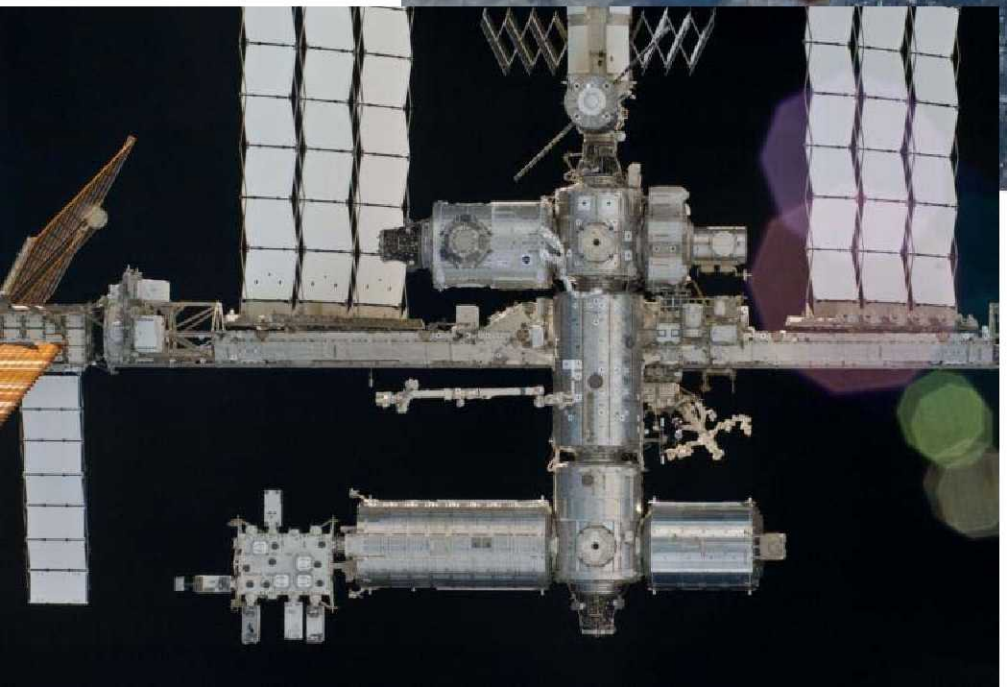
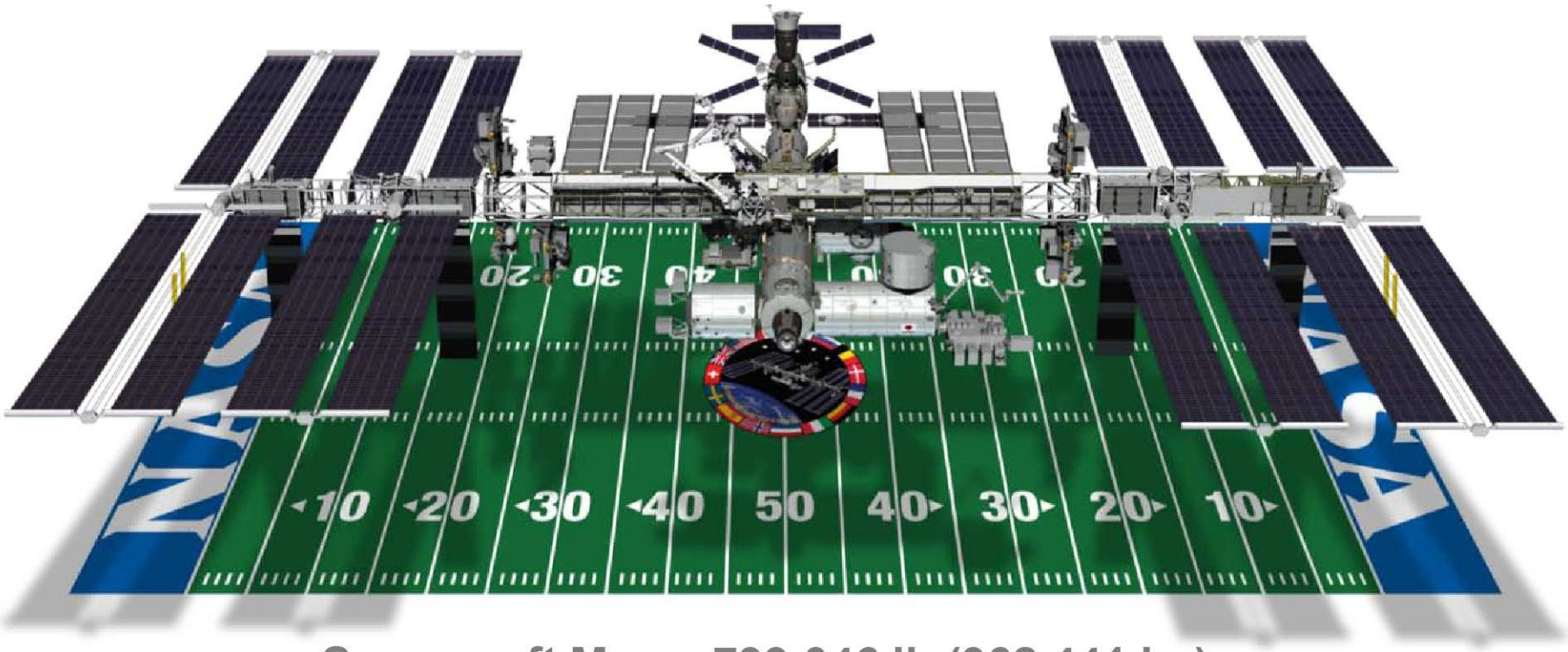
International Space Station Capabilities and Payload Accommodations

Rod Jones, Manager, ISS Payloads Office



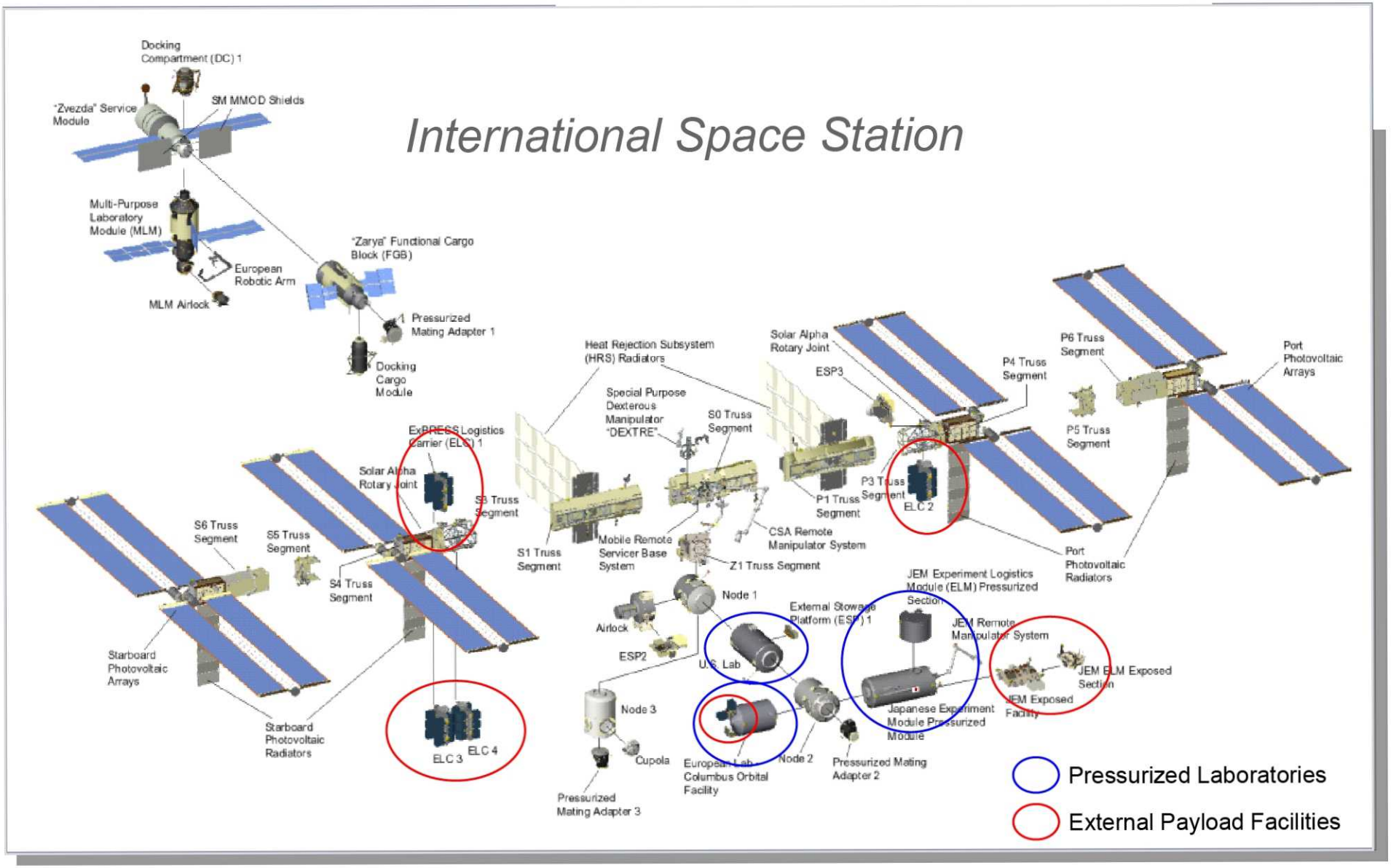
Current Stage

International Space Station Facts



Spacecraft Mass: 799,046 lb (362,441 kg)
Velocity: 17,500 mph (28,200 kph)
Altitude: 220 miles above Earth
Power: 80 kW continuous
Science Capability: Laboratories from four international space agencies – US, Europe, Japan, and Russia

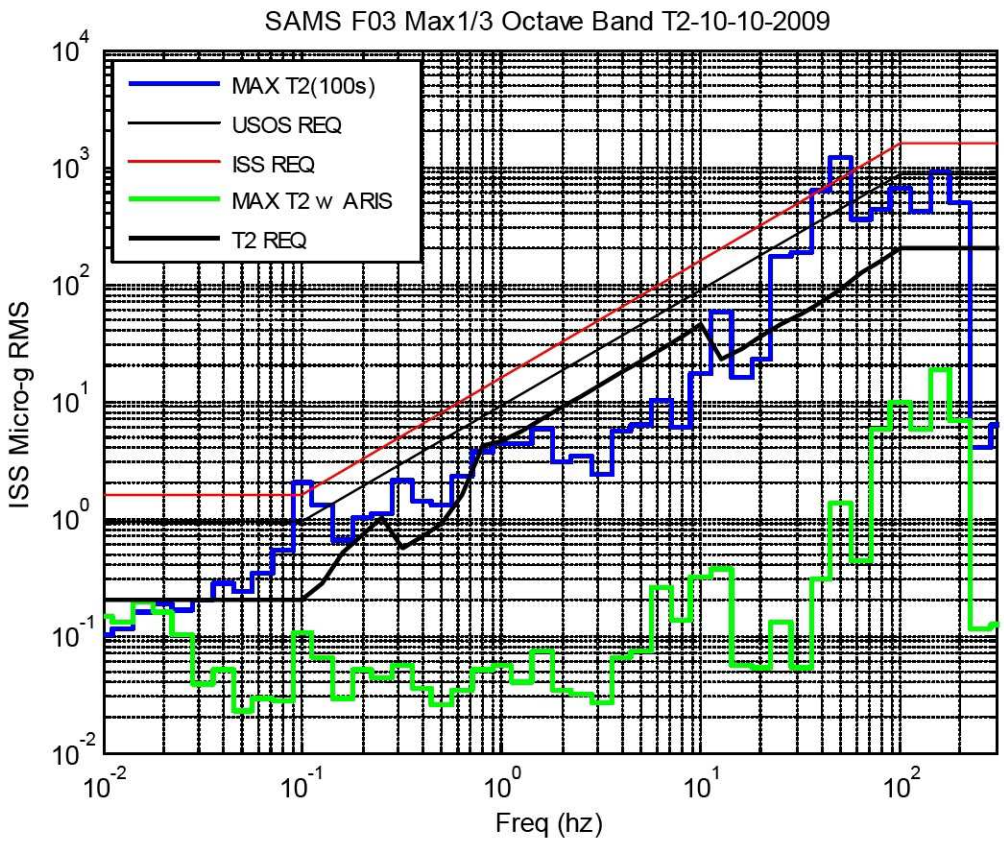
Assembly Complete Configuration

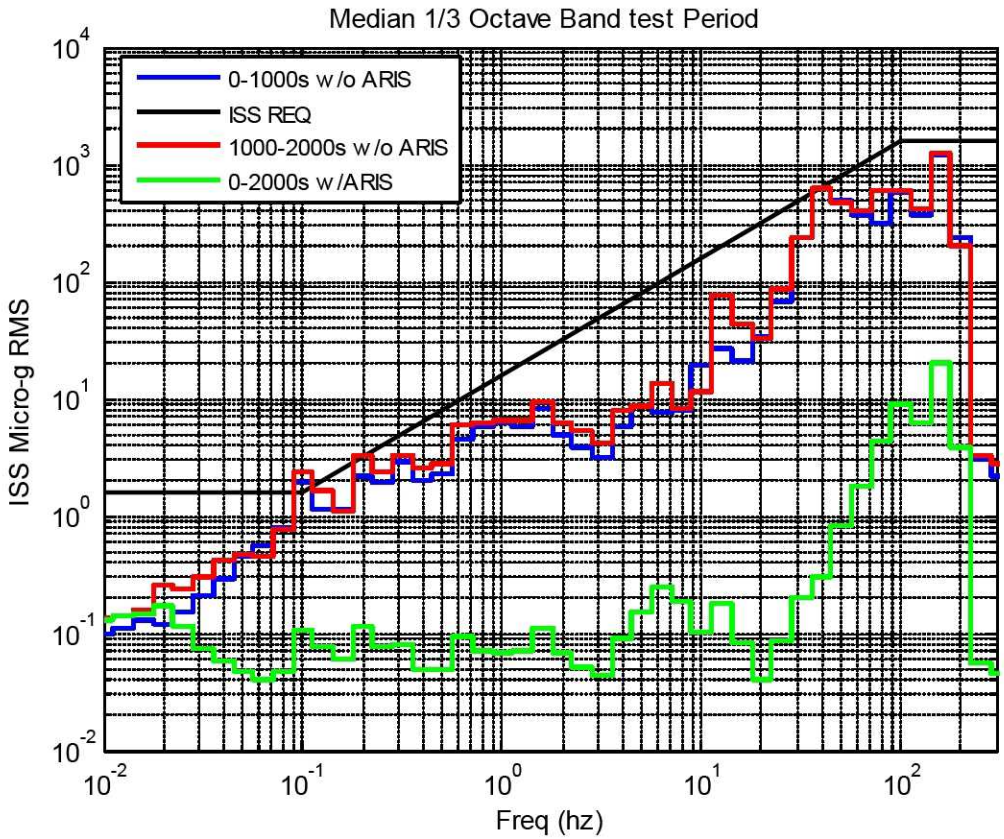


The Microgravity Environment

The ISS is equipped with an array of sensors that monitor perturbations to the microgravity state on-orbit.

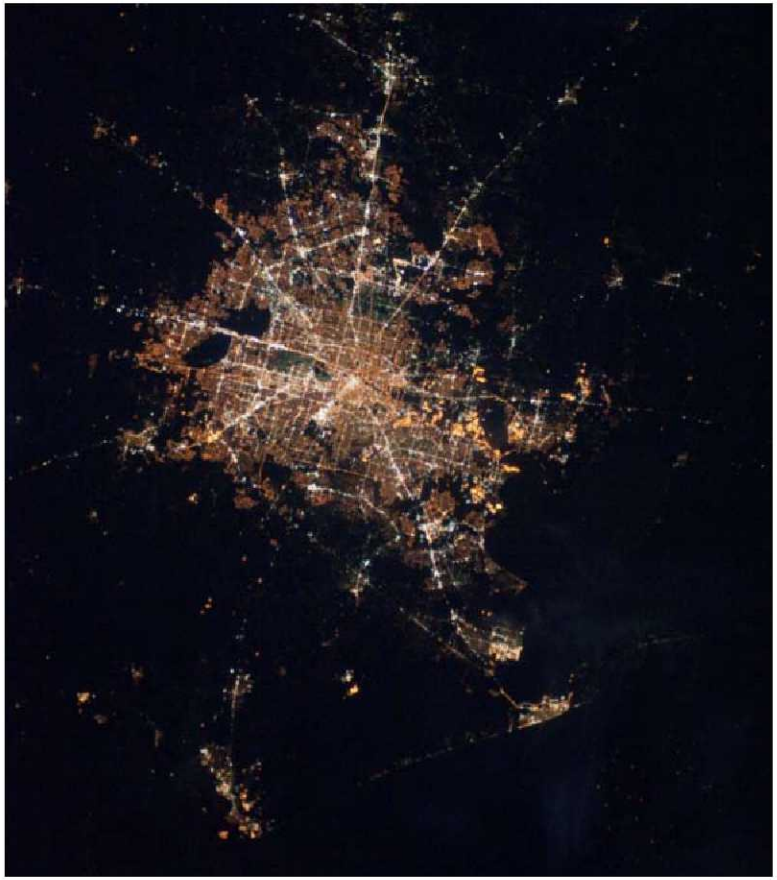
Even without the Active Rack Isolation System, vibrations are typically within ISS requirements.





While the Station is at its most “quiet” during the eight hours of crew sleep, the Active Rack Isolation System can be effective even during crew exercise.

Earth Observation



Houston at Night
Expedition 22

Artificial islands of Dubai
Expedition 22

Soufriere Hills volcano
Expedition 21

The ISS provides coverage of 85% of the Earth's surface and 95% of the world's populated landmass every 1-3 days, depending on orbital track and field-of-view.

Our Windows on the Earth

US Laboratory Window
50-cm diameter
Telescope-quality optical glass

Service Module Window
40-cm diameter

The Cupola
80-cm diameter
(top window)

ON Orbit Resources Provided to Payloads

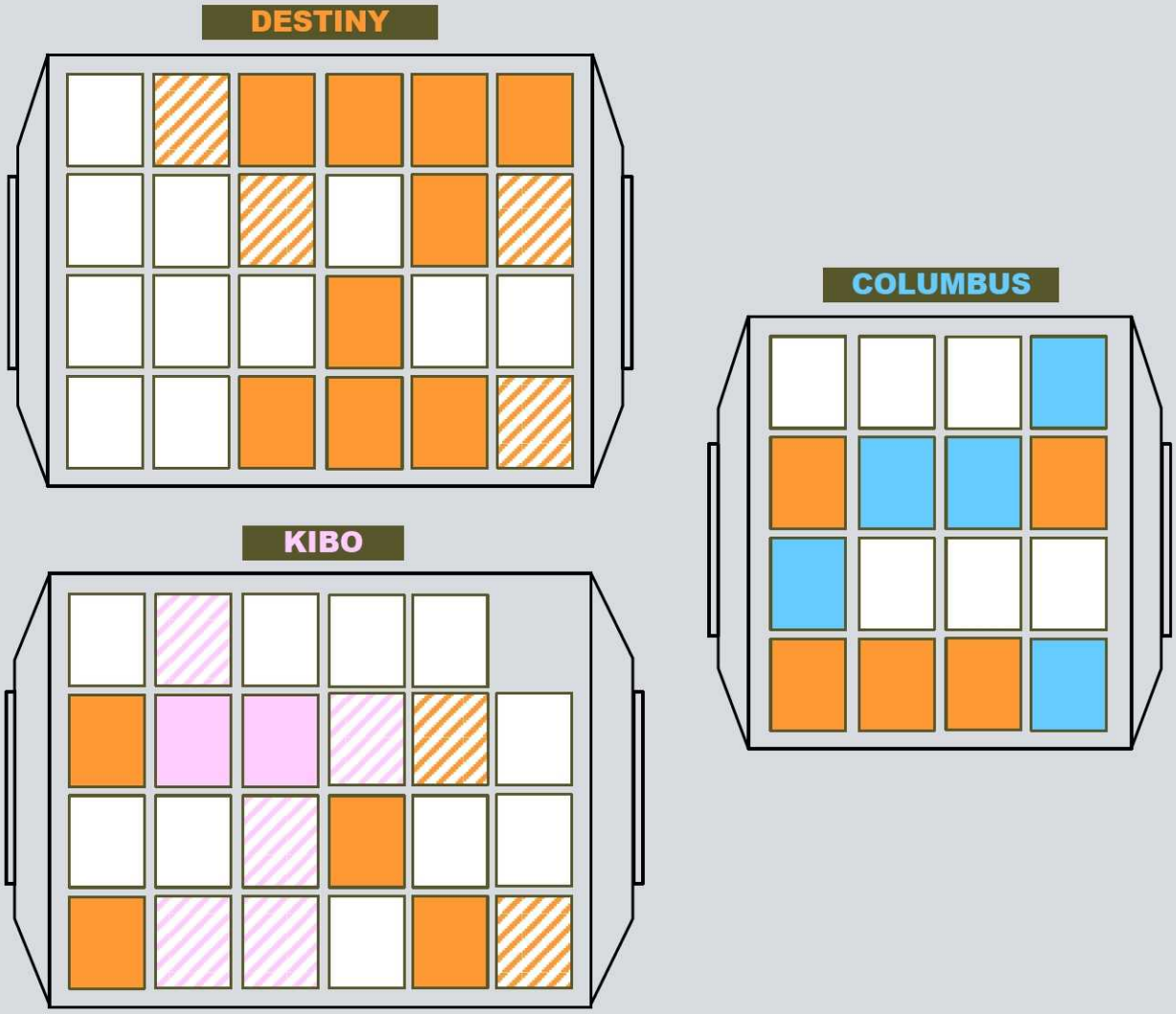
Power	30kw average
Air to Ground Data	~37.5 Mbps of video (3 lines of video at 12.5 Mbps each)
	~8 Mbps of MRDL data (Science return)
	~5 Mbps for payload still imagery downlink
	~20 Mbps utilized for payload data recorded over LOS
Internal Racks	13 U.S. Lab
	5 ESA Lab
	6 JAXA Lab
External Sites	8 Truss ELC Platform Sites
	5 JAXA Platform Sites
	2 ESA Platform Sites
Crewtime	35 hrs per week (average)

Upgrades In Work

Enhanced Processor and Integrated Communications (EPIC) Project	Phase A will upgrade the three Command and Control (C&C) MDMs and the two Guidance, Navigation, & Control (GN&C) MDMs.
	Phase B will upgrade the two Payload MDMs, and add Ethernet support for the C&C and Payload MDMs.
Air to Ground High Rate Communications System (HRCS) Project	Increase data rates internally and on the RF link (300 Mbps downlink, 7/25 Mbps uplink)
	Combine audio and video on orbit
	Provide two way, high quality audio
	Open the door to internet protocol communications
	Open the forward link to multiple users
	Allow for the capability of transmitting & recording HDTV
On Orbit External Wireless High Rate	100 Mbps 2-way Ethernet capability
	1 Mbps 1553 capability
	Up to 4 antennas attached to EVA handrails on US Lab

What space is available for research?

Science Rack Topology



19 NASA payload science racks at Assembly Complete

Partner		Utilization Rack at Assembly Complete	Utilization/ Stowage/ Future
NASA	=		
JAXA	=		
esa	=		

National Lab is a capacity within the NASA resource

NASA Science Rack Facilities

2 Human Research Facility

Microgravity Sciences GloveBox

6 ExPRESS Racks

ER1

ER2A

ER3A

ER4

ER5

ER7

MELFI and MELFI-2

Euro. Modular Cultivation System (EMCS) In ER3A (July 2006)

SpaceDRUMS In ExPRESS 5

ER6 (Galley and Research)

Window Observational Research Facility

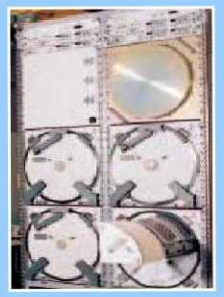
Combustion Integrated Rack

Fluids Integrated Rack

Materials Science Research Rack

ExPRESS-8

MELFI-3



Muscle Atrophy Research Exercise System (MARES)

On-Orbit ***ULF-5***

More detailed information available at http://www.nasa.gov/iss-science/ Click on "Facilities Catalog"

Station to Internal Rack Resources

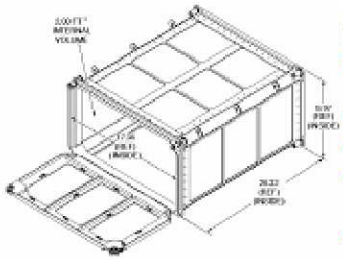
Power	3, 6, or 12 kW, 114.5 - 126 voltage, direct current (VDC)	
Data	Low Rate	MIL-STD-1553 bus 1 Mbps
	High Rate	100 Mbps
	Ethernet	10 Mbps
	Video	NTSC
Gases	Nitrogen	Flow= 0.1 kg/min minimum; 517-827 kPa, nominal; 1,379 kPa, maximum
	Argon, carbon dioxide, helium	517-768 kPa, nominal; 1,379 kPa, maximum
Cooling Loops	Moderate temperature	16.1 C – 18.3 C
	Flow rate	0 - 45.36 kg/h
	Low temperature	3.3 C – 5.6 C
	Flow rate	233 kg/h
Vacuum	Venting	10^{-3} torr in less than 2 h for single payload of 100 L
	Vacuum resource	10^{-3} torr

ExPRESS Rack Accommodations

(Expedite the Processing of Experiments for Space Station)

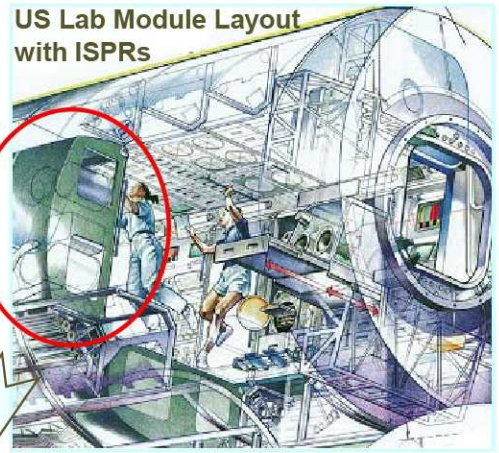
Peggy Whitson works the Advanced Astroculture (ADVASC) plant growth chamber during Expedition 5 in July 2005

Middeck Locker
P/N V502-661604



Features
- 4 rear captive fastener attachments
- Friction hinge
- Dual door locks
- Installation tool guides on 4 corners
- Weight – 12 lbs

US Lab Module Layout with ISPRs

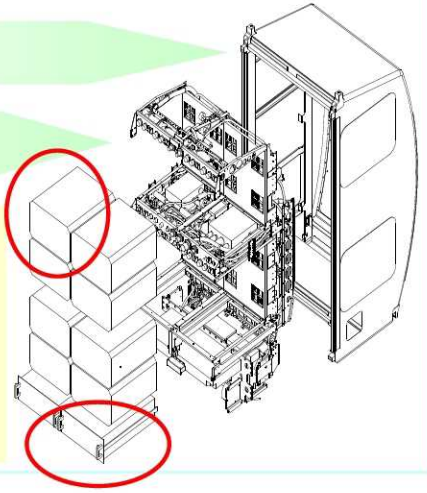


EXPRESS 8/2 Configuration

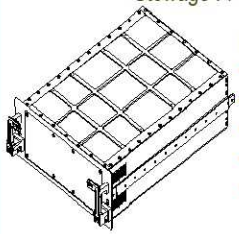
International Standard Payload Rack

Secondary Structure & Subsystems

8/2 Payload Configuration (8 Middeck Lockers, 2 Powered ISIS Drawers)



International Subrack Interface Standard Drawer
Powered P/N 683-43650
Stowage P/ N 683-43656



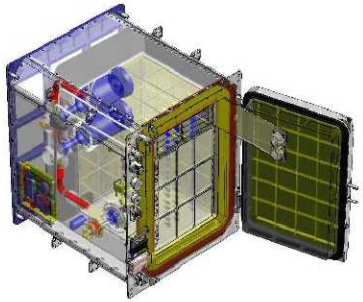
Features
- 4 PU (Panel Unit)
- Blind Connectors
- Locking Handles
- Weight – 27 lbs
- Rated to at least 37 lbs

ExPRESS Rack Resources

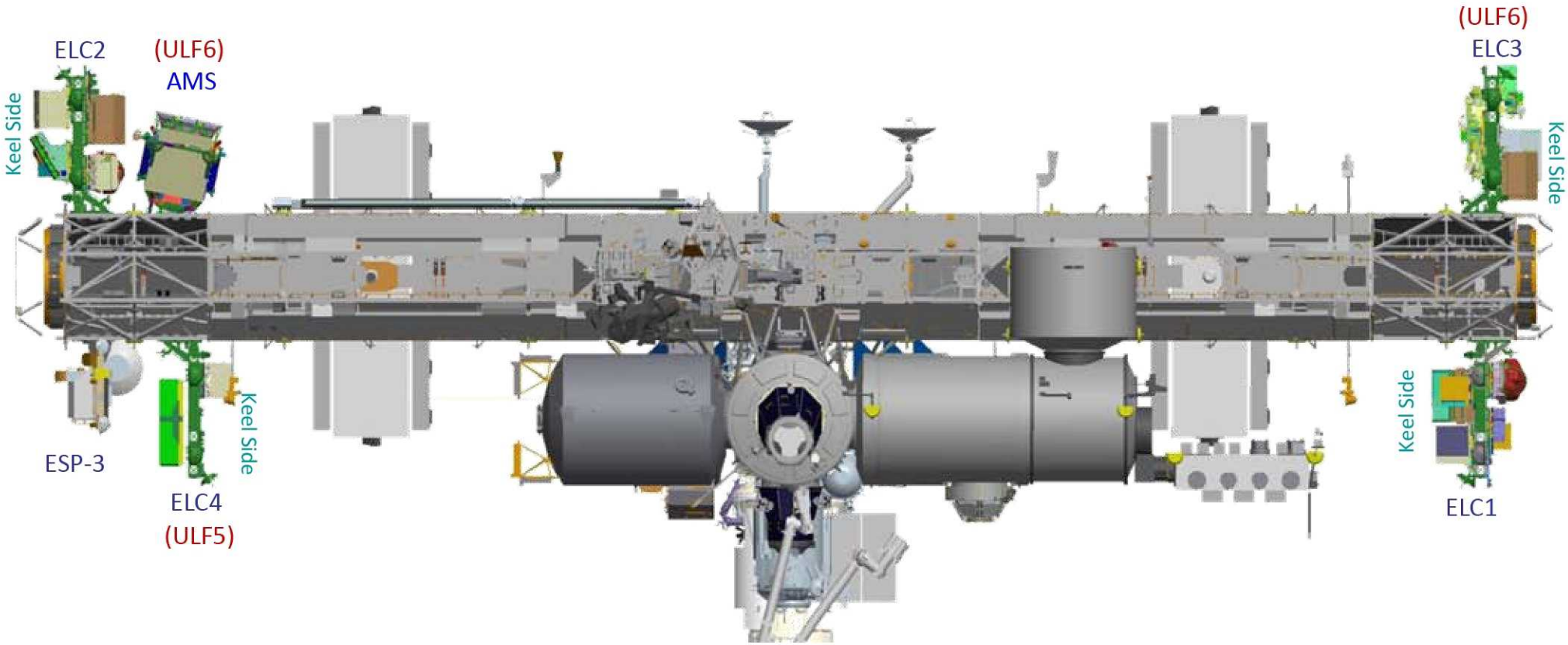
(Expedite the Processing of Experiments for Space Station)

System	Middeck Locker Locations	ISIS Drawer Locations	Rack-Level Accommodation
Structural	72 lbs. within cg constraints	64 lbs. within cg constraints	8 Mid deck Lockers 2 ISIS Drawers (4 Panel Unit)
Power	28 Vdc, 0 – 500 W	28 Vdc, 0 – 500 W	2000 Watts 28Vdc power
Air Cooling	≤ 200 Watts	<100 Watts	1200 Watts
Thermal Control System Water Cooling	500 Watts (2 positions per rack)	500 Watts (2 positions per rack)	2 positions per rack
Command and Data Handling	RS422 Analog Ethernet 5 Vdc Discrete	RS422 Analog Ethernet 5 Vdc Discrete	RS422 Analog Ethernet 5 Vdc Discrete
Video	NTSC/RS170A	NTSC/RS170A	NTSC/RS170A
Vacuum Exhaust System	1 payload interface per rack	1 payload interface per rack	1 payload interface per rack
Nitrogen	1 payload interface per rack	1 payload interface per rack	1 payload interface per rack

Cold Stowage Accommodations

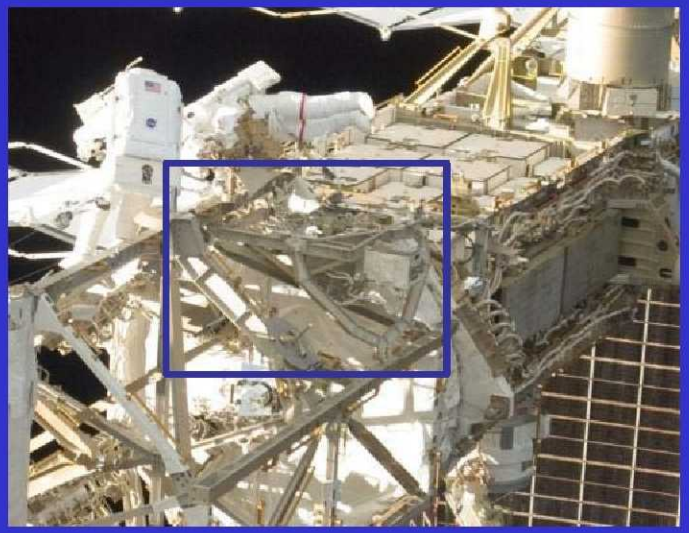
	MELFI	MERLIN	GLACIER	Single and Double Coldbag with ICEPAC's
				
First flight	2006	2007	2008	2006
On-orbit stowage	Yes	Possible	Possible	No
Transport	No	Yes	Yes	Yes
Power	Yes	Yes	Yes	No
On-orbit temperature (°C)	+4, -26, -80	+45 to -20	+4 to -185	N/A
Transport temperature (°C)	N/A	+45 to -5	+4 to -160	+4 to -32
Useable volume (L)	175	19	30	6.8/18.7
External volume	1 rack	1 MLE	2 MLE	0.5/1 MLE

Truss Attach Site Usage



External Research Accommodations

Common Attachment System (CAS) Site

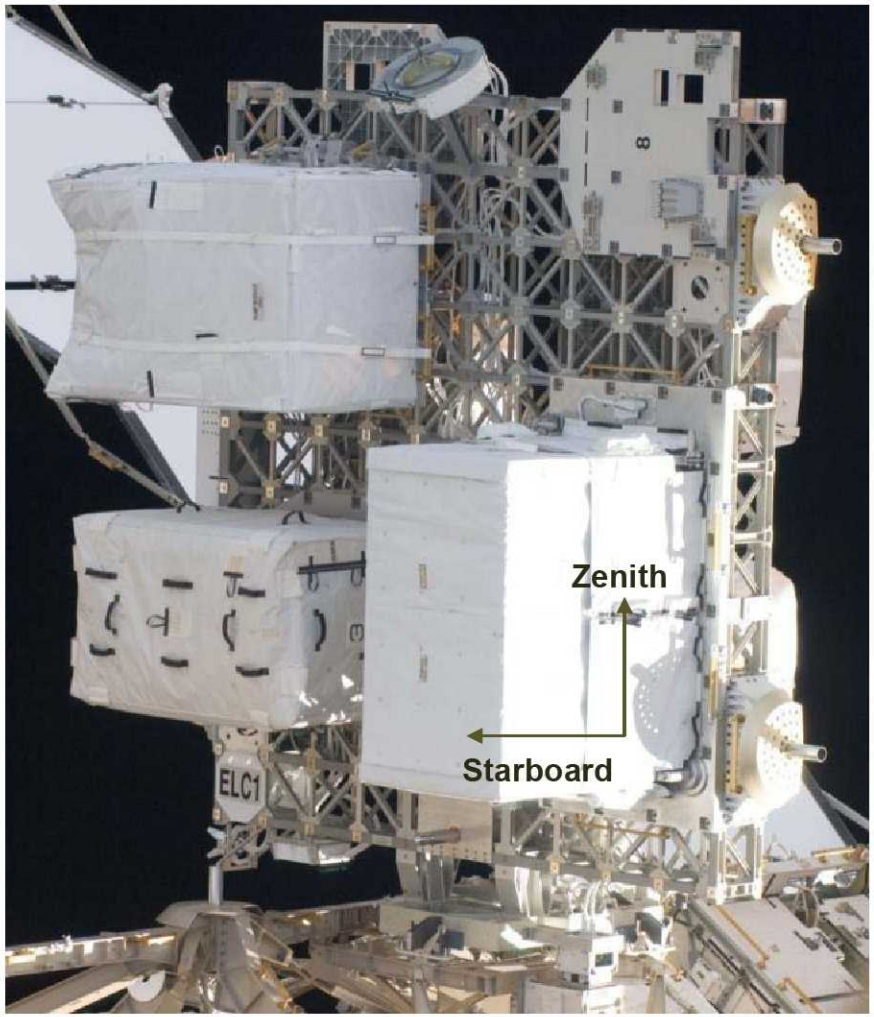


Mass capacity	1360 - 8618 kg (3000 - 19000 lb)
Power	3 kW each on two lines (primary, auxiliary)
Thermal	Passive
Low-rate data	1 Mbps (MIL-STD-1553)
High-rate data	100 Mbps (shared)
Sites available to NASA	6 sites

Recent ISS Assembly Science Facilities

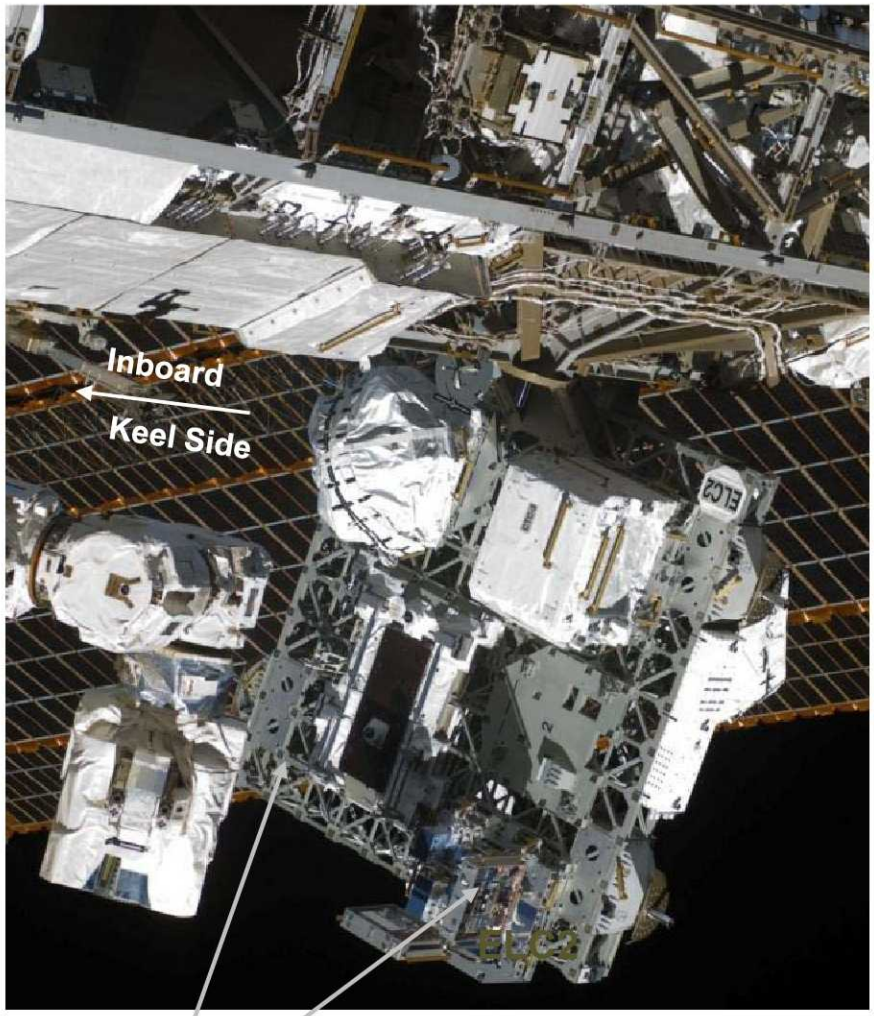
NASA Express Logistics Carriers (ELCs)

S3 Truss



ELC1, ELC3, & ELC4

P3 Truss

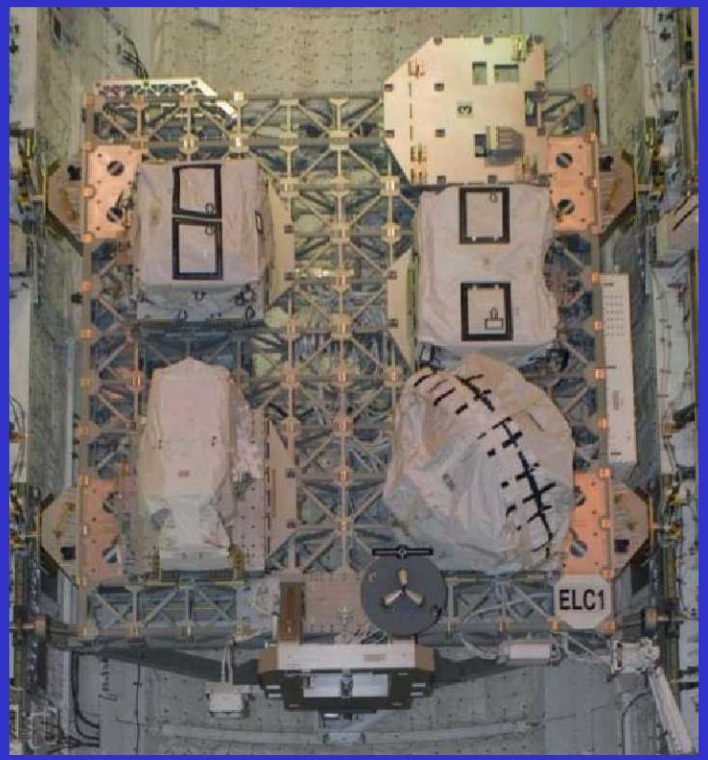


ELC2

2 payload sites per ELC

External Research Accommodations

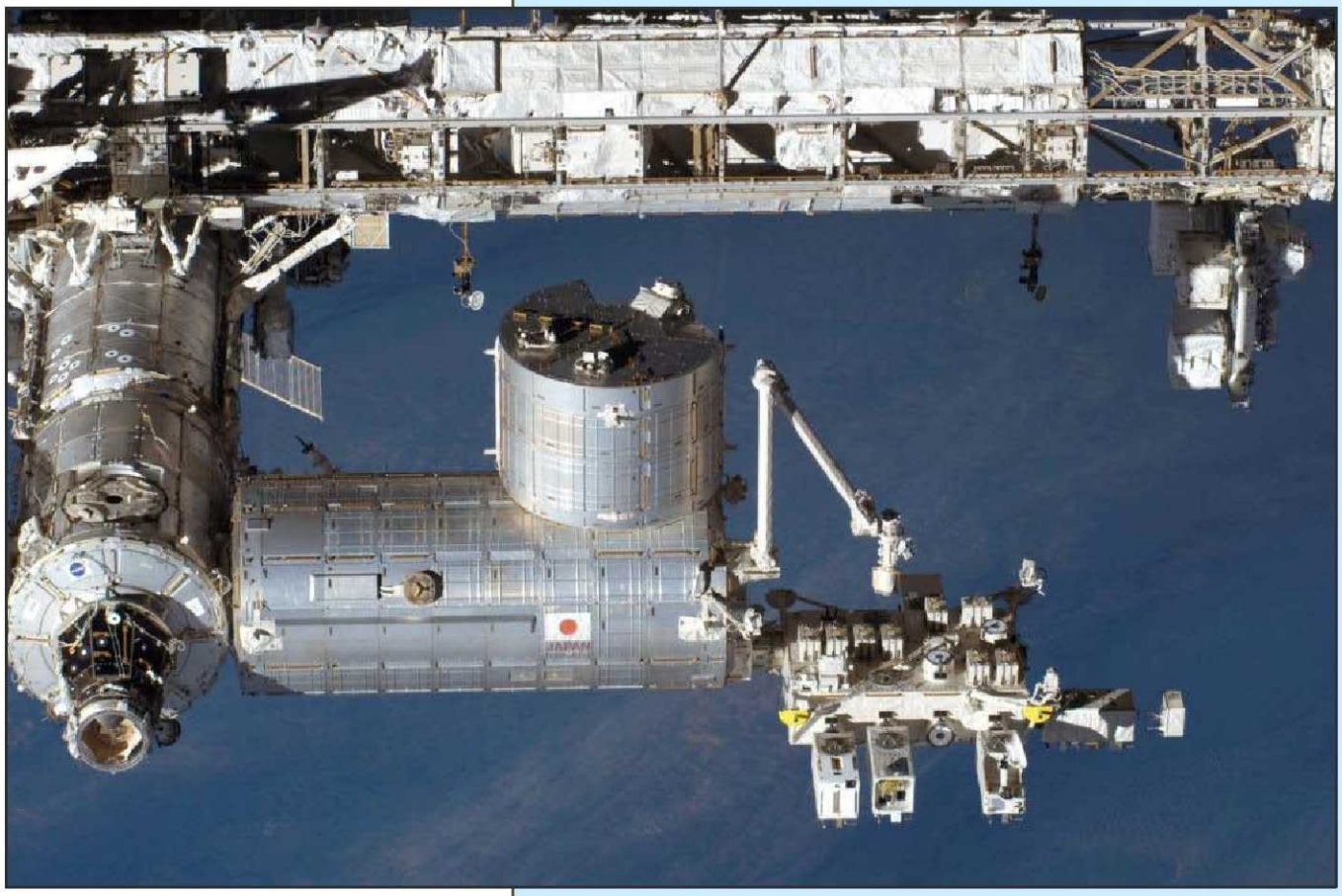
ELC Single Adapter Resources



Mass capacity	227 kg (500 lb)
Volume	1 m^3
Power	750 W, 113 – 126 VDC; 500 W at 28 VDC per adapter
Thermal	Active heating, passive cooling
Low-rate data	1 Mbps (MIL-STD-1553)
Medium-rate data	6 Mbps (shared)
Sites available per ELC	2 sites
Total ELC sites available	8 sites

Recent ISS Assembly Science Facilities

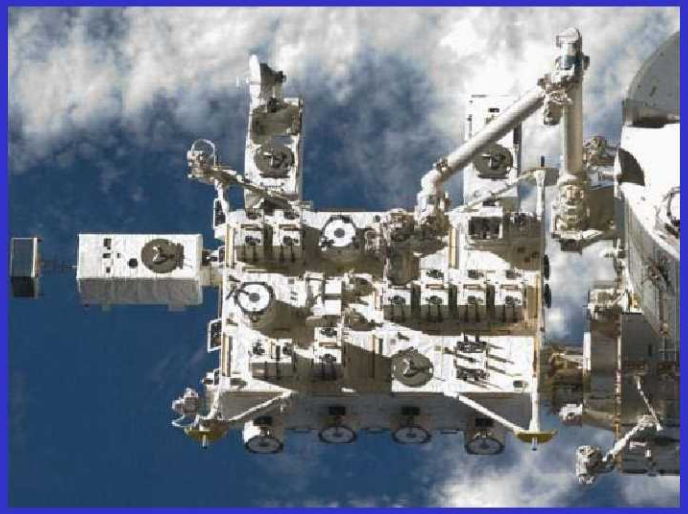
Japanese Experiment Module - Kibo



- *5 external payload sites allocated to NASA on the JEM Exposed Facility*
- *6 internal active payload rack locations allocated to NASA inside the JEM Pressurized Module*

External Research Accommodations

JEM-EF Resources



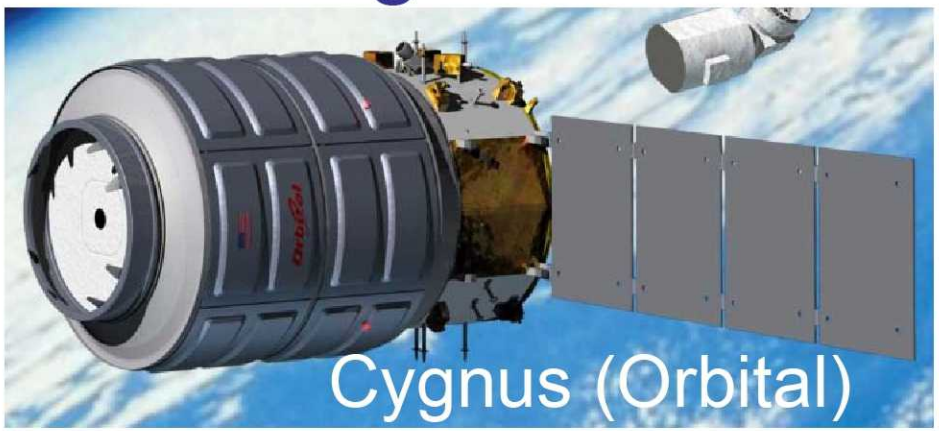
Mass capacity	550 kg (1,150 lb) at standard site 2,250 kg (5,550 lb) at large site
Volume	1.5 m^3
Power	3-6 kW, 113 – 126 VDC
Thermal	3-6 kW cooling
Low-rate data	1 Mbps (MIL-STD-1553)
High-rate data	43 Mbps (shared)
Sites available to NASA	5 sites

External Research Accommodations

Columbus External Resources

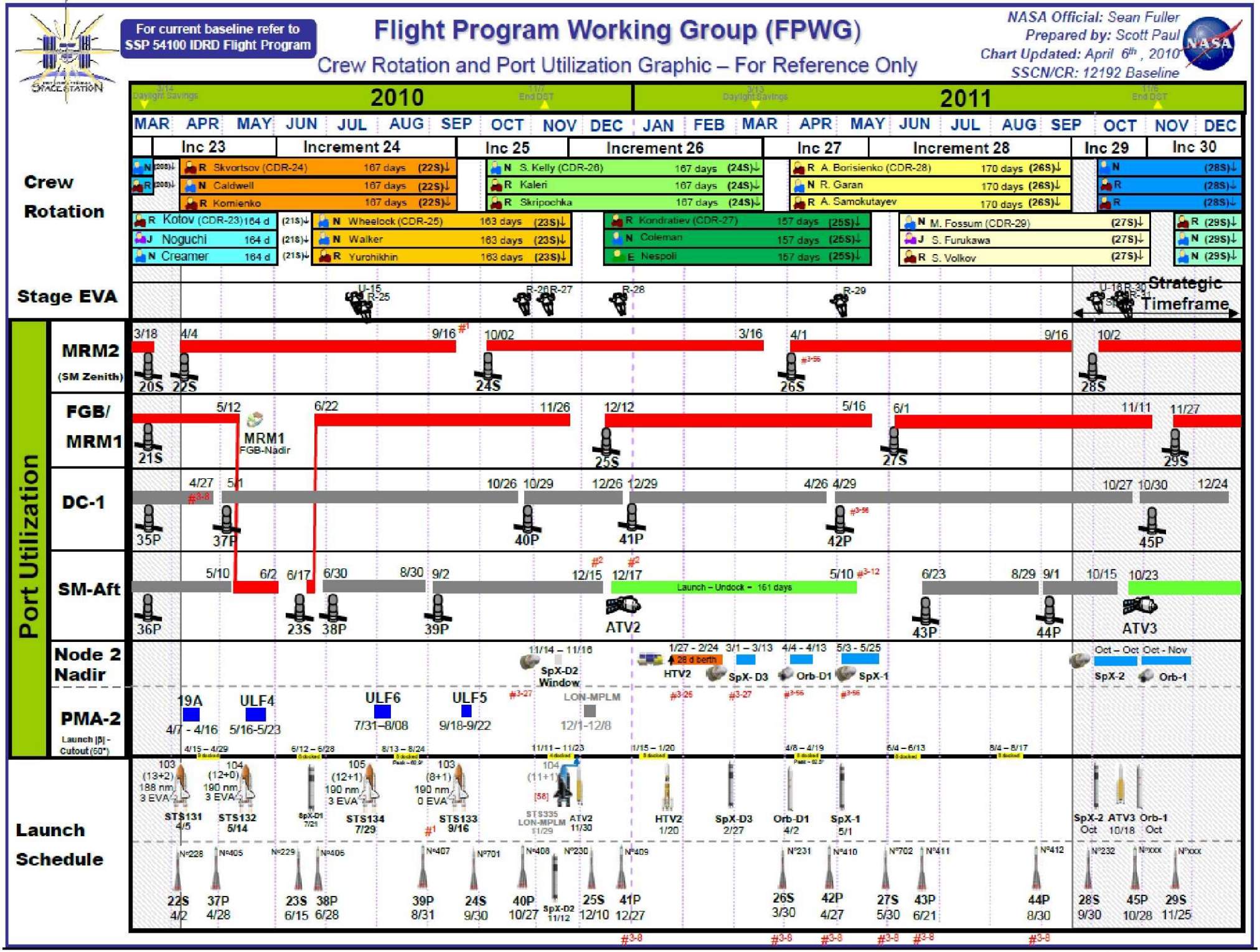
Mass capacity	230 kg (500 lb)
Volume	1 m^3
Power	2.5 kW total to carrier (shared)
Thermal	Passive
Low-rate data	1 Mbps (MIL-STD-1553)
Medium-rate data	2 Mbps (shared)
Sites available to NASA	2 sites

ISS Visiting Vehicles Post-Shuttle



Progress/Soyuz (Energia)

HTV (JAXA)


For current baseline refer to SSP 54100 IDRD Flight Program
Flight Program Working Group (FPWG)
Crew Rotation and Port Utilization Graphic – For Reference Only
NASA Official: Sean Fuller
Prepared by: Scott Paul
Chart Updated: April 6th, 2010
SSCN/CR: 12192 Baseline
2010
2011
MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
Inc 23
Increment 24
Inc 25
Increment 26
Inc 27
Increment 28
Inc 29
Inc 30
Crew Rotation
R Skvortsov (CDR-24) 167 days (22S)
N Caldwell 167 days (22S)
R Kornienko 167 days (22S)
N S. Kelly (CDR-26) 167 days (24S)
R Kaleri 167 days (24S)
R Skripochka 167 days (24S)
R A. Borisienko (CDR-28) 170 days (26S)
N R. Garan 170 days (26S)
R A. Samokutayev 170 days (26S)
R Kotov (CDR-23) 164 d
J Noguchi 164 d
N Creamer 164 d
N Wheelock (CDR-25) 163 days (23S)
N Walker 163 days (23S)
R Yurchikhin 163 days (23S)
R Kondratiev (CDR-27) 157 days (25S)
N Coleman 157 days (25S)
E Nespoli 157 days (25S)
N M. Fossum (CDR-29) (27S)
J S. Furukawa (27S)
R S. Volkov (27S)
Stage EVA
U-15 R-25
R-26 R-27
R-28
R-29
Strategic Timeframe
Port Utilization
MRM2 (SM Zenith)
3/18 4/4 9/16 #1 10/02 3/16 4/1 9/16 10/2
20S 22S 24S 26S 28S
FGB/ MRM1
5/12 6/22 11/26 12/12 5/16 6/1 11/11 11/27
MRM1 FGB-Nadir
21S 25S 27S 29S
DC-1
4/27 5/1 10/26 10/29 12/26 12/29 4/26 4/29 10/27 10/30 12/24
35P 37P 40P 41P 42P 45P
SM-Aft
5/10 6/2 6/17 6/30 8/30 9/2 12/15 12/17 5/10 6/23 8/29 9/1 10/15 10/23
Launch – Undock = 161 days
36P 23S 38P 39P ATV2 43P 44P ATV3
Node 2 Nadir
11/14 – 11/16 SpX-D2 Window
1/27 - 2/24 28 d berth HTV2
3/1 – 3/13 SpX- D3
4/4 - 4/13 Orb-D1
5/3 - 5/25 SpX-1
Oct – Oct SpX-2
Oct - Nov Orb-1
PMA-2
Launch |β| - Cutout (60°)
19A 4/7 - 4/16
ULF4 5/16-5/23
ULF6 7/31–8/08
ULF5 9/18-9/22
LON-MPLM 12/1-12/8
4/15 – 4/29
6/12 – 6/28
8/13 – 8/24
11/11 – 11/23
1/15 – 1/20
4/6 – 4/19
6/4 – 6/13
8/4 – 8/17
Launch Schedule
103 (13+2) 188 nm 3 EVA STS131 4/5
104 (12+0) 190 nm 3 EVA STS132 5/14
105 (12+1) 190 nm 3 EVA STS134 7/29
103 (8+1) 190 nm 0 EVA STS133 9/16
104 (11+1) [58] STS335 LON-MPLM 11/29 ATV2 11/30
HTV2 1/20
SpX-D3 2/27
Orb-D1 4/2
SpX-1 5/1
SpX-2 Oct
ATV3 10/18
Orb-1 Oct
№226 22S 4/2
№405 37P 4/28
№229 23S 6/15
№406 38P 6/28
№407 39P 8/31
№701 24S 9/30
№408 40P 10/27
SpX-D2 11/12
№230 25S 12/10
№409 41P 12/27
№231 26S 3/30
№410 42P 4/27
№702 27S 5/30
№411 43P 6/21
№412 44P 8/30
№232 28S 9/30
№xxx 45P 10/28
№xxx 29S 11/25
#3-8

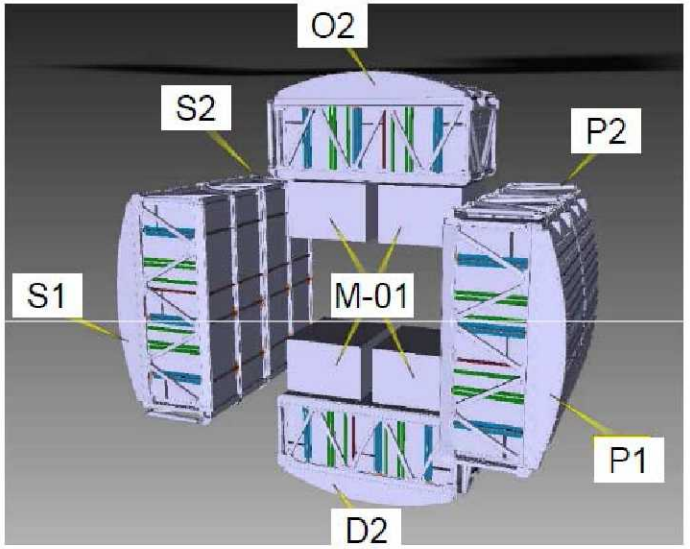
ATV

Upmass

- Internal
  - Powered: None
  - Late Load
    - » Up to 28 bags (not CTBE) of late access
  - Racks
    - » Up to 8 passive racks
- External
  - None
- On Dock
  - Cargo: L-14 weeks
  - Late Load: L-4 weeks

Downmass

- Internal
  - Disposal only
- External
  - None



ATV-2 Racks with M-01 bags

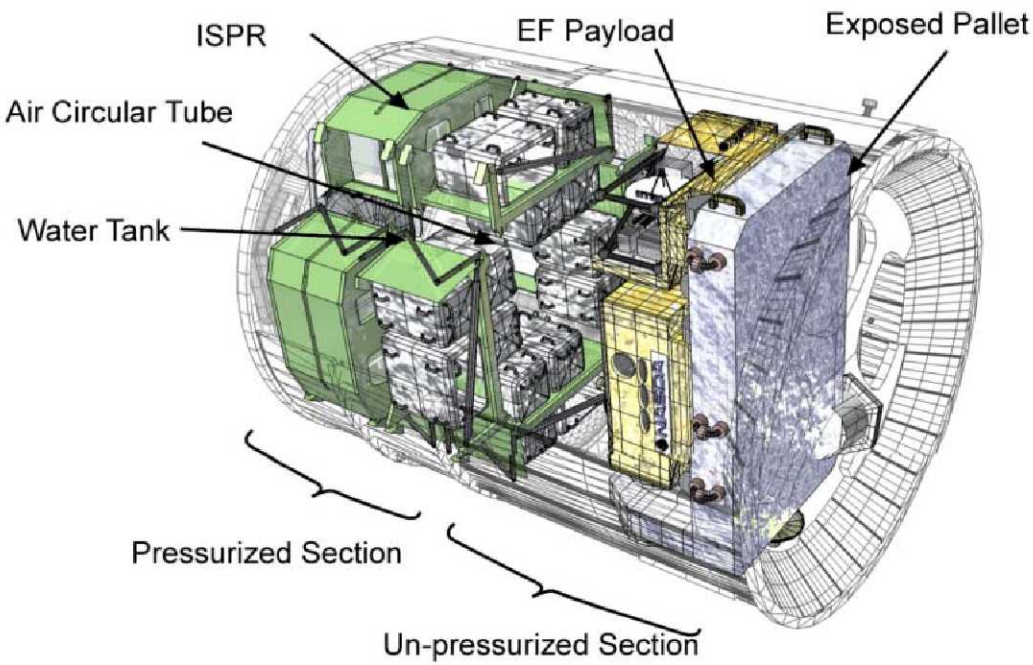
HTV

Upmass

- Internal
  - Powered: None
  - Late Load
    - » Maximum 3 CTBE (0.5 or 1.0 CTB), each <20 kg
    - » Additional possible if negotiated in advance.
  - Racks
    - » Up to 8 passive racks
    - » Forward Bay: ISPR compatible
    - » Aft Bay racks fixed: HTV Resupply Rack
- External
  - Exposed Pallet (on following chart)
- On Dock
  - Cargo: L-6 months
  - Late Load: L-6 weeks

Downmass

- Internal
  - Disposal only
- External
  - Disposal only



HTV External Pallet Configurations

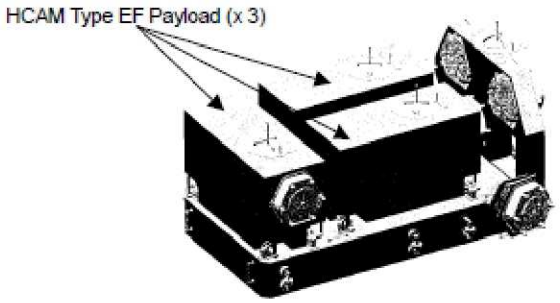


Fig. 3.3.2-1 Type I-a: HCAM Type EF Payload (x 3)

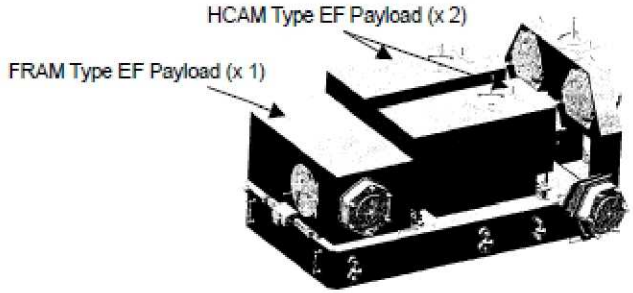


Fig. 3.3.2-2 Type I-b: HCAM Type EF Payload (x 2) and FRAM Type EF Payload (x 1)

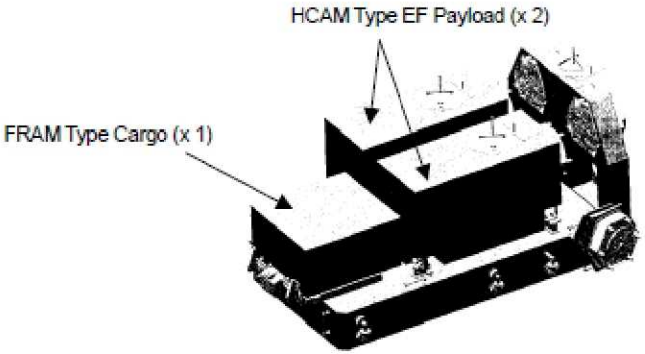
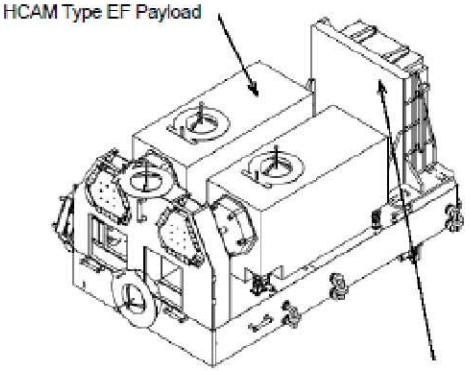


Fig. 3.3.2-3 Type I-b': HCAM Type EF Payload (x 2) and FRAM Type Cargo (x 1)



TBD
(Battery Transportation Demonstration)

Fig. 3.3.2-4 Type I-c: HCAM Type EF Payload (x 2) and Battery Transportation Demonstration (x 1)

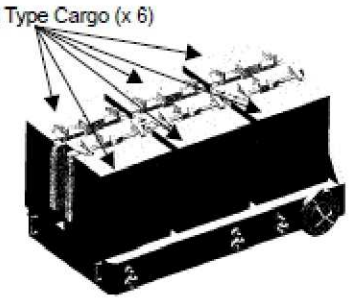


Fig. 3.3.2-5 Type III-a: FRAM Type Cargo (X6)

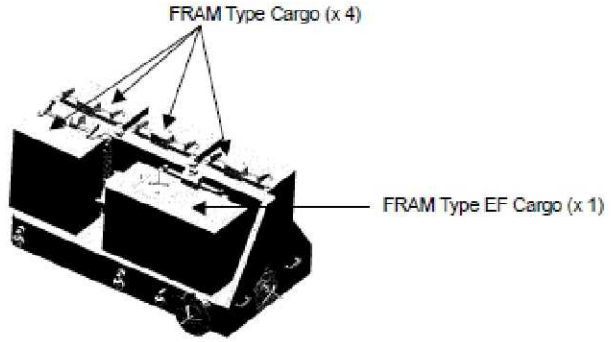


Fig. 3.3.2-6 Type III-b: FRAM Type EF Payload (X1) and FRAM Type Cargo (X4)

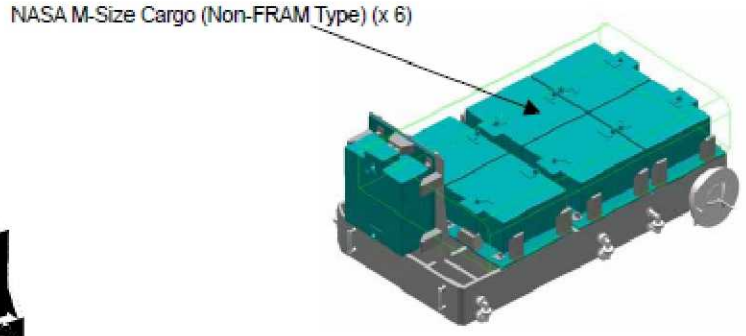


Fig. 3.3.2-7 Type III-c: Non-FRAM Type Cargo (X6)

Progress

Upmass

- Internal
  - Powered: Special allowance only
  - Late Load
  - Racks: None
  - Items up to 8-10 kg in vehicle containers
  - Larger items installed in special transport frames
- External
  - None

Downmass

- Internal
  - Disposal only
- External
  - None

Soyuz

Upmass

- Internal
  - Powered: Special allowance only
  - Late Load
  - Racks: None
  - Items up to 5 kg in vehicle containers
  - Larger items installed in special transport frames
- External
  - None

Downmass

- Internal
  - Items up to 5 kg in container under crew seat
  - Special container available for larger items if only two crew on return
- External
  - None

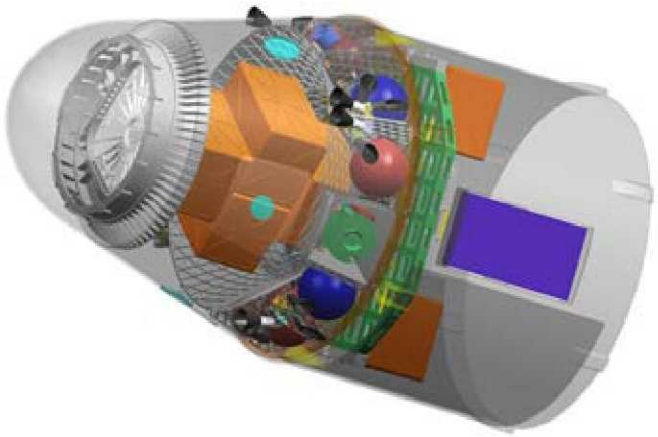
Dragon

Upmass

- Internal
  - Powered: Double MLE
  - Late Load: T-12 hrs for powered MLE; TBD days for nominal
  - Racks (SpaceX-designed)
    - » ~3300 kg mass
- External
  - Trunk capability

Downmass

- Internal
  - Powered: Double MLE
  - ~1700 kg return
  - Early destow at dock available
  - Fast boat return available
- External
  - Disposal only



Cygnus

Upmass

- Internal
  - Powered: Double MLE
  - Late Load: TBD
  - Racks
    - » 2000 kg mass (standard)
    - » 2700 kg mass (expanded)
- External
  - None

Downmass

- Internal
  - Disposal only
- External
  - None

References

- ISS Program Scientist Toolbox - http://iss-science.jsc.nasa.gov/index.cfm
- ISS National Laboratory Office - http://www.nasa.gov/mission_pages/station/science/nlab/index.html
- Advanced Avionics Development Office - http://iss-www.jsc.nasa.gov/nwo/avionics/aado/home/web/
- Attached Payload Interface Requirements Document, SSP 57003
- Common Interface Requirements Document, SSP 50835
- ATV-2 Cargo Summary (24 Sep 2009)
- HTV Cargo Accommodation Handbook, JFX-99102
- Requirements for International Partner Cargo Transported On Russian Progress and Soyuz Vehicles, П32928-103
- SpaceX Introduction For Payloads (OZ3, Jan 2010)
- Cygnus Fact Sheet (Orbital, 2009)

Backup

Science Facilities Overview

Science Facilities On Orbit

Expedition 2 crewmember Susan Helms activating the HRF 1 rack

2 **Human Research Facility** (HRF) Racks - Biomedical investigations, including ultrasound, body mass measurement, metabolic gas analysis, pulmonary monitoring, ambulatory blood pressure measurement, Holter monitor, and experiment unique hardware

Expedition 12 crewmember Bill McArthur activating the SLAMMD in the HRF 2 rack

- **Microgravity Sciences Glovebox** (MSG) Principally materials and fluid physics experiments to date

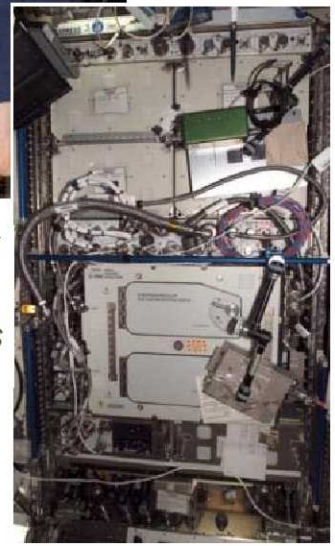
Expedition 13 crewmember Jeff Williams performing the PFMI experiment in the Microgravity Science Glovebox

Science Facilities On Orbit

Expedition 3 crewmember Frank Culbertson conducting cell culture experiment in CBOSS in EXPRESS Rack 4

- 7 Multi-User (**EXPRESS**) Racks - Middeck locker scale instruments in various research disciplines such as biotechnology and plant research

Expedition 14 crewmember Mike Lopez-Alegria conducting TROPI plant growth experiment in EMCS in EXPRESS Rack 3

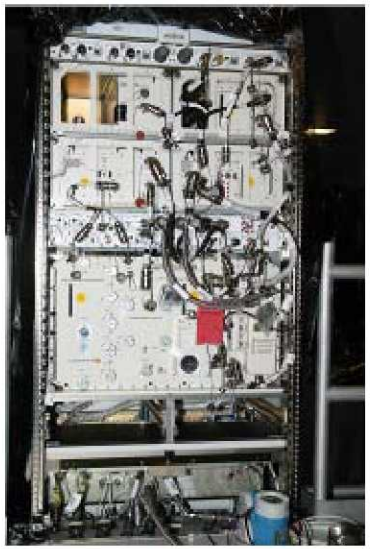


- 2 **Minus Eighty-degree Laboratory Freezer for ISS** (MELFI) - Provides thermal conditioning at +4°C, -26°C and -80°C

Expedition 14 crewmember Thomas Reiter removing frozen samples from MELFI

MELFI 3

Science Facilities On Orbit



SpaceDRUMS

WORF

CIR

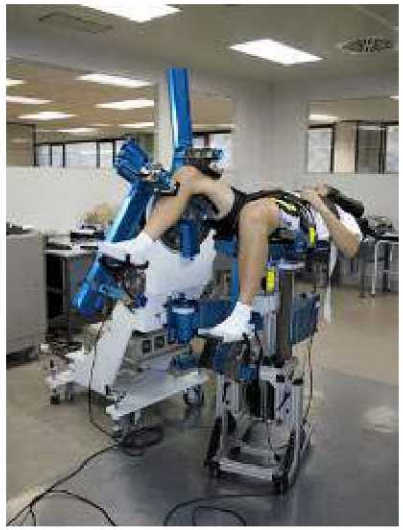
- **Space Dynamically Responding Ultrasound Matrix System** (SpaceDRUMS)
- **Window Observation Research Facility** (WORF) (2009)
  - Facility to support visual and multispectral remote sensing using Lab Optical Window
- **Combustion Integrated Rack** (CIR) (2008)
  - Facility dedicated to research in combustion science

Science Facilities On Orbit

- **Materials Science Research Rack** (MSRR) (2009)
  - Facility to support ESA Microgravity Science Lab furnace
- **Fluids Integrated Rack** (FIR) (2009)
  - Facility dedicated to fluid physics research, with Light Microscope Module
- **Muscle Atrophy Research Exercise System** (MARES) (2009)
  - Facility for musculoskeletal, biomechanical, neuromuscular and neurological physiology measurements

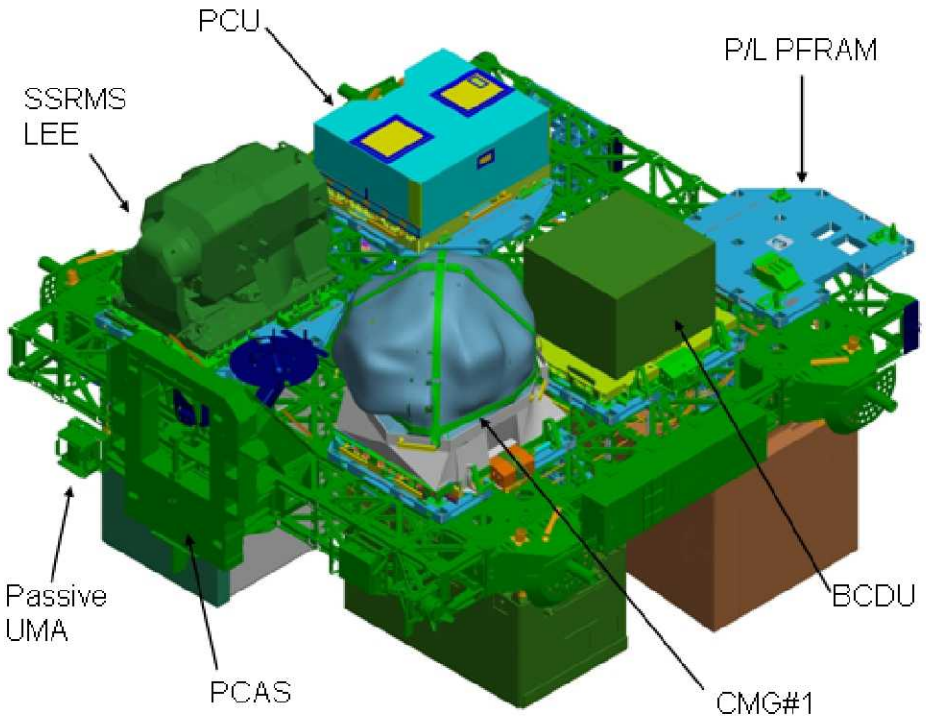
MSRR

FIR

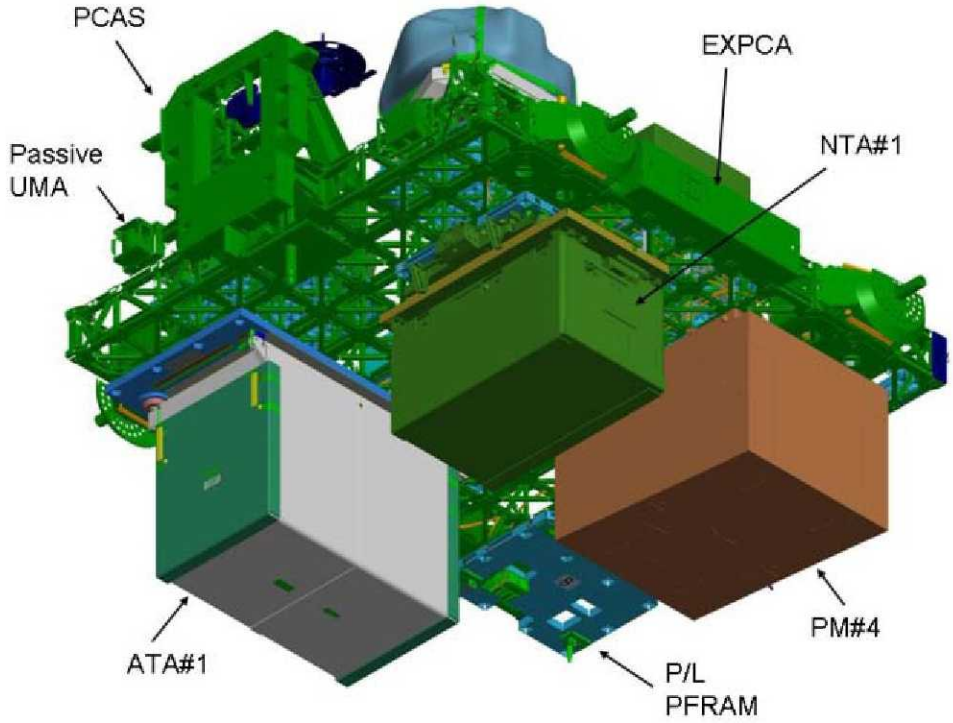


MARES

ELC1 Configuration

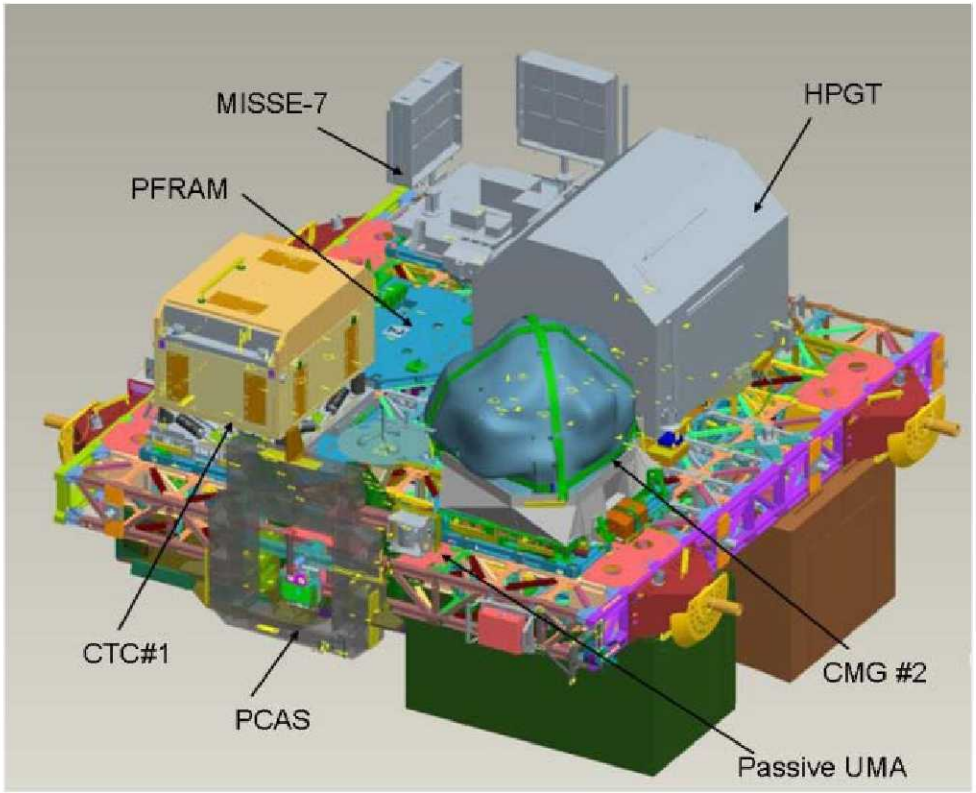


ELC1 Top Side

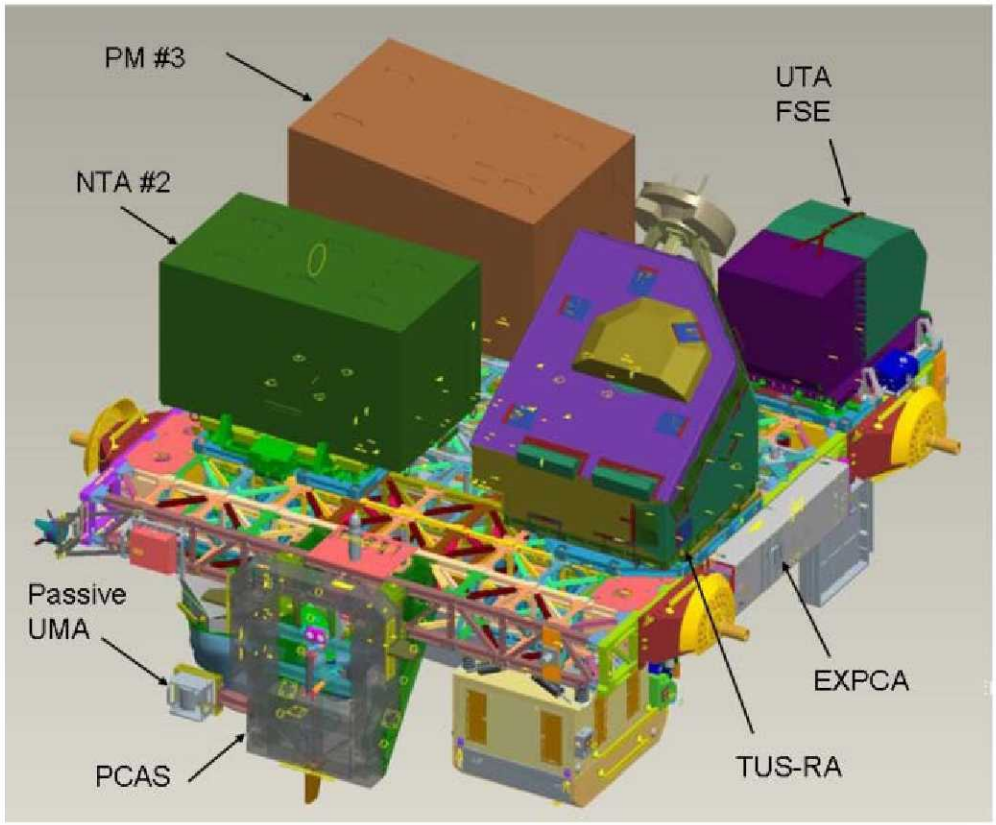


ELC1 Keel Side

ELC2 Configuration

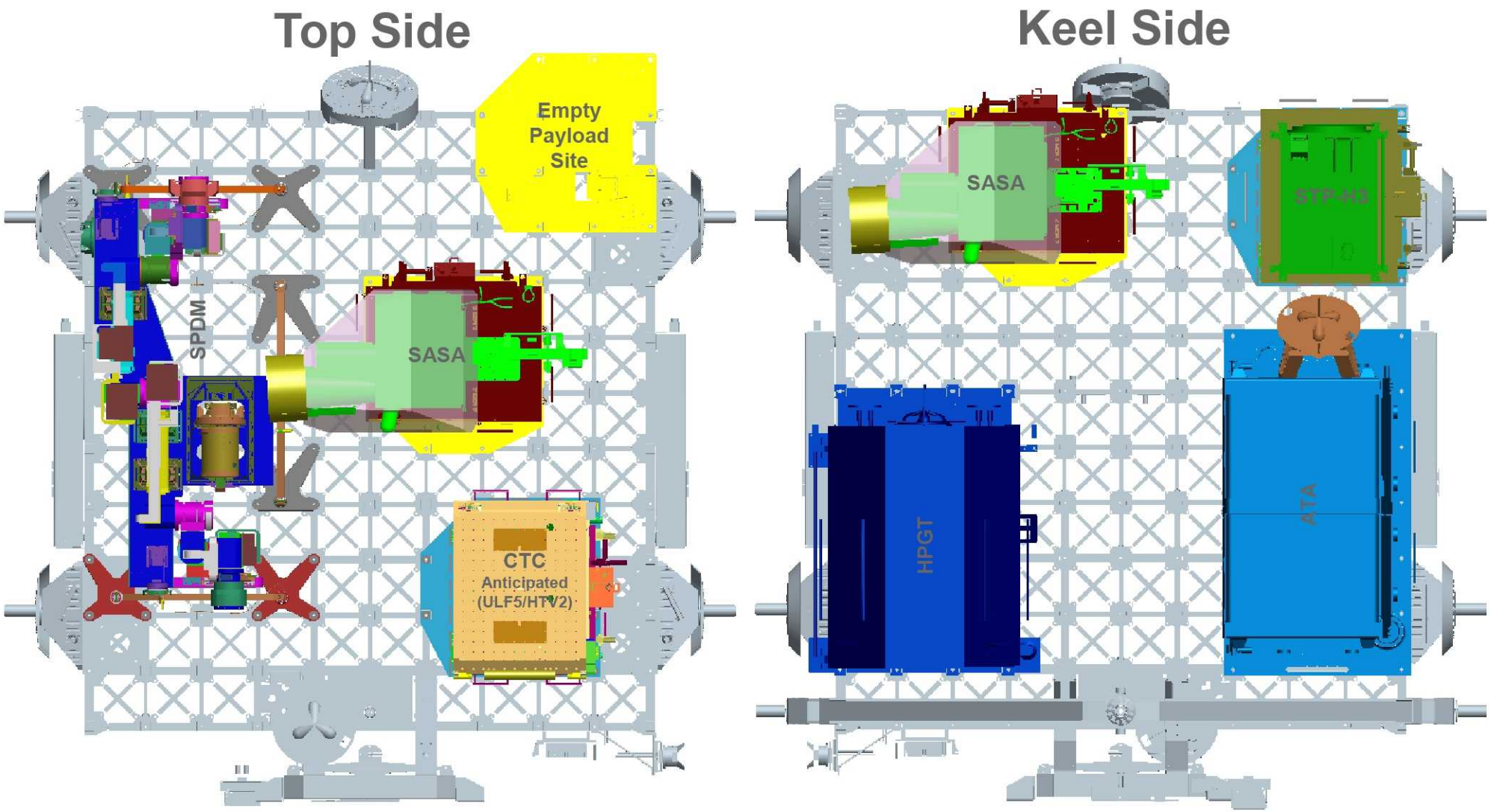


ELC2 Top Side



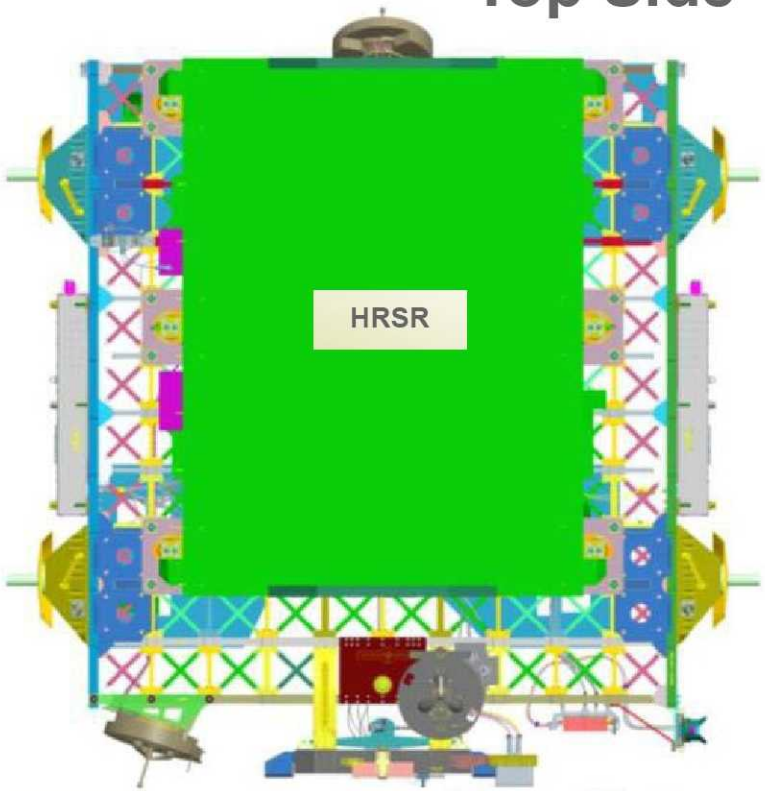
ELC2 Keel Side

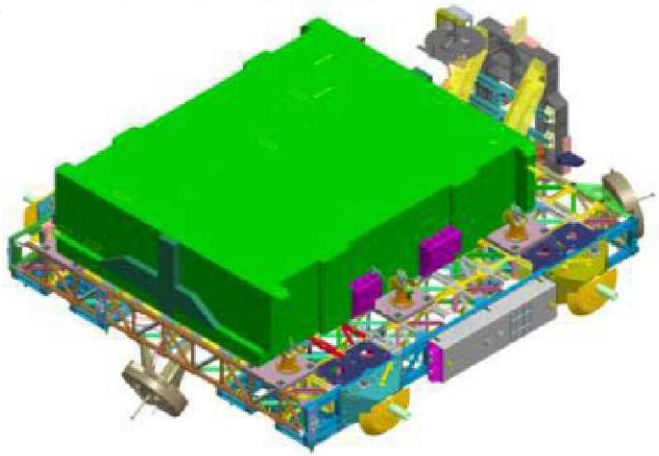
ELC3 Configuration



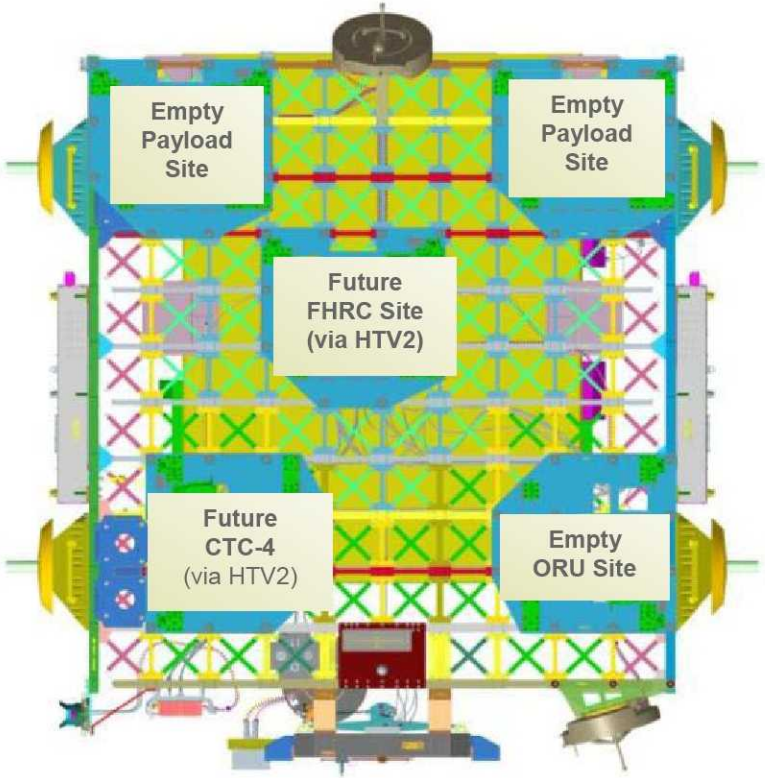
ELC4 Configuration

Top Side

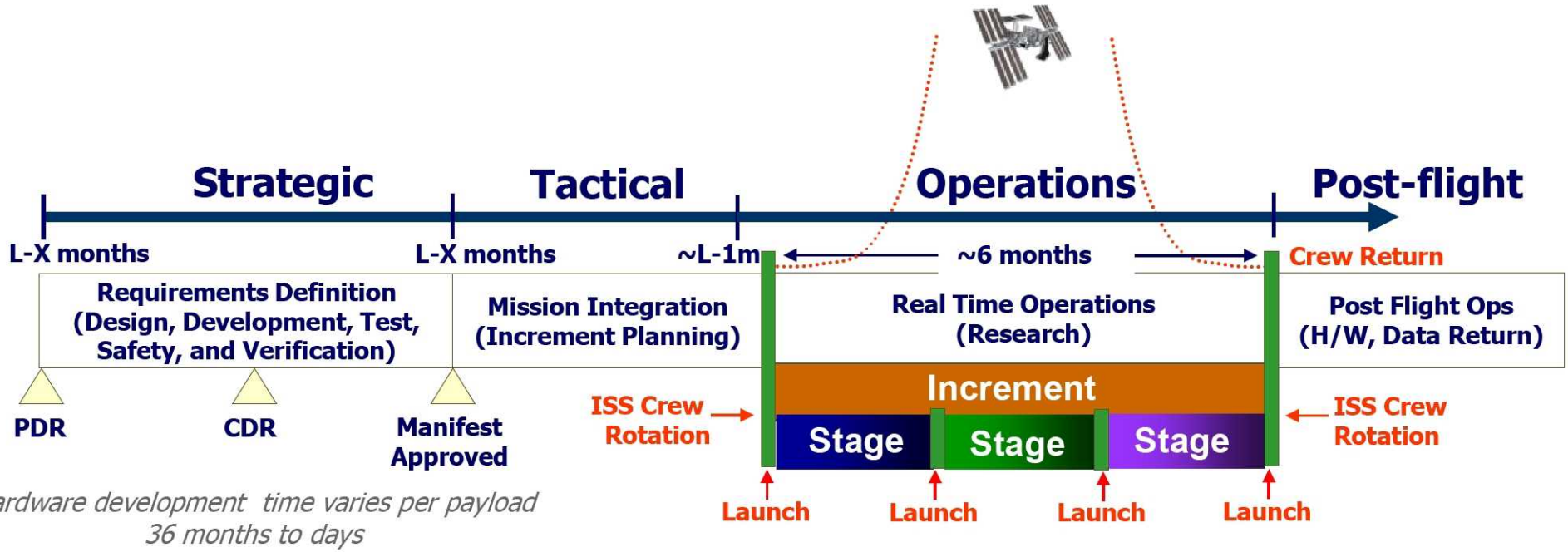




Keel Side



ISS Payload Integration Process



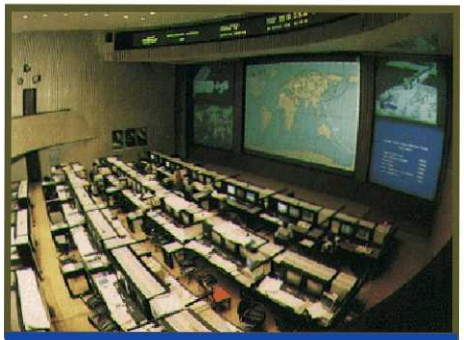
ISS Payload Control Centers

Payload Operations Center (POIC) - Huntsville

POIC: Responsible for execution of on-orbit NASA research

Mission Control Center—Houston

MCC-H: Responsible for flight command and control of overall vehicle

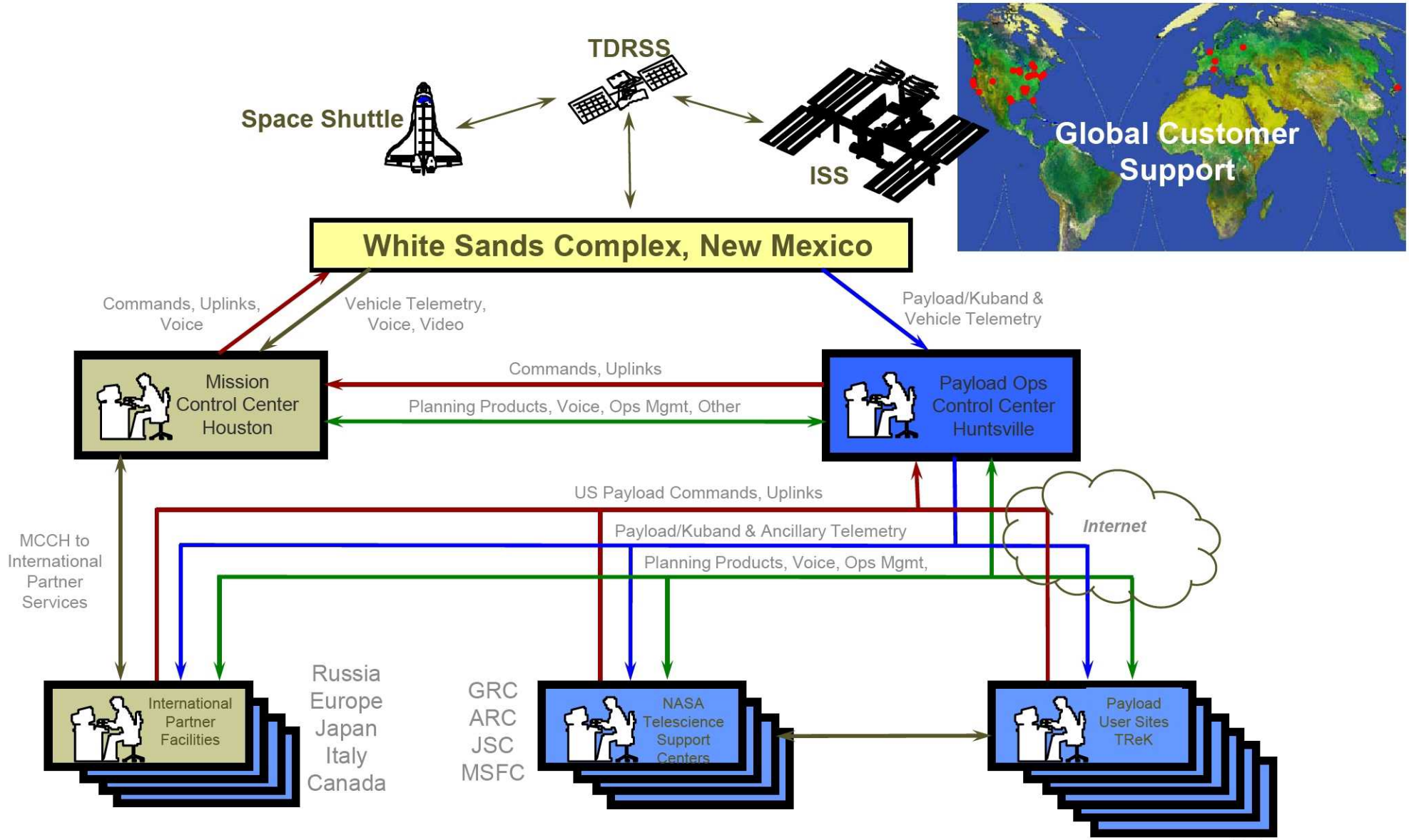


Mission Control Center—Moscow

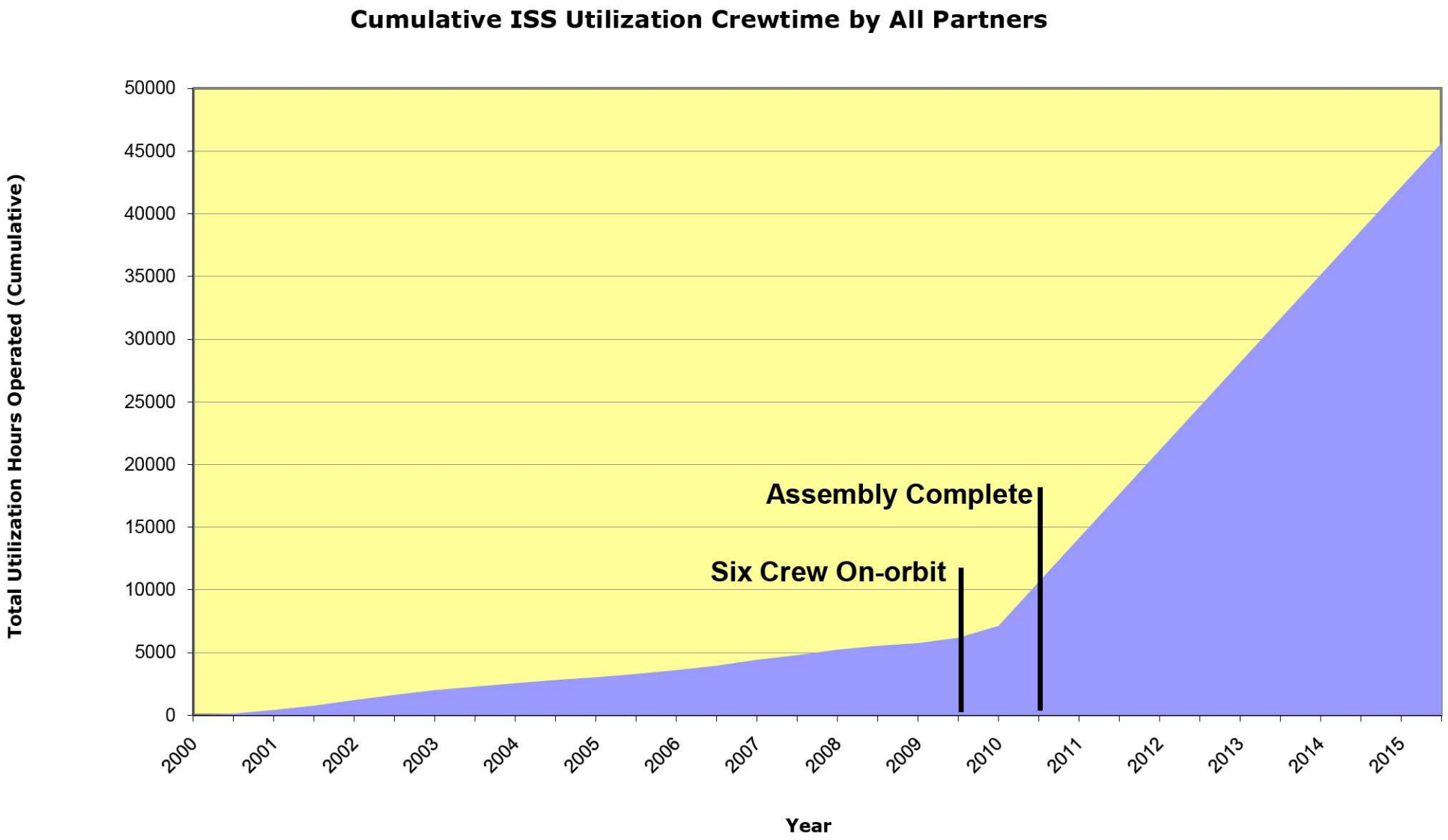
MCC-M: Responsible for flight command and control of Russian segment.

Payload Ops Integration Center Interfaces

MCC-H, 4 IP Control Centers, 4 Telescience Support Centers, 49 Telescience Resource Kit (TReK) clients



ISS Transition From Assembly to Utilization



USOS RESEARCH CREW TIME

12 March 2010 (Data through 28 February 2010)

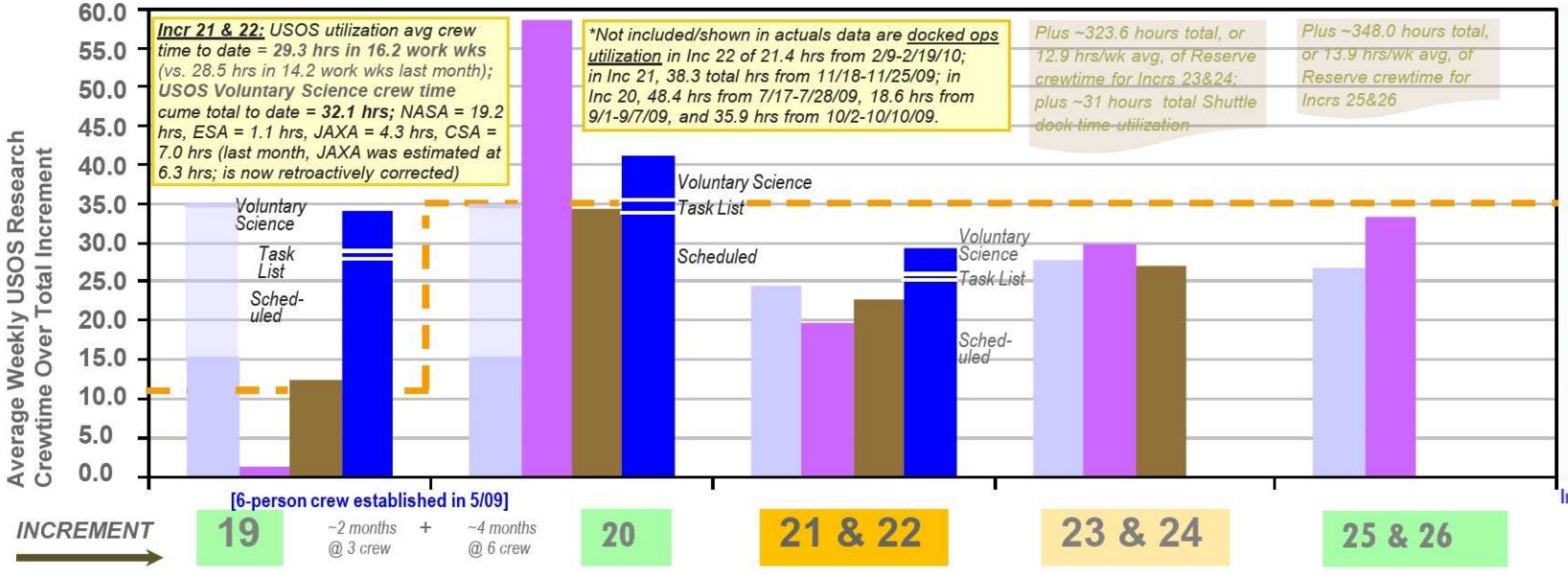
Average Weekly Actuals Provided as Compared to Minimum Requirements, Subscriptions, and Allocations

[POC: Rod Jones/OZ]

Legend

- Generic Groundrules, Requirements & Constraints *(GGR&C)* Minimum Requirement
- L-12 Month Increment Definition and Requirements Document Subscription (or Requirement)
- L-12 Month Increment Definition and Requirements Document *(IDRD)* Allocation
- L-1 Month Most Recent to Launch On-Orbit Operations Summary *(OOS)* (or most-current-to-launch IDRD until final pre-flight OOS release)
- Actuals Provided -- includes all Scheduled, Task-List, and Voluntary Science hours *(IMC)*; docked ops utilization not included/shown*
- Plus *n*# Hours Per Week Average Reserve Crewtime *(from Annex 5 PTP or MPCB Approval)*

Status: YELLOW ↑
Based on increase in Incrs 23 & 24 latest crewtime allocation as per L-1 Final Preflight OOS; last month ↓



INCREMENT	19		20		21 & 22			23 & 24		25 & 26	
	~2 months @ 3 crew + ~4 months @ 6 crew										
	Avg weekly	Total	Avg weekly	Total	Avg weekly	To Date	Total	Avg weekly	Total	Avg weekly	Total
GGR&C (Min Reqt)	11.3	101.7	35.0	595.0	35.0	567.0	875.0	35.0	875.0	35.0	875.0
L-12 IDRD Subscription	15.3	137.8	15.3	260.2	24.4[d]	395.5	610.3[d]	27.7[g]	693.1[g]	26.8	671.0
L-12 IDRD Allocation	1.2	10.4	58.5[b]	995.0[b]	19.7[e]	318.8	492.0[e]	29.8[g]	744.0[g]	33.3	833.4
L-1 OOS *(or IDRD)* Alloc	12.4	111.9	34.4[c]	584.0[c]	22.7[f]	458.0	567.8[f]	**27.0[h]**	**675.5[h]**	--	--
Actuals* (to date)	34.2	123.0	41.2[a]	597.6[a]	**29.3[a]**	**475.3[a]**	**475.3[a]**	--	--	--	--

Int'l Partner Sub-Allocations and Actuals Breakdowns

IP	L-1 hrs	Percent	Final
NASA	74.3	66.3%	81.4
ESA	9.6	10.7%	13.2
JAXA	22.0	17.9%	22.1
CSA	6.0	5.1%	6.3

IP	L-1 hrs	Percent	Final
NASA	416.4	67.3%	402.0
ESA	87.3	14.5%	86.4
JAXA	61.4	12.5%	74.9
CSA	18.9	5.7%	34.3

IP	L-1 hrs	To Date	Percent
NASA	416.7	**323.0**	**67.9%**
ESA	44.8	**46.9**	**9.9%**
JAXA	77.9	**75.9**	**16.0%**
CSA	28.4	**29.5**	**6.2%**

IP	L-1 OOS hrs	Percent
NASA	478.6	70.8%
ESA	74.9	11.1%
JAXA	109.5	16.2%
CSA	12.5	1.9%

Data as per Incrs 25 & 26 Research Plan baselined in 11/09 and OC Planning Authorization Letter signed in 11/09. New allocation expected next month.

[a] *Inc 21 & 22 USOS Actuals* to date in **16.2** work weeks*

[b] *Per Inc 19 & 20 IDRD Main Vol, Baselined MIOCB 7/08*

[c] *Per Inc 19 & 20 Final Pre-Flight OOS, 3/09*

[d] *Per Inc 21 & 22 Research Plan, Baselined 12/3/08*

[e] *Per Inc 21 & 22 IDRD Main Vol, Baselined 12/08*

[f] *Per Inc 21 & 22 Final OOS, 9/09*

[g] *Per Inc 23 & 24 Research Plan, Baselined 7/29/09*

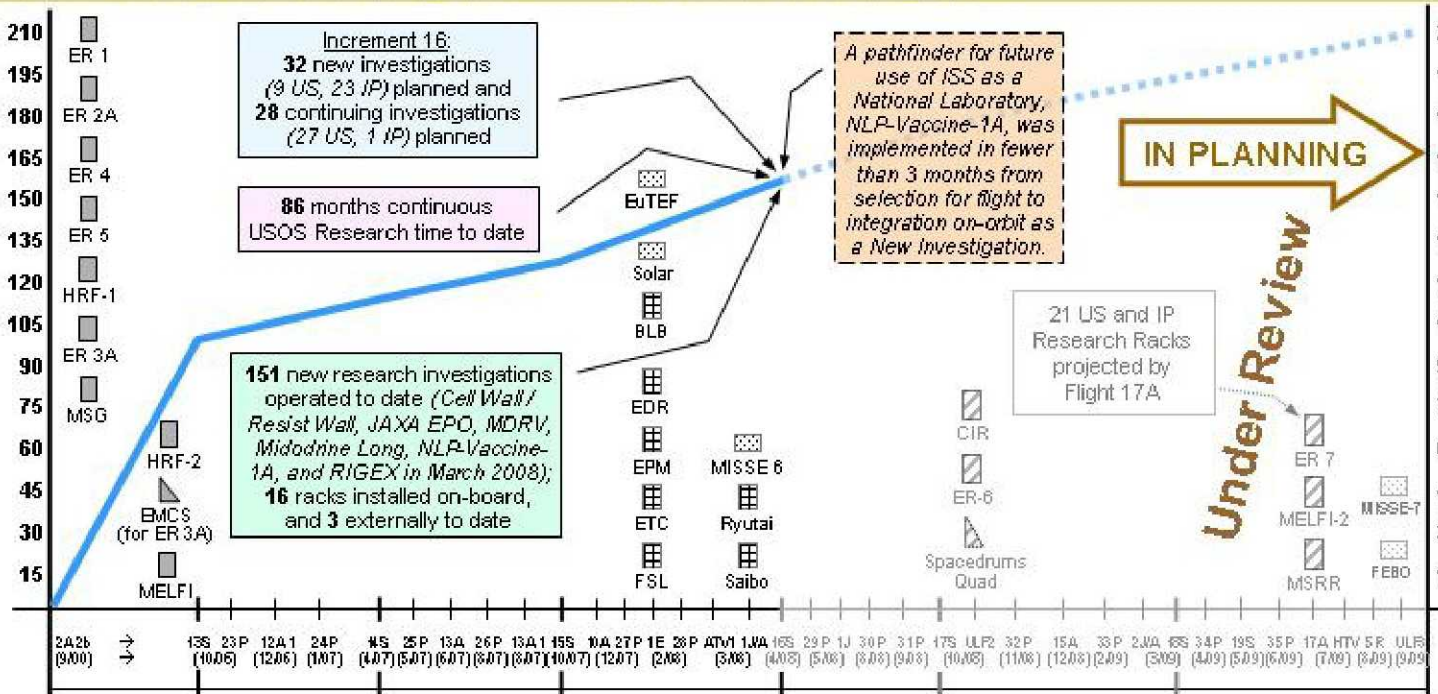
[h] *Per Inc 23 & 24 Final Pre-Flight OOS, 2/10*

ISS Research Accommodations Status

18 April 2008 (Data through 31 March 2008) ***[POC: Rod Jones/OZ]***

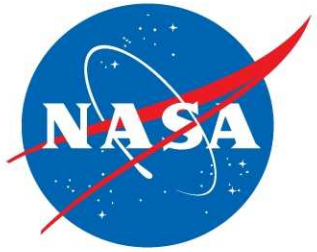
Acronyms

- = US Payload Rack Launched
- = (Planned) US or IP Payload Rack
- = (Planned) External Payload
- A = Active Rack Isolation System
- BLB = ESA Biolab Facility
- CIR = Combustion Integrated Rack
- EDR = European Drawer Rack
- EMCS = European Modular Cultivation System
- EPM = European Physiology Module
- ER = EXPRESS Rack
- ESA = European Space Agency
- ETC = European TransportCarrier
- EuTEF = European Technology Exposure Facility
- FSL = First Science Laboratory
- HRF = Human Research Facility
- IDRD = Increment Definition and Requirements Document
- Incr = Increment (or Expedition)
- IP = International Partner
- JAXA EPO = Japan Aerospace Exploration Agency - Education Payload Observation
- MELFI = Minus Eighty-degree Laboratory Freezer for ISS
- MDRV = Microbial Drug Resistance and Virulence
- MIOCB = Mission Integration and Operations Control Board
- MISSE = Materials International Space Station Experiment
- MSG = Microgravity Science Glovebox
- NLP-Vaccine-1A = National Laboratory Pathfinder – Vaccine – 1A
- OOS = On-Orbit Operations Summary
- POIWG = Payload Operations Integration Working Group
- RIGEX = Rigidizable Inflatable Get-Away-Special Experiment
- Solar = Solar Monitoring Observatory
- USOS = U.S. Operating Segment



	Incrs 0-13 (consolidated)	Incr 14	Incr 15	Incr 16 (to date)	Incr 17	Incr 18	Incr 19 / 20	Cumulative Actual Totals (thru Mar 31, '08)
						M. Fincke, NASA S. Sharipov, FSA G. Chamitoff, NASA S. Magnus, NASA K. Ushiro, JAXA		
Research Crew Time Total (USOS / Russian)	2581 / 1357	276 / 197	170.1 / 196.4	**282.3 / 118.4** *(92 / 78)**	*(156.0 / 147.0)†*	*(111.7 / 86.3)****	Under Review *(tbd)*	3309 / 1869 hrs
Avg Crew Time Per Work Week (USOS / Russian)	9.4 / 4.9	10.6 / 7.6	8.5 / 9.8	**18.1 / 7.6** *(3.9 / 3.3)**	*(5.8 / 5.4)†*	*(4.3 / 3.3)****	Under Review *(tbd)*	10.4 / 6.1 hrs (Inc 3 to date)
Research Rack Mass to Orbit (kg)	50833	0	0	**4476.5** *(3560.4)***	*(0)††*	*(1750.0)†††*	Under Review *(3118.6)*	9560 kg
Research Mass to Orbit (kg) *Includes Shuttle Middeck, Spacehab, Cargo Bay, Soyuz, Progress, Node 2 Harmony Module, Columbus Module, Japanese Experiment Module-Experiment Logistic Module-Pressurized Section (JEM-ELM-PS), Automated Transfer Vehicle (ATV1), H-II Transfer Vehicle (HTV)*	3876.2	572.5	549.9	**363.8** *(1883.1)***	*(337.4)††*	*(828.4)†††*	Under Review *(1338.5)*	5332 kg

(XX) = most recent plan for entire Increment
** Planning number from Incr 16 L-1 Month OOS*
***Approved Payload Tactical Plan Manifest, Incr 16, 7/19/07*
† Planning number from Incr 17 L-1 Month OOS, 3/17/08
†† Approved Payload Tactical Plan Manifest, Incr 17, 1/28/08
††† Approved Payload Tactical Plan Manifest, Incr 18, 1/23/08
****IDRD Main Vol, Tech Concurrence, MIOCB, 4/10/08*


NASA