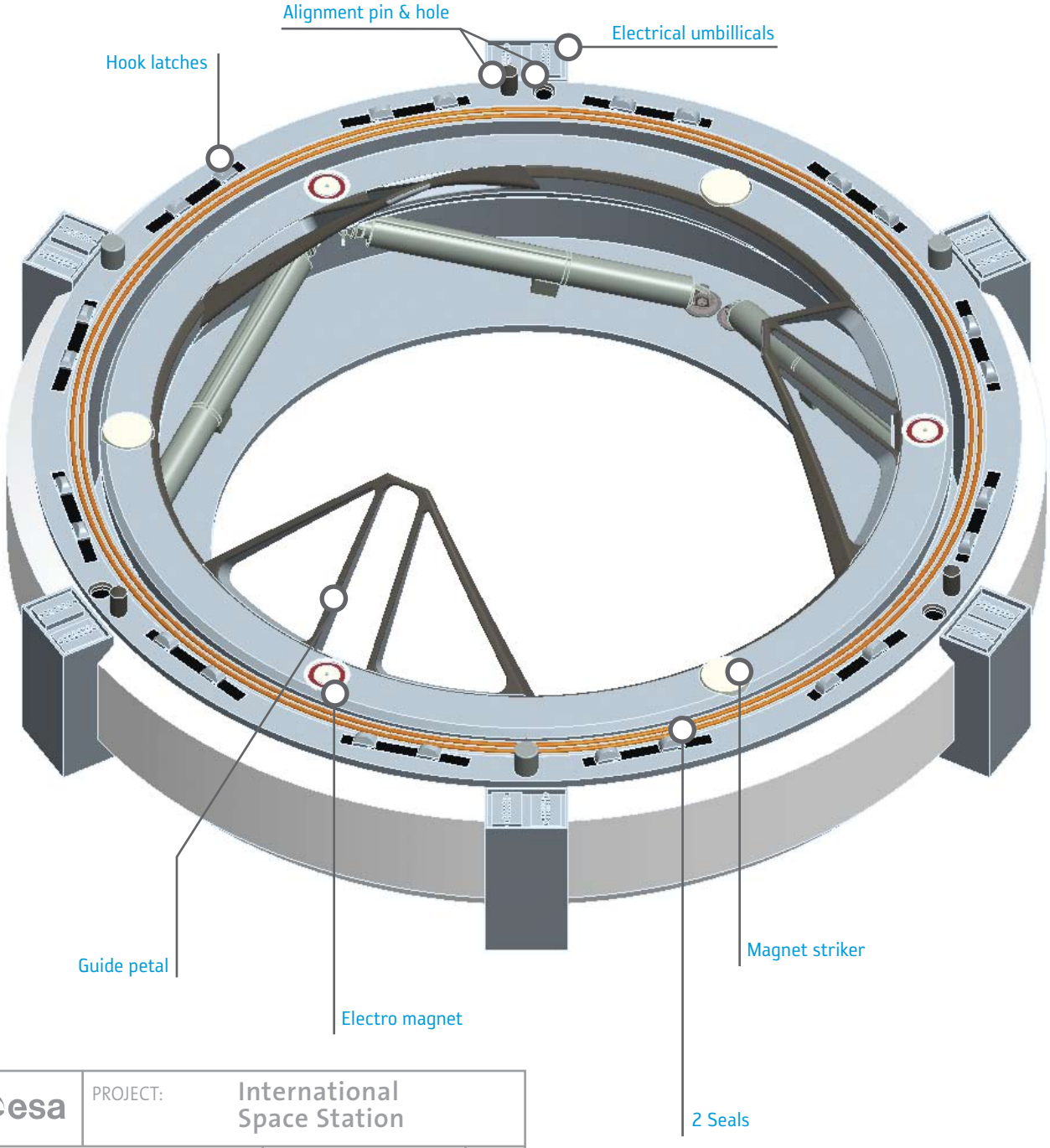
→ INTERNATIONAL BERTHING DOCKING MECHANISM (IBDM)

European Docking System for the ISS

The International Berthing and Docking Mechanism is the European docking mechanism compatible with the future ISS USOS docking ports. The IBDM captures the vehicle flying to the ISS and it damps the residual relative motion between the vehicle and the ISS. Once captured and damped, the IBDM provides a structural pressurized connection between the vehicle and the ISS. The IBDM also allows berthing of a vehicle to a compatible ISS port by the ISS robotic manipulator. The application of the IBDM is not limited to the ISS scenario, as the IBDM will allow docking of two free-flyer vehicles in LEO or deep-space missions.



esa	PROJECT: International Space Station		
TITLE: IBDM		DOCUMENT N°: ESA-HSF-COU-027	REV. 2.0

Common Berthing Mechanism (CBM)

The ISS provides the following berthing locations that are not permanently occupied by Station elements:

Node 2 Nadir: nominal berthing port for visiting vehicles (HTV, Dragon, Cygnus)
Node 2 Zenith: back-up berthing port for visiting vehicles
Node 3 Forward: free
Node 3 Aft: free

Note 1: Node 2 Forward is currently occupied by the PMA2. Upon shuttle retirement the port might become available but is likely to be used for visiting vehicle docking (Orion).
Note 2: Cupola currently on Node 3 Nadir port might be relocated in the future to Node 3 Forward port in order to offer on Node 3 Nadir an additional berthing location for visiting vehicles.
Note 3: Node 3 Port is currently occupied by the PMA3. PMA3 function was the back-up port for Shuttle docking. Its only function is now stowage volume.

Berthing ports are equipped with Common Berthing Mechanisms (CBM) that are identical on all ports of the station. The berthing mechanism is composed of two halves an active and a passive.
The above mentioned ISS ports incorporate the Active CBM while the structure to be berthed will have to incorporate the Passive CBM.

The functions of the CBM are:
- Allow the berthing/de-berthing of two modules;
- Ensure the structural connection of mated modules;
- Ensure the pressure integrity of the connection;
- Allow the (dis-)connection of utilities between both mated modules;
- Provide a passageway between mated module.

Active CBM installed on Node 3 port.

Node 3 and Cupola being mated before launch.

Alignment guides of Passive and Active CBMs.

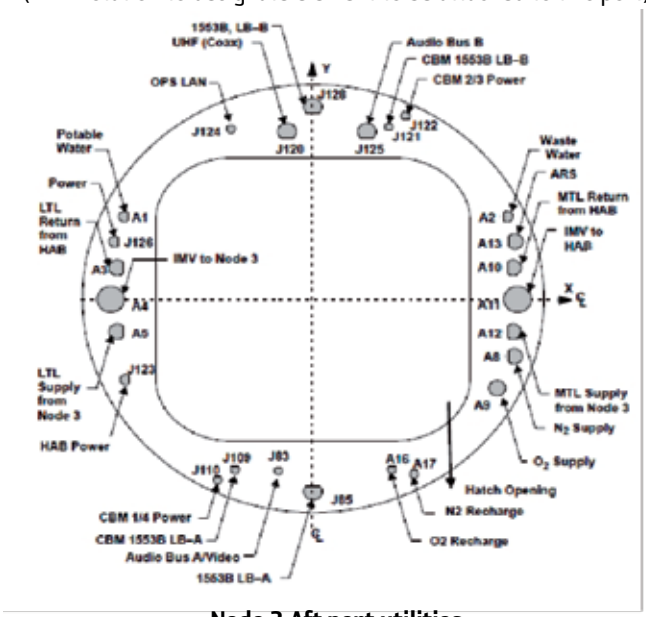
Passive CBM installed Cupola.

The CBM interface to pressurised elements is described in document SSP41004.

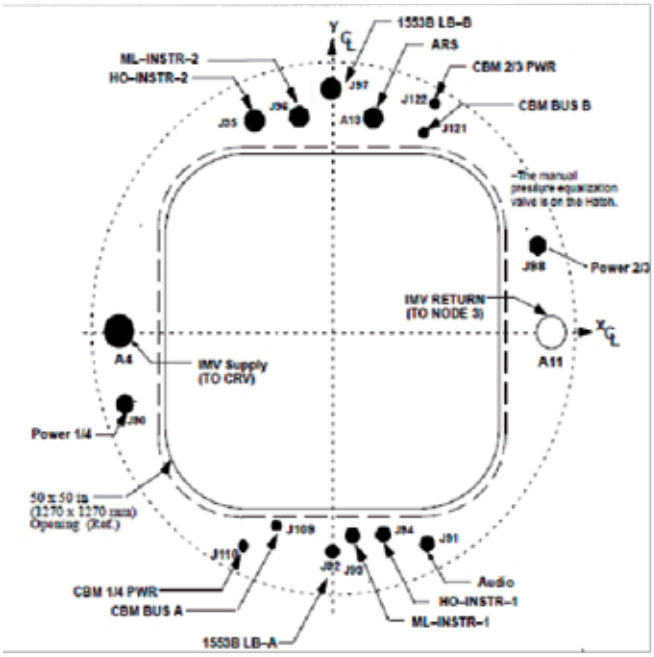
The non-permanently occupied berthing ports provide the following function:
- Supply power,
- Send/receive Data,
- Supply/receive air,
- Receive atmosphere sample air,
- Supply/receive coolant.

Additional functions are available at certain ports:
- Supply/receive audio,
- Supply video,
- Supply nitrogen,
- Supply oxygen,
- Receive fuel cell water,
- Receive waste water.

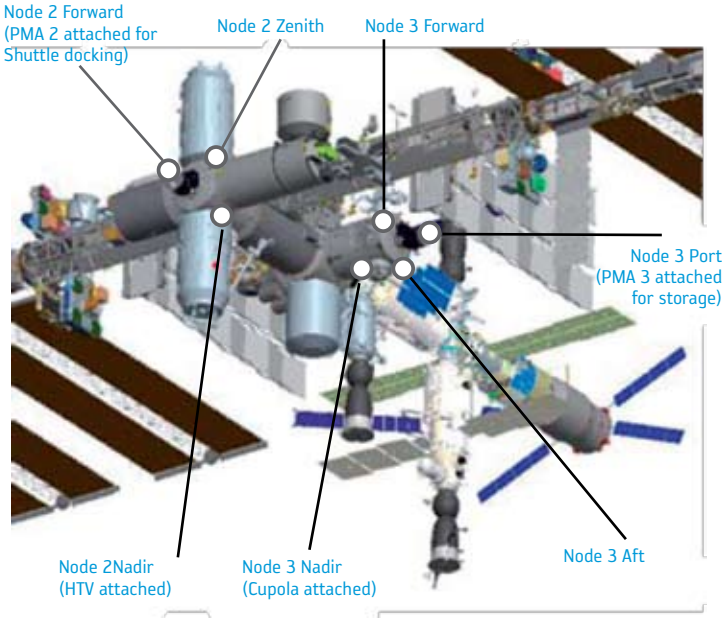
Node 3 Forward port utilities
(HAB notation to designate element to be attached to this port)



Node 3 Aft port utilities
(CRV notation to designate element to be attached to this port)



Photos: Thales Alenia Space-Italy



IBDM Specifications

DIMENSIONS

External diameter:	1,485 mm
Height from vehicle interface plane to docking plane:	250 mm
Height from vehicle interface plane to tip of petal (stowed configuration):	437 mm

OPERATIONAL CAPABILITIES

On-orbit environment:	-100˚C to +100˚C survival -50˚C to +50˚C operational
On-orbit life:	15 years
Allowable number of docking/un-docking cycles:	30

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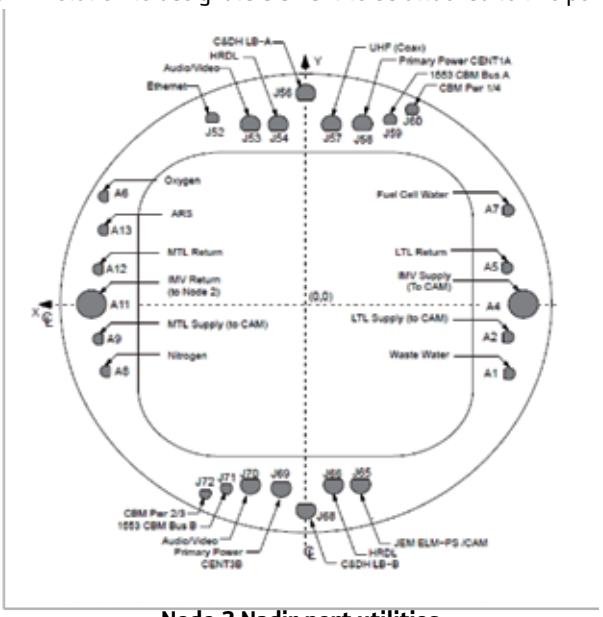
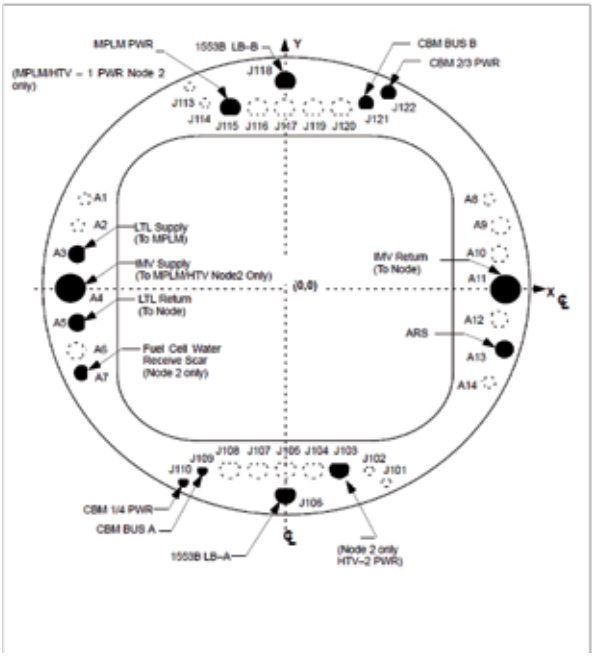
Node 2 Zenith port utilities

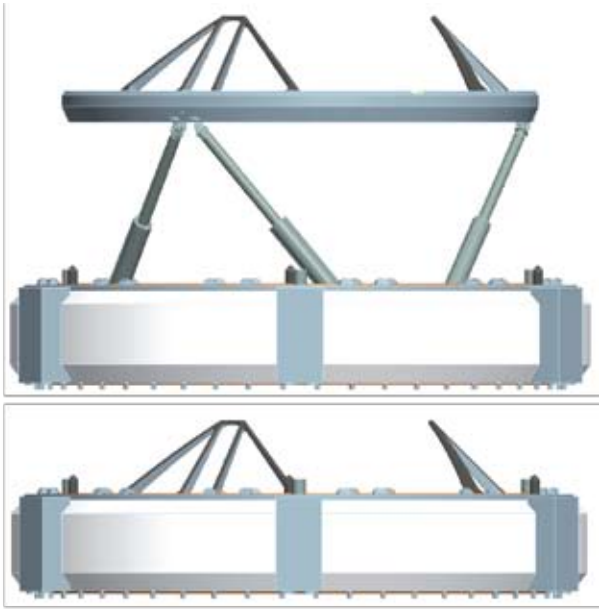
(CAM notation to designate element to be attached to this port)

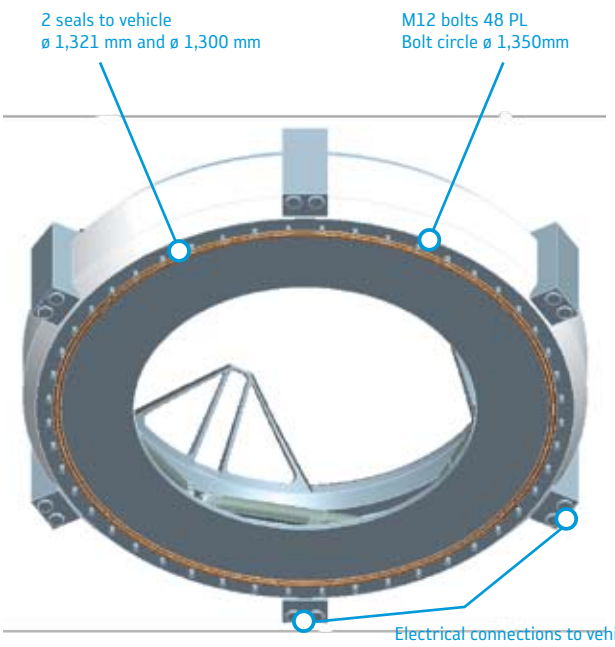


Node 2 Nadir port utilities

(MPLM notation to designate element to be attached to this port)





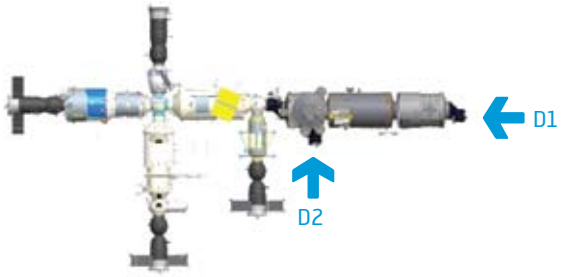


Utilisation Relevant Data

DOCKING PORT ON USOS

Location: See figure below

Position of Docking Ports (D)



Clear passageway: Ø 685 mm
Ø 800 mm when petals stowed
Other Services: Power and data connections

IBDM

Initial docking conditions:
Relative longitudinal closing velocity, m/s 0.05-0.10
Relative total lateral closing velocity, m/s < 0.02
Relative angular rate:
- pitch/yaw, relative angular rate, °/s < 0.15
- roll angular rate, °/s < 0.4

Angular misalignment of longitudinal axes:
- pitch/yaw misalignment, deg. < 5.0
- roll misalignment, deg. < 5.0

Lateral misalignment/eccentricity, m < 0.10

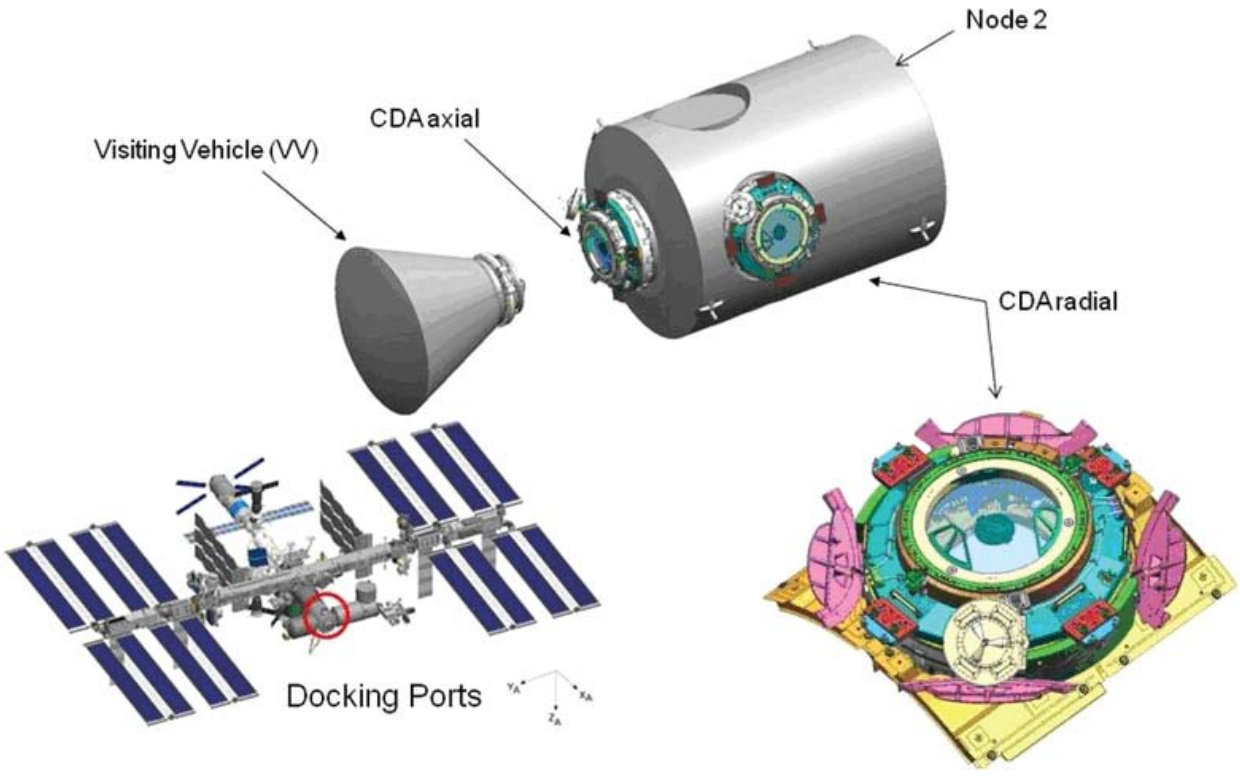
Clear passageway: Compatible with USOS docking ports

In-orbit allowable interface loads while attached to the ISS:

Max. Design Pressure:	1,100 hPa
Compressive Axial Load:	17,659 N
Tensile Axial Load:	17,659 N
Shear Load:	16,636 N
Torsion Moment:	15,000 Nm
Bending Moment:	68,650 Nm

Other capabilities:
- Berthing
- Clocking around the symmetry axis allows for location or re-location of the attached vehicle in 3 orientations at 120 degrees intervals.

USOC Docking Port Description



The CDA will be installed on the axial and radial ports of the ISS's Node 2 module to provide a new docking interface for a wide variety of visiting vehicles. Illustration: NASA