

A vertical image of an ESA Vega rocket is positioned on the left side of the slide. The rocket is white with a yellow and red stripe near the base. It features the ESA logo and the word "esa" in a stylized font. The rocket is shown from the bottom, with a bright orange and yellow flame at its base.

9TH EUCASS CONFERENCE

EUROPEAN LAUNCHERS: PREPARING THE FUTURE

June, 29th , 2022

Claudio Ferraris (AVIO)

Head of System Synthesis, Processes and Studies

INDEX

1. Company Overview
2. Vega/VegaC transition
3. VegaE
4. Special Services: Small&NanoSats, re-entry and IOS
5. Roadmap



Company Overview – Avio: a pure player in Space launchers



- 
- 320 M€ revenues
 - 1.100 employees
 - 300 M€ Mkt Cap
 - 60% free float
 - 4% Mgmt share



Ariane 6

NEW



Vega C



- European heavy launcher (10.5 tons in GTO)
- Avio: partner and supplier for strap-on boosters

- European light launcher (1.5 tons in LEO)
- Avio: developer, manufacturer, launcher system integrator

COMPANY OVERVIEW ENGINEERING AND INDUSTRIAL OPERATIONS IN EUROPE AND FRENCH GUIANA



Paris, France

Headquarters of Europropulsion (50% Avio and 50% AG), main contractor of the solid-propellant motors for Ariane 5 and Ariane 6.



Colleferro, Italy

The Company's Headquarters and production plants of solid/liquid propellant motors for Launch Vehicles.

Turin, Italy

Avio design and produce the Lox turbopump for the Vulcain and Vinci Engines (A5 and A6)



Kourou – CSG, French Guiana

Avio runs three facilities: (i) REGULUS for propellant manufacturing and casting, (ii) EUROPROPULSION for stages' final integration and (iii) Avio GUIANA for Vega stages' integration and launch operations.



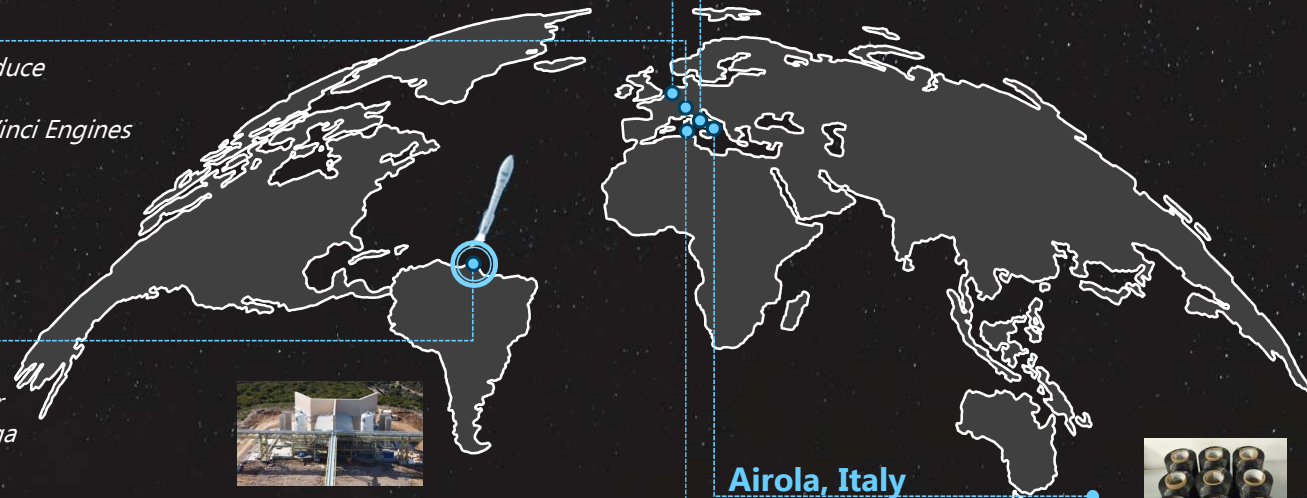
SPTF, Sardinia - Italy

Space Propulsion Test facility, for green, cryogenic Liquid Engine bench testing



Airola, Italy

Carbon fiber impregnation facility.



Company Overview – OUR Products, technologies and capabilities



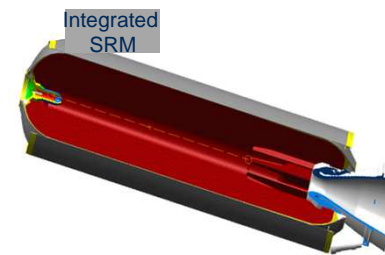
Raw Materials



Booster Cases, Interstages, Nozzles



Solid Propulsion



Liquid Propulsion

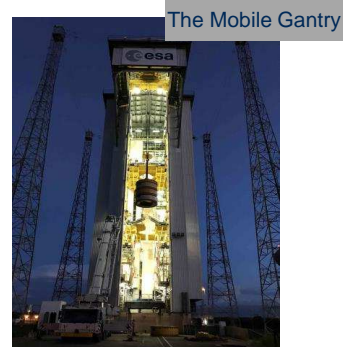


Company Overview – OUR Products, technologies and capabilities

Assembling



Integration



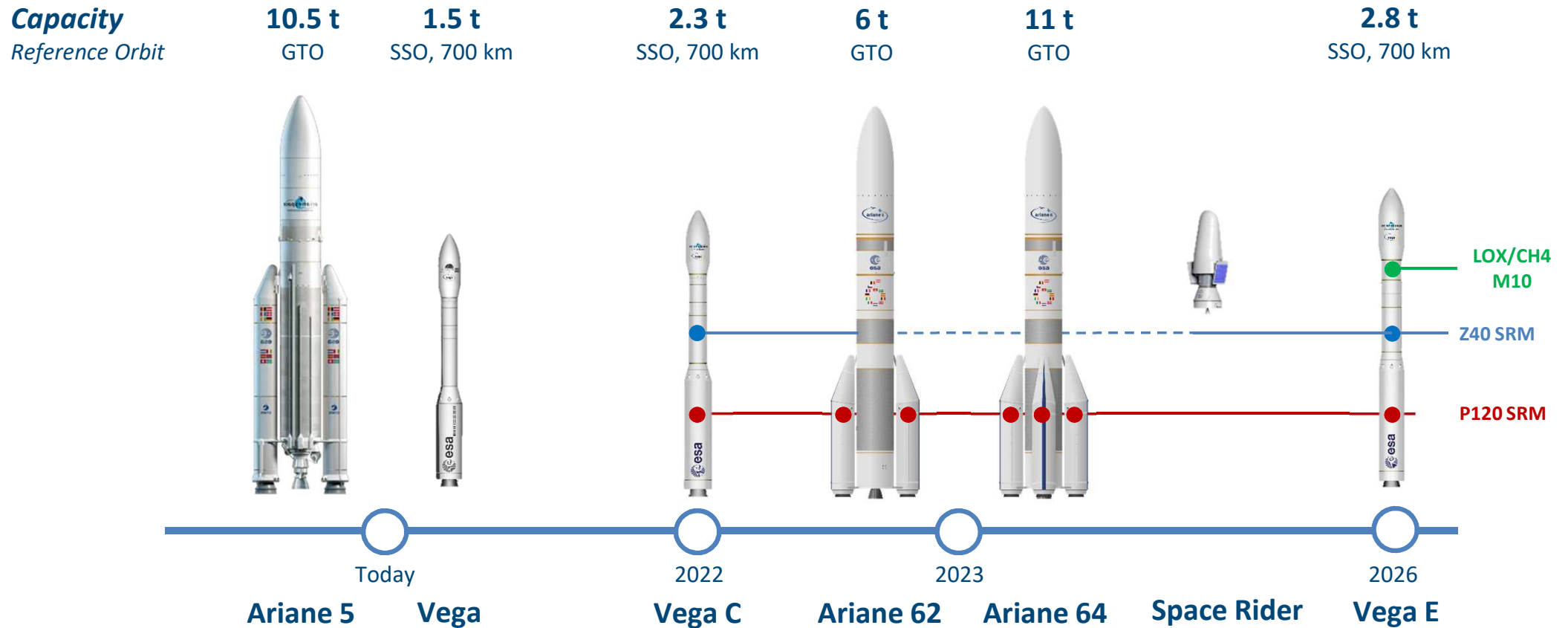
Testing



Launch Operations



Company Overview – Avio in Orbit: the European fleet



Vega/VegaC transition - Vega missions proving high flexibility for payload accommodation

Vega VV16



~1,000 kg

**Rideshare
(SSMS)**

Vega VV19



~1,000 kg

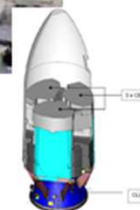
**Main passenger +
auxiliary payloads**

Vega VV20



~1,350 kg

**3 Main passengers
Ceres constellations**



Vega/VegaC transition - Vega C Maiden Flight

Vega C preparations



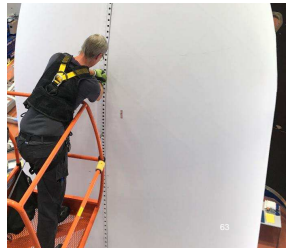
P120 motor flight item



Z40 motor flight item



Z9 motor flight item





Fairing flight item



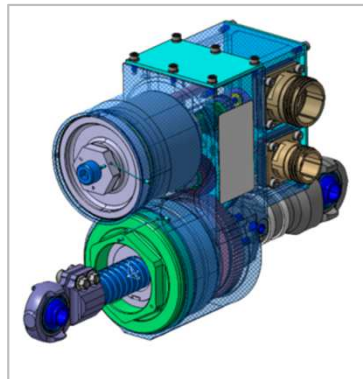
Vega/VegaC transition - VegaC Improvements

New products and solutions to reduce related costs

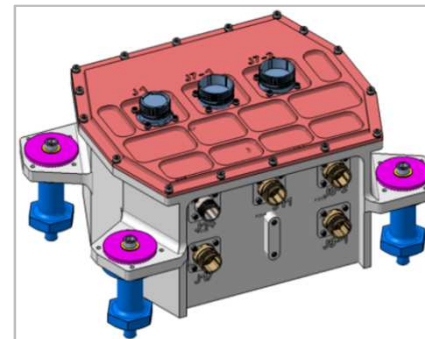
2023	2024	2025	2026	2027	2028
 - Vespa R	 - TM-TX (Temis) - IS23 cost reduct - Z9 Thermal Battery (SABCA) - EMA europeo (SABCA) - T800	 - Common IPDU Avum - P120+	 - Common IPDU Avum Z9		- VNE



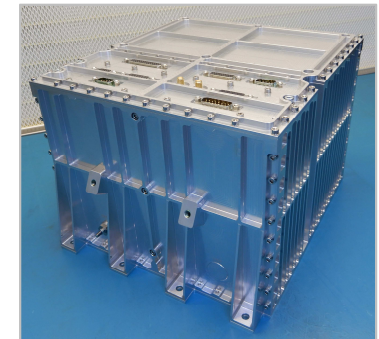
T800
Carbon
Fibers



European
EMA



COMMON IPDU



VNE

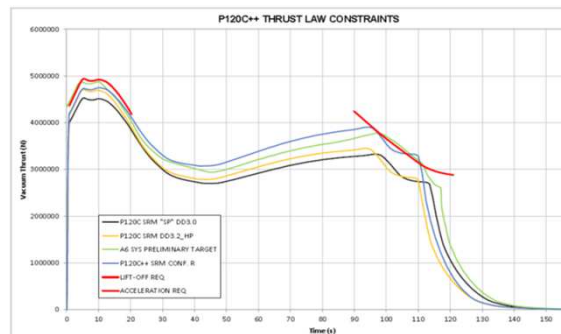
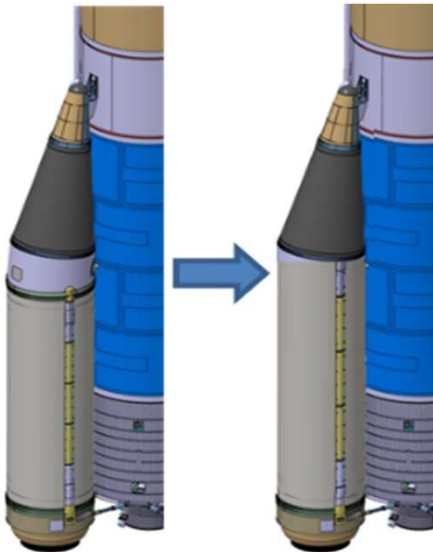
Vega/VegaC transition - Increase perfo and contribute to the Kuiper Constellation deployment

P120+ SRM D&Q

- IMC: 1m longer, iso-diam.
- LMC: +14t prop. loading
- Δ perfo Vega C+: +200 kg
- Price/kg reduction: 10%

Kuiper Constellation Deployment with A64

- 2 Ariane 64 Flights (8 P120 boosters)
- 16 Ariane 64+ Flights (64 P120 C+ boosters)



Vega E - development

Vega E development

- Development contract signed with ESA
- Improved version of Vega with a new **LOX-CH** upper stage engine replacing the last 2 stages of Vega C
- Further improved performance, flexibility and cost competitiveness
- Maiden Flight expected in 2026



Vega E

SPTF completion

- Firing test facility for liquid rocket engines
- Construction works completed
- Commissioning under way
- TPC M10 firing tests completed



Comb. chamber



SPTF

Vega E - critical developments



Vega E at completion

Launch system

- Launch System activities (synthesis, GNC, propulsion, mechanics, avionics, ...)
- Flight Qualification Review
- Maiden Flight preparation and execution (excluding HW)

Launcher system

- Completion of Phases from C to E1
- Qualification of M10 engine, cryo tanks, avionics, IS 2-3, PLA, PLF, Non-detonc SepSys, safety S/S
- EQSR of reused components
- Launcher System AIT

Launch complex

- Development Phases from C to E1
- Civil works and mechanical, fluid (cryo), avionics ground systems
- Ground support for facilities and applicative software

Vega E: full scale M10 firing test completed



M10
LOX-CH
Upper stage



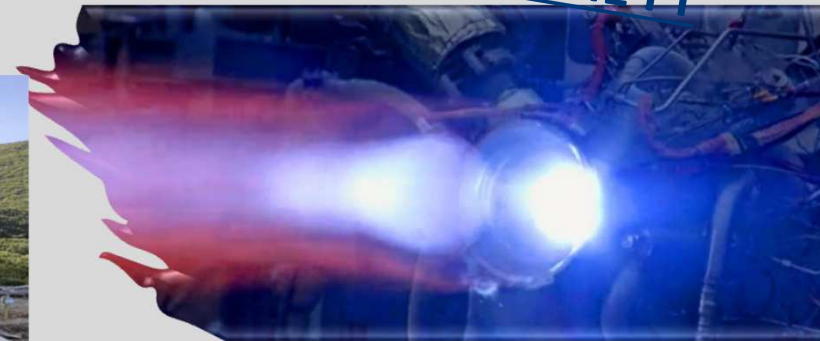
2026 - MF



2022 - M10 DM1 FT



SPTF - 2021
completed



2018 – Reduced
scale FT

2020 – 1st Full
scale test

2022 – M10
DM1 test

2026 - MF

14

Special Services - LAUNCH SERVICE MISSION PROFILES

Solution

Piggy Back / Rideshare

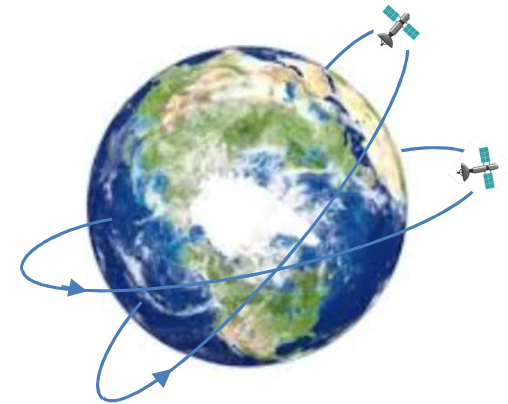
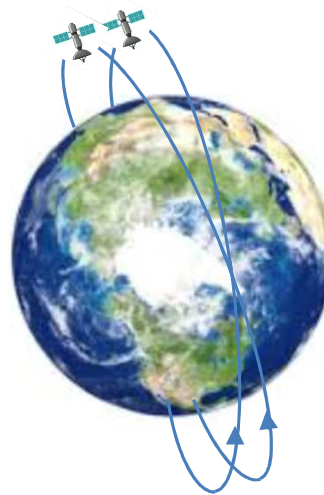
Dedicated Launch

Traditional SSO (midday/midnight)
i≈96deg @500km LTAN≈10:30

Non-Traditional SSO (dawn/dusk)
i≈96deg @300-700km LTAN≈16:30

Mid-to-Equatorial Inclinations
i≈5-70deg @300-500km

Orbit



Site

Any

Any

Mid-Low Latitudes

Standard Missions / Large Constellations

Less Frequent Needs

Unique / Specific Requirements



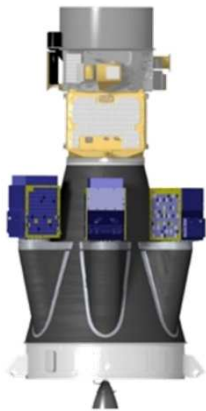
AVIO SpA- All rights reserved – subject to the restrictions of last page.

Special Services - Launch service offer types for Small&nanoSats

PIGGYBACK



Service offered from Small/Medium LVs with main passenger selecting destination orbit (Vega C)



RIDESHARE



Service offered from Small/Medium LVs by means of dedicated structures (Vega C SSMS) with orbit shared between the Customers



DEDICATED



Micro/Mini Launch Vehicle: dedicated launch in uncommon orbits covering specific needs

Special Services - Experience with smallsats

- Avio offers a plethora of possible different missions for Smallsats from **rideshare** to **piggyback**.
- The versatile product providing Vega family launchers with this offers is SSMS (Small Spacecraft Mission Service):
- SSMS successes:
 - VV16 → more than 50 satellites for 21 customers (**rideshare** mission)
 - VV18 → Pléiades Neo 3 satellite along with five auxiliary payloads through the **piggyback** mission
- Vega-C SSMS planned in early 2023



Special Services - Space Rider: Performing the 1st mission and preparing the future

Maiden Flight and 1st Re-Flight

- Vega C Flight for SR
- 2 months-In orbit operations
- Return to Earth
- Refurbishment and re-flight

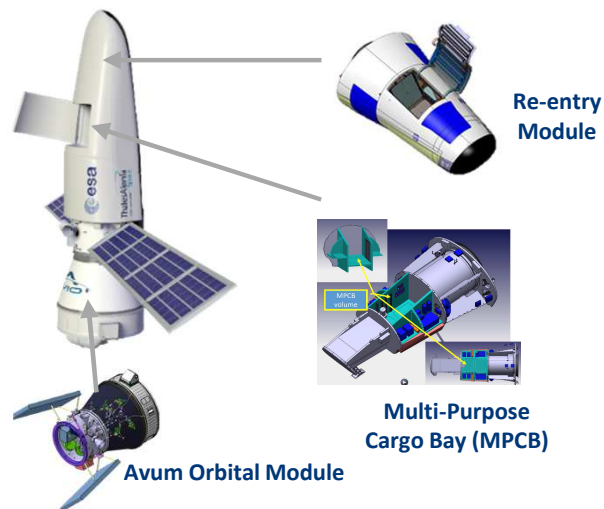
SR Evolution

- Vega E compatibility & extension of reusability
- Development of a new Orbital Service Module
- Enable SR-Evo to perform IoS operations
- 30% increase in payload and 30% reduction in recurring cost

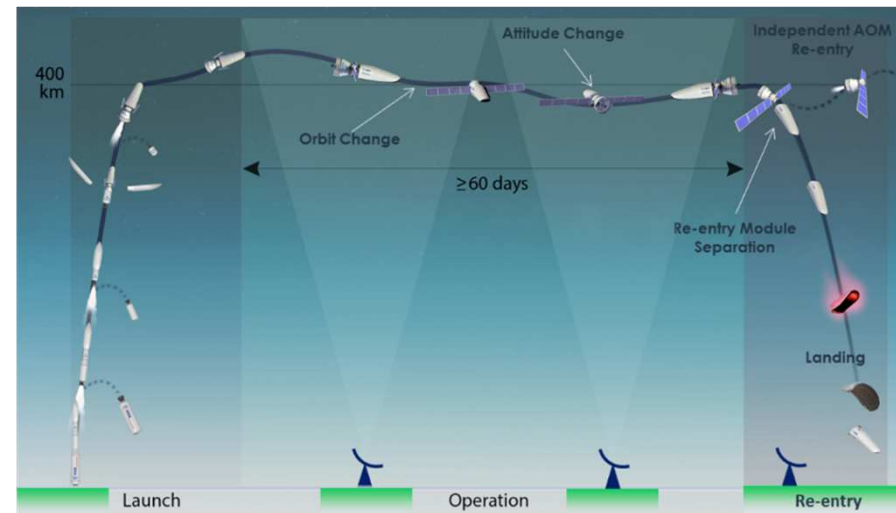


Special Services - Space Rider: the re-usable orbital and re-entry vehicle

Space Rider Configuration



Typical Mission Profile



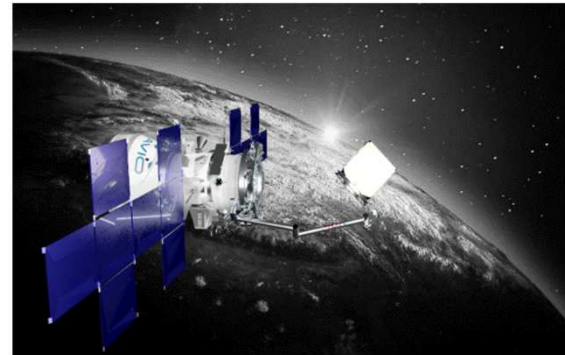
Provides **highly customizable recoverable and reusable orbital space laboratory** for **Microgravity, Earth Observation, Science, Research, Robotic exploitation**
 Launched on **Vega-C** ranging from **equatorial to SSO orbits**
 Performs **in-orbit PL operations, de-orbits, re-enters, lands and re-flies** after limited refurbishment

Special Services - Further applications possible with Space Rider and service technologies

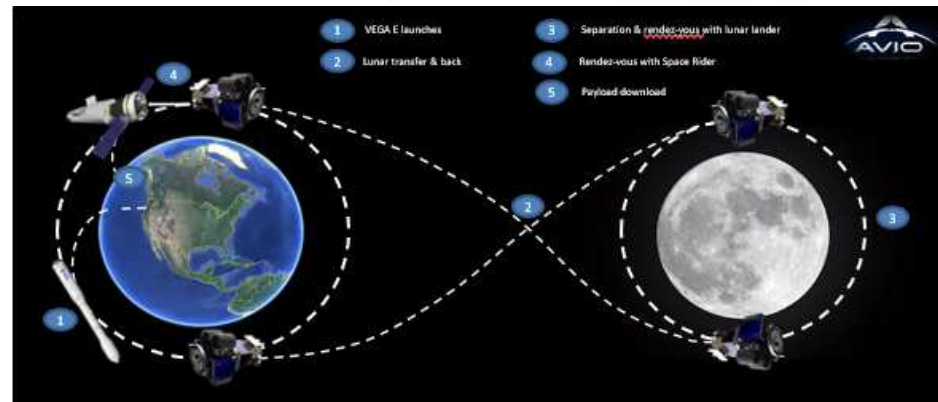
Vega Space Transportation Module



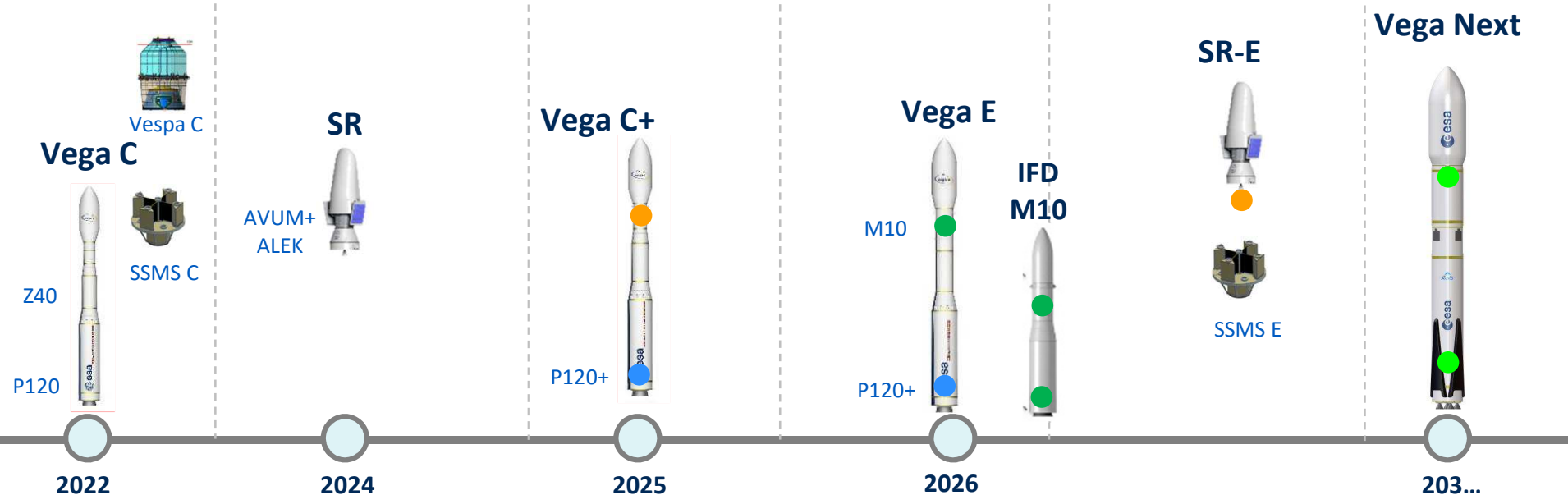
Vega In-Orbit Service Module



Inter-planetary travel module



Roadmap for product development: from full 'Solid' to 'Liquid'





THANK YOU

avio.com