



Bartolomeo - Multi-purpose Payload Hosting Facility on Columbus

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Airbus DS and Teledyne Brown Engineering – Bringing together experience from two worlds



Airbus DS Integrated Cargo Carrier



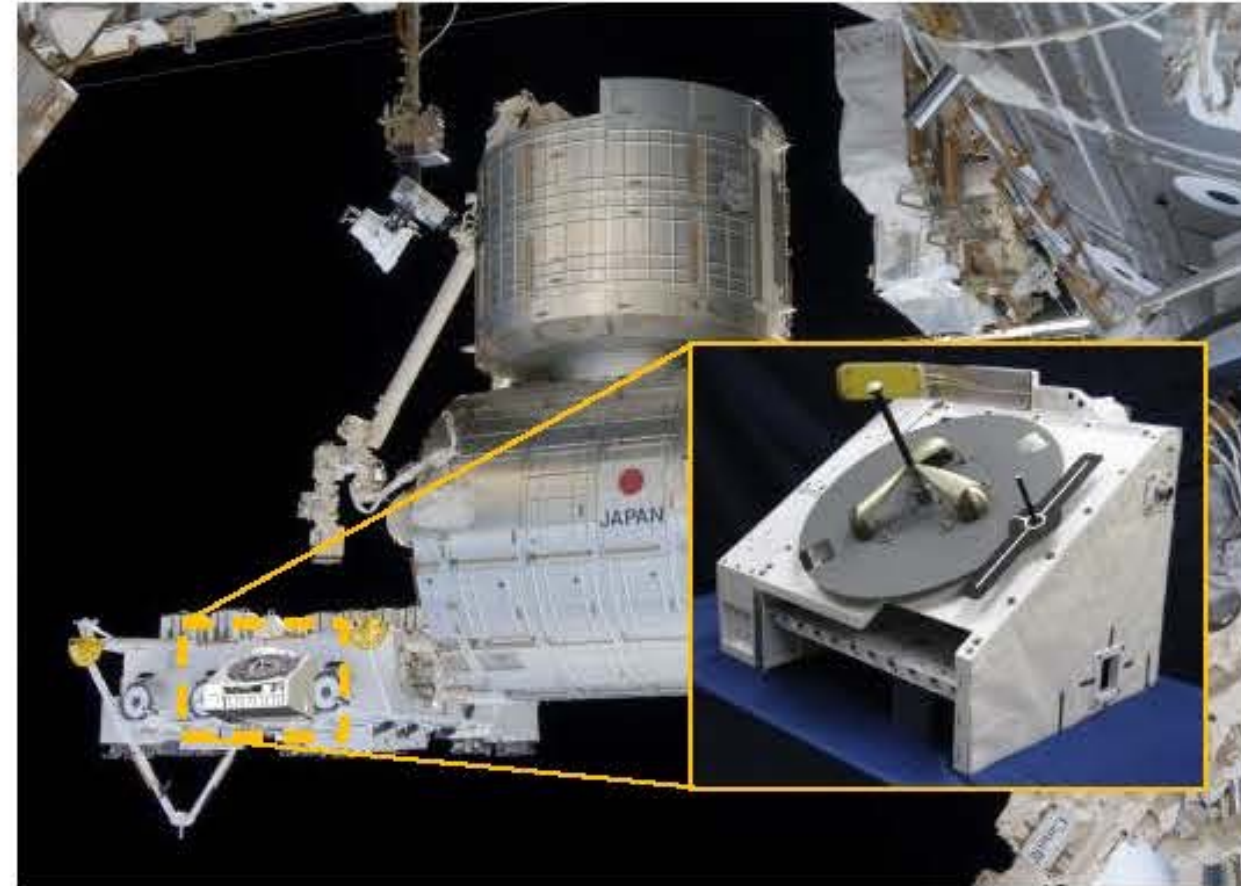
European Columbus Module



European Automated Transfer Vehicle



Airbus DS External Stowage Pallets



NanoRacks External Platform



Teledyne Brown MUSES Platform

Bartolomeo Use Cases

- Access to LEO with high technical and schedule reliability
- Short mission lead times of 12 to 18 months
- Turnkey mission prices
- End-to-end service concept

- Testing of concepts for on-orbit assembly
- Use of ISS robotic systems

- ISS as laboratory in space
- Access to ISS with low TRL
- Capability to return payload back to Earth

Earth Remote Sensing

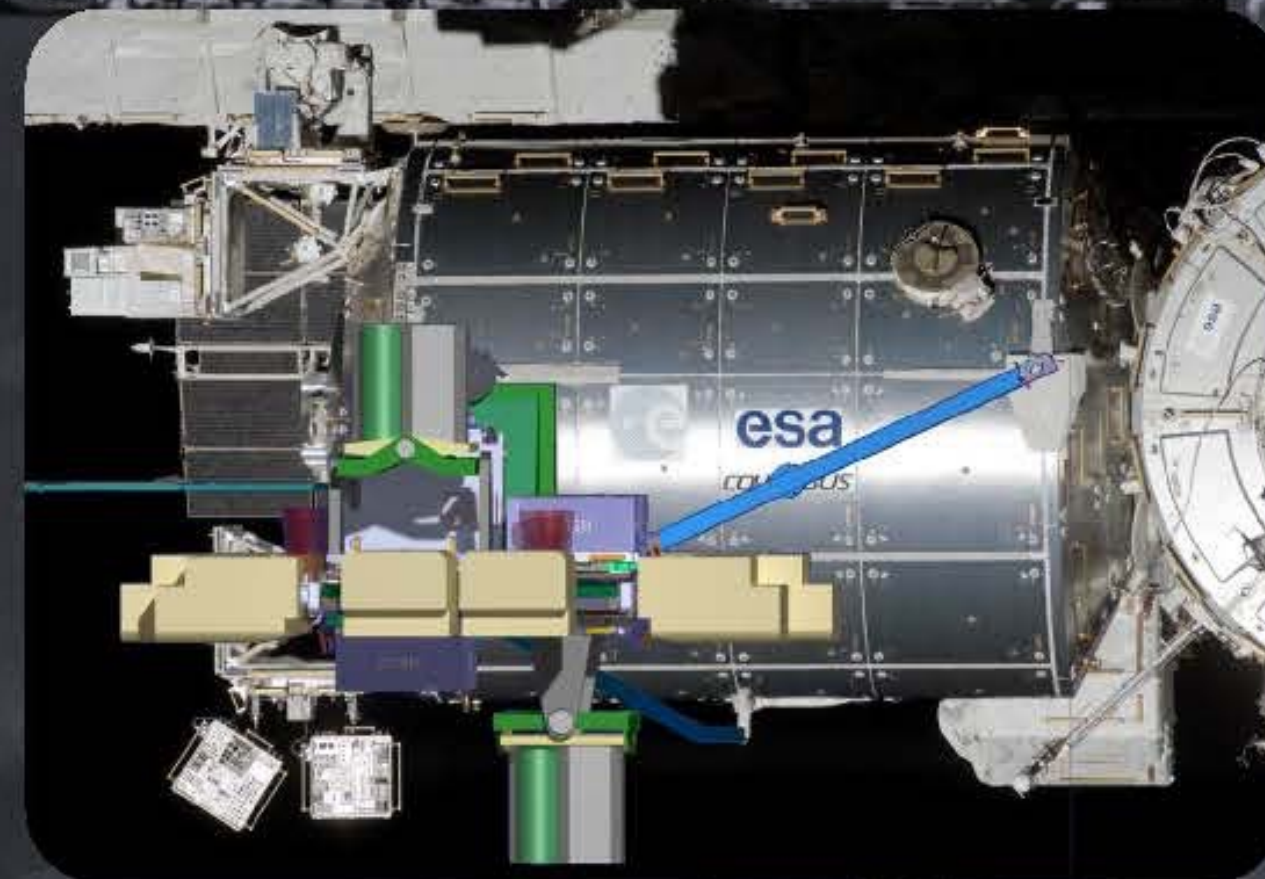
- Unconstrained Nadir view from the platform
- Stabilization and pointing with the Teledyne Brown MUSES facility
- Near-real time data capability of ISS

Commercial Utilization

Astrophysics Heliophysics

- Unconstrained Zenith view from the platform
- Stabilization and pointing with the Teledyne Brown MUSES facility
- Near-real time data capability of ISS

On-orbit Assembly



Space Research

- Exposure of payload to space environment
- Capability to return payload back to Earth

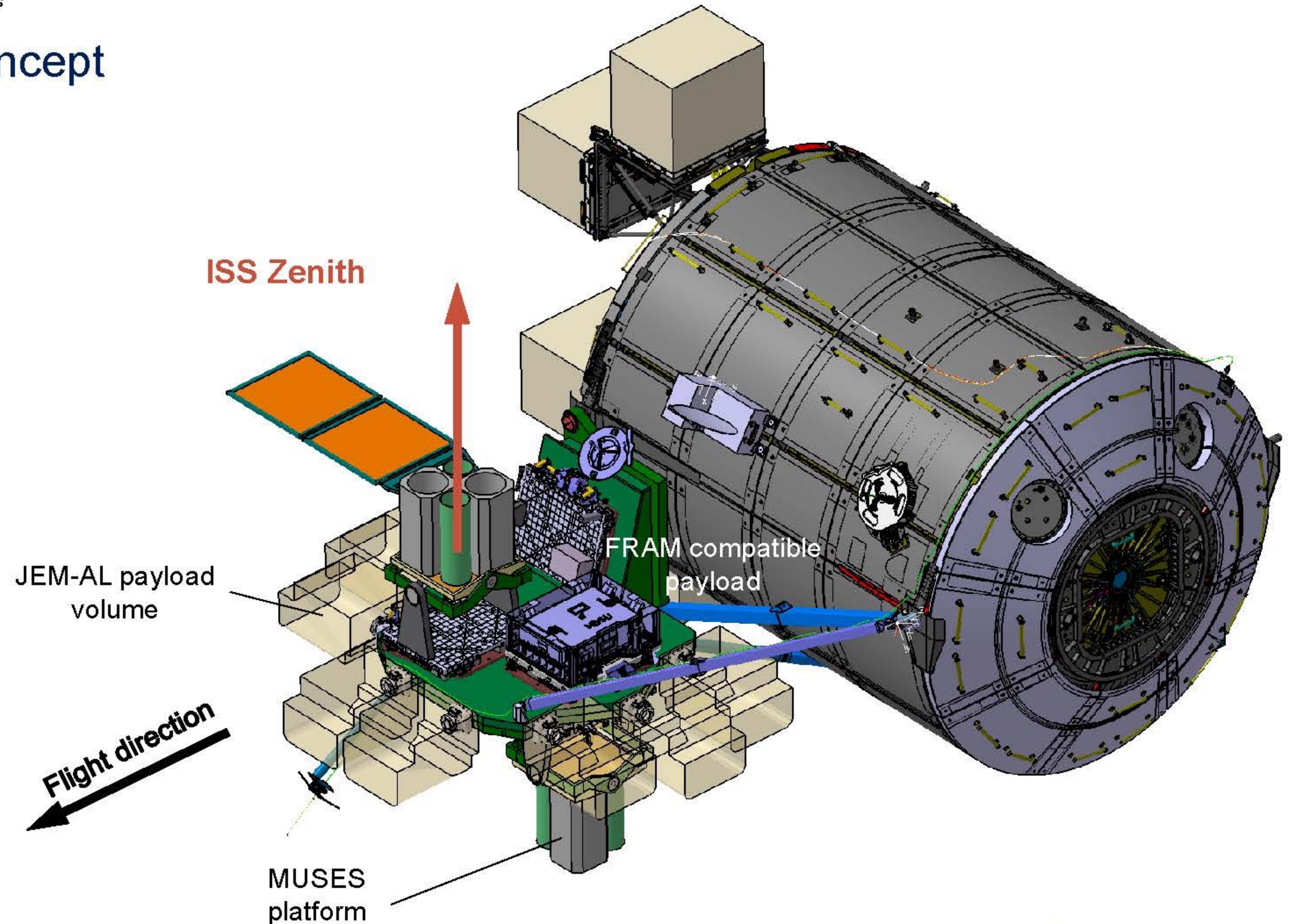
Technology Demonstration

Propulsion Testing

- Power available for testing of low thrust electric propulsion systems

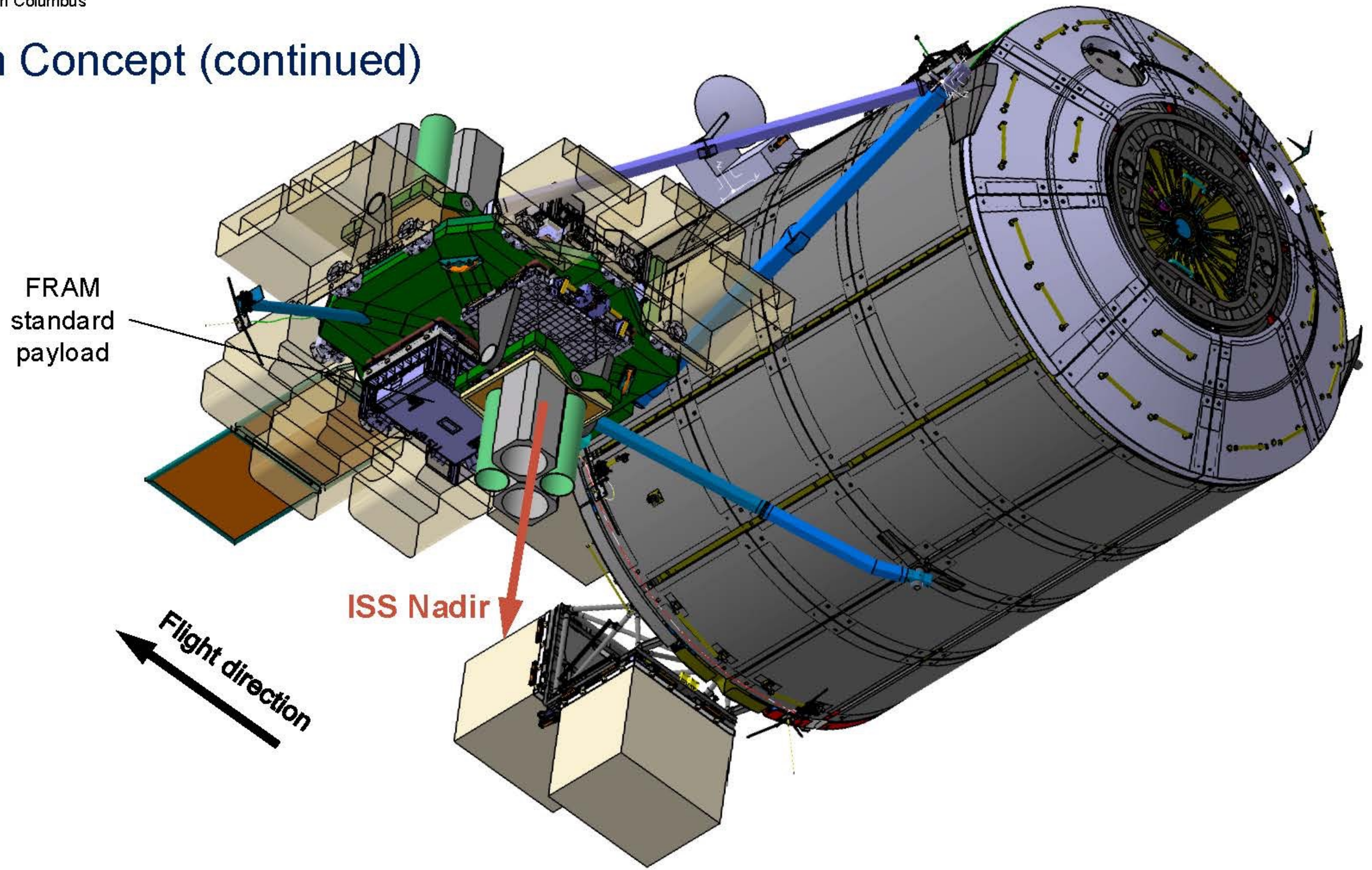
Bartolomeo System Concept

- » Mechanical attachment with 2 Ram Trusses and 1 Keel Truss
- » 2 principal payload classes
 - JEM-AL compatible (pressurized upload)
 - FRAM standard (unpressurized upload)
- » Flight configuration compatible with SpaceX Dragon Trunk



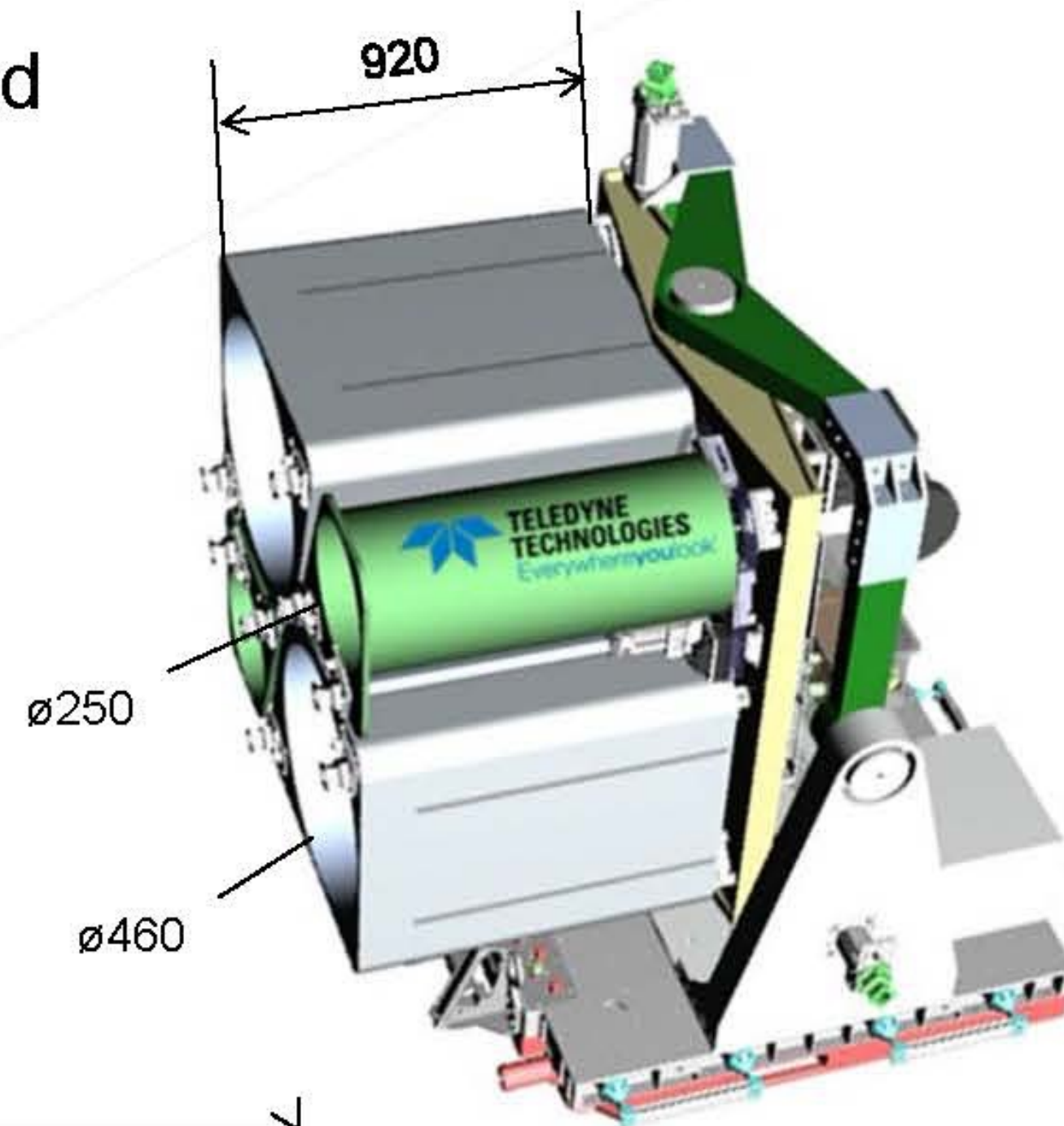
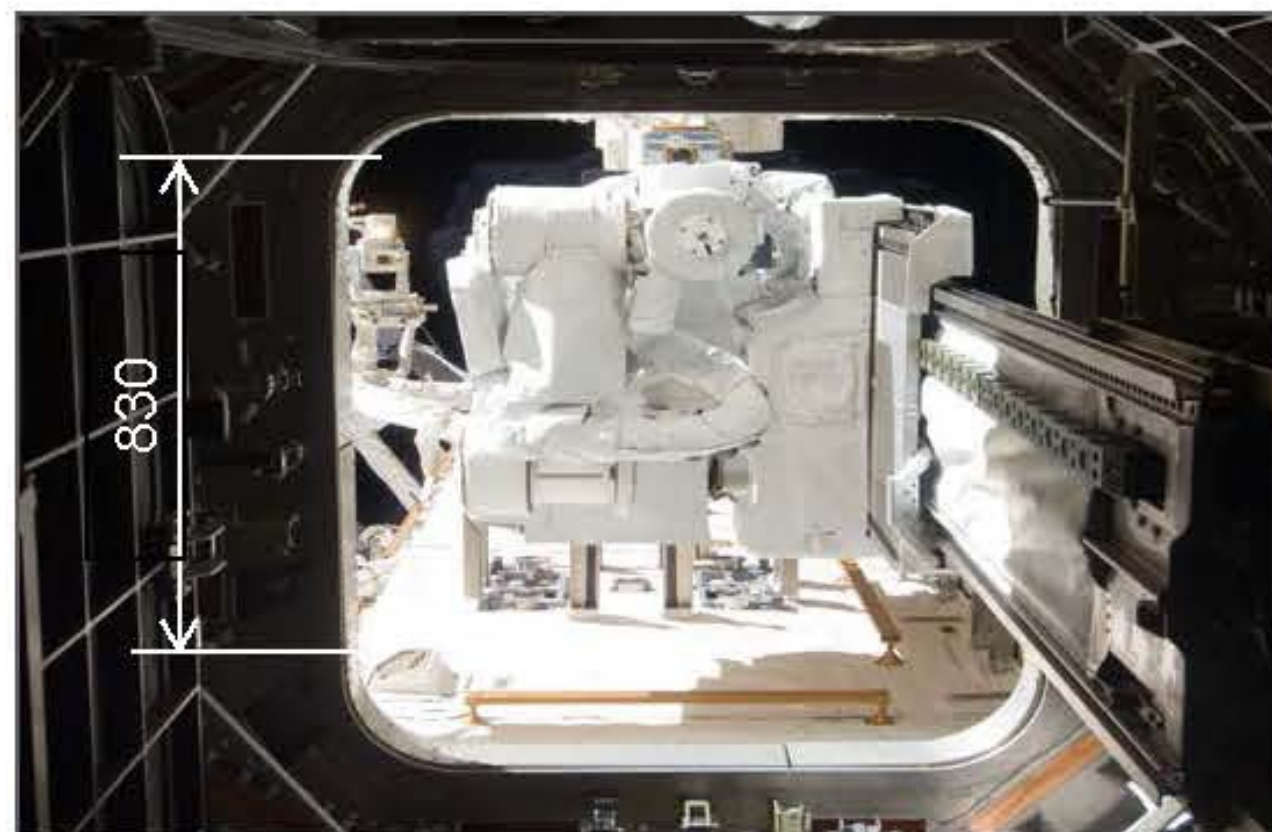
Bartolomeo System Concept (continued)

- » Optimal positioning of payloads for best Zenith / Nadir / Limb viewing conditions
- » Active cooling system for payloads
- » Own power and data management unit
- » Payloads accommodated using standard mechanical / electrical / robotic interfaces
- » Full EVR compatibility
- » No EVA required for payload installation / de-installation during service phase

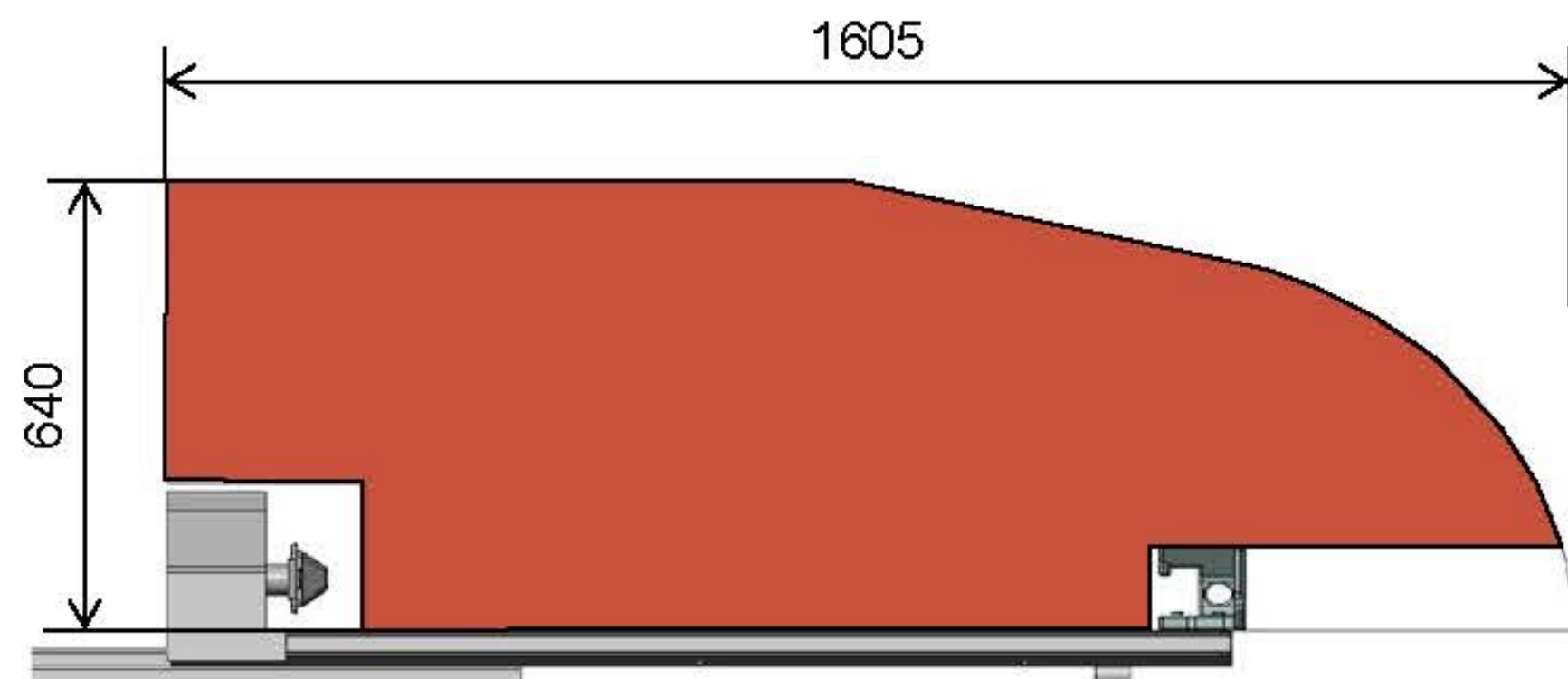


Bartolomeo System Concept (continued)

» *Bartolomeo* standard payload sizes

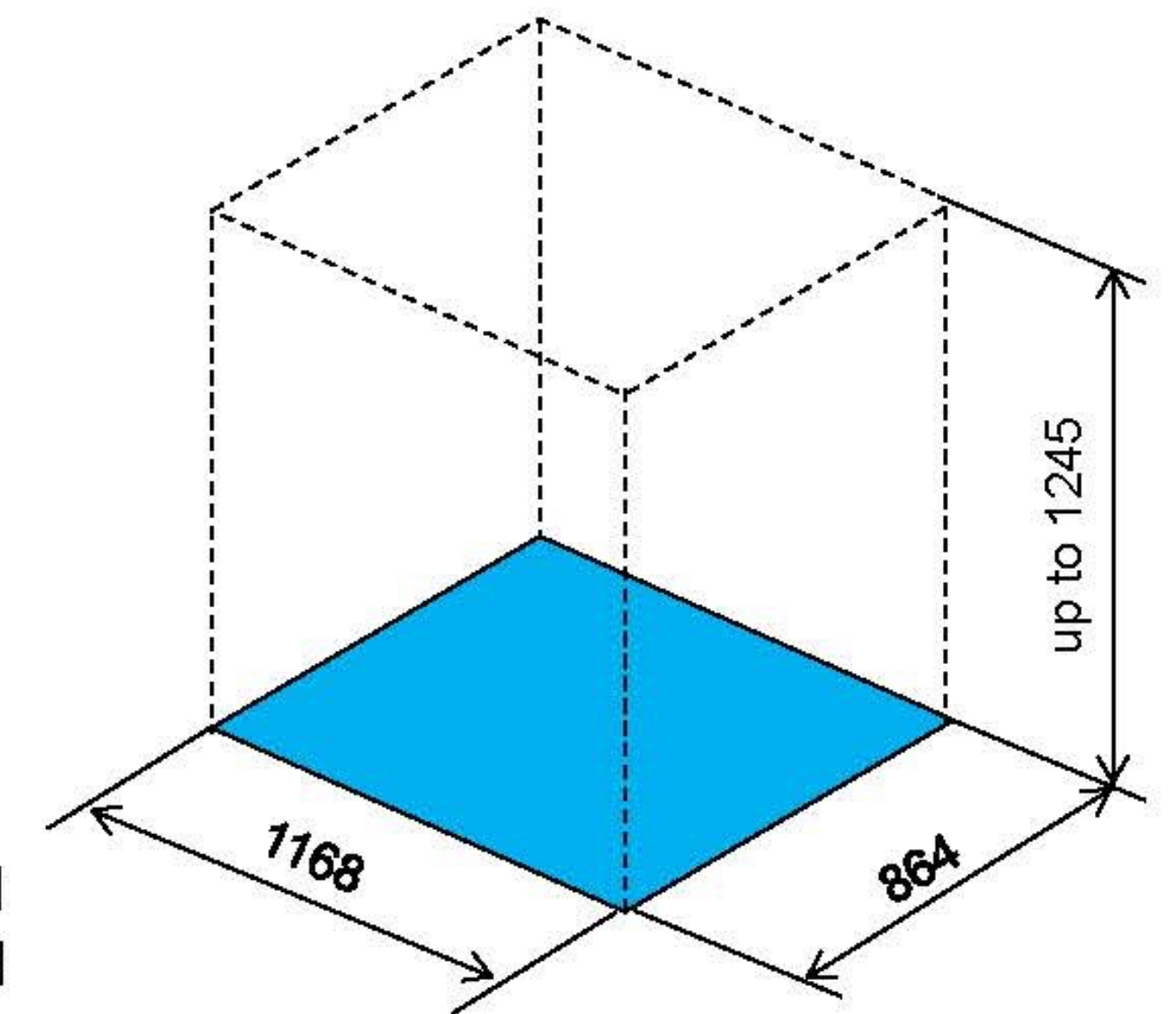
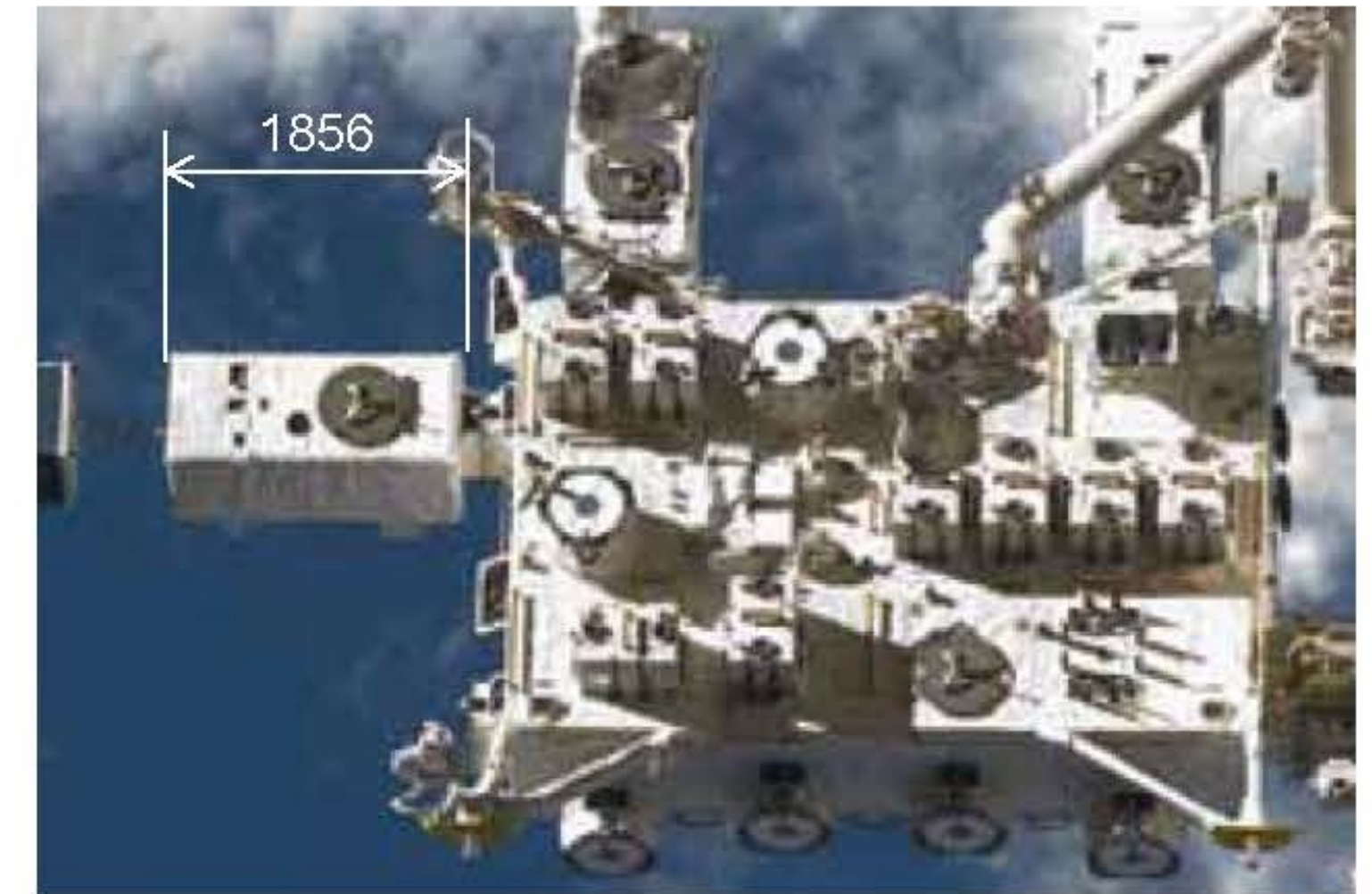


MUSES compatible



JEM-AL compatible

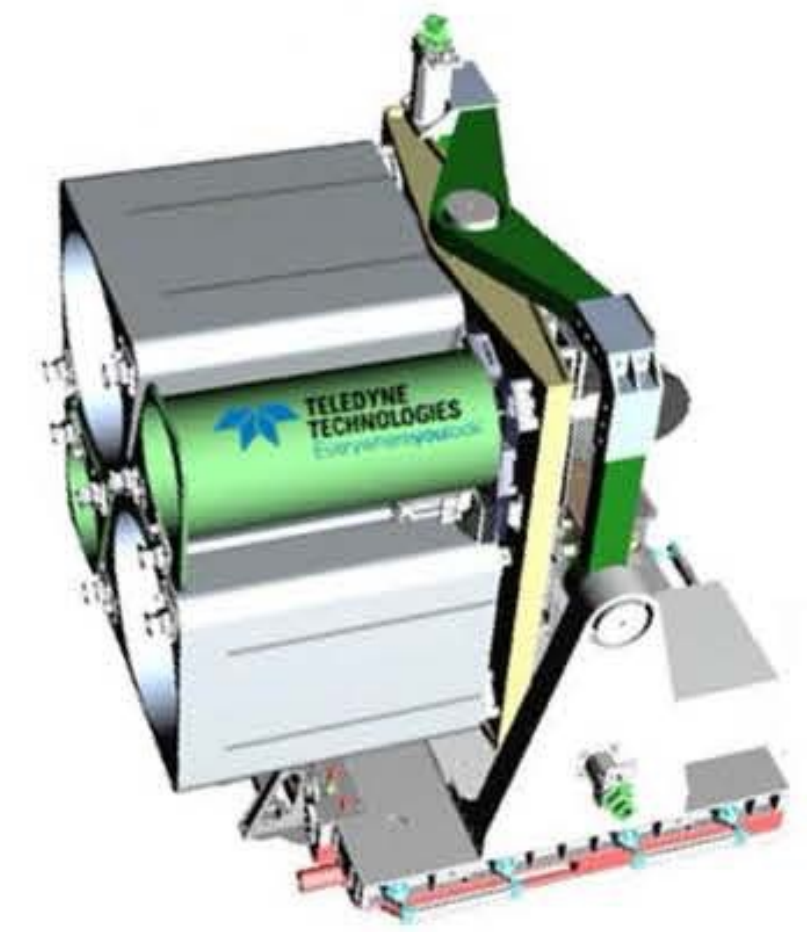
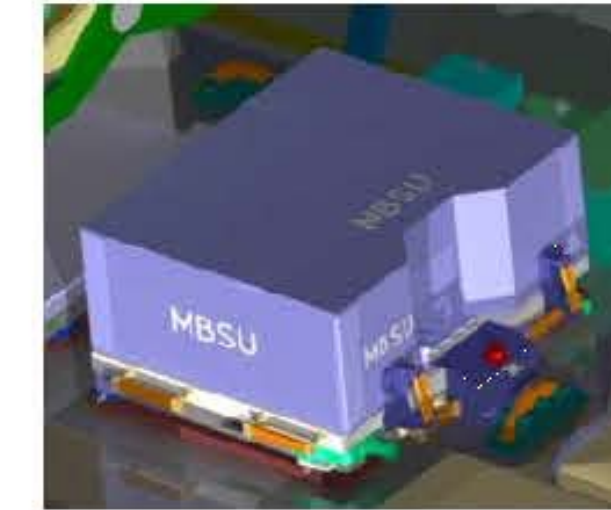
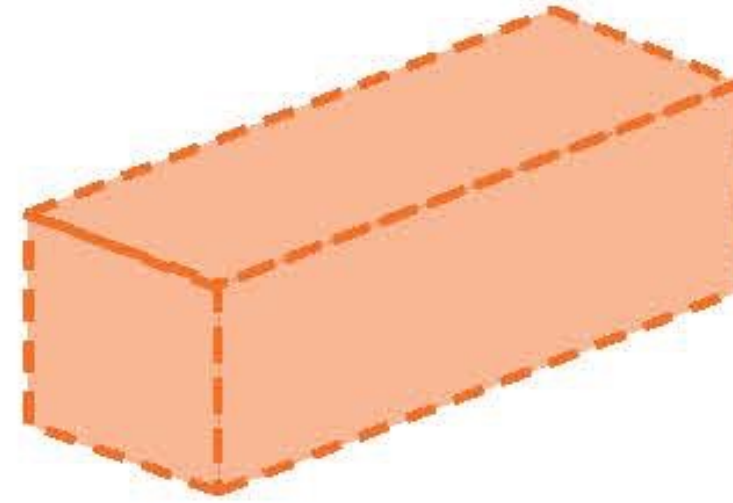
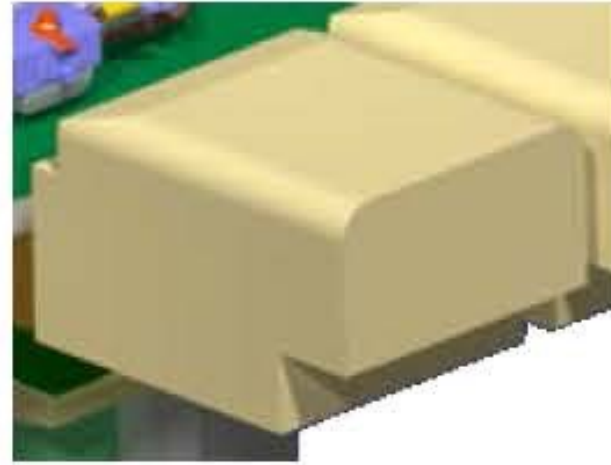
JEM-EF compatible



FRAM Standard

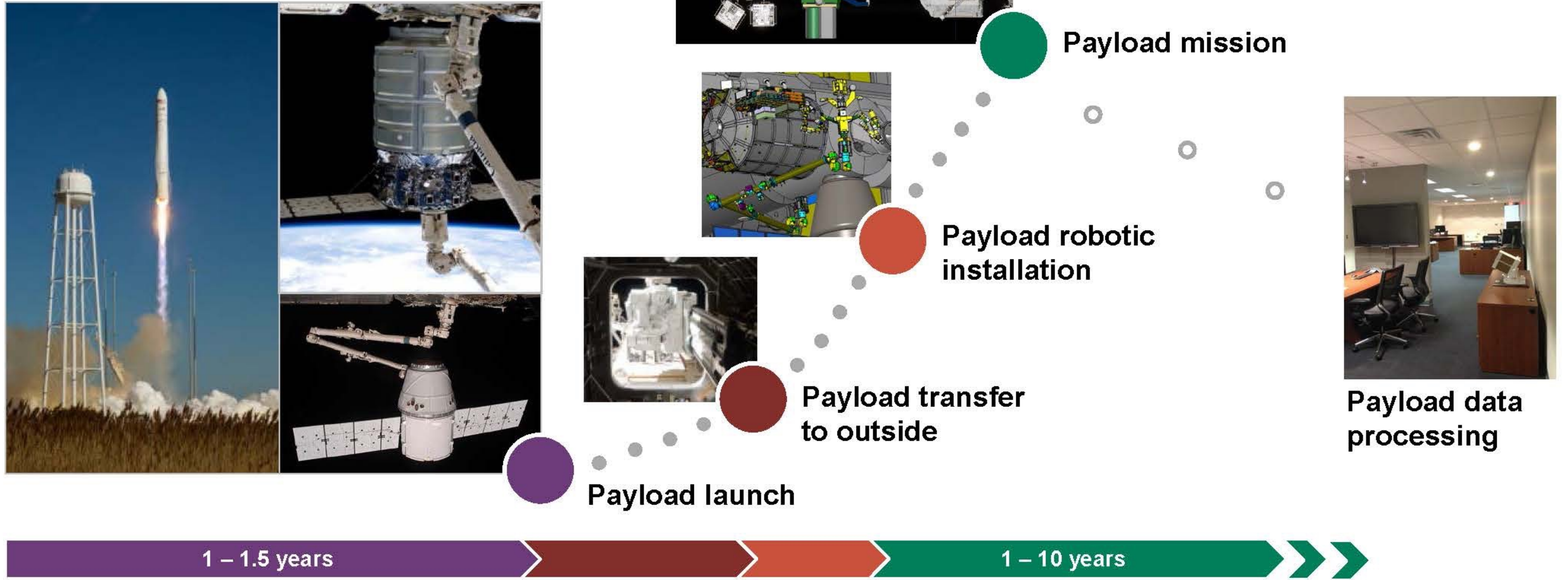
Bartolomeo System Concept (continued)

➤ Bartolomeo standard payload sizes



Item	JEM-AL compatible	JEM-EF envelope cmptbl.	FRAM-based	MUSES compatible
Concept of operations	<ul style="list-style-type: none"> Pressurized launch in soft stowage Transfer through JEM-AL Robotic installation 	<ul style="list-style-type: none"> Unpressurized upload Robotic installation 	<ul style="list-style-type: none"> Unpressurized upload Robotic installation 	<ul style="list-style-type: none"> Pressurized upload Transfer through JEM-AL Robotic installation
Maximum dimensions	640 x 830 x 1000 mm	816 x 1037 x 1856 mm	864 x 1168 x 1245 mm	ø 250 x 920 mm ø 460 x 920 mm
Mass	up to 100 kg	up to 500 kg (TBC)	up to 500 kg	up to 100 kg
Power	up to 200 W @ 120 V up to 280 W @ 28 V	up to 200 W @ 120 V up to 280 W @ 28 V	up to 1200 W @ 120 V up to 100 W heater power	up to 224 W @ 28 Vdc
Data link to avionics	up to 100 Mbit/s	up to 100 Mbit/s	up to 100 Mbit/s	up to 100 Mbit/s
Cooling capability	up to 1.5 kW in total for all payloads			
Robotic interface	SPDM micro fixture	SPDM micro fixture	SPDM micro fixture	SPDM micro fixture
Payload to platform interface	MDA wedge adapter	MDA wedge adapter	FRAM	MUSES standard interface

Bartolomeo End-to-end Service Concept



Bartolomeo Collaboration with CASIS

30 November 2015

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14 November 2015

Mr. Uwe Pape
Senior Manager, Commercial ISS Operations
Airbus Defence and Space

Send electronically to: uwe.pape@airbus.com

Dear Mr. Pape:

The purpose of this memorandum is to express the support of the Center for Advancement of Science in Space (CASIS) for your "Bartolomeo" project concept: the development, integration and operation of a multi-user, multi-purpose commercial external platform on the International Space Station (ISS).

The CASIS mission is to exploit the capabilities of the ISS to conduct research and explore technologies for humanitarian, commercial, and educational benefit. Utilization of the ISS for earth observation offers great opportunities to the remote sensing community. The provision of remote sensing imagery, data, and other products to benefit both the private/commercial sector as well as humanitarian needs is a major element of a CASIS Campaign entitled "Good Earth". However, the available ISS infrastructure and resources required to address this demand appropriately is extremely limited. A recent ISS gaps and needs analysis conducted on behalf of CASIS recommended the following action: *"Expand the number of nadir mounting points. Despite existing ISS payload capabilities, nadir mounting points are expected to soon reach capacity. Increasing the number of nadir viewing mounting options (e.g., expanding existing ELCs, adding new ELCs, or adding a new dedicated remote sensing platform) will facilitate deployment of more Earth observing sensors."*

This memorandum in support of the Airbus "Bartolomeo" project concept is intended to provide a level of commitment from CASIS, the managers of the ISS U.S. National Laboratory. Given the limited capacity of ISS to accommodate external payloads, CASIS is hopeful this support will assist in discussions and negotiations with other ISS partners, external ISS payload operators, and other ISS stakeholders at large. You are welcome to contact Mr. Ken Shields, kshields@iss-casis.org, for clarification and confirmation of CASIS support.

Regards,

Ken Shields

Ken Shields
Director, Operations
Center for the Advancement of Science in Space
CASIS

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 **AIRBUS**
DEFENCE & SPACE

Bartolomeo Hosted Payload Compared to Satellite-based Mission

Parameter	Small Satellite	Medium Satellite	Large Satellite	Bartolomeo
Maximum payload mass	50 kg	150 kg	200 kg	50 – 500 kg
Orbit parameters	Fully selectable			ISS orbit
Average payload power @ EOL	50 W	140 W	386 W	up to 1000 W
Data downlink rate	80 Mbit/s	105 Mbit/s	105 Mbit/s	approx. 30 Mbit/s
Life time	5 - 10 years in LEO			
Time to launch	31 months	31 months	39 months	12 – 18 months
Estimated operations cost for customer per year	1.5 MUSD	1.5 MUSD	1.5 MUSD	2 - 7 MUSD
Platform price / initial payment per customer	17 MUSD	24 MUSD	36 MUSD	0 MUSD
Launch cost	2.5 – 7 MUSD	10 – 15 MUSD	30 MUSD	SAA?
Estimated mission cost at commissioning	26 MUSD	40 MUSD	68 MUSD	2 - 7 MUSD
Estimated Mission cost after 5 years	35 MUSD	50 MUSD	75 MUSD	15 – 35 MUSD



Contact

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