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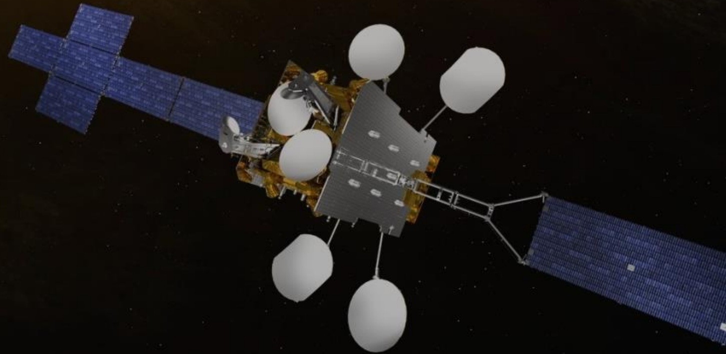
EDDA

EUROPEAN DIRECT-DRIVE ARCHITECTURE



Commission européenne

The project has received funding from the European Union's Horizon 2020 Space Research Program under Grand Agreement N°870470

EDDA in a nutshell

EDDA

EUROPEAN
DIRECT-DRIVE ARCHITECTURE

6 partners | 02 years | 40 delivrables | 1M funding

H2020 EDDA will enable a transversal architecture compatible with various electric thrusters available on the market, allowing to enhance the global efficiency from solar array to thruster

Architecture benefit

- large telecom satellite with electric propulsion for orbit raising
- In-orbit service mission
- Interplanetary transportation

Partners

THALES ALENIA SPACE – France & Belgium

Leader in space telecommunications, navigation, Earth observation, exploration and orbital infrastructures

SITAEL – Italy

Design, Development and Production of Small Satellites, Advanced Propulsion Systems, Instruments and Avionics

THALES – Germany

Designs and manufactures Traveling-Wave Tubes, space amplifiers and ion thrusters

UC3M – Spain

Plasmas and Space Propulsion Team – Modeling, simulation and testing of plasma thruster technologies

EFFICIENT INNOVATION – France

Innovation Funding Consulting Company

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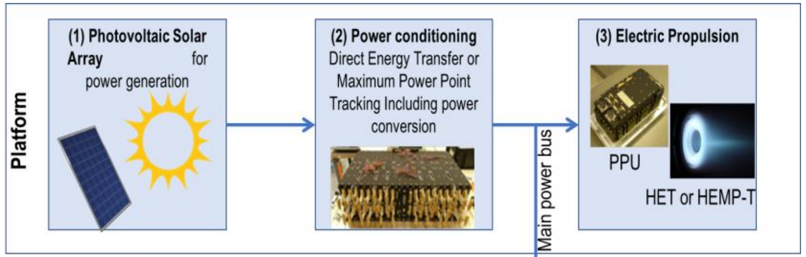
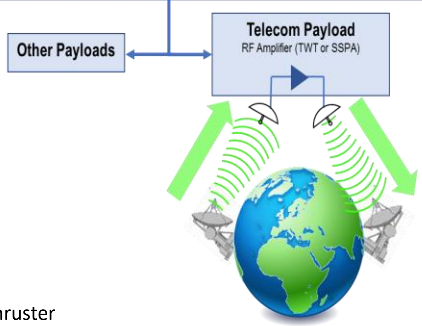
Electric Propulsion Challenges

Electric propulsion represents one of the major power-demanding subsystems for a spacecraft and drives almost all the subsystems architecture. That is why space industry is continuously seeking innovative technologies and architectures that help facing the increasing demand on compactness, cost reduction, performance, and flexibility



The power system of a satellite is composed of (1) a solar array (SA) to generate the electric power, (2) a power conditionning unit (PCU) which extract the power from SA, charge the battery, and provide power to the satellite.
For (3) electric propulsion (EP) the power processing unit (PPU) is in charge of voltage conversion for thruster power supply. Direct-drive aims at simplifying the PPU for better performances



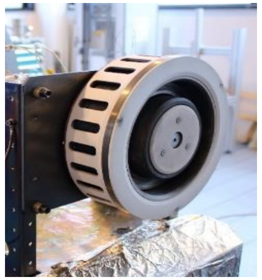
HET : Hall-Effect Thruster
HEMP-T : High-Efficiency Multi Plasma Thruster

Yet the power chain efficiency is not perfect : power electronics which ensure voltage conversion between the voltage bus (usually 100V) and the thrusters dissipate solar energy into heat (up to 10%) thereby increasing the complexity of thermal control subsystems in addition to not exploiting all the energy extracted from solar arrays.

EDDA Concept

Leveraging the know-how acquired in other Research & Innovation projects (H2020 HV-EPSA, H2020 CHEOPS, ESA ARTES 100kW), EDDA consortium aims to design a direct drive architecture power chain for Electric Propulsion Systems with a high voltage bus (between 300 to 400V).

As game-changing concept, the direct connection between solar arrays and the thrusters (i.e removal of power converters) will maximize the efficiency of the power chain (less power losses) while simplifying its overall architecture thereby saving mass and costs. EDDA direct-drive will be validated on 2 types of thrusters : Hall-Effect Thrusters (HET) and High-Efficiency Multi Plasma Thrusters (HEMP-T).



HT5k-TU DM3 (SITAEL)

THR30250 HEMP (THALES-D)

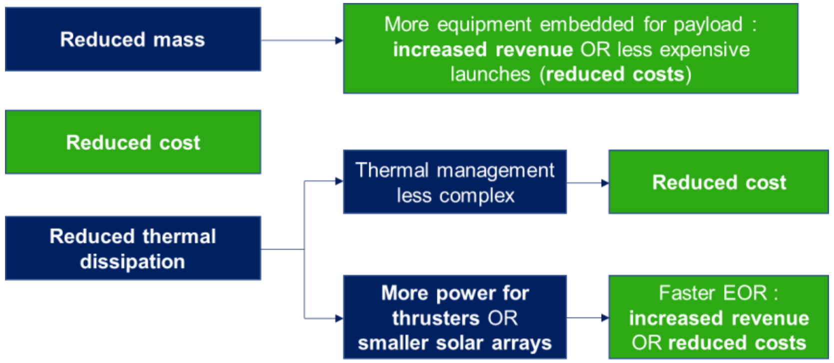
Key Performances Indicators	State-of-the-art	EDDA objectives
Power extracted from Solar Array	90%	100%
PPU efficiency	95%	>99%
PPU Mass and cost saving	/	-50%
Direct-Drive Architecture maturity	TRL2	TRL4

Benefits & Market applications

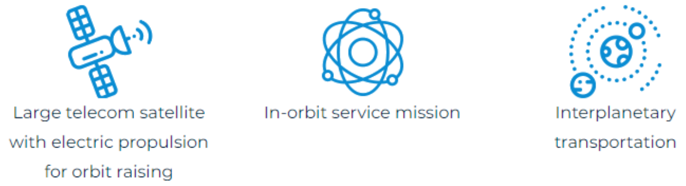
The direct impacts of direct-drive architecture are :

1. Mass reduction
2. Cost savings
3. Less thermal dissipation

Subsequent benefits for space propulsion are :



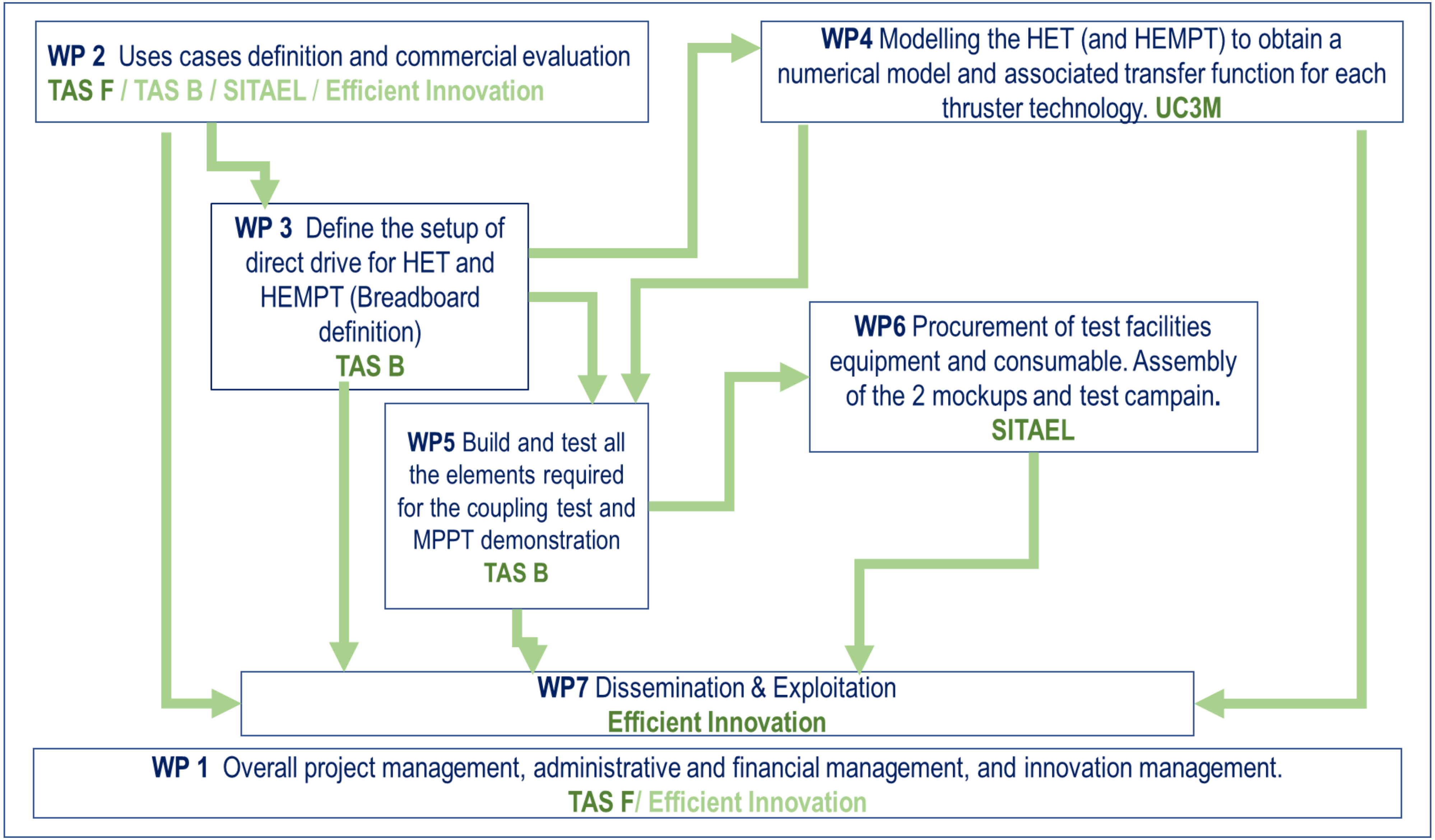
Direct Drive Architecture will allow the emergence of next-generation satellites & new space missions :



Market applications

On-orbit demonstration will be investigated after the project (starting 2023).

Work Plan


WP 2 Uses cases definition and commercial evaluation
TAS F / TAS B / SITAEL / Efficient Innovation
WP4 Modelling the HET (and HEMPT) to obtain a numerical model and associated transfer function for each thruster technology. UC3M
WP 3 Define the setup of direct drive for HET and HEMPT (Breadboard definition)
TAS B
WP6 Procurement of test facilities equipment and consumable. Assembly of the 2 mockups and test campain.
SITAEL
WP5 Build and test all the elements required for the coupling test and MPPT demonstration
TAS B
WP7 Dissemination & Exploitation
Efficient Innovation
WP 1 Overall project management, administrative and financial management, and innovation management.
TAS F/ Efficient Innovation