The IRIDE Programme: Overview of the System, Constellations and Services

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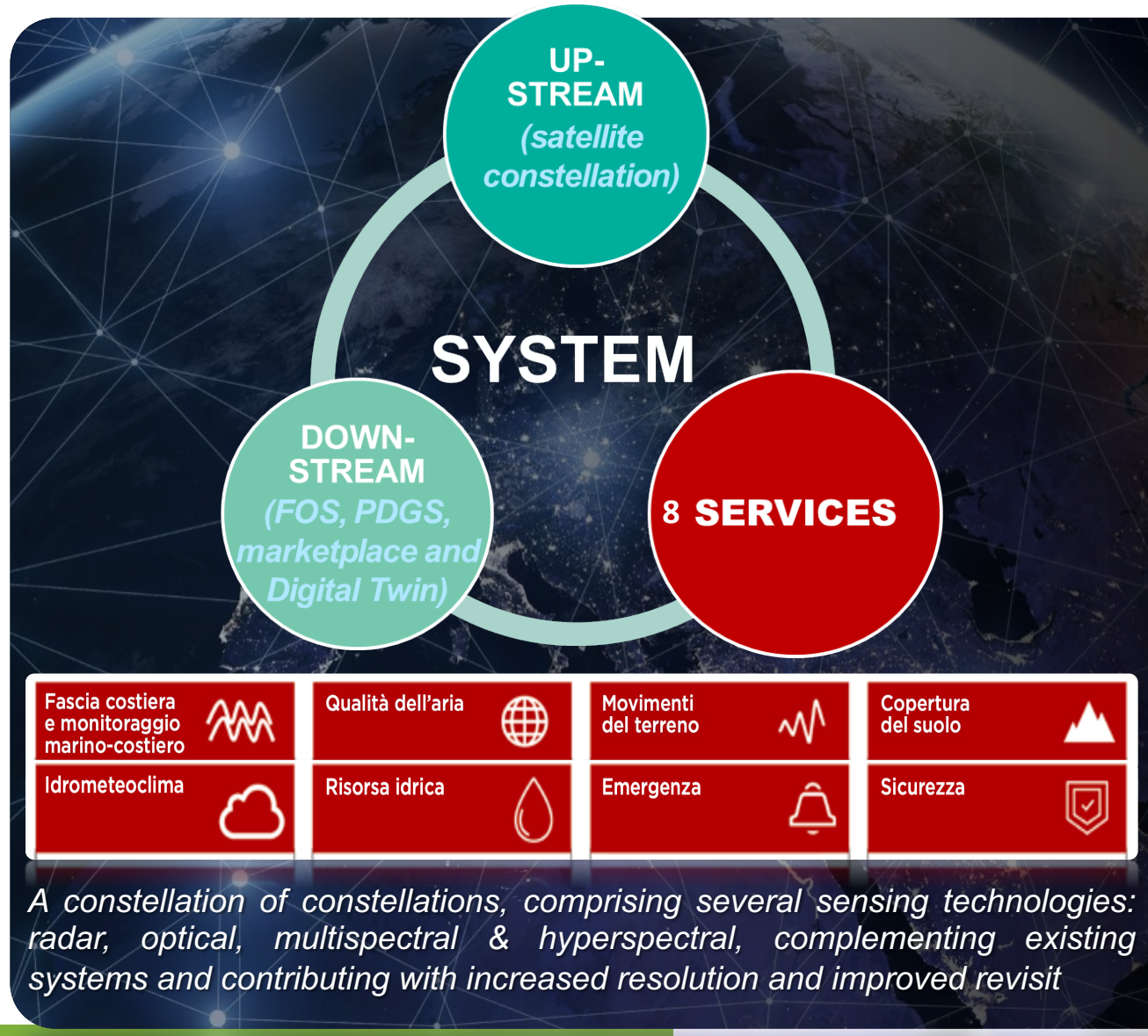
The IRIDE System and its objectives



A constellation of constellations, comprising several sensing technologies: radar, optical, multispectral & hyperspectral, complementing existing systems and contributing with increased resolution and improved revisit

Set up an operational EO system to fulfil Institutional services' needs expressed by Italian public Users, within the tight schedule imposed by the PNRR

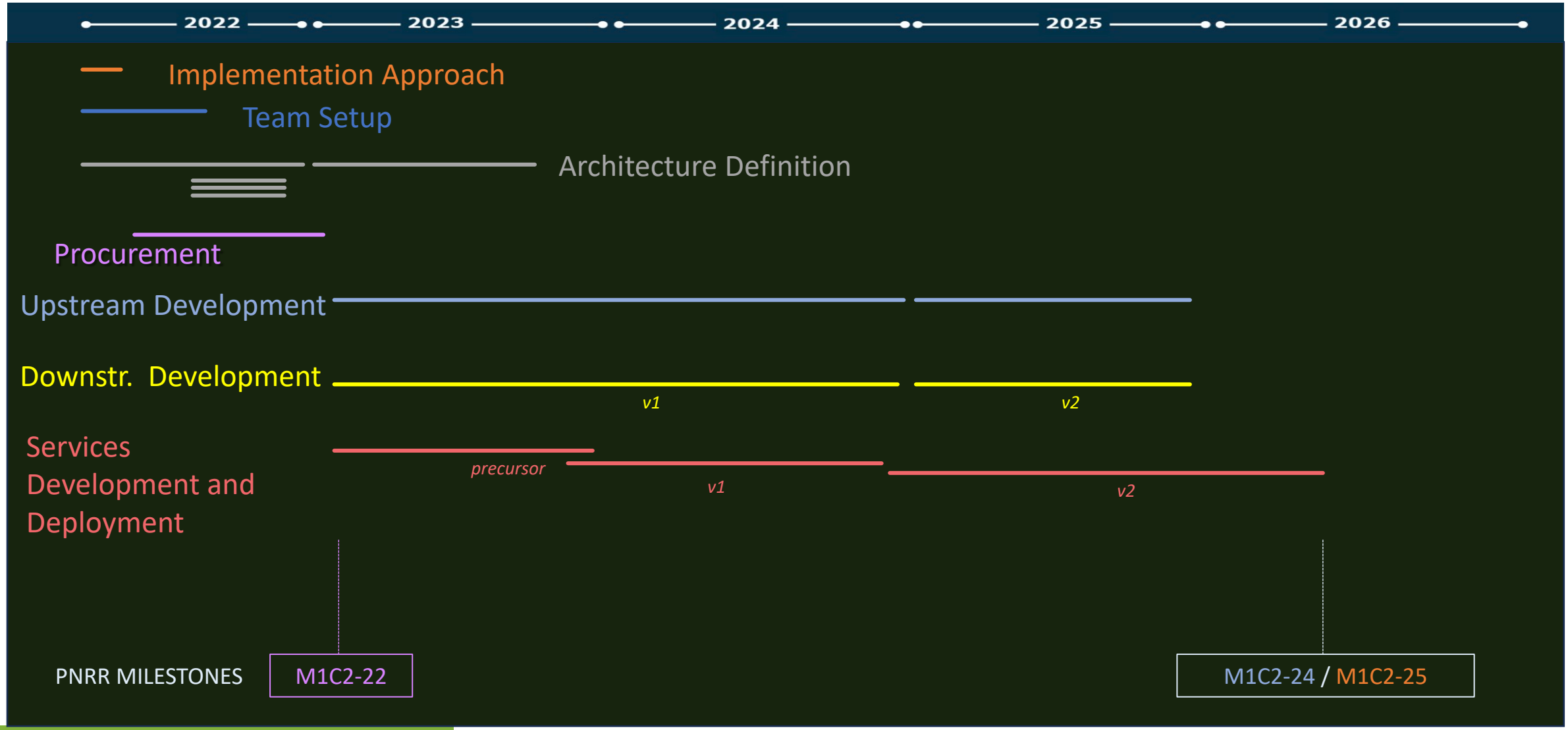
Enhance existing Italian and European systems, focusing on observations over Italy

Develop a geospatial-based services market at National/European level, strengthening national capabilities and promoting the competitiveness of Italian companies

Complement existing Italian and European systems

Progressively involve local administrations and private customers in the use of geospatial information (space economy)

IRIDE Project Implementation Timeline



IRIDE Project Budget

Budget ~ 1.1 B€

- 800 M€ EU RRF *(to be committed in 15 months)*
- 300 M€ National Complementary Fund

System

- Upstream *(satellite constellation)*
- Downstream *(FOS, PDGS, marketplace)*
- Services *(8 to PA, by National Users Forum)*

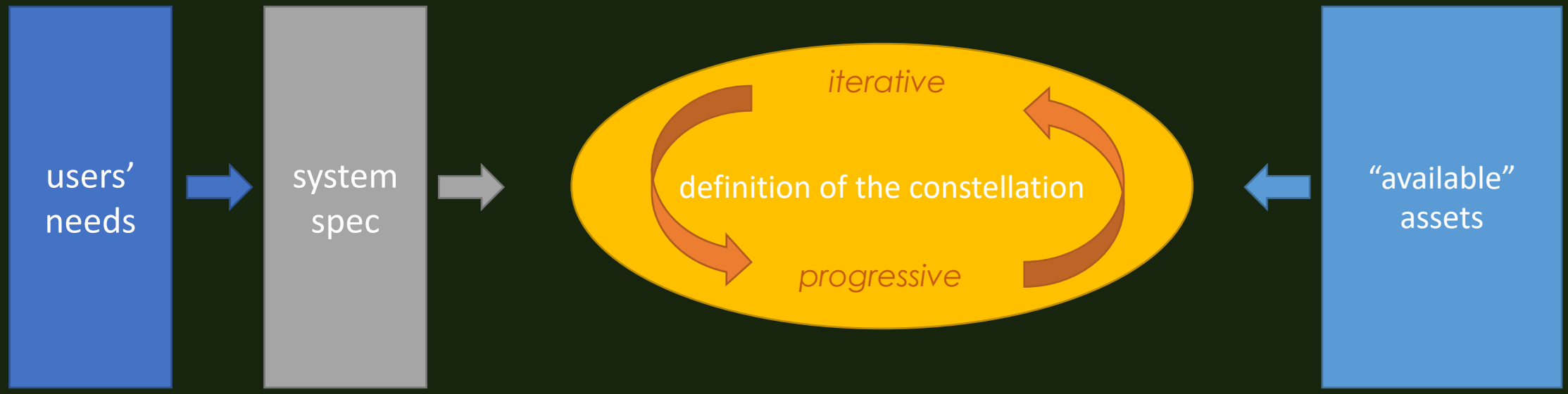
Milestone M1C2-22 : All contracts assigned by 31 March 2023

MILESTONE ACHIEVED

Milestone M1C2-24/25: Deliver the whole system to the Italian Government authorities (or to the Entity formally designated by those authorities) no later than 30 June 2026 in an "Operation-Ready" status

IRIDE System Definition Strategy

IRIDE System Iterative Approach, due to Schedule Constraints



Users' Forum
regularly consulted

Providers Consultation

IRIDE System Implementation Drivers

Inclusive

Architecture Definition - Technological Solutions
User Forum, Companies (LSI & SME), Academia, Research Centres

Distributed

Variety of Companies & Company Types
Modular, Scalable Architecture

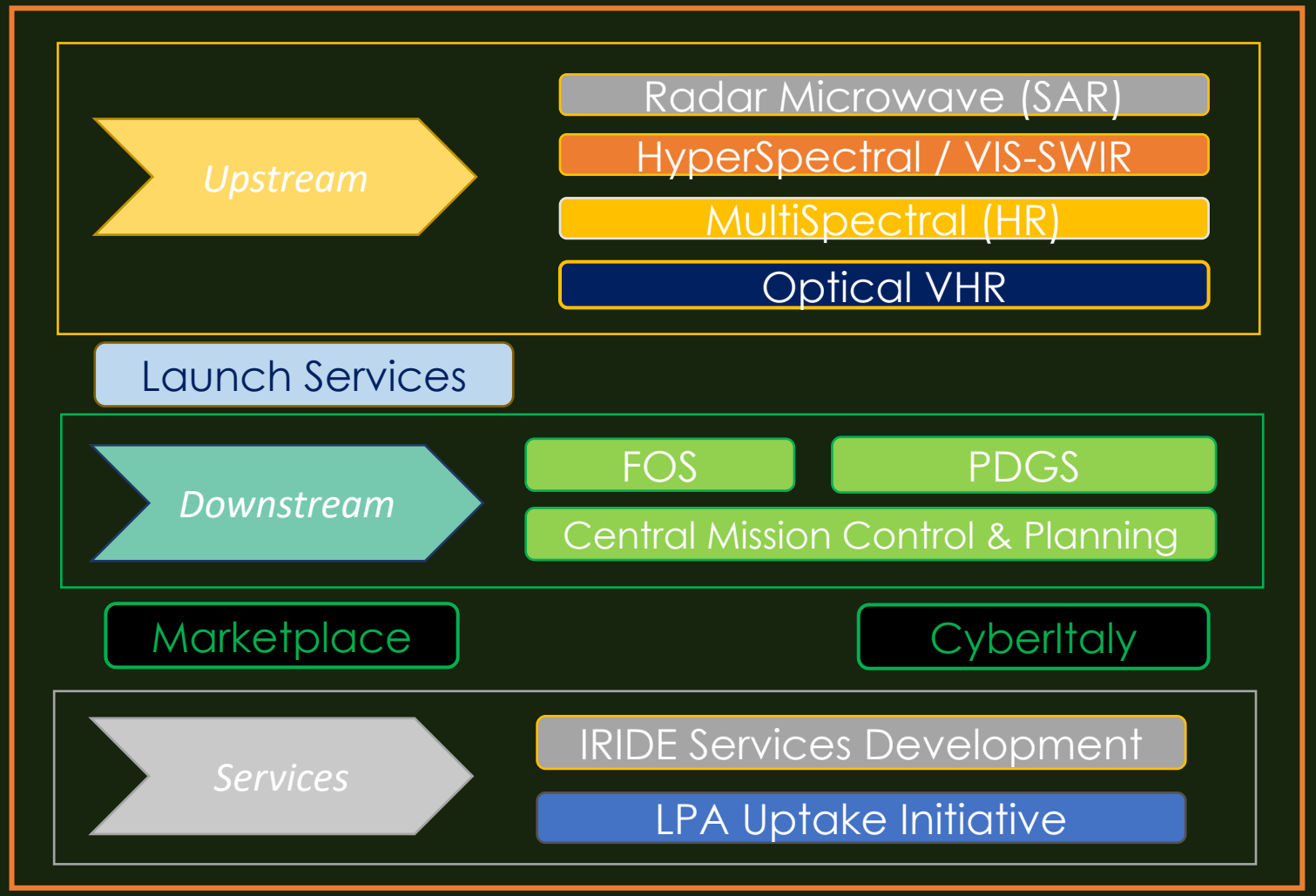
Resilient

No reliance on single solution nor on a single supplier
Staggered development
Strict development checkpoints

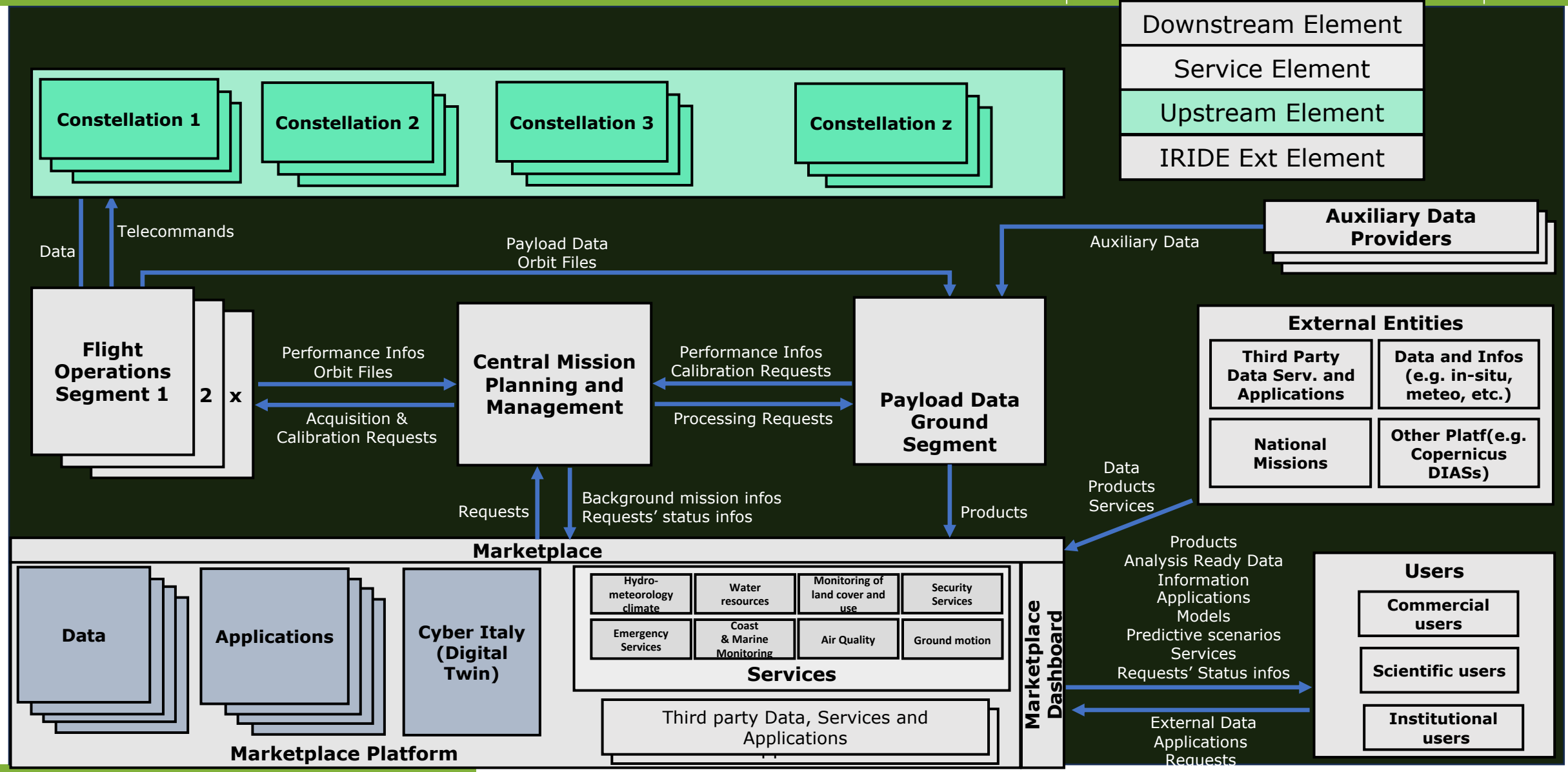
Multiplier

Value past investments (ASI, Difesa, commercial, self-funded initiatives)
IRIDE Complements and enhance existing systems' capabilities

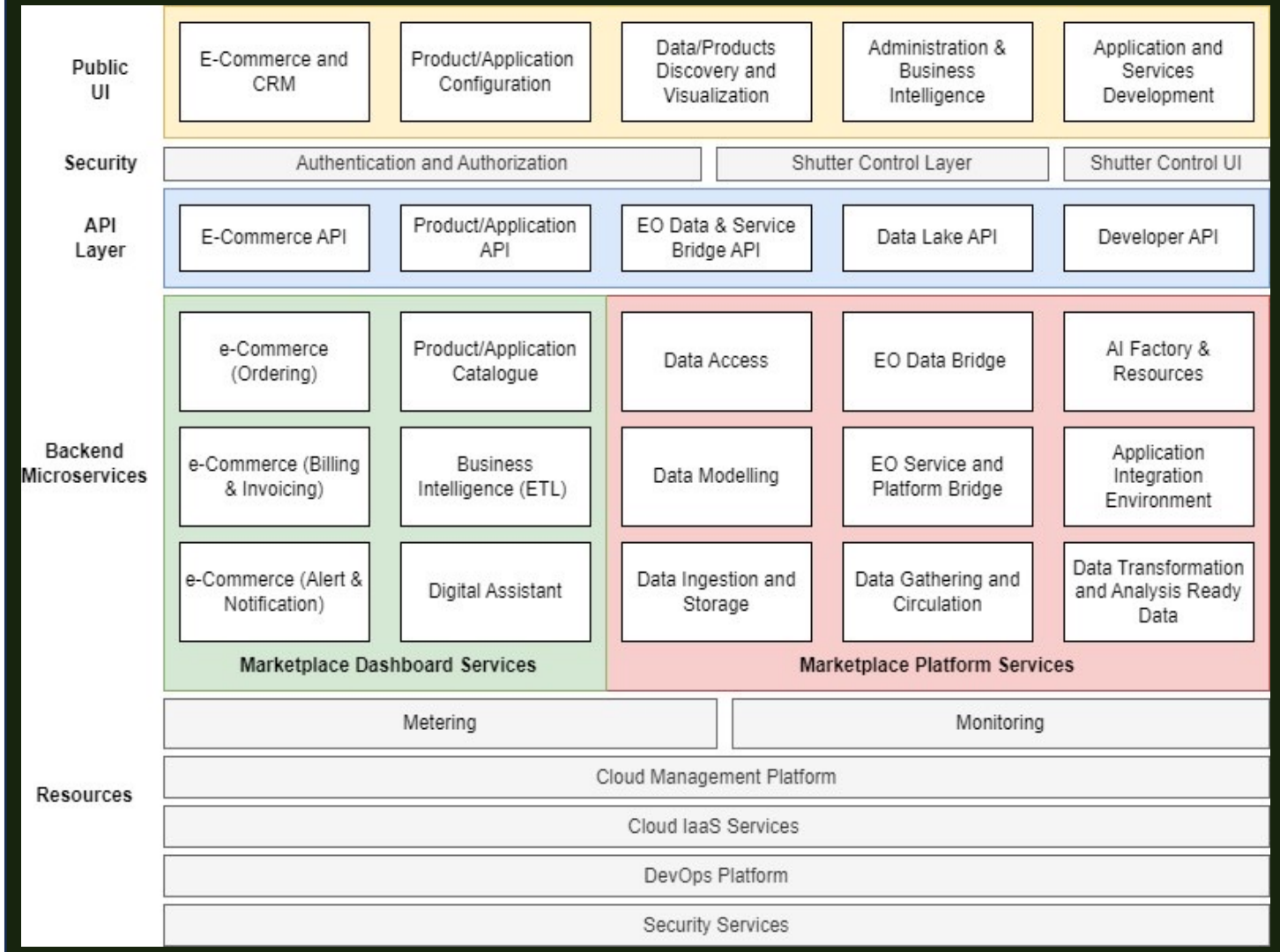
IRIDE System Constituents



IRIDE System Architecture



The MarketPlace



Integrates **State-Of-The-Art technologies & Open Standards**.

No vendor lock-in, since it does not make use of any Background Intellectual Propriety Rights or Third Party solutions.

Natively interoperable though standard API interfaces, for future federation with other digital infrastructures.

Scalable micro-services architecture, to manage a growing number of users, applications, services and volume of data.

Tight link to the IRIDE Ground Segment, granting a reliable and efficient unique access point to all the IRIDE Program resources.

Ready to onboard IRIDE Services and Digital Twin applications, providing rich hosting functions, adequate technical guidelines and a Developer Portal.

Reliable and *secure by design*, ensuring Business Continuity with a gold standard Security Operations (SOC).

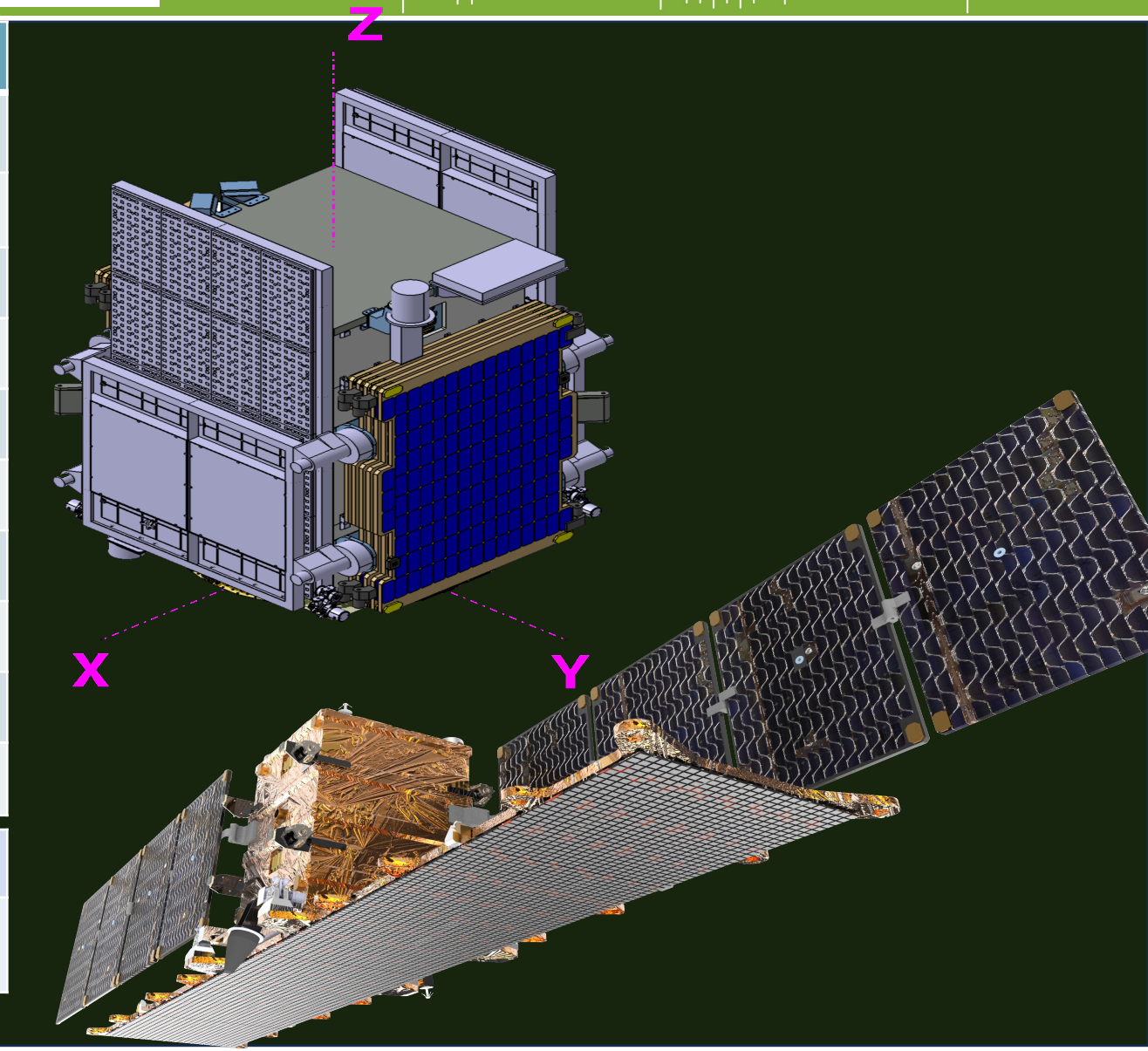
Fully complying with Italian and EU regulations on Security, Data Protection, implementing shutter control

Natively interoperable though standard API interfaces, for future federation with other digital infrastructures.

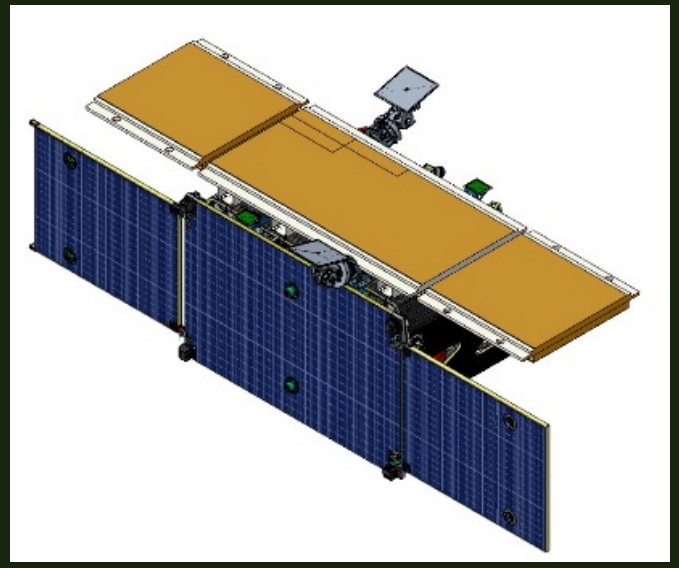
SAR NIMBUS Constellation

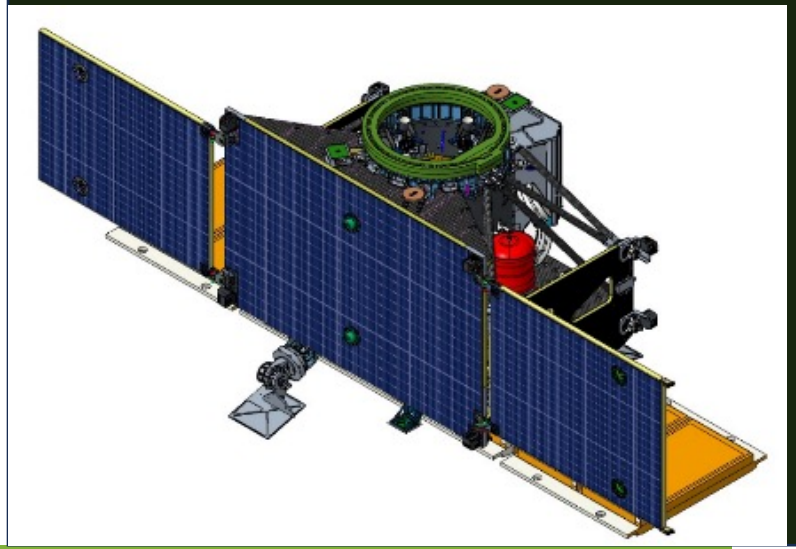
Parameter	Specification
Radar Frequency	X-band
Radar Operative BW	Up to 1000 MHz
RF Max Peak power	3840 W
Radar Polarization	Single pol (VV)
Radar Antenna Length	3.6 m
Radar Operative Modes	Spotlight, Stripmap, ScanSAR
Performance Range	15 - 50 deg incidence
Data Access Range	15 - 50 deg incidence
Swath	2.5km (spot); > 23km (strip); 100km(scan)
Ground Resolution	From 0.5 m to 17 m

Lifetime	5.25 years
Orbit	SSO nominal 490 km; LTAN from 01:30 up to 10:30, inclined orbit from 44° to SSO



NOX SAR Constellation: SAR Specification

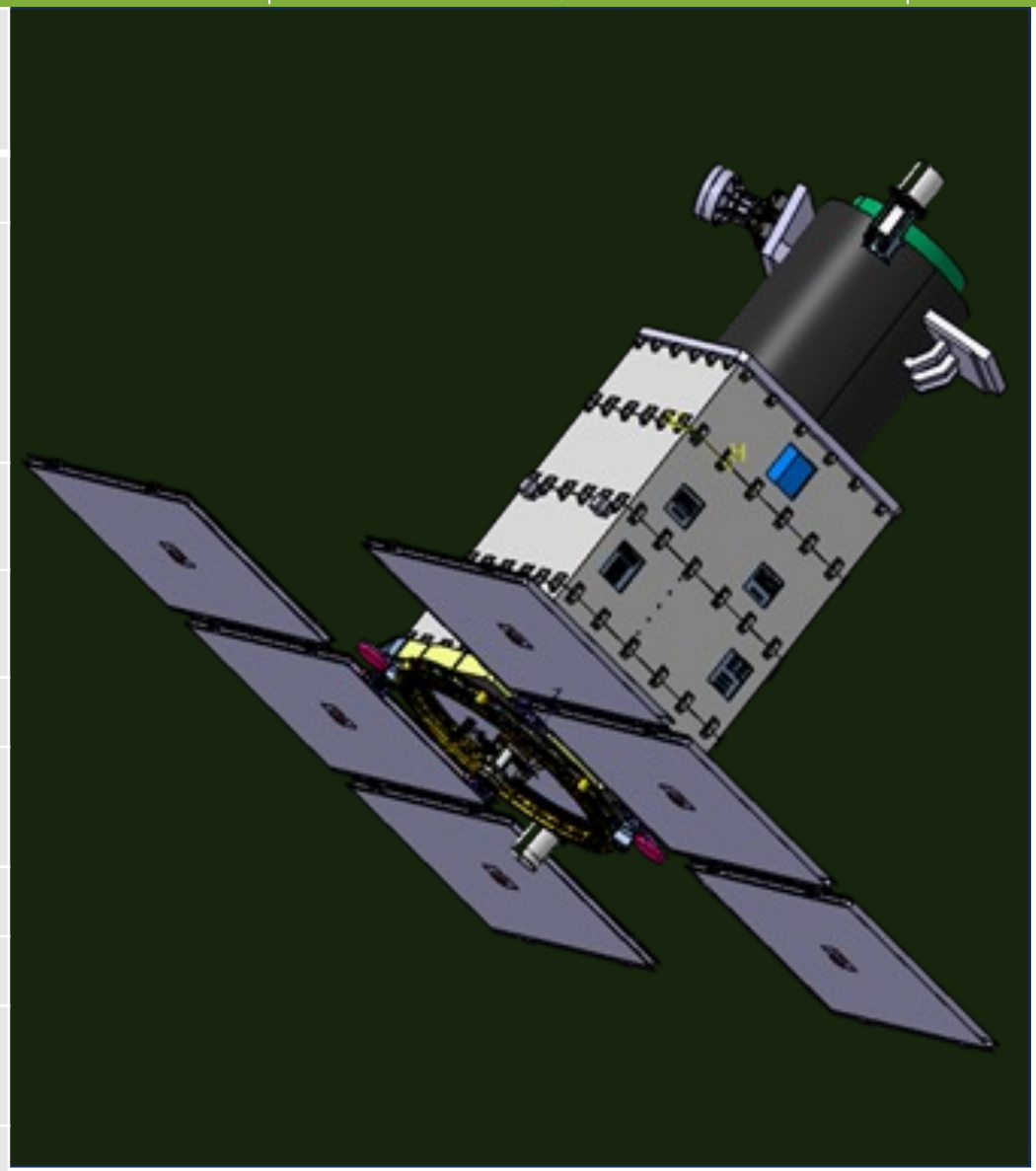




Parameter	Specification
Launchers Compatibility	Vega-C, Vega, Ariane 6, PSLV
Radar Frequency	X-band
Radar Operative Bandwidth	50-300 MHz
RF Max Peak power	4096 W
Radar Polarization	Single pol (VV)
Radar Antenna Length	3,2 m
Radar Operative Modes	Spotlight, Stripmap, ScanSAR
Performance Range	20-40 deg off nadir
Data Access Range	15-50 deg off nadir
Swath (Gnd x Az)	From [10 x 10 km] to [80 x 120 km and beyond]
Ground Resolution	From < 1.5 m to < 6 m
Max Downlink datarate	> 330 Mbps
On-board Data Storage (EoL)	0.5 TB
Reference Orbit	515 km; LTAN 18:00 ± 1h
Lifetime	5 years

IRIDE NIMBUS VHR#1

Parameter	Specification and Performances
Launchers Compatibility	Vega C, Falcon-9, others commercial
Optical Band	Panchromatic band: 450 – 800 nm MS band 1 (blue): 450 – 520 nm MS band 2 (green): 520 – 590 nm MS band 3 (red): 630 – 690 nm MS band 4 (VNIR): 770 – 890 nm
SNR	>80 PAN; > 140-177@ RGB/VNIR; TDI=16 MTF (end to end) > 0.06@Nyquist
Ground Sampling Distance @ nadir	< 1 m (PAN) native, < 4 m (RGB-VNIR) native
Operative Modes	Stripmap, Mosaic, N-Stereo
Field of regards: maximum off nadir angle	+/- 30 deg
Stripmap Swath Across-Track	≥ 10.5 Km
Max strip Along-Track	< 1200 Km (~200 sec acquisition)
Reference Operational Orbit	Around 460 km Indicative LTDN 10:30 – 14:30
Lifetime	5,25 years



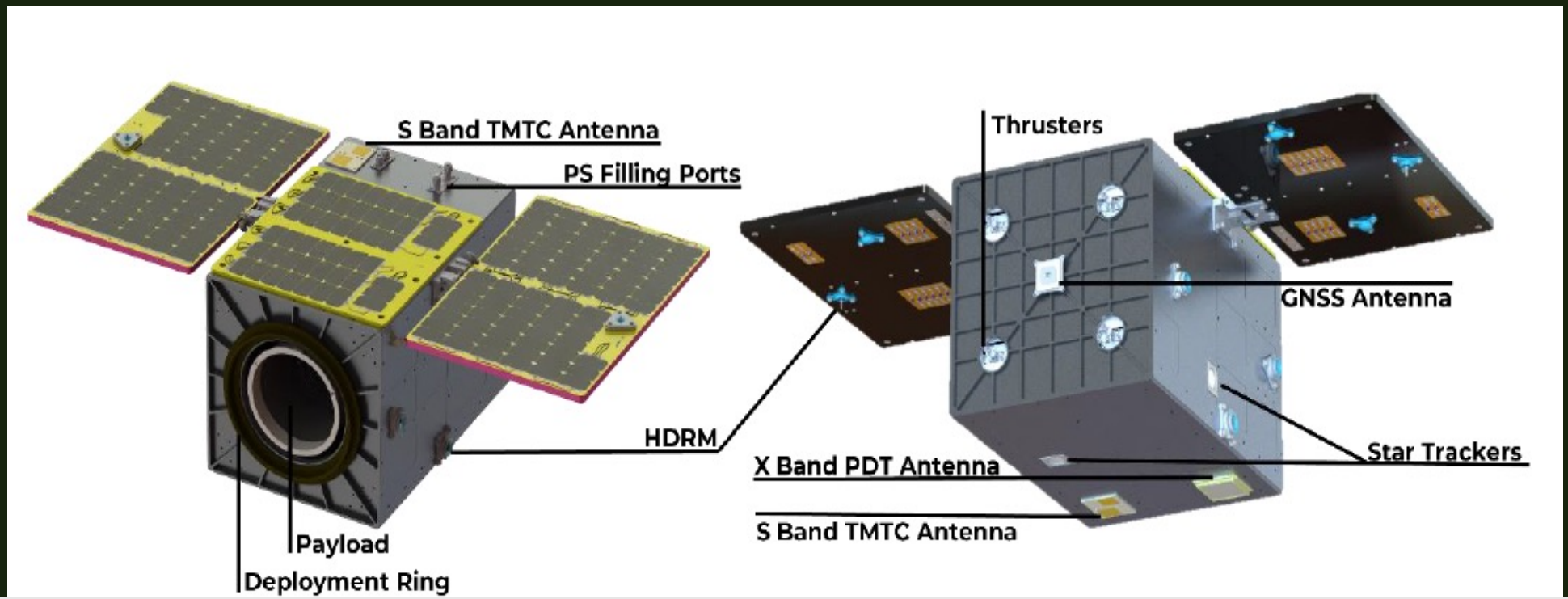
Hyperspectral Constellation (SITAEL-LEONARDO)

Orbit (SSO)

- Reference Orbit → Altitude of ~515 [Km]; Indicative LTDN 10:30 - 14:30

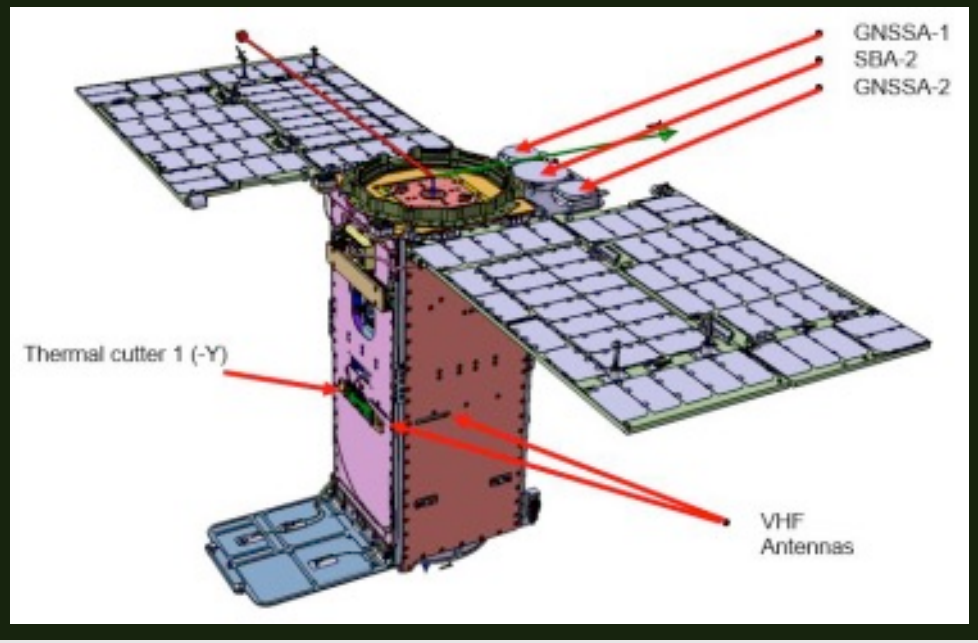
- Payload → Optical Hyperspectral (Pushbroom)
  - Acquisition Modes → Stripmap; Spotlight;
- Spectral Range → between 400 [nm] and 2500 [nm]
- Spectral Resolution = 10 [nm] - (> 200 spectral bands)
- greater than 31[m]@519km
- SNR = @450nm > 180 ; @600nm > 200 ; @1000nm> 180 ; @1600nm> 140; @2300nm
- GSD (at the nadir point on the ground track at sea level at the equator)
  - ~ 5 m@519 km - PAN
  - ~ 21m@519 km - SPOTLIGHT
  - ~ 31 m @519 km – STRIPMAP
- Swath (Across Track) = ~ 21 km @519km
- Payload Duty Cycle = ~3%
- (Min/max) Continuous Acquisition: 4 - 142 [sec] STRIPMAP; 8 - 60 [sec] SPOTLIGHT

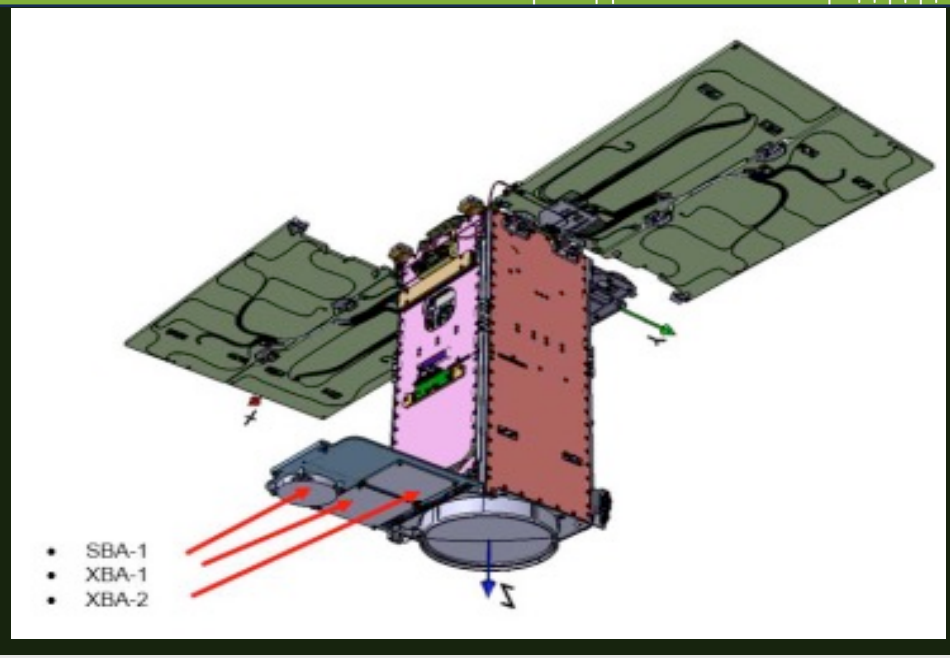
High Resolution Multi Spectral#1 (Hawk– Argotec, Officine Stellare



- **Wet Mass** = 60 [Kg] **Orbit (SSO; LEO:** Altitude of 560 km Nominal, LTAN 10:30 – 14:30; **Payload** → Optical Multi-Spectral High Res
- **Spectral Bands:** Red (610-690 [nm]); Green (530-610 [nm]); Blue (440-520 [nm]); NIR (440-520 [nm]); PAN (455-705 [nm])
- **GSD** = 2.66 [m] @560 [Km] → 7.98 [m] for the MS (RGB; NIR) with Binning 3x3; **Swath (Across Track)** = 10.9 [Km] @560 [Km]
- **Strip Length** = Up to 80 [Km]; **PDT User Data Rate (X-Band)** = Up to 225 [Mbps]
- **SNR:** 110.6 (PAN); 54 (MS) @ TDI = 4; 81 (MS) @TDI = 4 and 3x3 Binning
- **Maximum OFF-Nadir angle** = 13.4˚; **Payload Memory Storage** = Up to 240 [GB]

High Resolution Multi Spectral MS#2 (Eaglet 2) – OHB I, OPTEC





Nominal Mass = 25 [Kg]; **Orbit (SSO);** Altitude between 467 [Km] and 525 [Km] (Nominal); Local Time interval 09:30 to 11:30 i and from 12:30 to 14:30 . Ascending and descending.

Payload → Optical Multi-Spectral High Resolution + AIS

Spectral Bands = RGB → Red = (0.55 0.85) [nm]; Green = (0.45 0.65) [nm]; Blue = (0.35 0.55) [nm]

GSD = 1.75 [m] @467 [Km] ; **SNR=** >100 ; **Swath (Across Track)** = 16.3 [Km] @467 [Km]

Spot Image Size = (16.3 [Km] x 12.2 [Km]) @467 [Km]

Strip Image Size = (16.3 [Km] x 350-400 [Km]) @467[Km]

PDT User Data Rate (X-Band) = 100 [Mbps]

Summary and Next Steps

- ~30 individual procurement actions carried out, covering upstream, downstream and services with a wide distribution of development effort across the entire industrial eco-system (~1/4 of the budget to SME's):
  - **Upstream**: Satellites: 34 (baseline) + 35 (order activated depending on progress)
  - **Downstream**: composed by the Ground Segment, Marketplace and CyberItaly
  - **Services**: National institutional services (8) + complemented by local services (5)
  - **Launch services**: 2 dedicated launches with option for 1 additional launch

- **Next Steps:**
  - Finalization in Q4 2023 of the Mission aspects for each Constellation as closure of the iteration between User Need and Constellations flexibility to move towards the proposed mission ranges (orbit, LTAN, etc)
  - Monitor the evolution of the contracts and support the development of the assets

Thank you!