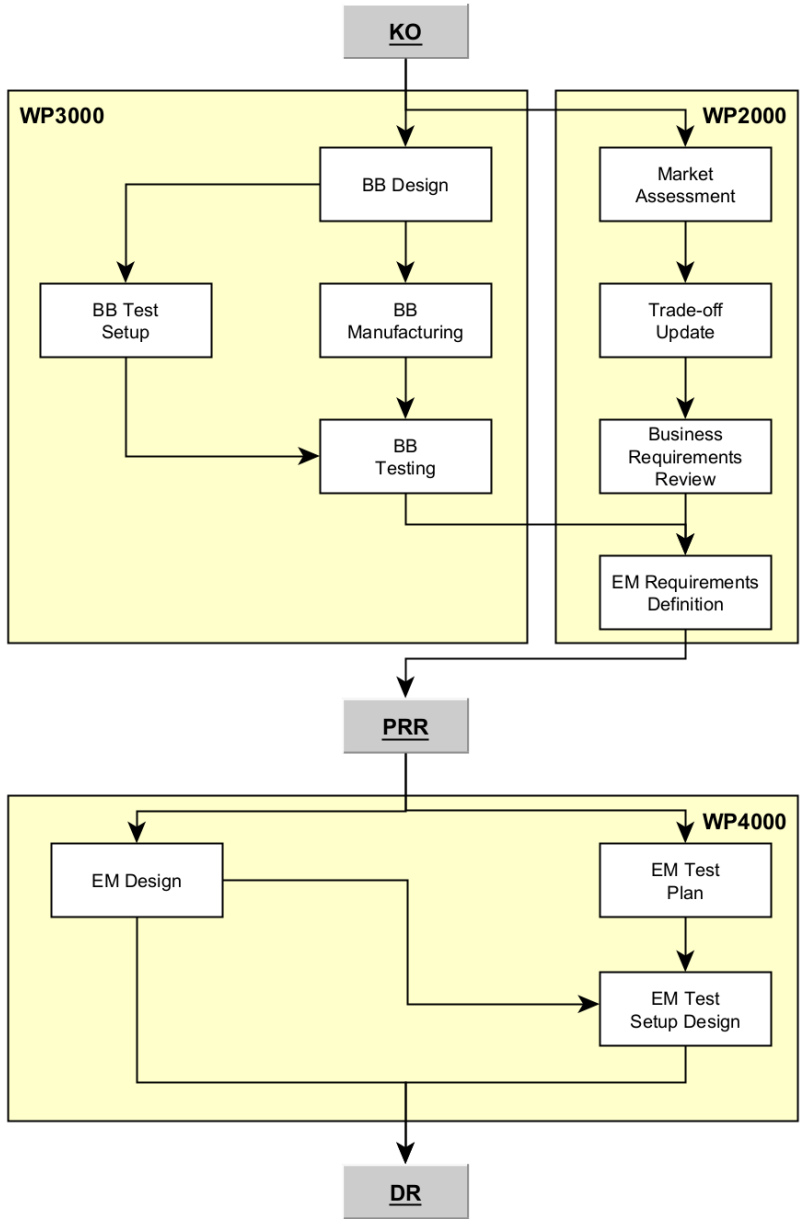
PFT – Follow-on Activity Development Plan

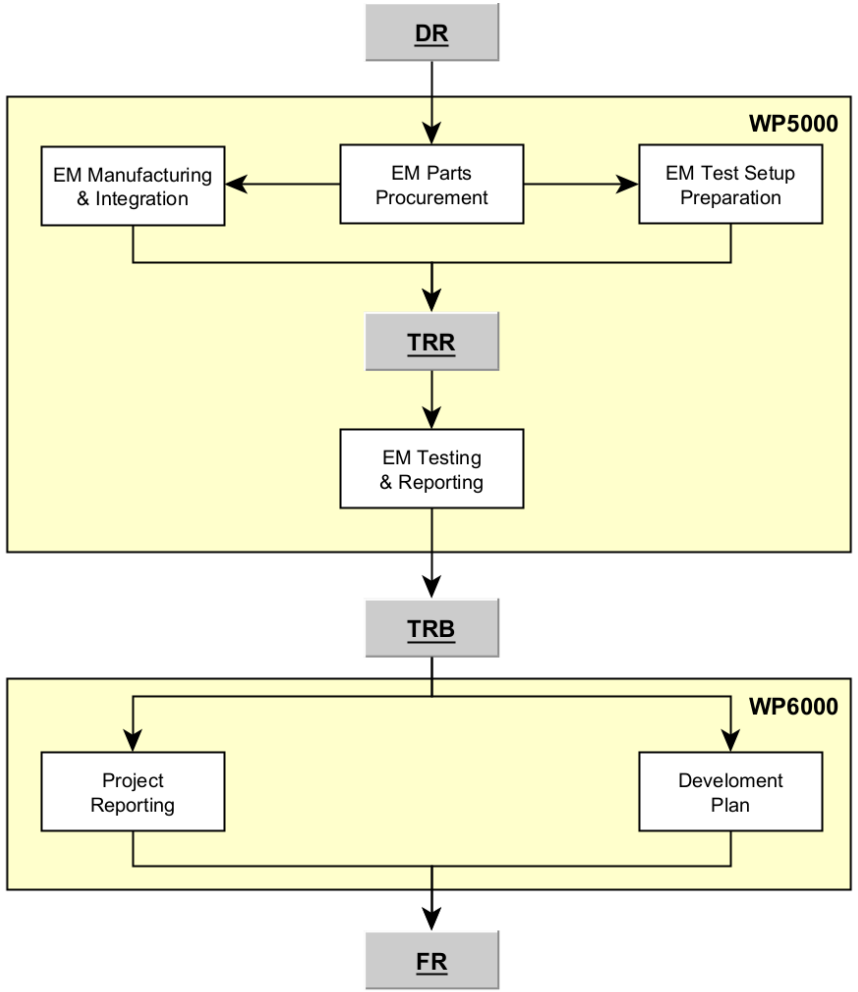
WBS



PFT – Follow-on Activity Development Plan

Work Logic





PFT – Follow-on Activity Development Plan

- **Duration:** 24 months
- **Total budget:** 500k€
- **TRL Target:** 5

Thank You!