

human spaceflight



Radiation Dosimetry in the European Columbus Module

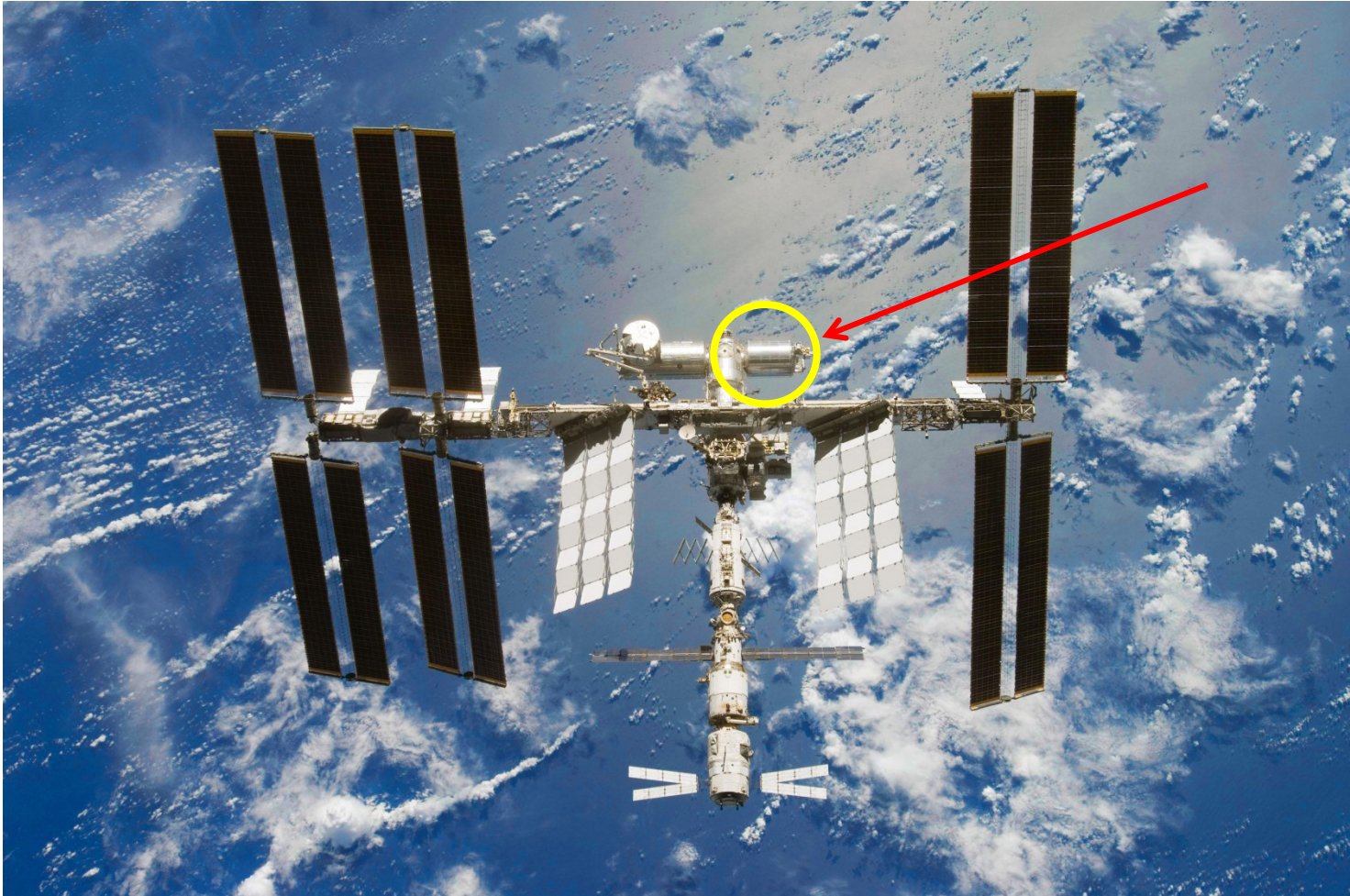
René Demets (ESTEC HSO-USL)

17th WRMISS

Austin, Texas

Wednesday 5 September 2012

The European Columbus module



ESA Dosimetry in Columbus

- ☐ **No operational dosimetry**
- ☐ **Only research dosimetry***
- ☐ **Based on individual experiment proposals submitted by European research teams**
- ☐ **Consequence: ESA radiation dosimetry in Columbus not permanent**

* Additionally: personal dosimetry for astronauts, results confidential

Three experiments

ongoing:

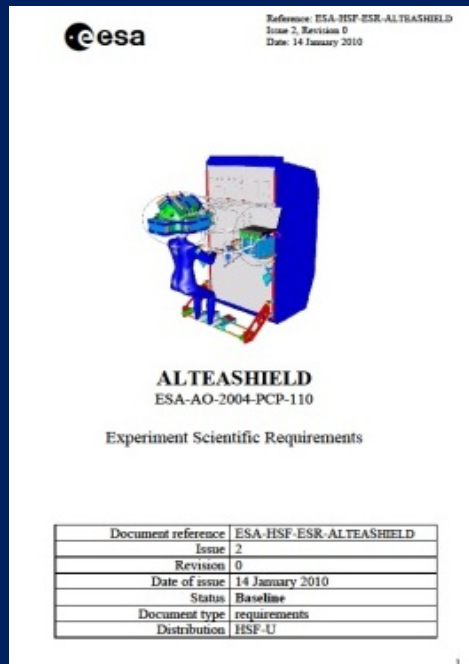
- **ALTEA-SHIELD** (ILSRA-2004-110)
Anomalous long-term effects in astronauts
lead scientist: Livio Narici
- **DOSIS 3D** (ILSRA-2009-0778)
Dose distribution inside the International Space Station
lead scientist: Thomas Berger

in preparation:

- **TRITEL** (SURE-AO-2006-018)
Tri-axis telescope:
New complex method for determining the equivalent dose of astronauts
lead scientist: Attila Hirn

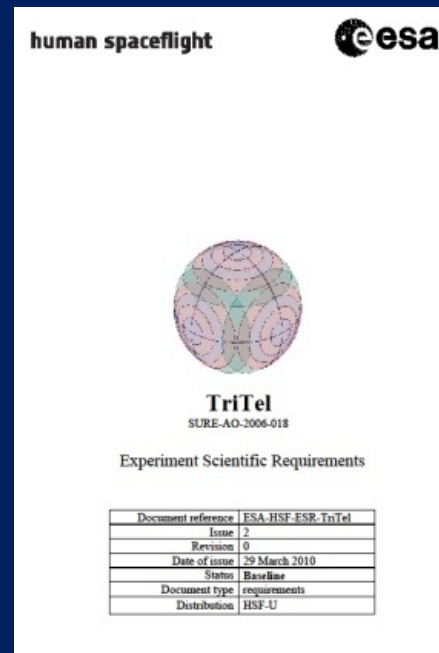
Experiment Definition document: ESR (Experiment Scientific Requirements)

ALTEA-SHIELD



14 January 2010

TRITEL



29 March 2010

DOSIS 3D



26 May 2012

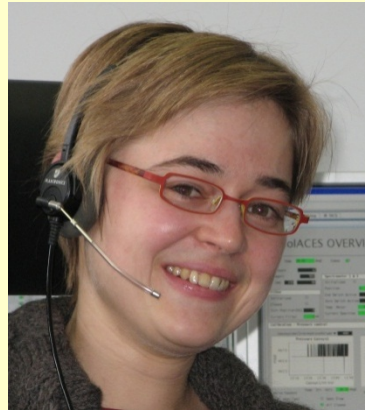


Eric Istasse

Colleagues at ESTEC: **Mission Science Office (MSO)**



Hilde Stenuit



Liesbeth De Smet



Ines Antunes



Nicole Vagt

Who is ESA?



September 2012
19 ESA member states



DOSIS 3D: Germany
ALTEA-SHIELD: Italy
TRITEL: Hungary



Germany: member state
Italy: member state
Hungary: co-operating state

Current status of the three ESA experiments

ALTEA-SHIELD

goal: **comparative testing of shielding materials**

lead scientist: Livio Narici

Shielding tiles delivered to ISS on 29 March 2012 by ATV-3

Deployed on 8 June 2012 by André Kuipers

First run:

Polyethylene tiles

Start: 9 June (FD 160)

Finish: 9 August (FD 222)

54 cumulative days of recording

Tiles were swapped on 9 August by Aki Hoshide

Second run:

Kevlar tiles

Start: 9 August (FD 222)

Current status of the three ESA experiments

DOSIS 3D

goal: **area dosimetry inside Columbus** (and ISS)

lead scientist: Thomas Berger

Upload 15 May 2012 on Soyuz 30S

Deployed 21 May 2012 by André Kuipers

11 passive detector packages (PDPs)

1 active package with two DOSTELS

Current status of the three ESA experiments

TriTel

goal: **directional dosimetry inside Columbus** (4π scan)

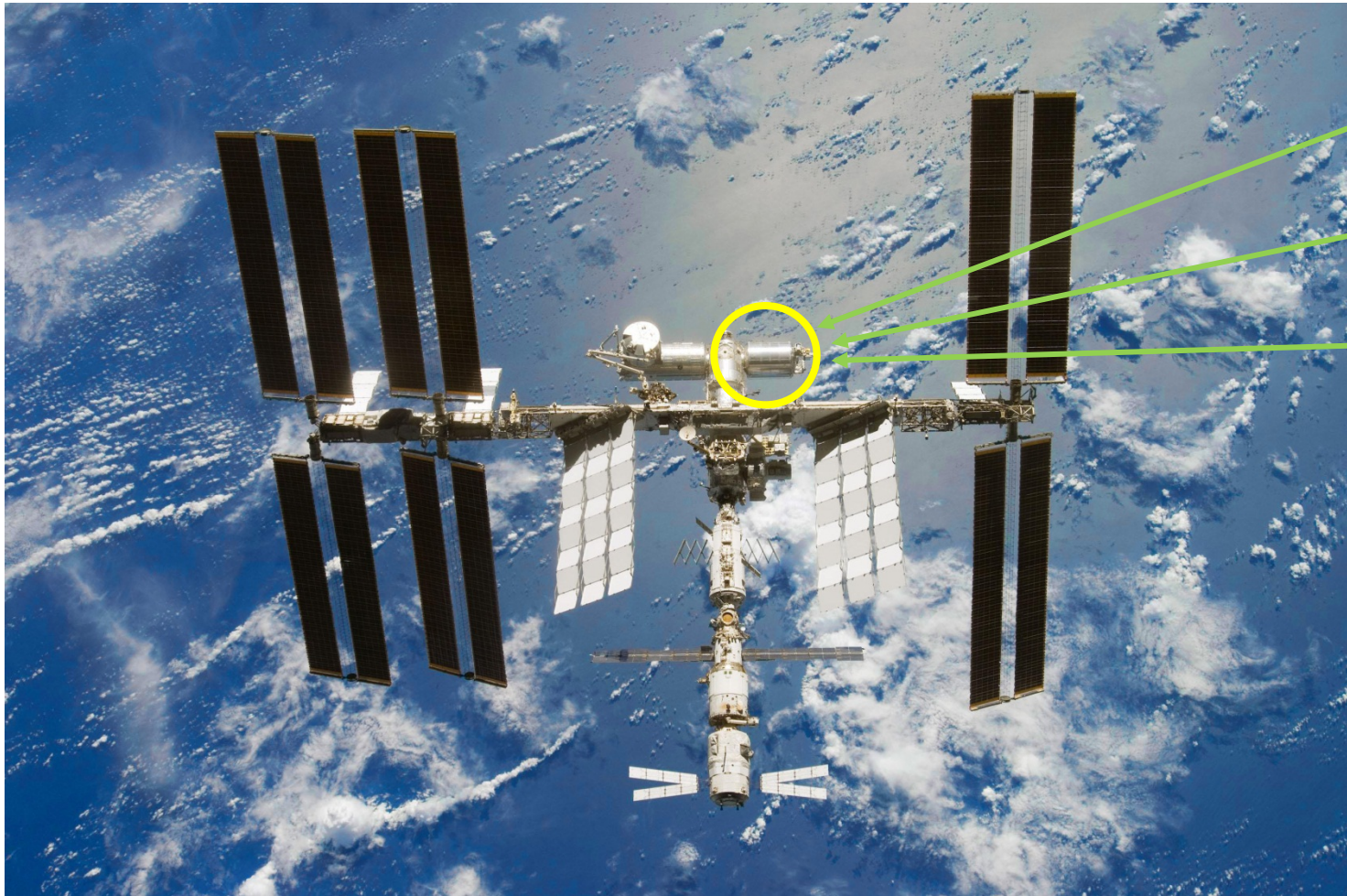
lead scientist: Attila Hirn

Upload active detectors: planned for 31 October 2012 on Progress 49P

Upload passive detectors: planned for 5 December 2012 on Soyuz 33S
second chance: 28 March 2013 on Soyuz 34S

- 1 passive detector package
- 1 active package (tri-axis telescope)

Position on the ISS



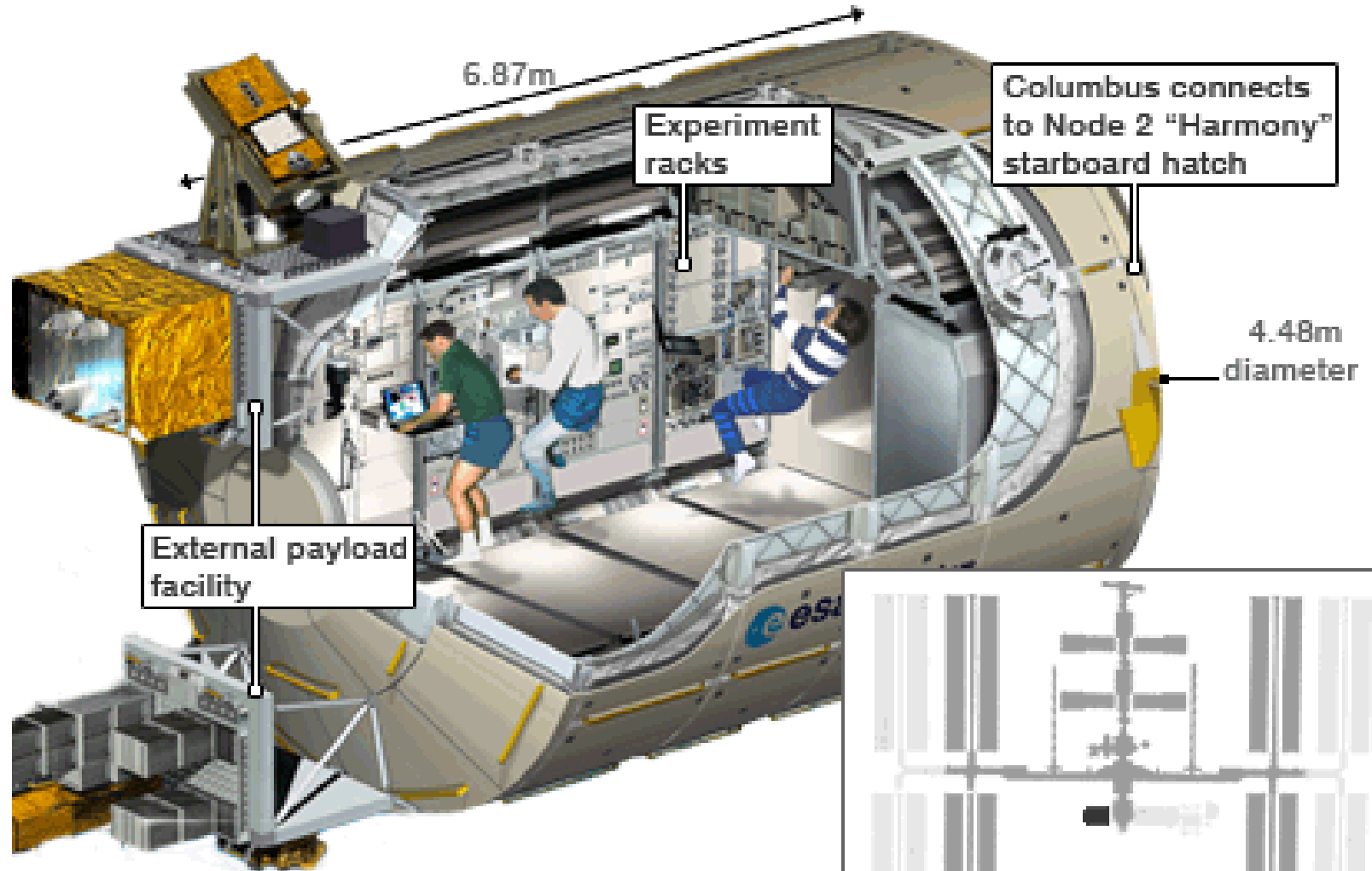
ALTEA-SHIELD

DOSIS 3D

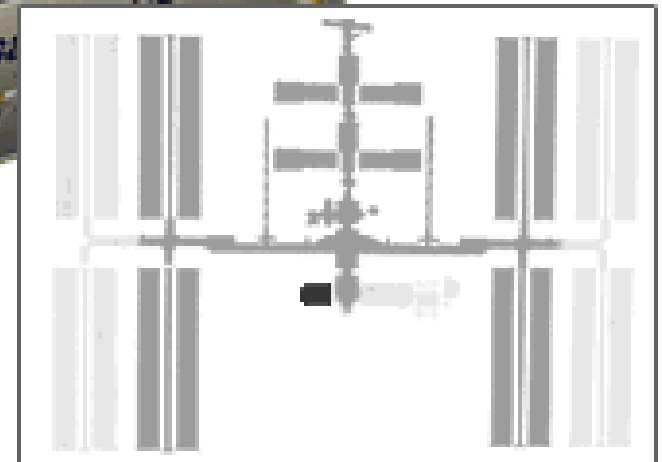
TRITEL

Columbus module – cut-away illustration

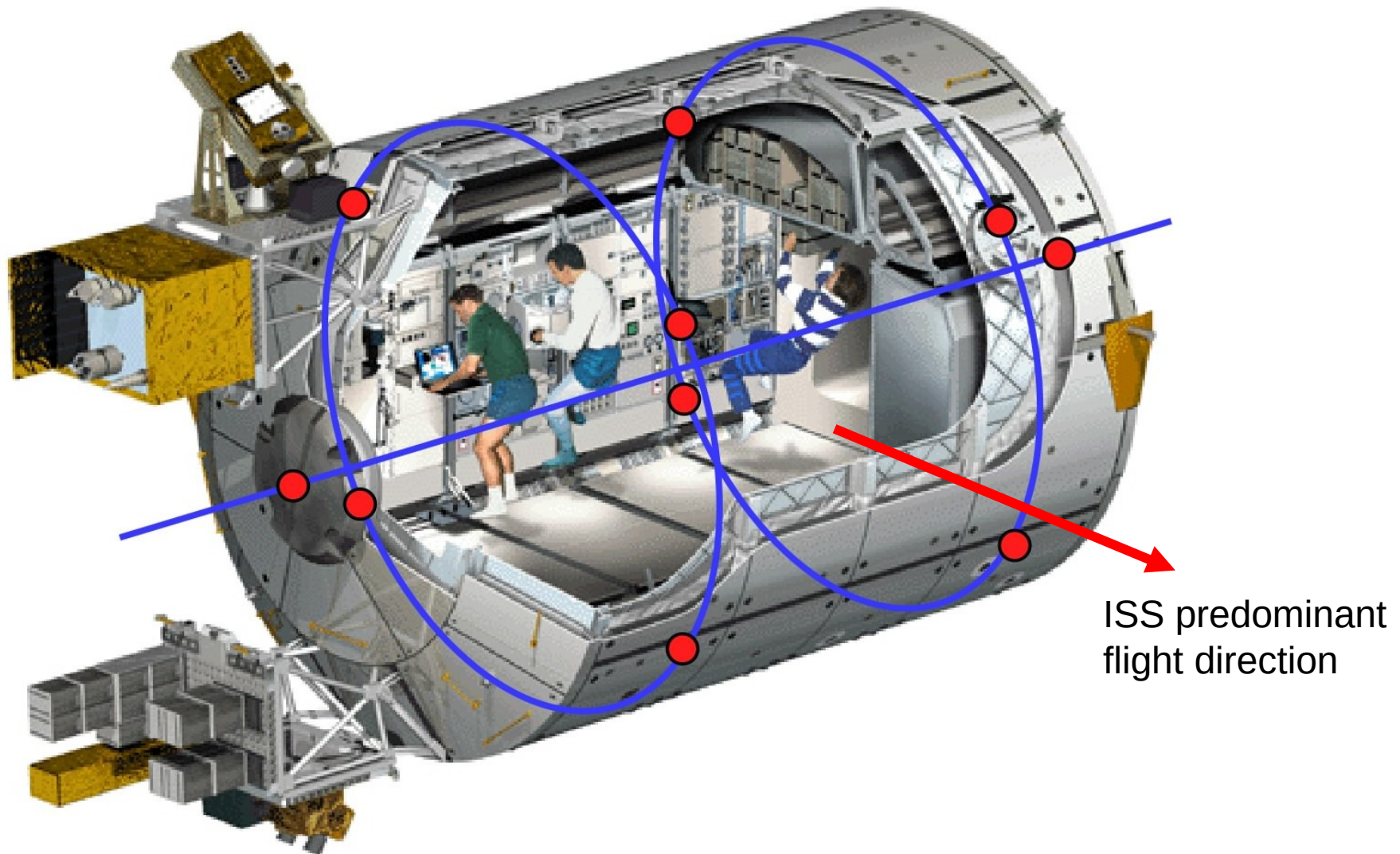
INTERNATIONAL SPACE STATION - COLUMBUS



SOURCE: ESA



Proposed position of the DOSIS 3D PDPs

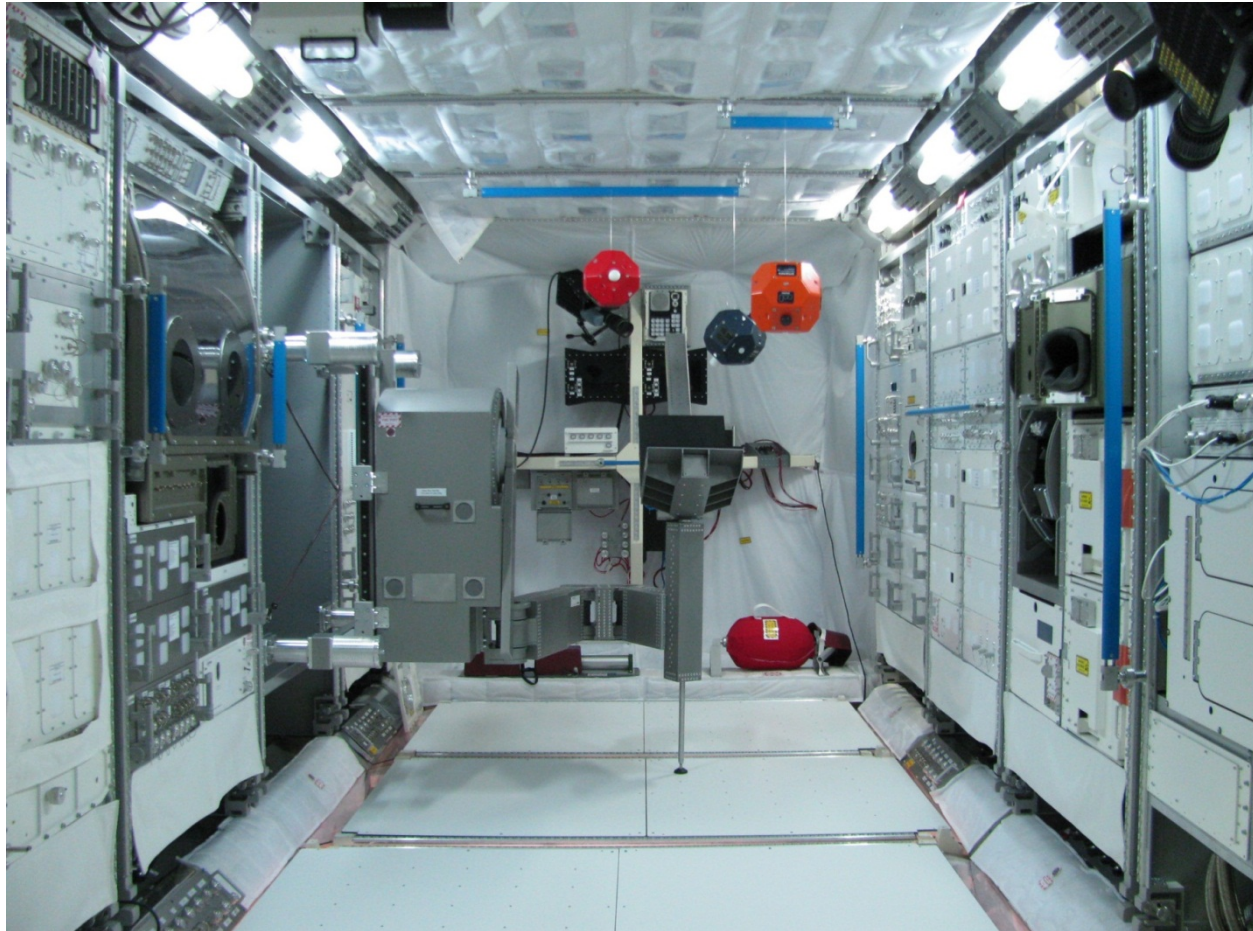


Columbus mock-up at ESTEC



(there is another one in Cologne at EAC, the European Astronaut Centre)

Columbus mock-up at ESTEC: interior



Columbus in space: interior



Columbus in space: interior





Where are ALTEA-SHIELD, DOSIS 3D, TRITEL?

Where is:

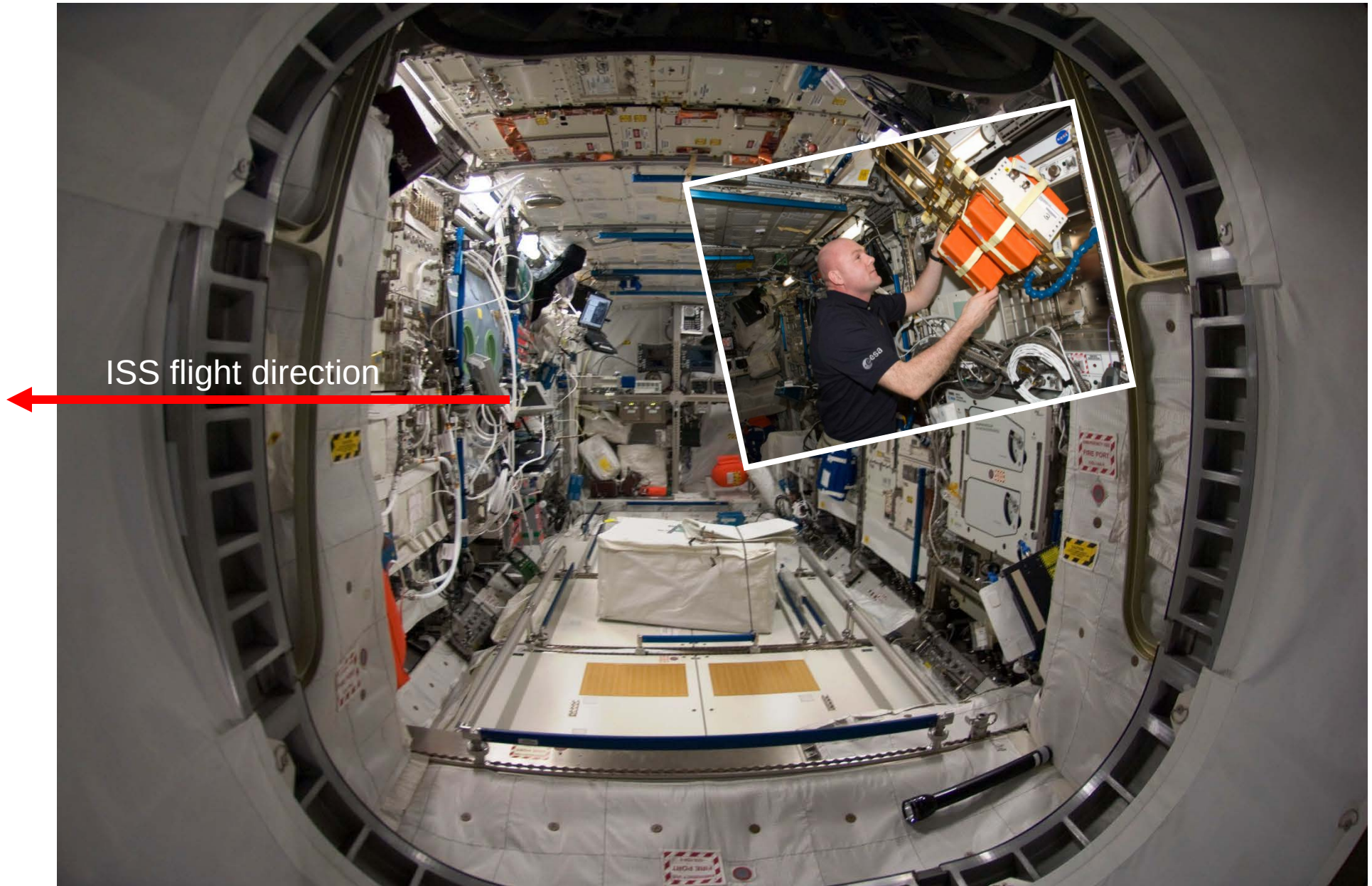
ALTEA-SHIELD

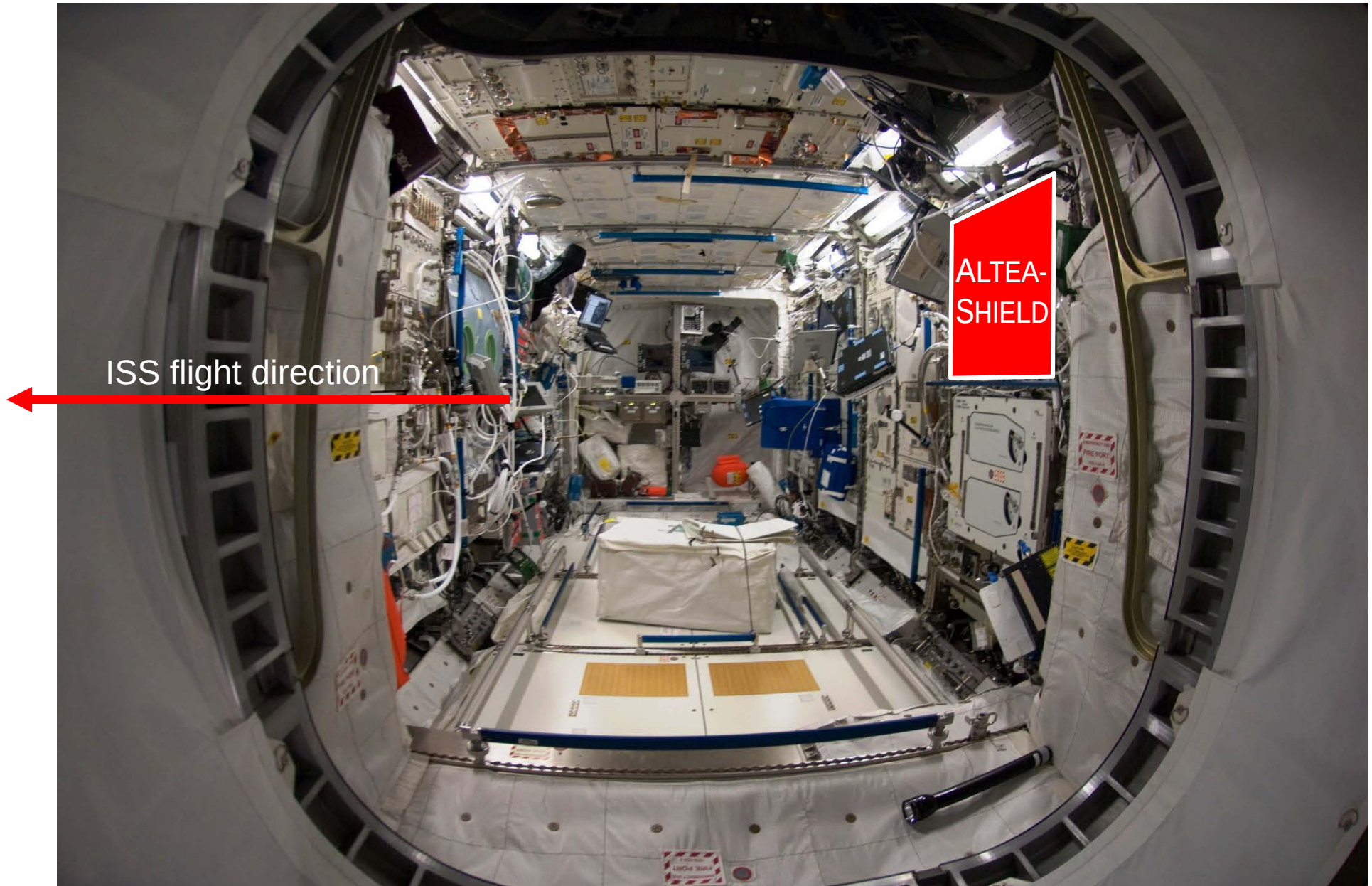
lead scientist: L. Narici



ESA astronaut André Kuipers configuring hardware for the ALTEA-Shield experiment in the Columbus laboratory on 8 June 2012 (Image: NASA).







Where is:

DOSIS 3D

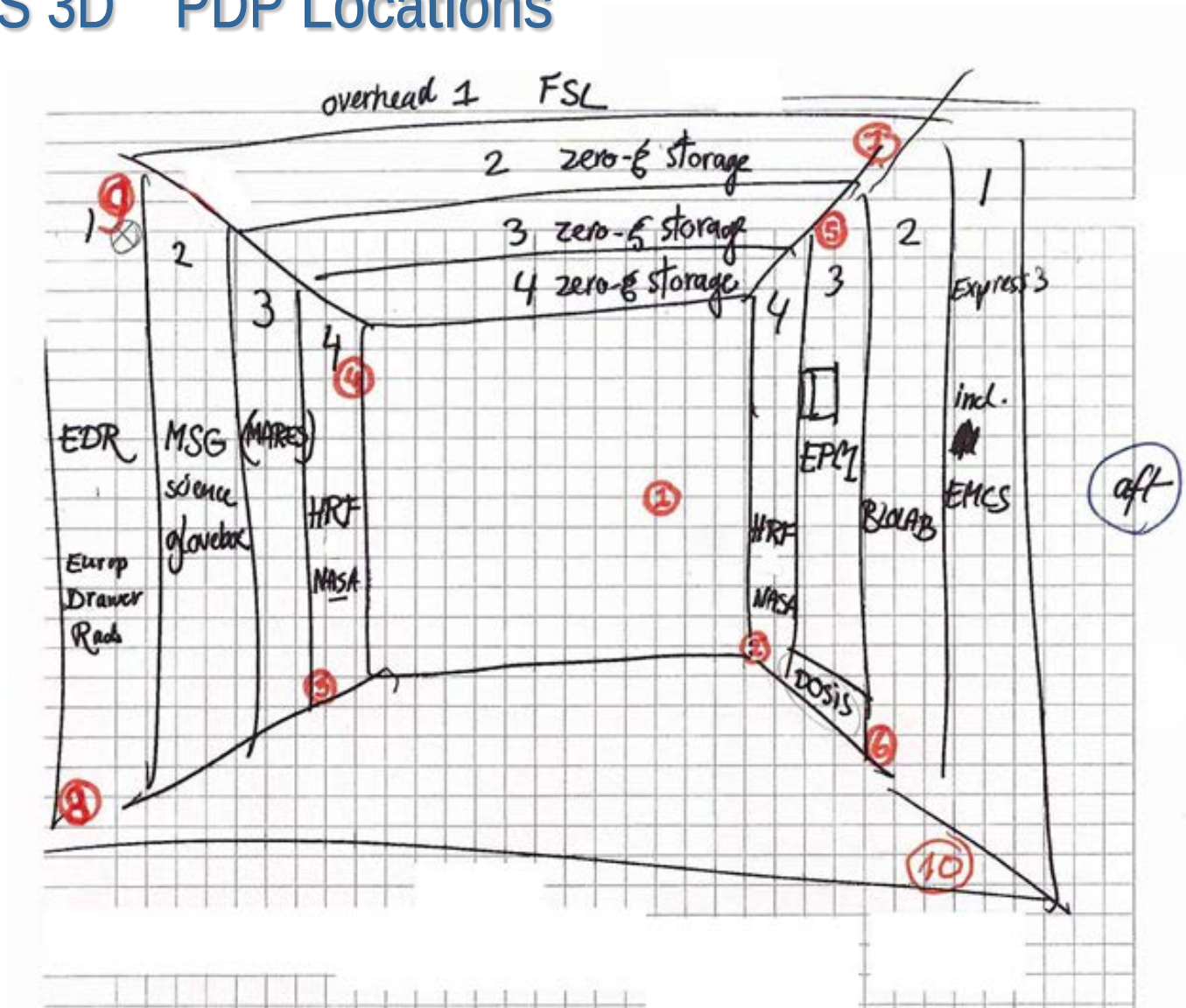
lead scientist: T. Berger



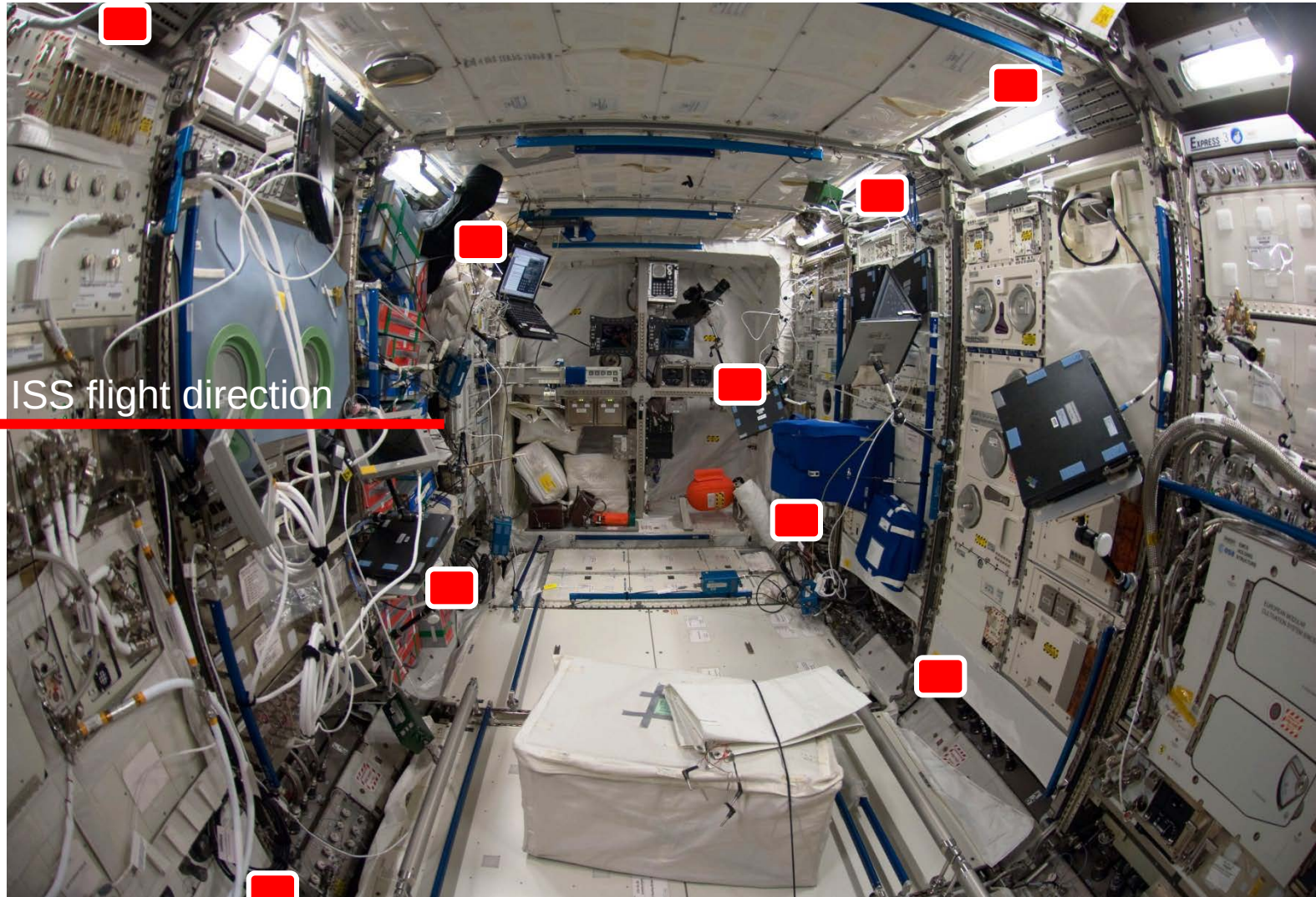
DOSIS 3D PDP Locations

PDP Nr.	COLUMBUS	Related rack	Position
-021	Star Cone	-	Behind bend in right cone structure
-022	A4 UIP	HRF 2	Left side on UIP next to Vacuum connector
-023	F4 UIP	HRF 1	Left side on UIP next to Vacuum connector
-024	F4 HRF 1	HRF 1	On HRF Cooling Stowage Drawer
-025	A3 EPM	EPM	Top of EPM on the right of the EPM label
-026	A2 UIP	BLB	Left side on UIP next to Vacuum connector
-027	O2 UIP	ZSR	Left side on UIP next to Vacuum connector
-028	F1 EDR	EDR	Left side on UIP next to Vacuum connector
-029	F1 UIP	EDR	EDR upper right edge
-030	PBA	-	On Portable Breath Apparatus Cover

DOSIS 3D PDP Locations



DOSIS 3D PDP Locations



Cardboard PDP dummies



DOSIS 3D PDPs on board photography



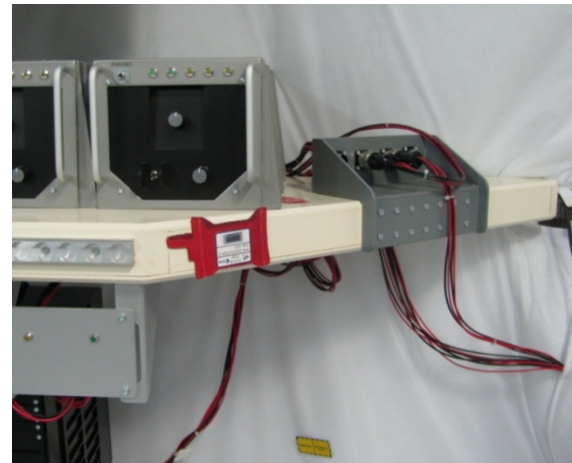
DOSIS 3D PDP # 021

Position: Columbus Star Cone

space



ground (ESTEC)



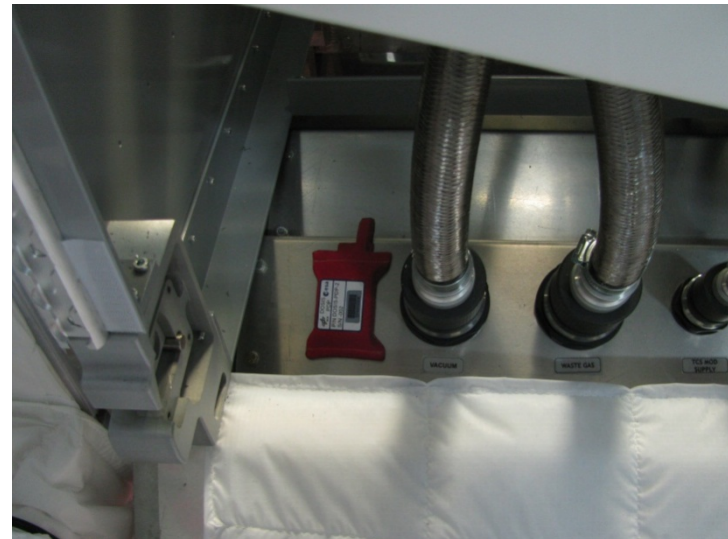
DOSIS 3D PDP # 022

Position: A4 HRF2 left side on UIP next to vacuum connector

space



ground (ESTEC)



DOSIS 3D PDP # 024

Position: Columbus F4 HRF1 on cooling stowage drawer

space

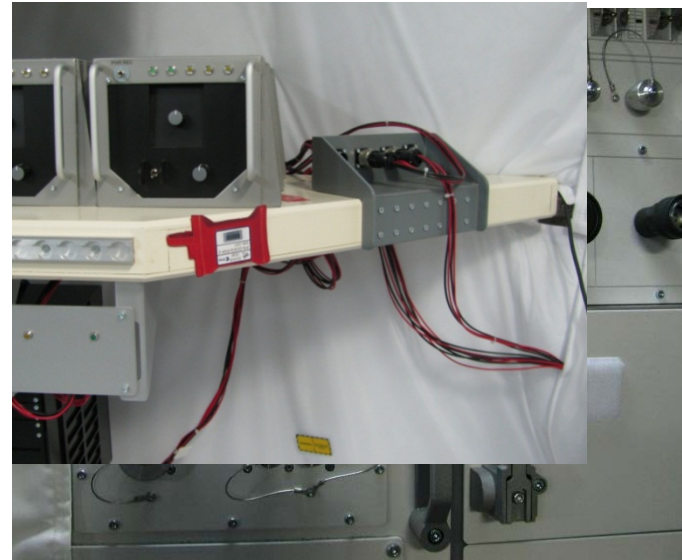
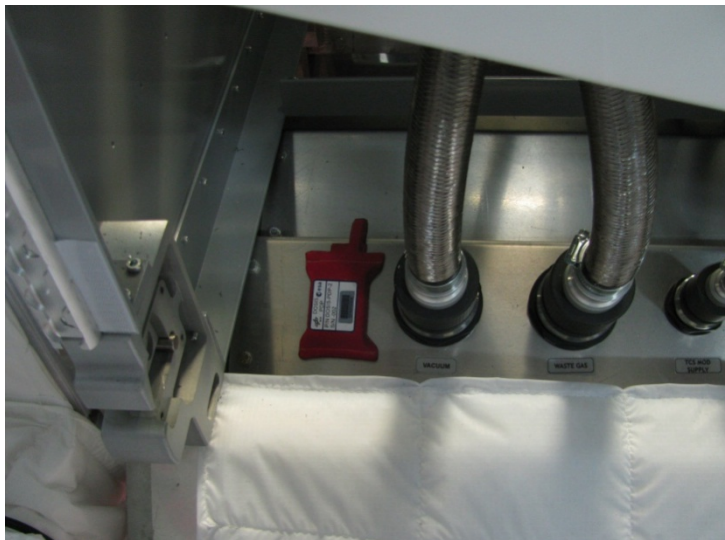


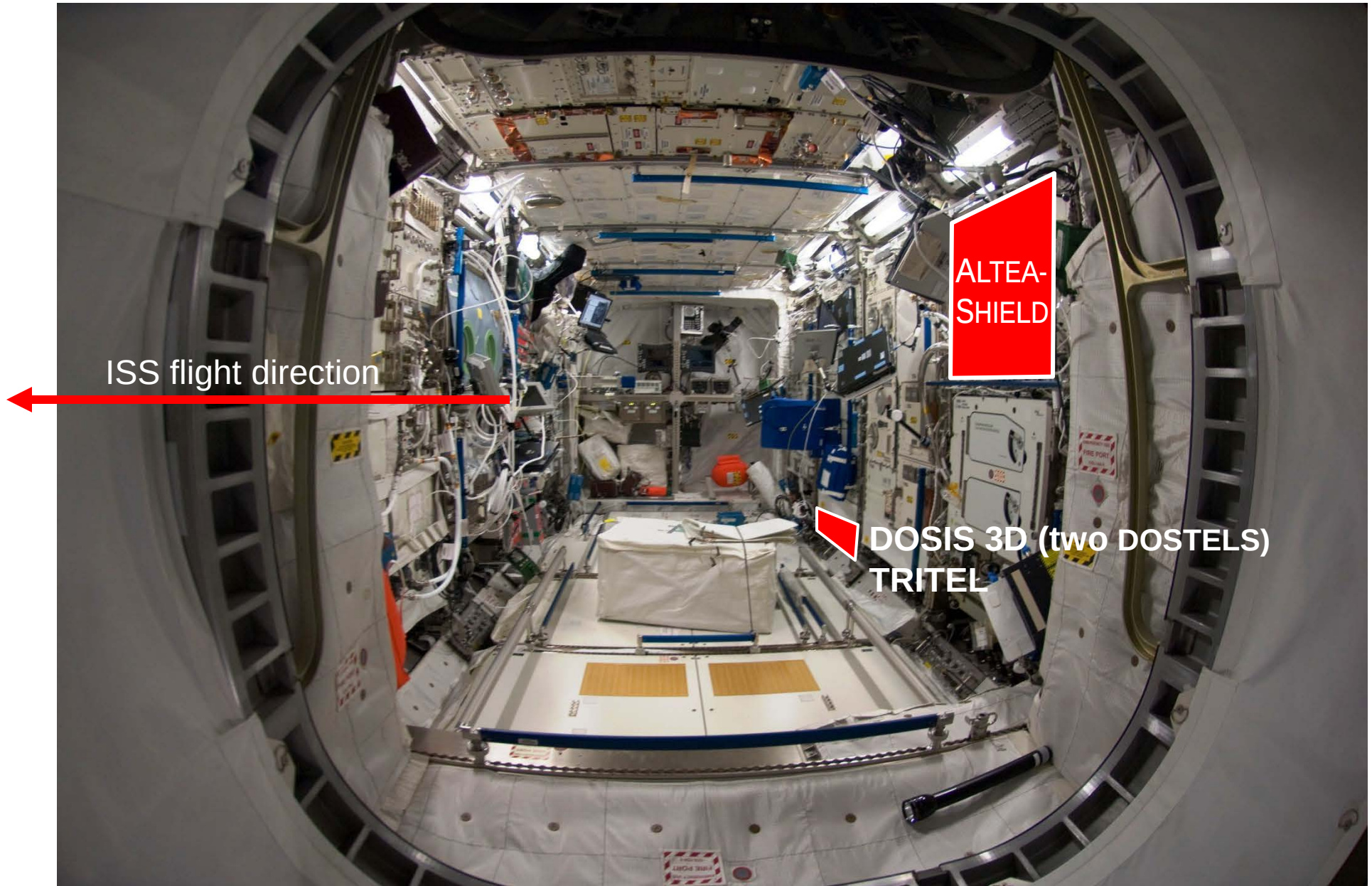
ground (ESTEC)



DOSIS 3D PDPs

Conclusion: some PDPs inclined (not precisely pointing in x, y or z direction)



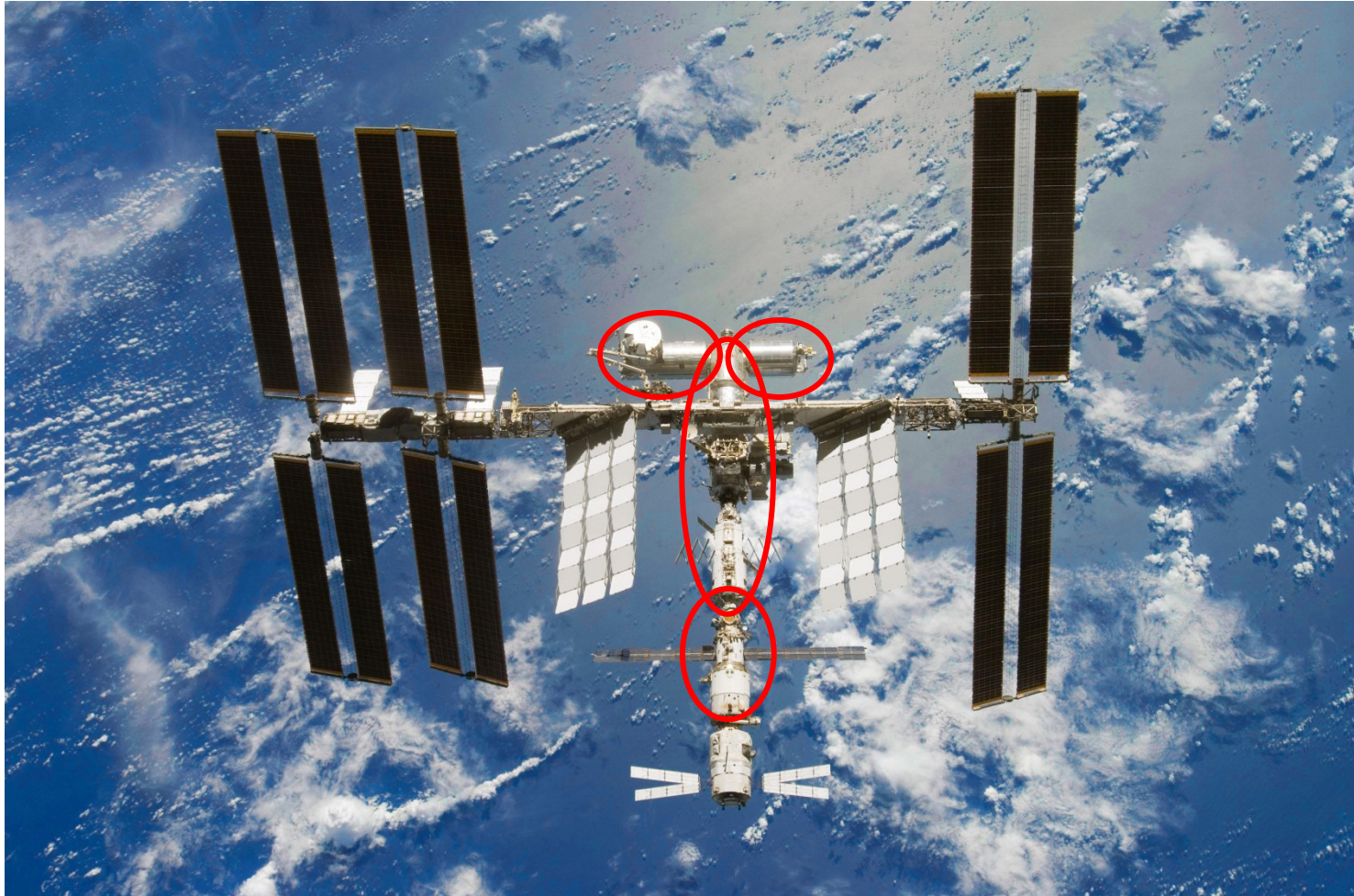


Configuration

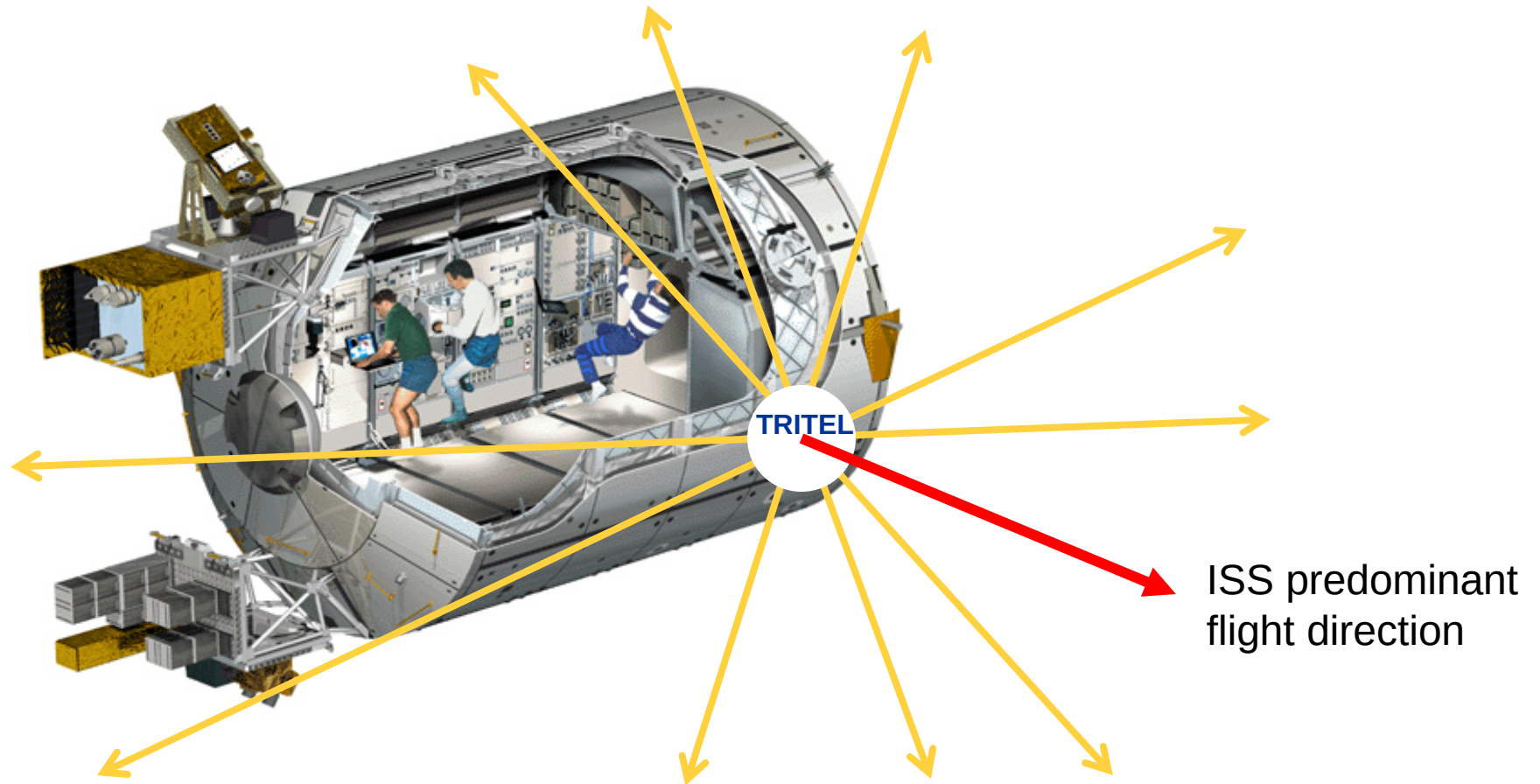
	passive detectors	active detectors	detector types
ALTEA-SHIELD		x	3 silicon detector telescopes (SDU)
TRITEL	x	x	3 silicon detector telescopes CR-39, TLD
DOSIS 3D	x	x	2 silicon detector telescopes (DOSTELs) CR-39, TLD

Configuration

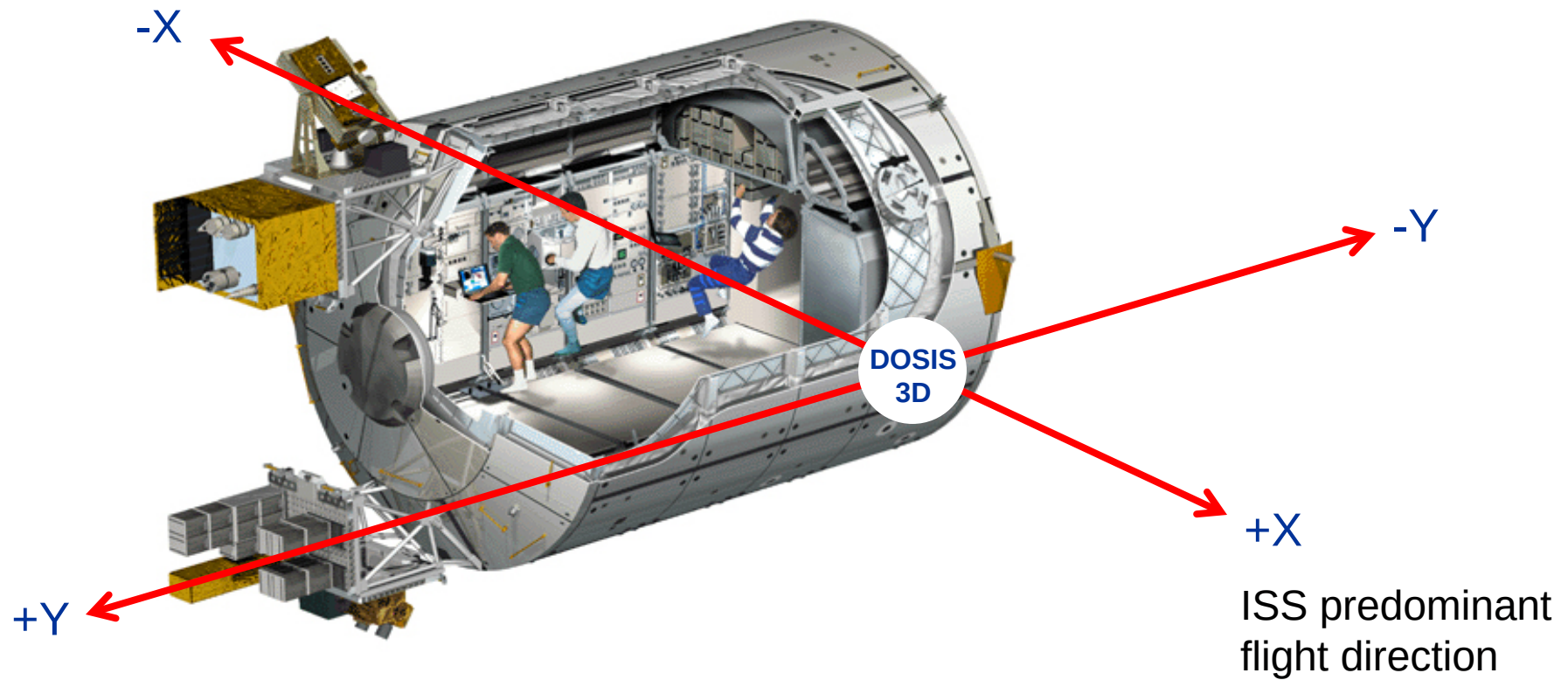
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DOSIS 3D	x	x	2 silicon detector telescopes CR-39, TLD
	x		<i>partners:</i> RAMs NASA
	x		PADLES JAXA
	x		SPD Roscosmos
	x		Pille Roscosmos
		x	TEPC NASA
		x	DB-8 Roscosmos



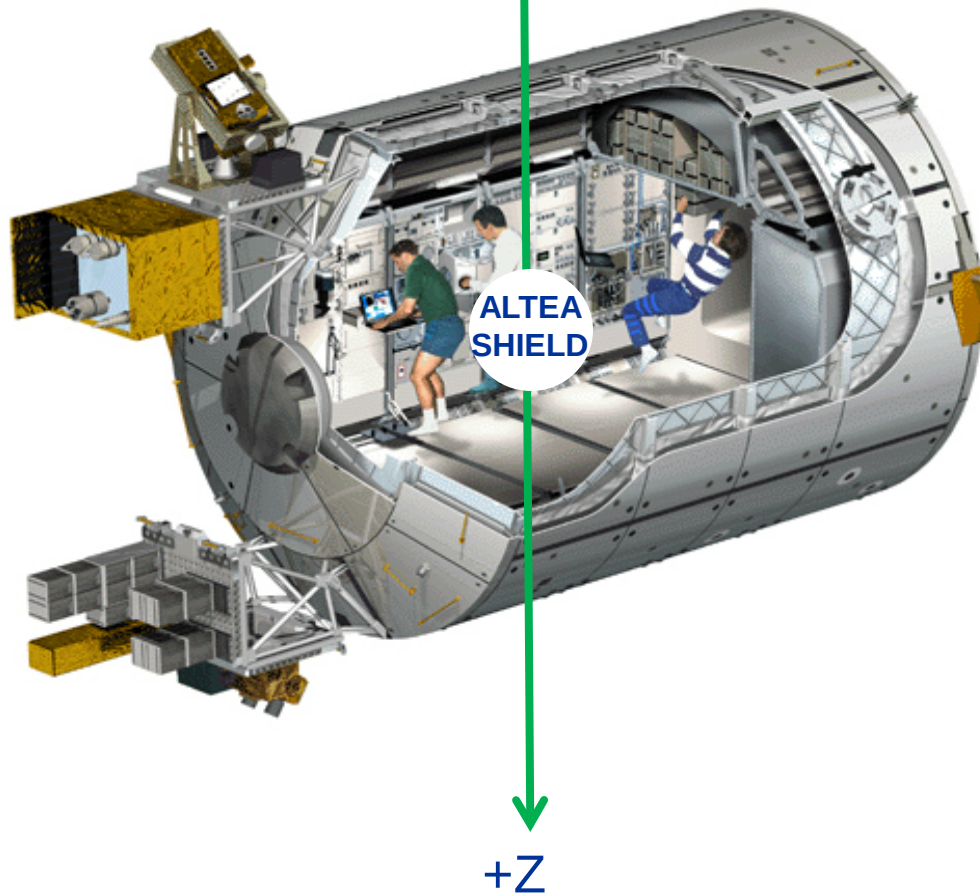
TRITEL – viewing directions



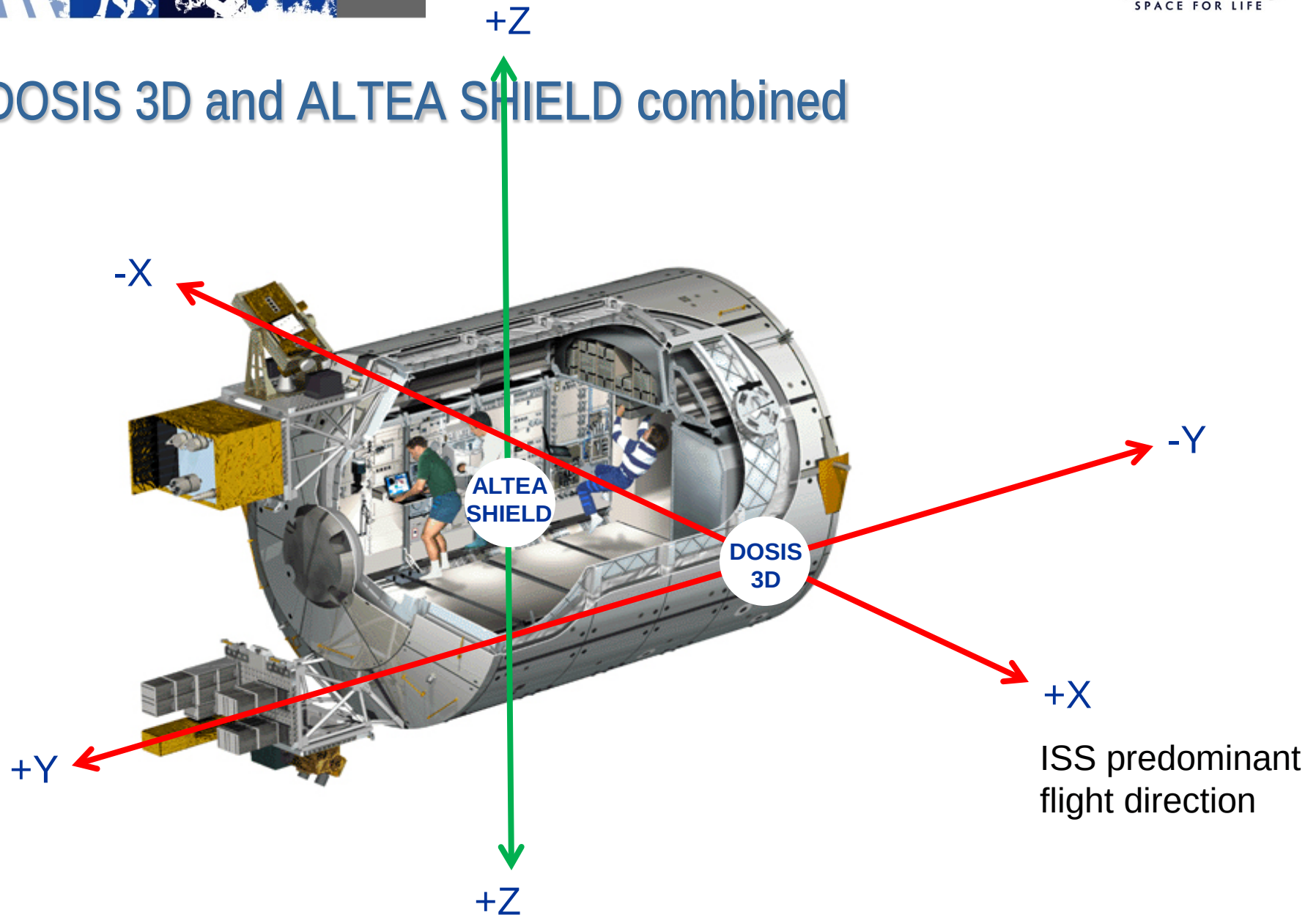
DOSIS 3D – viewing directions



ALTEA SHIELD – viewing directions



DOSIS 3D and ALTEA SHIELD combined





Thank you !