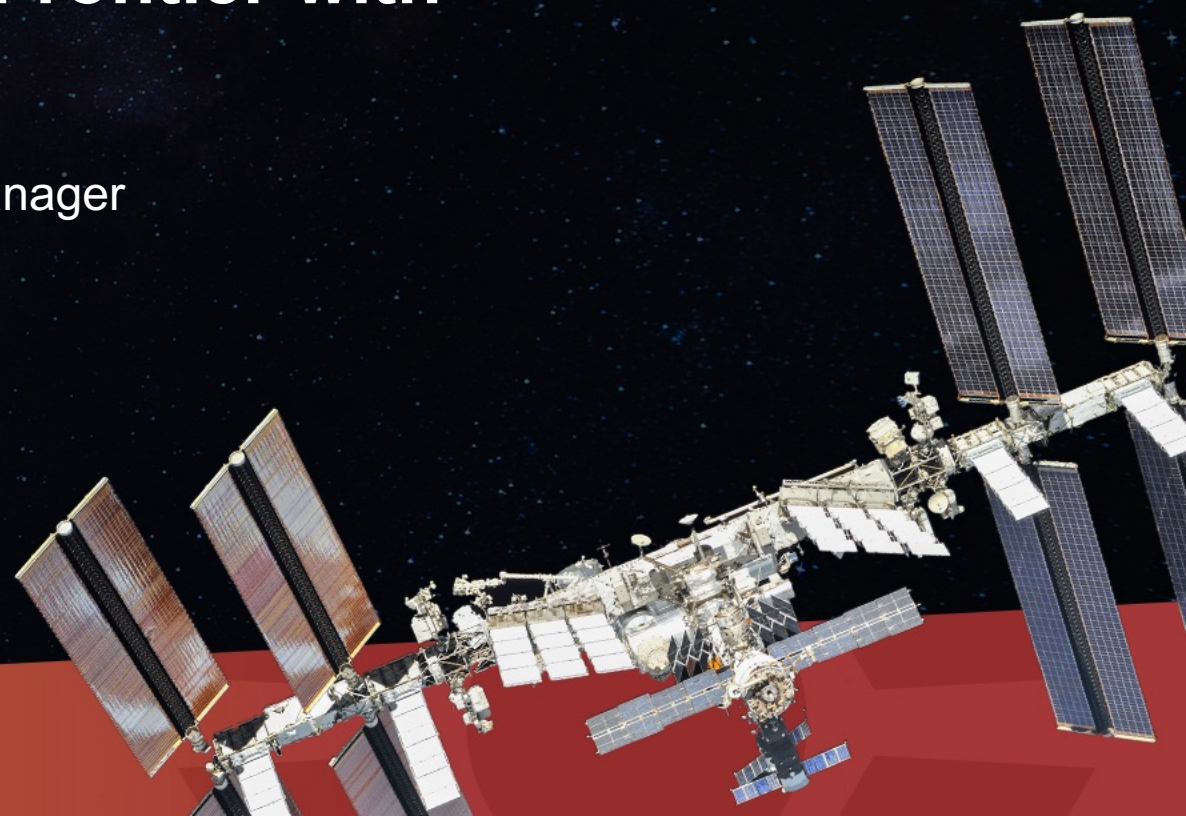
ISSRDC

ESA Space Rider:

Supporting a New Space Frontier with Unmanned Vehicles

F. Caramelli
Space Rider Payloads and Exploitation Manager



AIRBUS
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COMMERCIAL AND INSTITUTIONAL UNCREWED TRANSPORTATION SYSTEM

A NEW PARADIGM FOR TECHNOLOGY PROGRAMS

In Order to Take Action and Achieve a New Paradigm for Technology Projects, ESA has Identified Four Major Pillars:

I. Engagement
II. Interoperability
III. Scalability
IV. Partnership

SPACE RIDER FOUR PILLAR STRATEGY AND ACTION PLAN

First Pillar: **ENGAGEMENT**

- CONNECT ECOSYSTEM MEMBERS
- ALIGN TO TERRESTRIAL ENGAGEMENT MODELS
- MARKETING AND BUSINESS DEVELOPMENT WITH END USERS

Second Pillar: **INTEROPERABILITY**

- SYSTEM OF SYSTEMS CULTURE
- TECH/PROG BEST PRACTICES
- STANDARDS AMONG STAKEHOLDERS
- REALISTIC ACCESSIBILITY
- ENABLING TECHNOLOGIES

Third Pillar: **SCALABILITY**

- FOCUS ON AUTOMATED FLEXIBILITY
- COMPLEMENT MANNED PLATFORMS
- PROVIDE FLEX TECH SOLUTIONS
- FOCUS LIFE SCIENCE & MANUFACTURING
- SERVICES STEPPED UPGRADE

Fourth Pillar: **PARTNERSHIP**

- PUBLIC PRIVATE PARTNERSHIPS
- SUB-AGGREGATOR PARTNERSHIPS
- IOS STAKEHOLDERS AGREEMENTS
- SYSTEM PARTNERSHIPS

SPACE RIDER COMMERCIAL SEGMENTS

SPACE RIDER has multiple offerings geared towards 5 segments

SR Transportation System

- Transportation Vehicle to support Commercial Service Provider Facilities and Capability

SR Qualification System

- Pre-eminent IOV and IOD qualification platform

SR ISS Complement

- Options for oversubscribed and soon to be de-commissioned ISS

Microgravity as a Service

- Platform that supports a wide range of life and physical science applications

In-Orbit Servicing

- Pioneering the interoperability in LEO platforms

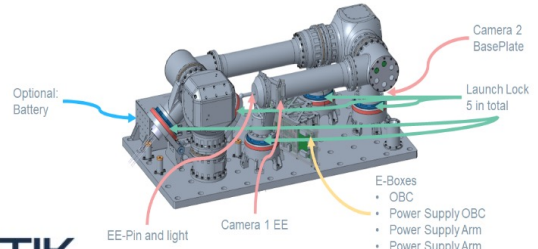
PILLAR TWO: INTEROPERABILITY

Space Rider as **IOS / CPO**

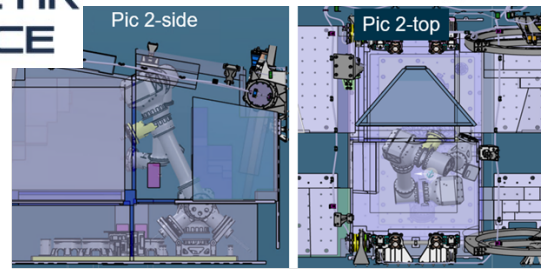
System studies ongoing and tech. dev. roadmap in preparation

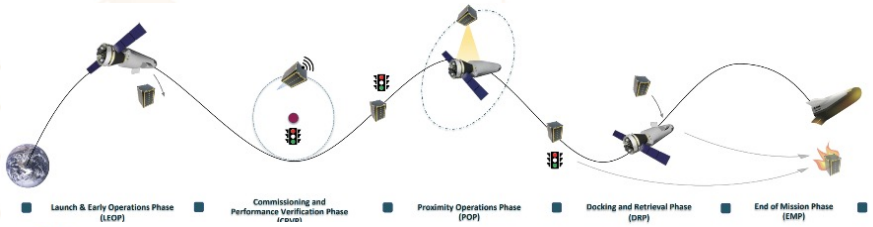
Following partner projects collaborations ongoing or offered by Space Rider

- Deploy and Retrieval: TYVAK SROC (Space Rider Observation Cubesat)
- Joint Operations: SAB IOSHEX, **Kinetik**, PIAP, Space Villages

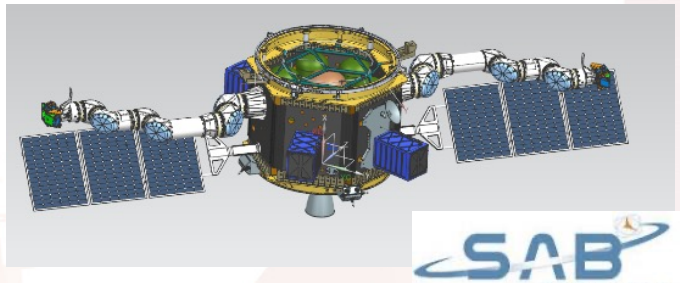


KINETIK SPACE





Tyvak International
A Terran Orbital Corporation

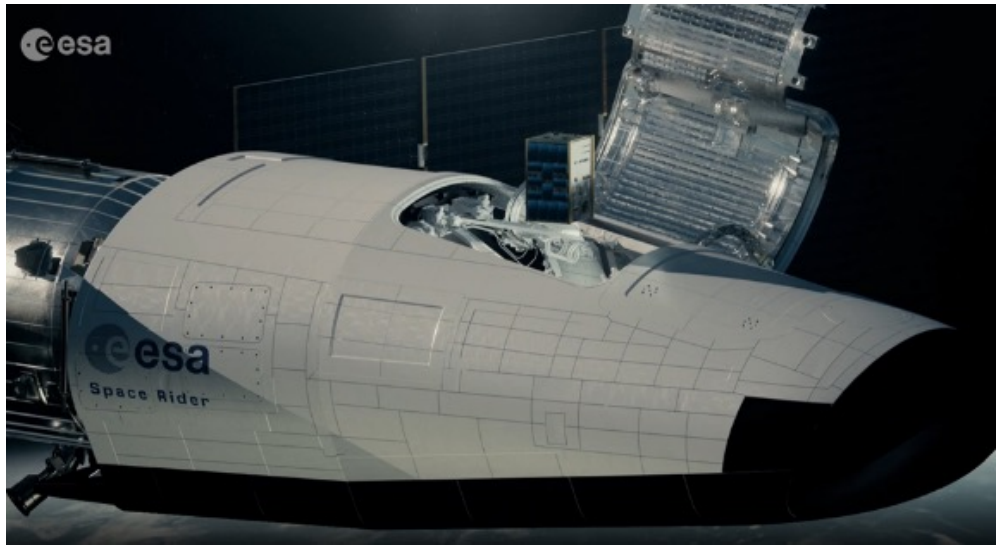


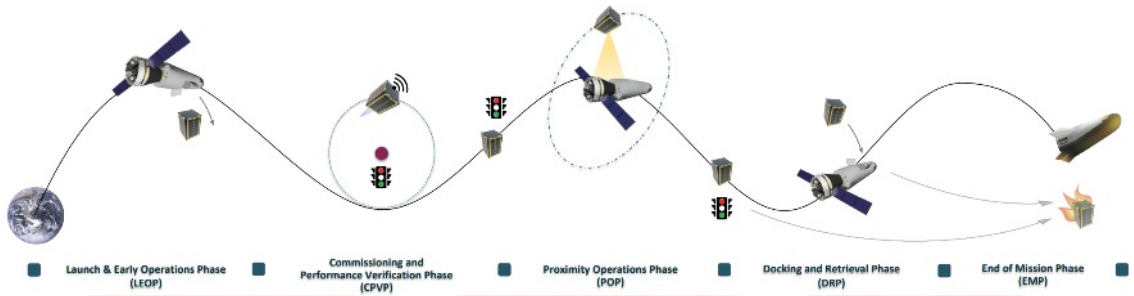
SAB Aerospace

PIAP SPACE

PILLAR TWO: INTEROPERABILITY

- The **Space Rider Observation Cube** (**SROC**), an ESA technology demonstration mission.
- Based on a CubeSat deployed from Space Rider, to perform **inspection**, **rendezvous** and **dock** with **dedicated retrieval mechanism** hosted in the SR cargo-bay
- SROC will allow the development of **in-orbit demonstration** technologies and capabilities for **small-satellite proximity operations**, with a particular focus on **propulsion**, **GNC**, and **docking/retrieval mechanisms**





Tyvak International
A Terran Orbital Corporation

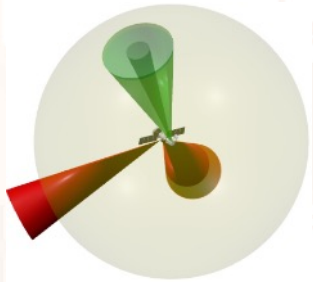
Politecnico di Torino

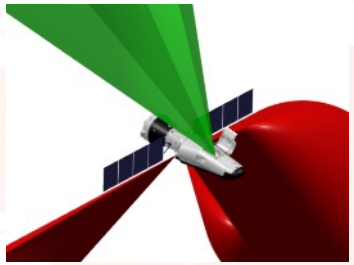
Università degli Studi di Padova

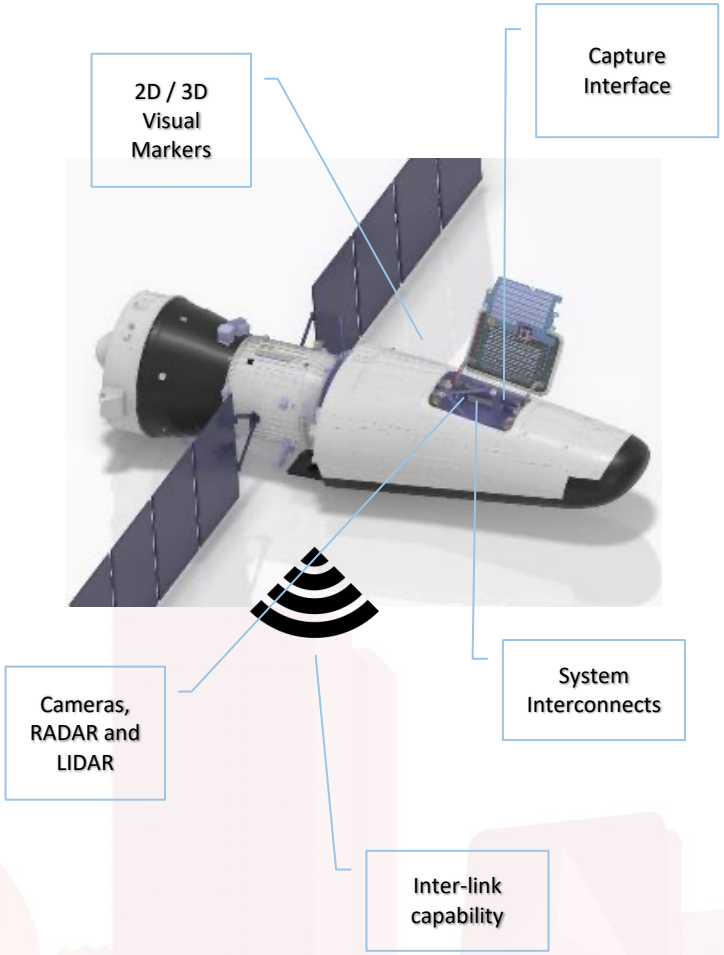
STELLAR PROJECT

INTERFACE STUDIES

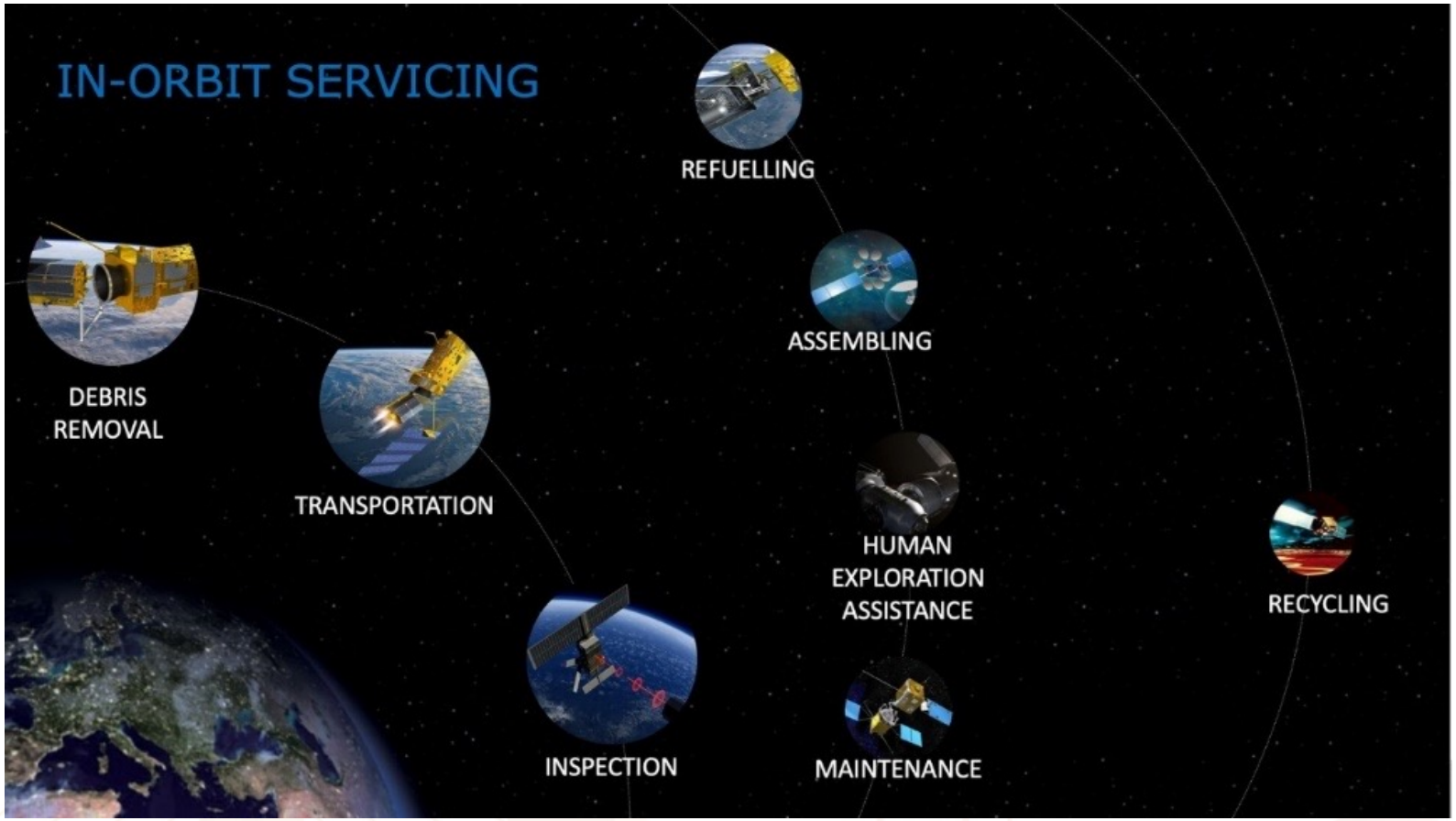
- **Visual Markers**: 2D/3D visual markers
- **Cameras, RADAR, LIDAR**: high-resolution, low latency camera and/or RADAR/LIDAR sub-systems.
- **Mechanical Capture / Grappling Interfaces**: mechanical fixture
- **System Interconnects**: advanced interface for exchanging power, data, and other services (e.g., fuels)
- **Standard-based Data and T&C Inter-link**: chaser / target inter-link for communication of vital T&C for CPO in a cooperative scenario and GNC co-ordination.
- Vehicle **parameters** for a **reference CPO configuration**
  - ***Approach Zone***
  - ***Keep-out Zone***
  - ***Approach Corridor(s)***
  - ***forbidden zones***





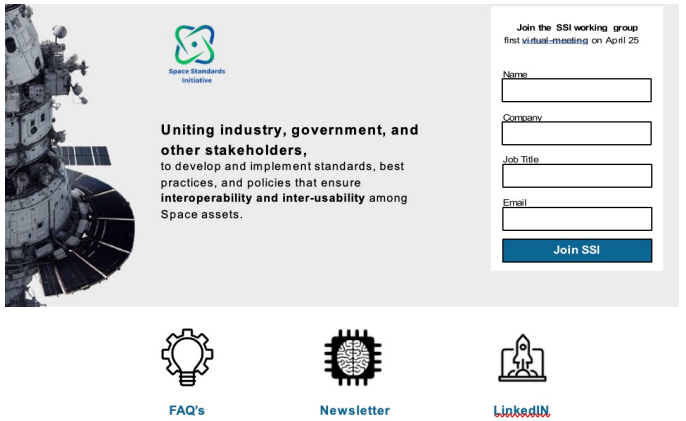


SYSTEM STUDIES



- Technologies & Deploy (and Retrieval) of P/Ls
- Rendez-vous, Docking / Berthing and Joint Operations
- Inspection, Refurbishment, Assembly and Manufacturing

And Creation of a
Space Rider digital platform

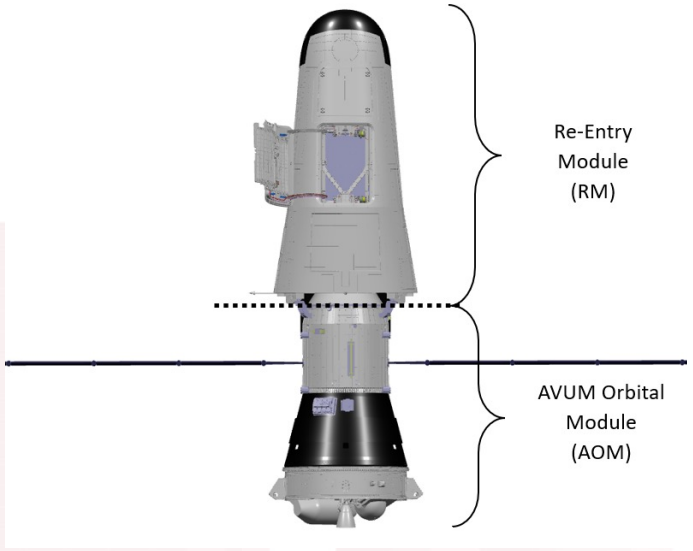


SPACE RIDER TRANSPORTATION SYSTEM

- The first European **affordable**, **independent**, **re-usable**, **uncrewed end-to-end commercial transportation system** for **routine access** to and **return** from LEO.

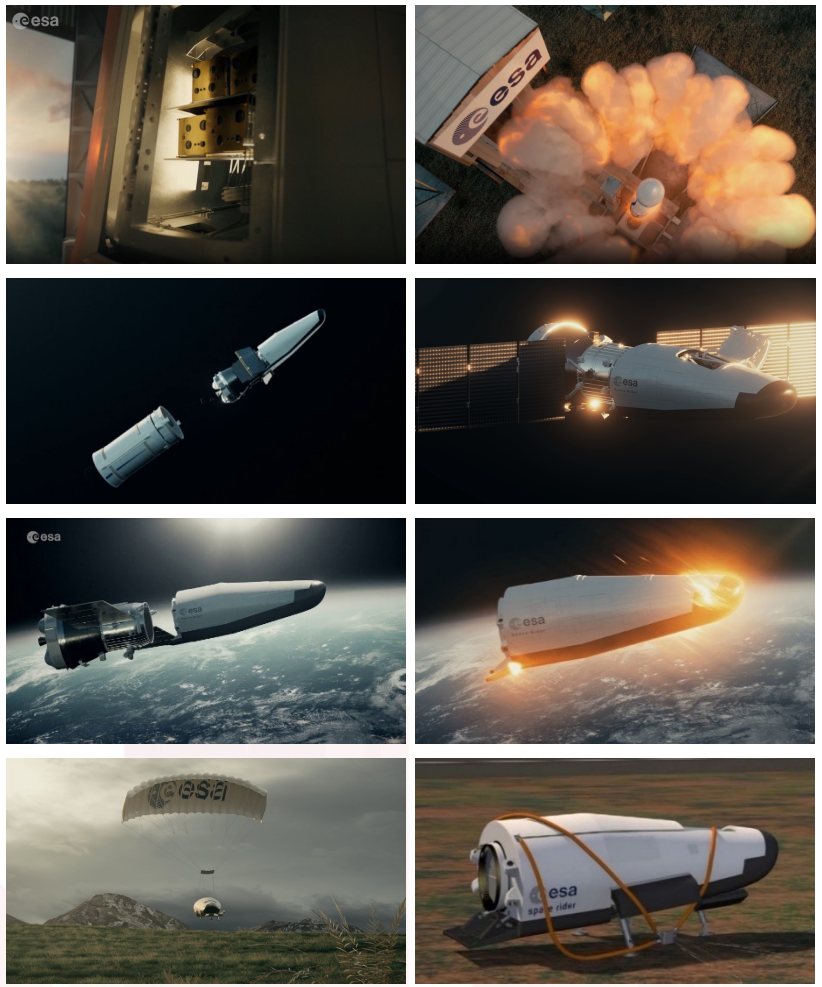
- **Space Rider (SR) vehicle:** uncrewed robotic laboratory (part of SRS) composed by a **re-entry module** (**RM**) built by **TAS-I** and an **orbital module** (**AOM**) built by **AVIO**. Hosts P/Ls for an **array of applications**, **orbit altitudes** and **inclinations** (w.r.t. performance of the launcher), and **mission durations**.

- In orbit for about **two months**, while **performing experiments** inside its cargo bay such as technology demonstration and research activities in different fields (e.g., pharmaceutics, biology, physical science, ...) communicating with the **Ground Segment** for **orbital vehicle control** (by **Telespazio**) and **P/Ls data & landing management** (by **ALTEC**).

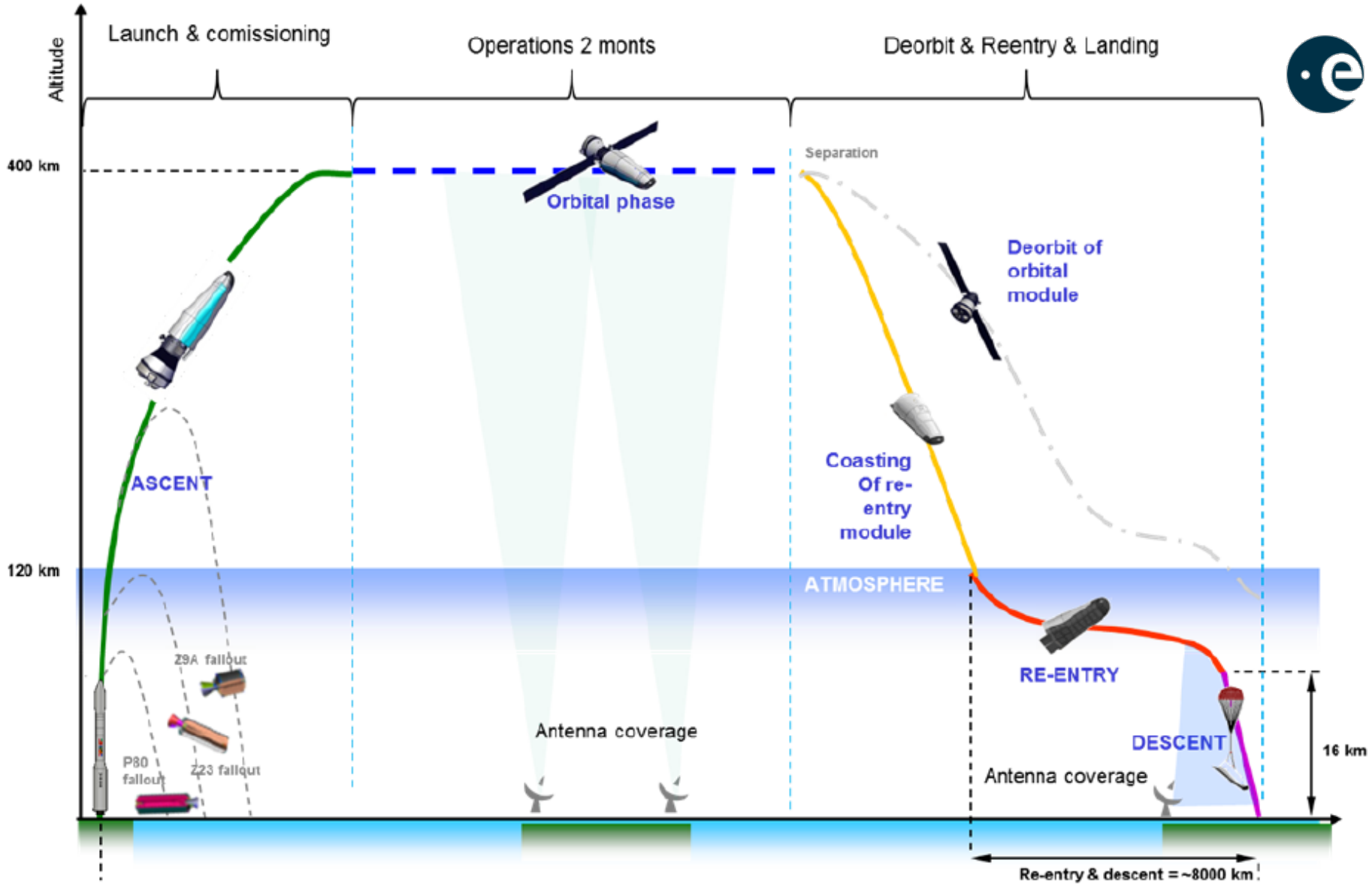


MISSION CONOPS

- **Pre-launch**: pre-integration and tests, transport to launch site final integration and tests, installation on launcher and transport to launch pad;
- **Launch and ascent**: launch vehicle mission, into near-circular orbit nominal inclinations (5-55°), extendable up to SSO;
- **Orbital flight:** payloads operations for a period of two months and more, each orbit lasting approximately 90 minutes;
- **De-orbiting**: reconfiguration of the Space Rider vehicle for deorbit, execution of the deorbit manoeuvre, separation of AOM and RM;
- **Re-entry and Landing**: AOM destruction and RM re-entry going from hypersonic to transonic flights till the deployment of a subsonic parachute at an altitude of 6-10 Km (M=0.2), followed by the triggering of a guided parafoil for a controlled descent till the landing site.
- **Post-Landing**: P/Ls retrieval, RM moved to refurbishment facilities;
- **Post-Flight**: RM inspection, analysis and refurbishment for next flight. The turn-over time is six-month. The RM is designed to perform 6 flights.

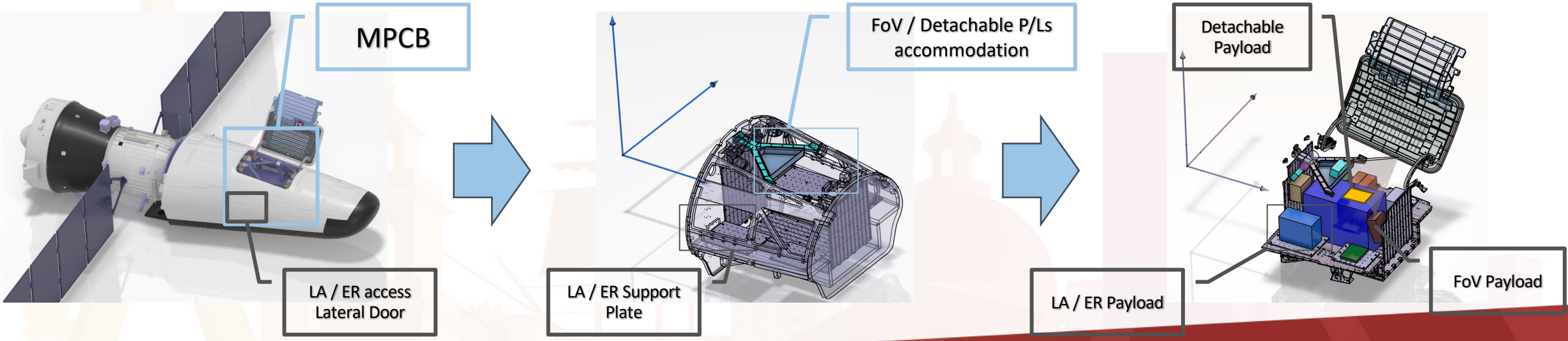


MISSION PROFILE



Multi Purpose Cargo Bay (MPCB)

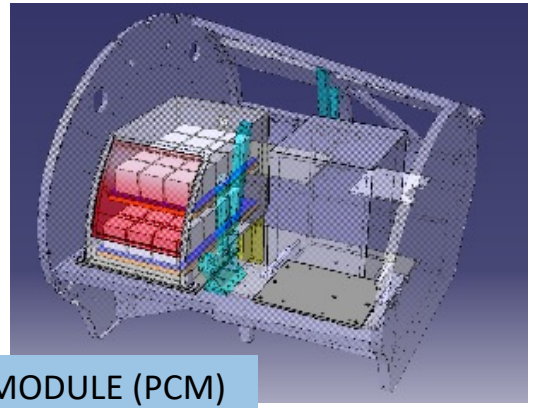
- Accommodation of **multiple P/L configurations**, **sealed** or **vented** P/Ls **directly** or **partially exposed** to space environment (e.g., direct illumination, FoV, …) **movable** or **detachable** (released from cargo-bay).
- Geometrical volume up to **1.2 m^3**, up to **600 Kg** of P/Ls instruments mass.
- Equipped with **power** and **data lines** plus **7 payload Support Plates** (**SP**) which purposes are to be:
  - Mechanical standardized fixing interface between the P/L and the RM cold structure.
  - Thermal conductive path between the P/L and the RM Thermal Control System.
- **Late-Access** (**LA**) and **Early-Retrieval** (**ER**) for environmental sensitive P/Ls, integration and retrieval through RM lateral doors dedicated access to the outer face of P/Ls mounted on LA/ER MPCB support plates.



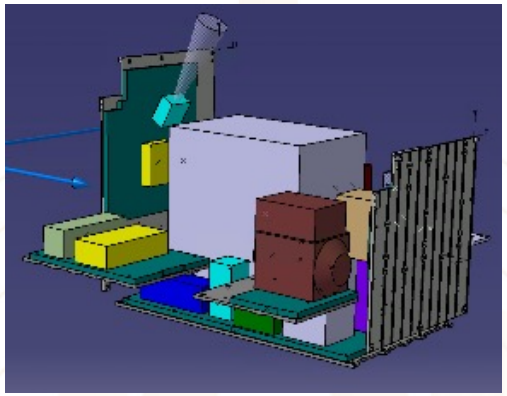
CARGO BAY FOR MAIDEN FLIGHT

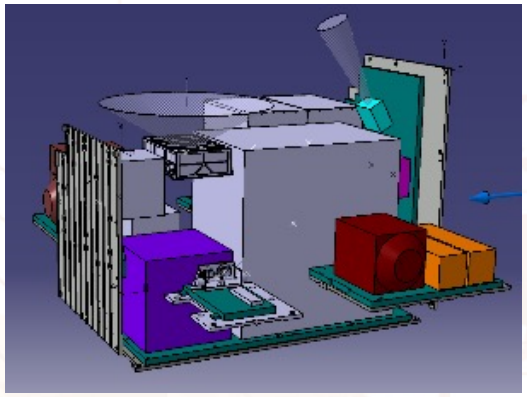
Space Rider **Payloads Aggregate** design for the **Maiden Flight** is currently **on going:**

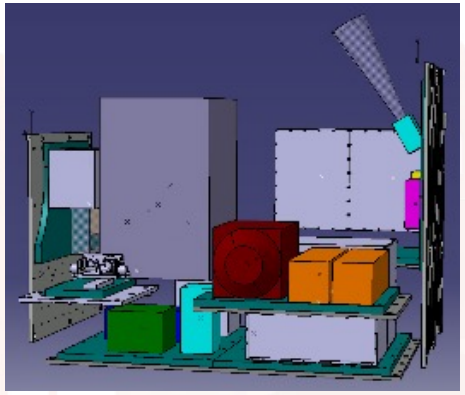
- **20 Payloads** from both **commercial** and **institutional** customers are at the moment on board, representing various typologies of experiments:
  - ✓ **Pharma/biotech micro-g R&D**
  - ✓ **Technology IOV/IOD**
  - ✓ **Physical science, remote sensing**
  - ✓ **In-orbit operation technologies and processes**
- Continuous update of Aggregate Payloads composition according to End Users evolution is on going

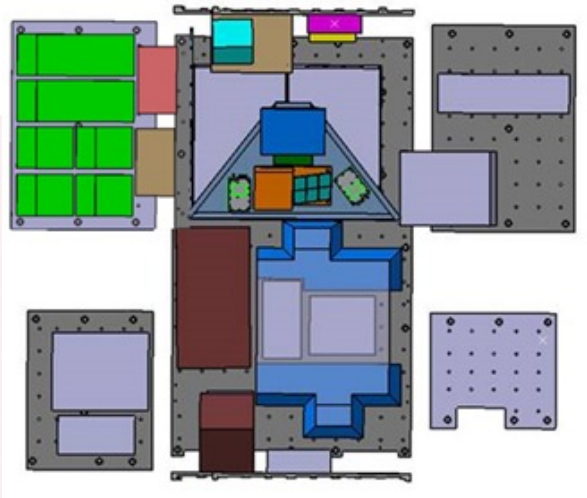


PRESSURISED CARGO MODULE (PCM)

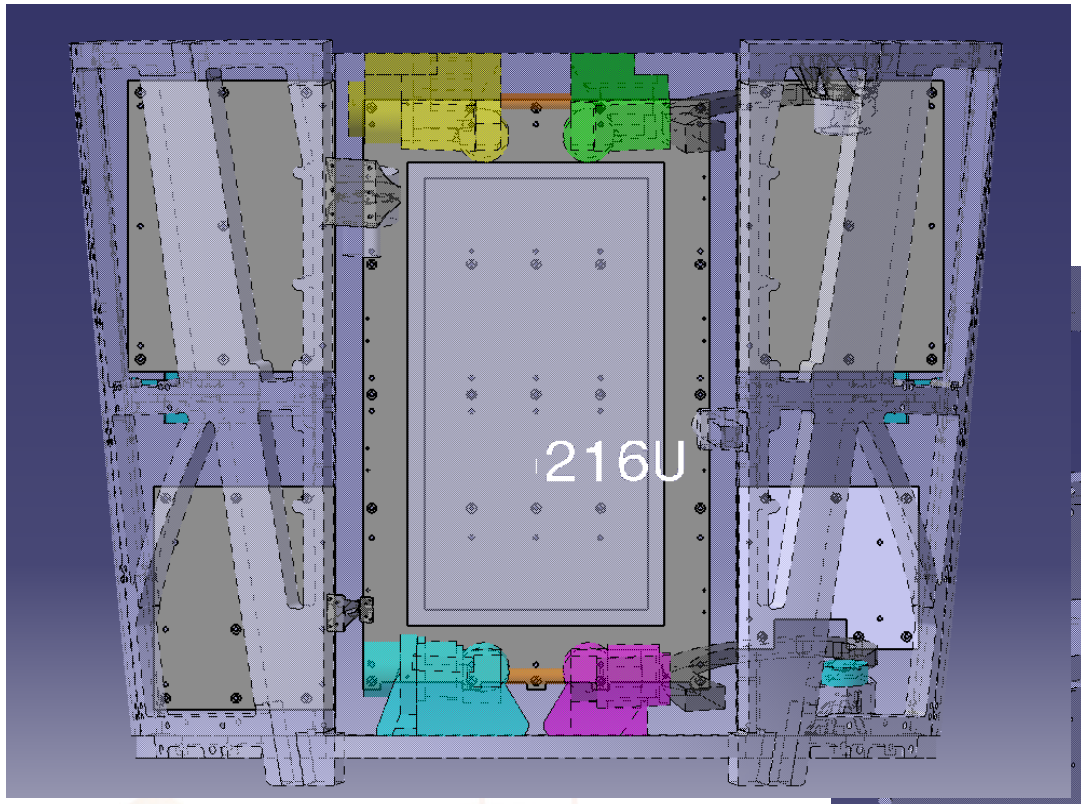


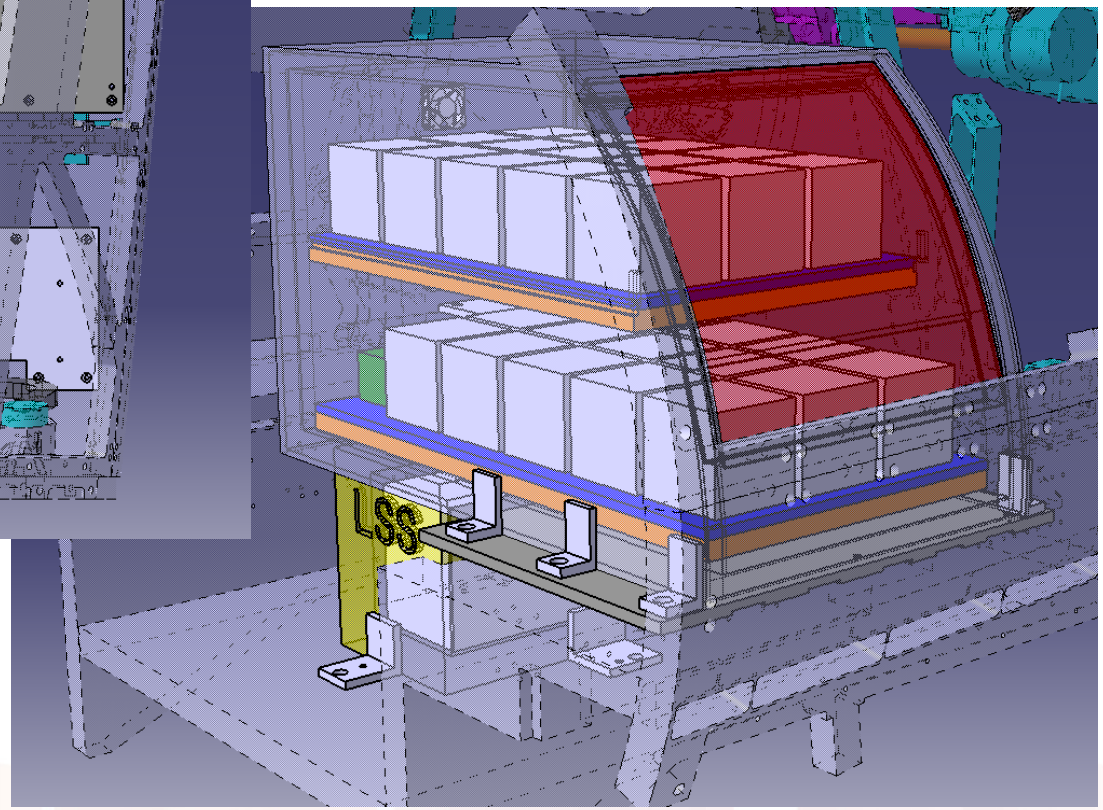






FOCUS PRESSURISED CARGO MODULE





PCM CONFIGURATIONS FOR

FACTORY MODULE in central cargo bay

LATE ACCESS MODULE in 2 late access lareral cargo bays

Courtesy: Voyager Space Europe

PAYLOAD USER GUIDE

CONTENTS

- Project highlights
- Cargo Bay Payload environment
- Payload Services
- Payload Operational cycle

ISSUES

- Issue 1 dated 09/09/2021 available
- Issue 2 dated 12/12/2023 released to the pub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USER GUIDE

for the SPACE RIDER Re-usable Free Flyer Platform

Prepared by	Space Rider Team
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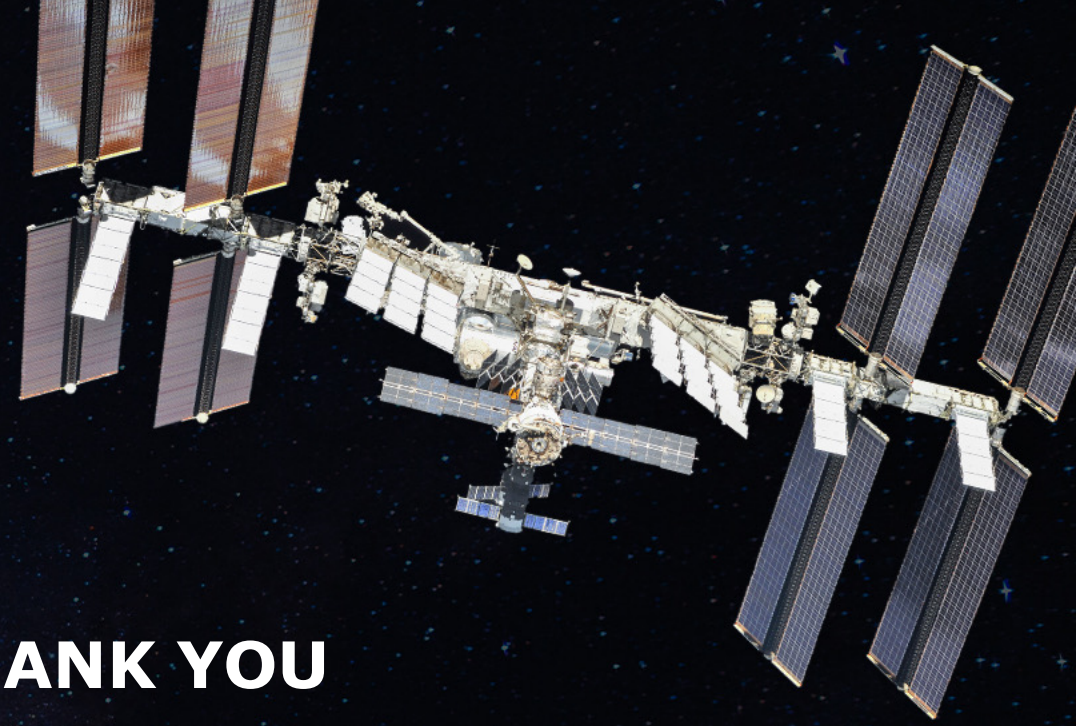
European Space Agency
Agence spatiale européenne



THANK YOU

Contacts:
STS/PS Fabio Caramelli - ESA/ESRIN
fabio.caramelli@esa.int

SCM Cynthia Bouthot….

SCM Jose Salgado….

Thanks to Cyndy and Jose for their invaluable contribution