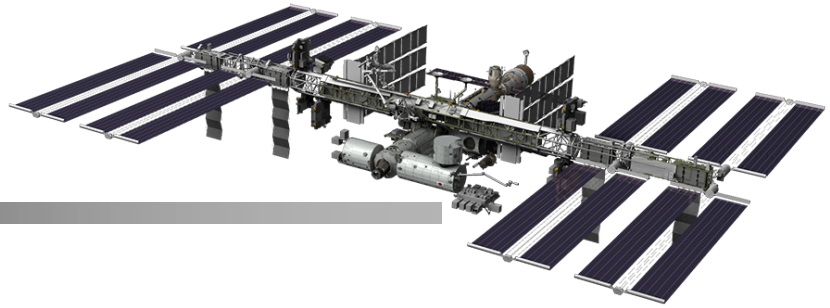
INTERNATIONAL SPACE STATION
P•R•O•G•R•A•M

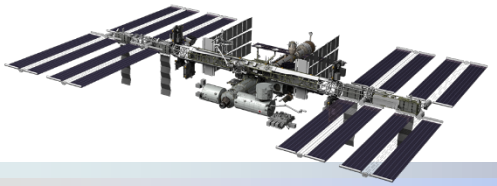


International Space Station Status

NASA Advisory Council
HEO Subcommittee

Sam Scimemi
ISS, Director
NASA Headquarters

July 2017



Upcoming Flight Plan

7/28/17 – Soyuz 51S launch (Bresnik, Nespoli, Ryazansky)

8/12/17 – SpaceX CRS-12 launch (Kennedy Space Center)

9/2/17 – Soyuz 50S landing (Fischer, Whitson, Yurchikhin)

9/12/17 – Soyuz 52S launch (Acaba, Misurkin, Vande Hei)

10/11/17 – Orbital ATK CRS-8 launch (Wallops Flight Facility)

10/12/17 – Progress 68P launch (Baikonur Cosmodrome)

11/1/17 – SpaceX CRS-13 launch (Kennedy Space Center)

12/14/17 – Soyuz 51S landing (Bresnik, Nespoli, Ryazansky)

12/27/17 – Soyuz 53S launch (Kanai, Shkaplerov, Tingle)

Increment 52 Overview: Crew

50S Dock 4/20/17
50S Undock 9/2/17

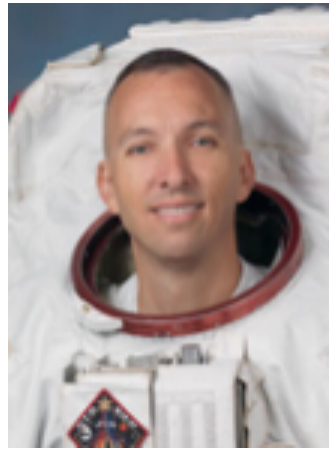
Peggy Whitson
FE (US) – 49S
(*CDR Inc 51)*

Fyodor Yurchikhin
Soyuz CDR (R) – 50S
(*CDR Inc 52)*

Jack Fischer
FE (US) – 50S

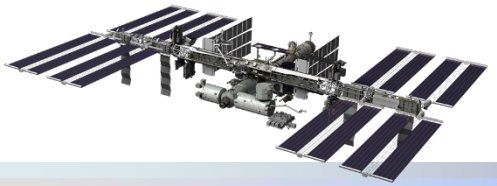
51S Dock 7/28/17
51S Undock 12/14/17

Sergey Ryzanski
Soyuz CDR (R) – 51S



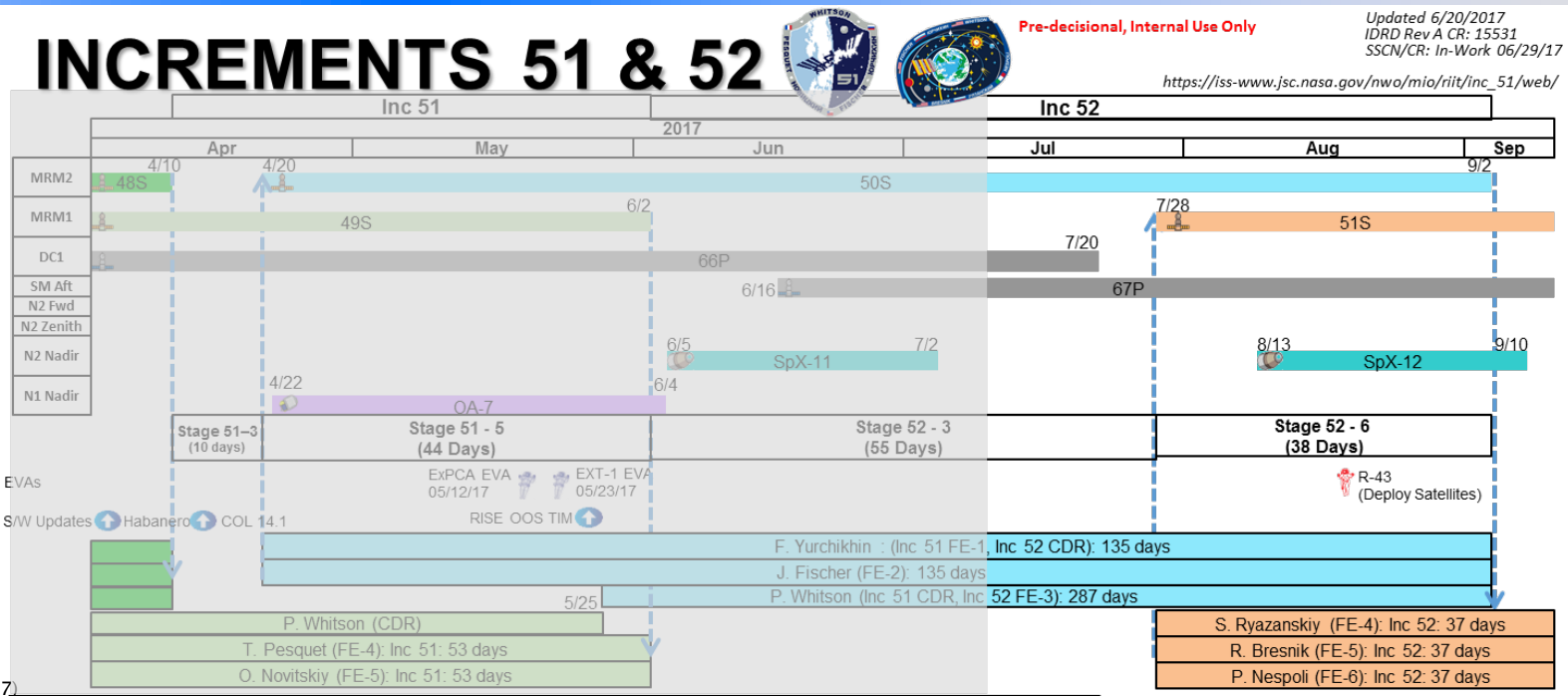
Randy Bresnik
FE (US) – 51S

Paulo Nespoli
FE (US) – 51S



Increments 51 & 52

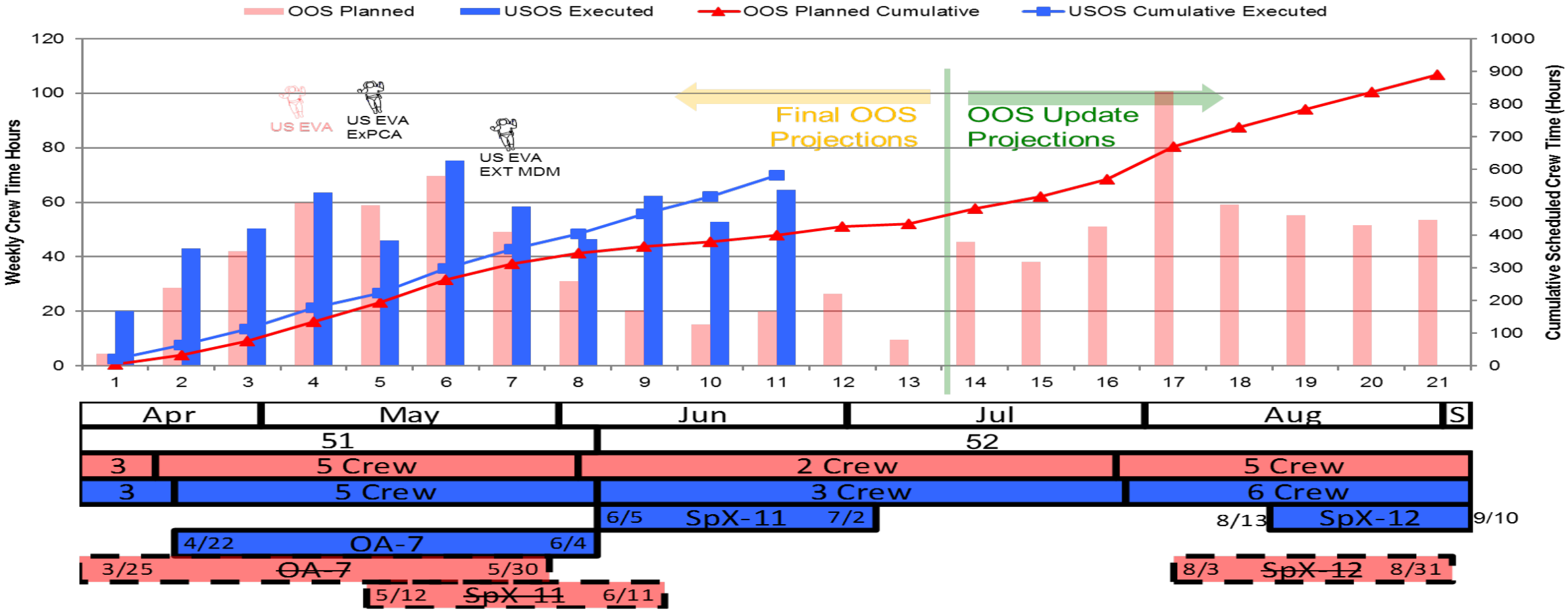
- **Increment 51: 54 days**
  - Stage 51-3: 48S undock to 50S dock: 10 days
  - Stage 51-5: 50S dock to 49S undock: 44 days
  - USOS EVAs: ExPCA EVA, EXT-1 R&R
  - Cargo Vehicles:
    - OA-7 Berth (4/22)
  - Science/Utilization:
    - NREP
    - MSG throughput pending OA-7 (OsteOmics, Magnetic 3D, ABC)
    - NRCSD pending OA-7
    - JSSOD pending SpX-11
    - Human Life Science
    - GRIP/GRASP
    - Sarcolab
    - SpX-11 science (RR-5, ROSA, MUSES, NICER)
  - Maintenance/Outfitting:
    - UPA troubleshooting/DA change out
    - JSL v10 / JSL Router Upgrades
    - Col Cycle 14.1 Software Update
    - MBSU 2 Robotic R&R
    - SSC client upgrade to ZBook
    - Cupola Scratch Pane R&Rs
    - Galley Rack Food Warmer Install
- **Increment 52: 93 Days**
  - Stage 52-3: 49S undock to 51S dock: 55 days
  - Stage 52-6: 51S dock to 50S undock: 37 days
  - EVAs (7/28-9/2)
    - Russian EVA #43 to install/remove experiments and deploy satellites (8/17)
  - Cargo vehicles:
    - SpX-12 berth (8/13), release (9/10)
  - Science/Utilization:
    - Human Life Science
    - SpX-12 (CREAM, Kaber/KE2M Deploy)
    - MSG throughput (Rodents, Antibody Conjugates)
    - Cool Flames, LMM Biophysics
  - Maintenance/Outfitting:
    - WPA MF bed change out (on watch list)
    - N3 CCAA Water Sep R&R (planned mid-July)
    - Cupola Scratch Pane R&R and Bump Shield install
    - USOS Reconfiguration continuation
    - UPA Firmware 6.3 upgrade
    - RPCM firmware update
    - MBSU i-Level maintenance
    - Robotic 50S inspection
    - iPEHG install into Express Rack 4, WORF, and HRF Racks



	Increment 51	Increment 52
Utilization	• Miniaturized Particle Telescope • Lighting Effects • Made in Space • Biochem Profile • LMM Biophysics 1 & 3 • Sprint • OsteoOmics • EML Batch • Nanoracks Module 48,52,54,56,70 • Aquapad • Veggie • Spaceborne Computer • NREP • Passive Thermal Testbed • Strata-1 • GRIP/GRASP • Capillary Structures • DECLIC • ACE-T1 • NRCSD #11 & 12 • Sarcolab-3 • JAXA PCG #12 • Phase Change HX • DOSIS-3D • ADCs in Microgravity	• Fluid Shifts • Neuromapping • Marrow • Payload Card-X • Group Combustion • Vascular Echo • ACE-T6, T8 & T9 • Microbial Tracking 2 • BRIC-LED • Rodent Research • Myogravity • Nanoracks Micosats • Petri Plants 2 • Saffire-III • Synthetic Bone • Multi Omics Mouse/Epigenetics • Seedling Growth-3 • CASIS PCG • ExHAM #1-3 • JSSOD • Nanoracks Module 63,66,67 • STaARS-1 • Fruit Fly Lab • Extremophiles • Cardiac Stem Cells
EVA, Robotics, Systems, Software	✓ Col Cycle 14.1 Software Update ✓ MBSU 2 Robotic R&R ✓ ExPCA R&R EVA ✓ EXT-1 MDM R&R EVA ✓ Start SSC Clients transition to ZBooks ✓ JSL Routers Upgrade (HTV-6) ✓ Galley Rack Food Warmer Install	• RS EVA 43 • Deploy nanosatellite experiments • Pressure Management Device Install (SpX-12) • iPEHG install into Express Rack 4, WORF, and HRF Racks • Crew Personal Active Dosimeter (CPAD) Tech Demo (SpX-12) • Backup Drive System install for JEM SFA (SpX-12) • SSC Clients transition to ZBooks (Cont.) • MPEP Modification on JEMAL Slide Table (SpX-11) • JAXA WAP R&R (SpX-11) • Node 2 IMV ducting for IDA Fwd/Zenith

IM - Hubert Brasseaux (x48079)
IDM - Frank Acevedo (x32561)
IE - Jorge Salazar (x39663) Cindy Cranford (x47677)
IPE - David Cook (x46387)
CTE - Sam Longwell (x48230)

Inc 51-52 Utilization Crew Time



Color Key:
FPIP
OOS

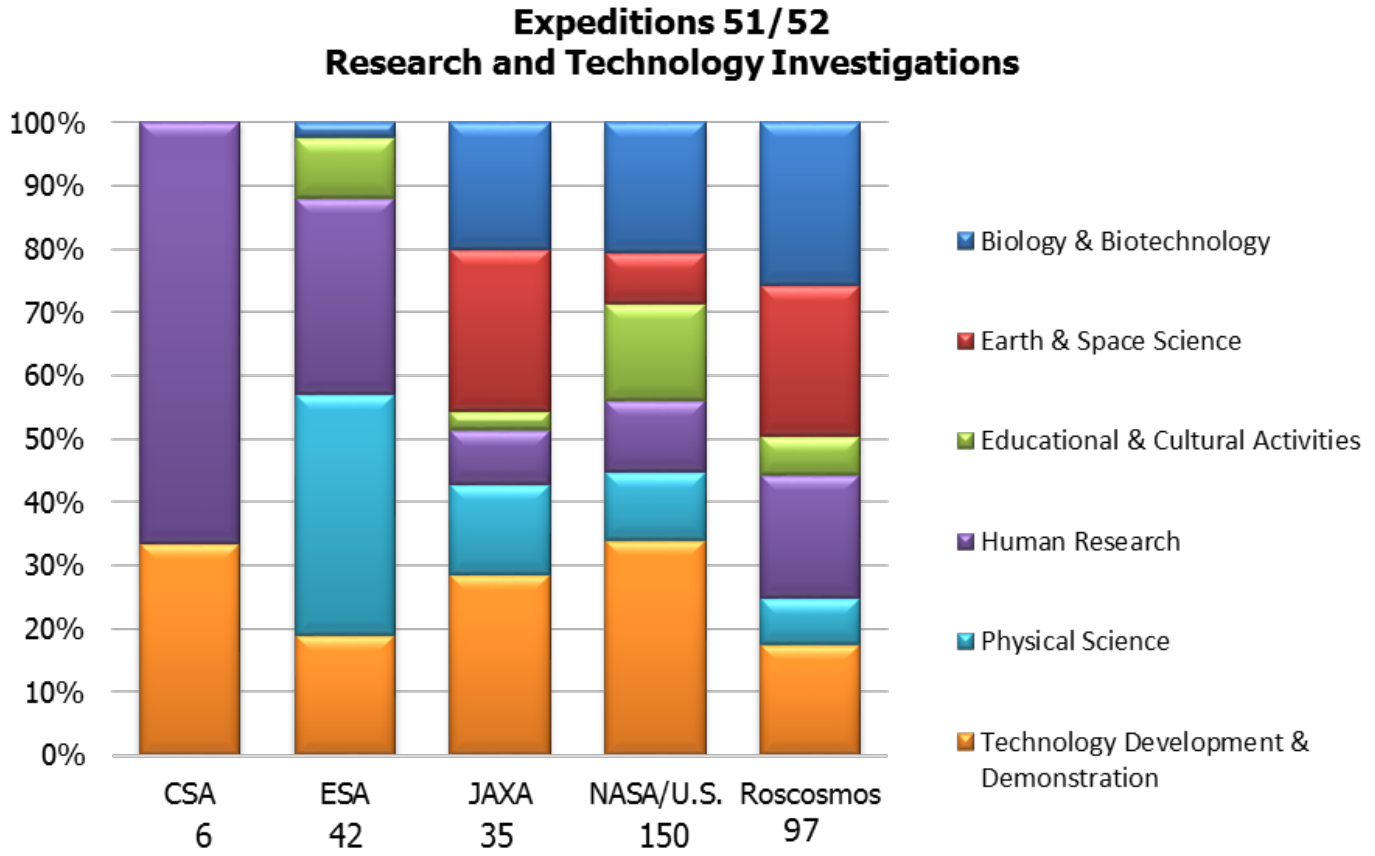
Executed through Increment Wk (WLP Week) 11 :	10.6 of 20 work weeks	(53.0% Complete)
USOS Actuals:	582.58 hours -> 54.96 hours/week	
USOS IDRD Allocation:	913 hours-> 45.65 hours/week	(63.8% Complete)
OOS USOS Planned Total:	889.6 hours **(Final OOS = 690)**	(65.5% Complete)
Voluntary Science Totals to Date:	0 hours (not included in the above totals or graph)	
RSA/NASA Joint Utilization to Date:	42.08 hours (not included in the above totals or graph)	

Pre-Decisional, For Internal Use Only
6-Jul-17

ISS Research Statistics

- 150 NASA/U.S.-led investigations
- 180 International-led investigations
- 85 New investigations
  - 1 CSA
  - 4 ESA
  - 10 JAXA
  - 67 NASA/U.S.
  - 3 Roscosmos

Number of Investigations for 51/52: 330



ISS Lifetime

- Estimated Number of Investigations Expedition 0-52: 2309*
- Over 3000 Investigators represented (Exp 0 – present)
- Over 1400 scientific results publications (Exp 0 – present)

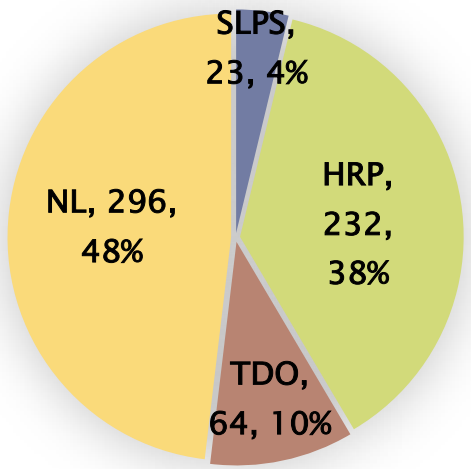
Working data as of May 31 2017
*Pending Post Increment Adjustments

Increment 49/50 Crew Time by Sponsor

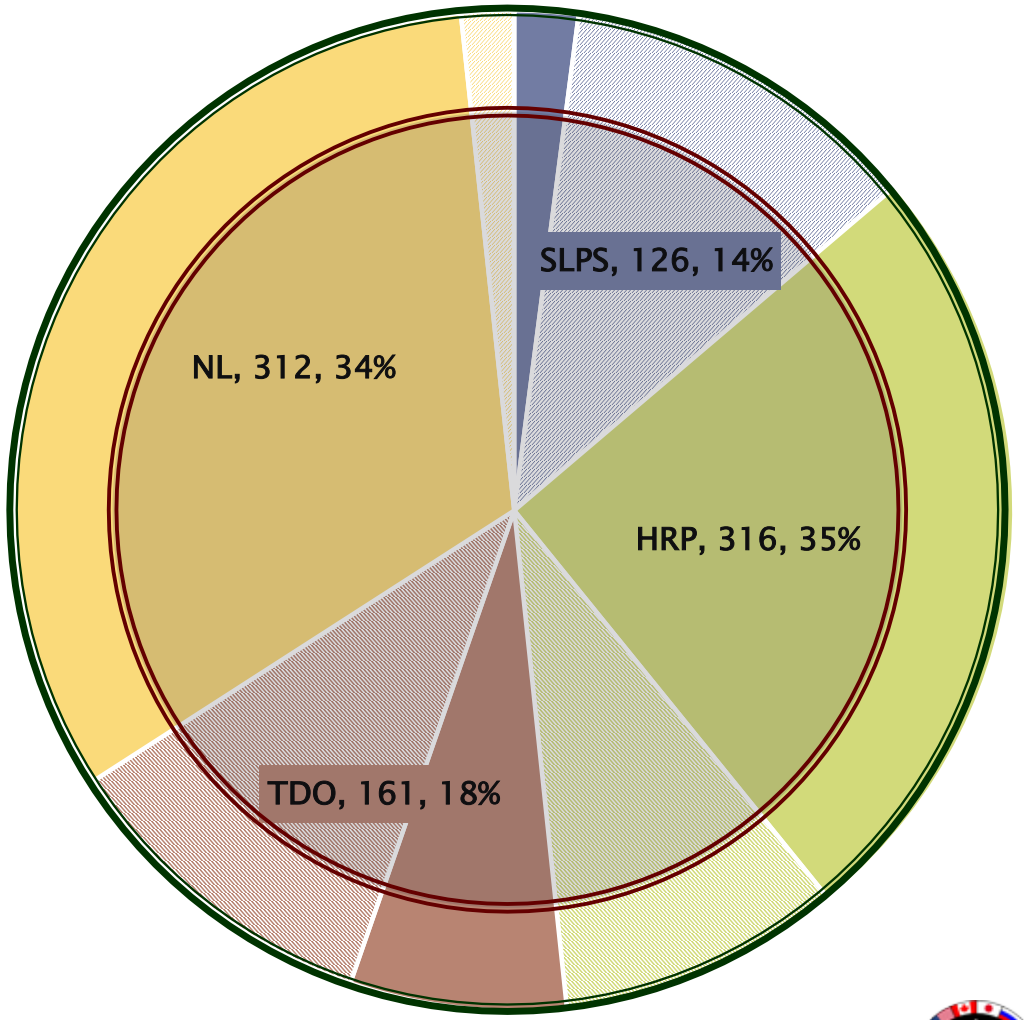
- Enablers
  - Operationally-ready reserve complement
  - Russian Crew time for MARES (HRP), SPHERES ZR (NL), EarthKAM (NL), RR-4 (SLPS), FLEX (SLPS)
  - Launch of reserve life sciences at risk
  - Increase of 69 total crew days
- Challenges
  - Loss of research requirements enabled by Sx11 and OA7 from Increment Pair
  - Utilization hardware anomalies
- Delta Explanations
  - Crew significantly exceeded performance expectations
  - Implemented the majority of the available science, including Reserve science, for all sponsors as permitted by constraints, including facility through-put
  - NL Reserve on orbit was insufficient to make up for the delay of OA7 and Sx11 flight to the next increment

Sept '16 – April '17	Planned	Actual
Research Hours	615	916
Total Crew Days (USOS)	317	386
Cargo Flights	OA-5 HTV6 SpX-10 OA-7 SpX-11	OA-5 HTV6 SpX-10
# EVAs	5	5
Russian Crew hours	169	183

Planned Hours



Actual Hours

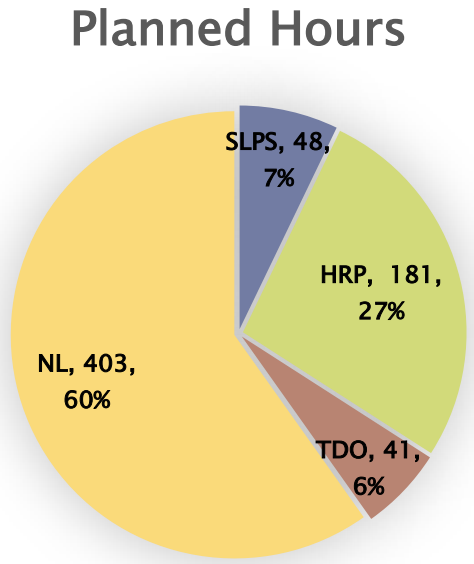


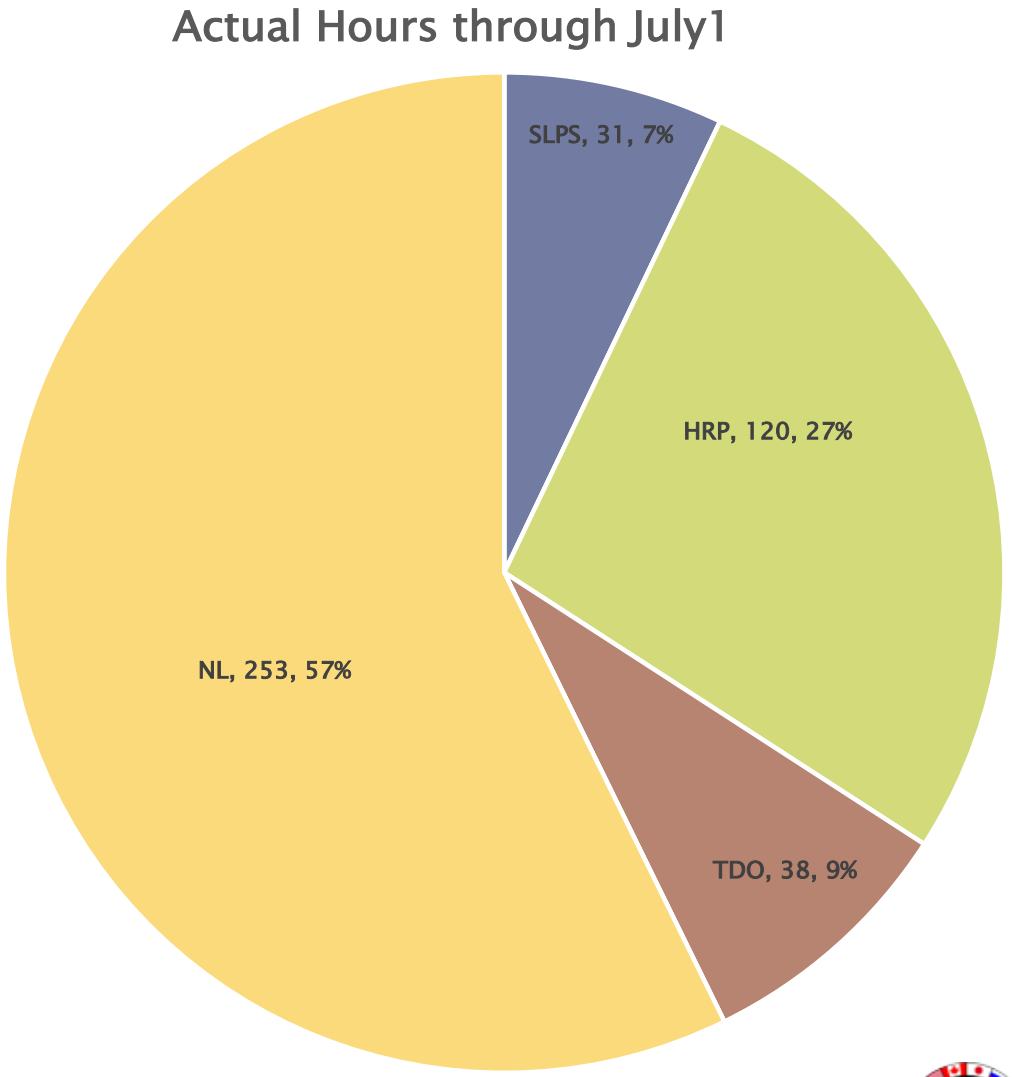
*Hatched wedges indicate increase from plan

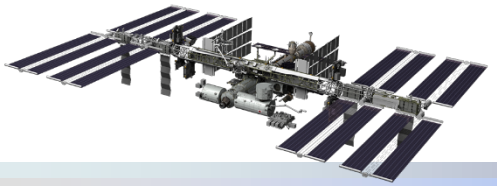
Increment 51/52 Crew Time by Sponsor

- Enablers
  - Russian Crew time for MARES (HRP), Fluid Shifts (HRP)
  - Launch of life sciences reserve at risk
  - Peggy Whitson mission extension provided extra crew time hours
- Challenges
  - Lack of operationally-ready reserve complement
  - ISS anomaly requiring unplanned EVA
  - Utilization hardware anomalies
- Delta Explanations
  - Crew significantly exceeded performance expectations
  - The CASIS plan being above 50% is due to flights from Increment 49/50 being delayed into the increment at a point when the later flights were not delayed out of the increment.

April '17 – Sept '17	Planned	Actual (July 1)
Research Hours	673	442
Total Crew Days (USOS)	214	35
Cargo Flights	OA-7 SpX-11 SpX-12	OA-7 SpX-11
# EVAs	1	2
Russian Crew hours	0	TBD

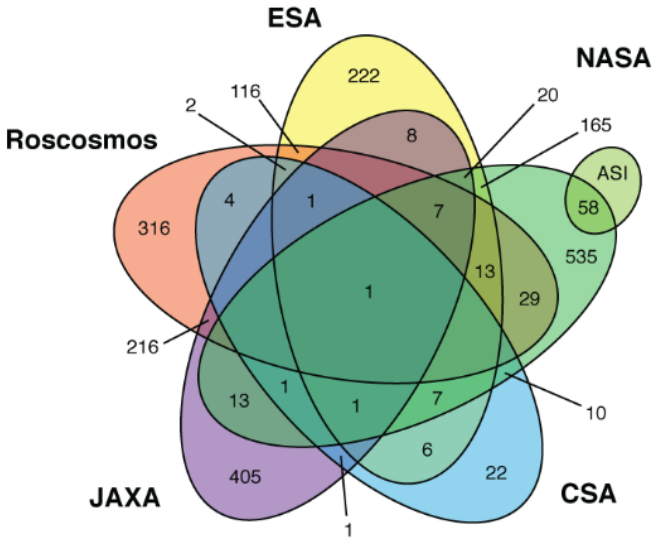






ISS Benefits Increased Through International Collaboration

	Agency Only	Collaboration (Hosting)	Investigations Implemented	Collaboration (Participating)	Total Agency Impact
CSA	22	9	31	25	56
ESA	222	74	296	273	569
JAXA	405	167	572	102	674
NASA*	593	174	767	93	860
Roscosmos	316	197	513	192	705
			2179		



*NASA Utilization includes investigations by the Italian Space Agency (ASI), an ISS Participant Agency

International collaboration investigations are sponsored by one of the ISS Partners and include scientists from other countries.

Ellipses show the intersection of Partner collaborations and counts show the increased number of investigations through international collaboration from the point of view of each Partner.

Expeditions 0-48 December 1998 – September 2016

Prime = 494 hrs
Reserve = 168 hrs

Biology & Biotechnology

Animal Biology
Joint Rodent Research-1
Fruit Fly Lab -02 (FFL-02)
Rodent Research-4 (RR-4)
Rodent Research-5 (RR-5)
Multi Omics-Mouse/Mouse Epigenetics-2
Space Pup
Cellular Biology
CORM
MYOGRAVITY
NANOROS
SERISM
ADCs in Microgravity
Cardiac Myocytes
Cardiac Stem Cells
Lung Tissue
Magnetic 3D cell culturing
OsteoOmics
SABL
Synthetic Bone
Stem Cells
Macromolecular Crystal Growth
CASIS PCG 6, 7
CASIS PCG 8 (↑)
LMM Biophysics 1, 3
JAXA Medium Temp PCG
JAXA PCG
Microbiology
APEX-02-2
Microbial Tracking-2
STaARS-iFUNGIS (↑)
EXTREMOPHILES
Plant Biology
BRIC-22
BRIC-Light Emitting Diode (LED)
Veg-03
Payload Card-X
Petri Plants-2
Asian Herb
Seedling Growth-3
Facilities
Plant Habitat
Veggie
STaARS-1 EF
BioLab
EMCS

Prime = 11 hrs
Reserve = 20 hrs

Earth & Space Science

Astrobiology & Astrophysics
CREAM (Ext)
NICER (Ext)
AMS-02 (Ext)
Meteor
CALET (Ext)
MAXI (Ext)
Earth Remote Sensing
CATS (Ext)
CEO
ISS RapidScat (Ext)
SAGE III-ISS (Ext)
STP-H5 FPS (Ext)
STP-H5 LIS (Ext)
NREP Inserts (Ext)
Near-Earth Space Environment
SEDA-AP (Ext)
Facilities
WORF

Prime = 135 hrs
Reserve = 37 hrs

Facilities/Multipurpose

Cold Stowage
Coldbag, Polar
GLACIER, MELFI, MERLIN
Kubik
Internal Infrastructure
HRF-1, 2
LMM
Mass Measurement Device
MSG
SAMS-II
NanoRacks Platforms
Programmable Isolation Mount
TangoLab-1
MSPR
Ryutai
Saibo
External Infrastructure
EFU Adapter
ExHAM#1, #2
J-SSOD#7
MUSES
NanoRacks Microsat Deployer
NanoRacks-extCygnus-NRCSD (↑)

Prime = 94 hrs
Reserve = 134 hrs

Physical Science

Combustion Science
ACME
Cool Flames Investigation
FLEX-2
ATOMIZATION
Group Combustion
Complex Fluids
ACE-T-1, -8, -9
DECLIC ALI-R (↑)
ACE-T-6
PK-4
Fluid Physics
DECLIC HTI-R
ZBOT
Eli Lilly-Lypholization
Two-Phase Flow
FLUIDICS
Fundamental Physics
DOSIS-3D
MAGVECTOR
Materials Science
DECLIC DSI-R
Strata-1
SUBSA Furnace & Inserts
Advanced Nano Step
ELF Investigation
EML Batch 1 & 2
MSL
MSL SCA-Batch 2b-ESA

Prime = 31 hrs
Reserve = 92 hrs

Education & Outreach

Cultural Activities
Google Street View
NanoRacks Module-48
Educational Competitions
NanoRacks Module-9
NanoRacks Module-52, 54, 55, 56
NanoRacks Module-66, 67, 70
SPHERES-Zero-Robotics
Educational Demonstrations
ISS Ham Radio
Sally Ride EarthKAM
Story Time From Space
Tomatosphere-US
JAXA EPO TBD
JAXA Payloads Place Holder
AstroPi
EPO Nespoli, Pesquet
ESA-EPO-TASK-LIST
Student-Developed
Genes in Space-2, -3

Prime = 95 hrs
Reserve = 128 hrs

Technology Development

Air, Water & Surface Monitoring
Formaldehyde Gas Monitor
Multi-Gas Monitor
Water Monitoring Suite
Avionics & Software
ARAMIS (↑)
CAST
Spaceborne Computer
STP-H5 CSP (Ext)
STP-H5 Space Cube - Mini (Ext)
Honeywell-Morehead-DM-7
NanoRacks Module-63
SG100 Cloud Computer
Characterizing Expt Hardware
IN SITU
ROSA (Ext)
MVIS Controller-1
ECHO
Commercial Demonstrations
Made In Space Fiber Optics
Communication & Navigation
SCAN Testbed (Ext)
Maritime Awareness
Vessel ID System (Ext)
MOBIPV
Fire Suppression and Detection
Saffire-III
Food & Clothing Systems
EVERYWEAR
Skinsuit
Imaging Technology
HDEV (Ext)
NanoRacks-Cavalier Space Processor
NanoRacks-CID
NanoRacks-KE IIM (↑)
360 Camera
Life Support Systems
Capillary Structures
LDST
MED-2
UBNT
Aquapad
Microbial Populations in Spacecraft
Biomolecule Sequencer (↓)
MATISS
Microgravity Measurement
STP-H5 SHM (Ext)
Radiation & Shielding
FNS
Miniaturized Particle Telescope
PERSEO (↑)
Radiation Environment Monitor
STP-H5 RHEME (Ext)
NanoRacks Gumstix (↓)
Area PADLES
PS-TEPC
Radi-N2
Robotics
Astrobee
Gecko Gripper
Robonaut
STP-H5 Raven (Ext)
JEM Internal Ball Camera
SUPVIS-JUSTIN
Small Satellites Technologies
SPHERES Halo
SPHERES-UDP
NRCSD #11, 12, 13
Space Structures
BEAM (Ext)
RED-Data2
Spacecraft & Orbital Environmts
RFID Logistics Awareness
STP-H5 APS (Ext)
STP-H5 GROUP-C (Ext)
STP-H5 iMESA-R (Ext)
STP-H5 LITES (Ext)
Spacecraft Materials
STP-H5 ICE (Ext)
Systems/Hardware Demonstration
Manufacturing Device
Thermal Management Systems
Passive Thermal Flight Experiment
Phase Change HX
STP-H5 EHD (Ext)
Other
NanoRacks Black Box

Prime = 276 hrs
Reserve = 41 hrs

Human Research

Bone & Muscle Physiology
Intervertebral Disc Damage (P)
Sprint
Brain-DTI (P)
EDOS-2
MUSCLE BIOPSY (P)
SARCOLAB-3
Marrow
Cardiovascular & Respiratory Systems
Cardio Ox
IPVI
Vascular Echo
Crew Healthcare Systems
Medical Consumables Tracking
Portable PFS
Habitability and Human Factors
Body Measures
Fine Motor Skills
Habitability
Human Behavior & Performance
Lighting Effects
Circadian Rhythms
At Home in Space
Immune System
Functional Immune
Multi-Omics (↑↓)
Probiotics
Immuno-2
Integrated Physiology & Nutrition
Biochem Profile
Dose Tracker
Repository
Telomeres (P)
Energy
Nervous & Vestibular Systems
Field Test (P)
NeuroMapping
GRASP
GRIP
Space Headaches
Straight Ahead in Microgravity (P)
Radiation Impacts on Humans
ESA-Active-Dosimeters
Vision
Fluid Shifts

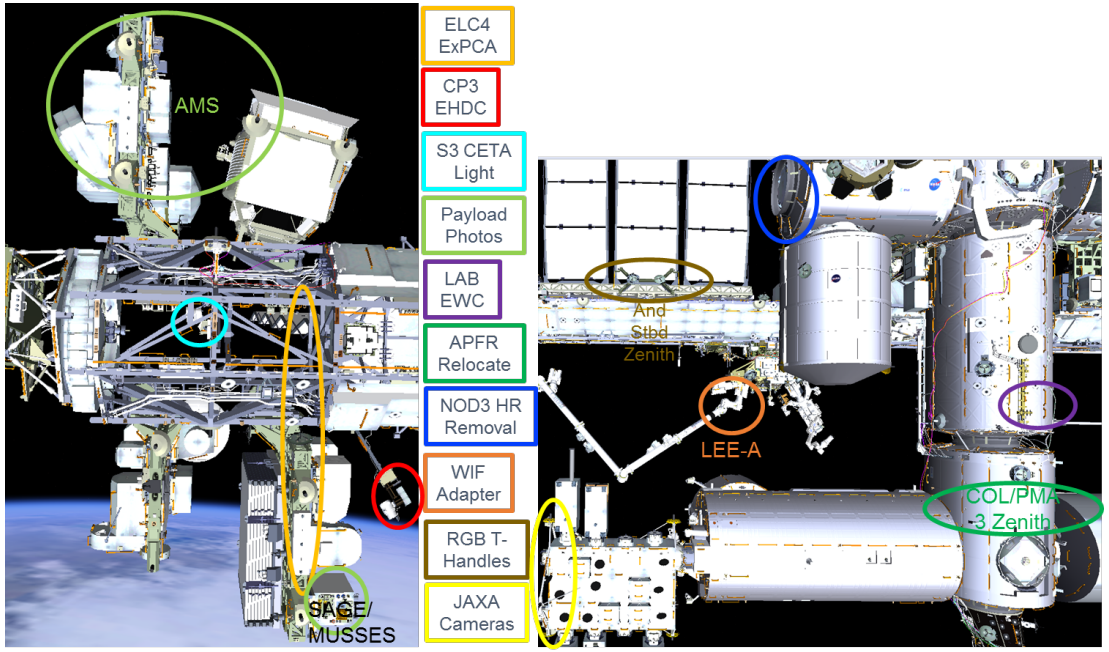
Key

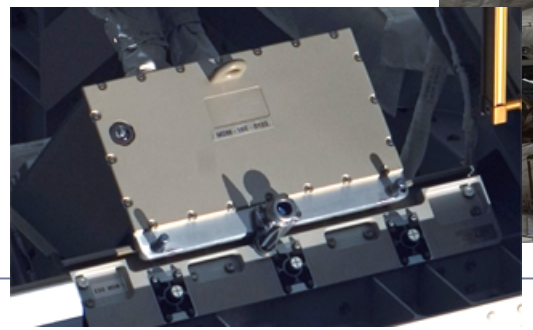
NASA	(P) = Pre/Post BDC only
National Lab	(Ext) = External
JAXA	(RJR) = Russian Joint Research
ESA	(↑) = Launch only
CSA	(↓) = Return only
RSA	

As of 28 April 2017

Completed EVAs

- **US EVA 40 – EPIC/SPDM LEE Lube EVA – Kimbrough & Pesquet**
  - Completed March 24, 2017, PET: 6:34
  - All planned tasks completed:
    - RBVM Inspection
    - EXT-2 EPIC MDM R&R
    - SPDM Lee Lube
    - PMA3 Disconnect
    - JEM RMS WVE Camera R&R
    - JEM EF FWD VE R&R
  - EVA-Get-Aheads Completed
    - replacing the S1-1 CETA Light
- **US EVA 41 – EPIC/Shields EVA – Kimbrough & Whitson**
  - Completed March 30, 2017, PET: 7:04
  - All planned tasks completed:
    - EXT-1 EPIC MDM-R&R
    - PMA3-Connect
    - PMA3-Cover Removal
    - N3-Axial Shield Installation (Partial completion, 3 of 4 Shields Installed)
    - PMA3-Cummerbund Installation
  - Unscheduled Tasks Completed
    - Installation of PMA3 Cover over the exposed portion of Node 3 Axial CDM
  - EVA-Get-Aheads Completed
    - Node 2 CMB Cleaning (Partial completion, 1 of 2 sites cleaned)
- **US EVA 42 – ExPCA Install EVA – Whitson & Fischer**
  - Completed May 12 2017, PET: 4:13
  - EVA shortened from plan due to SCU line leak prior to egress
  - Tasks completed:
    - Perform ELC4 ExPCA R&R.
    - PMA3 FWD Shield Install
    - AMS 1553 Terminator Installation/photos
    - Secure MLI on JEMRMS CLM and WVE Harness Connector
  - Scheduled tasks not completed: Install CP3 EHDC
  - Get ahead completed: Relocate APFR from Columbus to PMA3
- **US EVA 43 – EPIC/SPDM LEE Lube EVA – Whitson & Fischer**
  - Completed May 23, 2017, PET: 2:46
  - All planned tasks completed:
    - EXT-1 MDM R&R
    - Lab EWC Antenna Installation



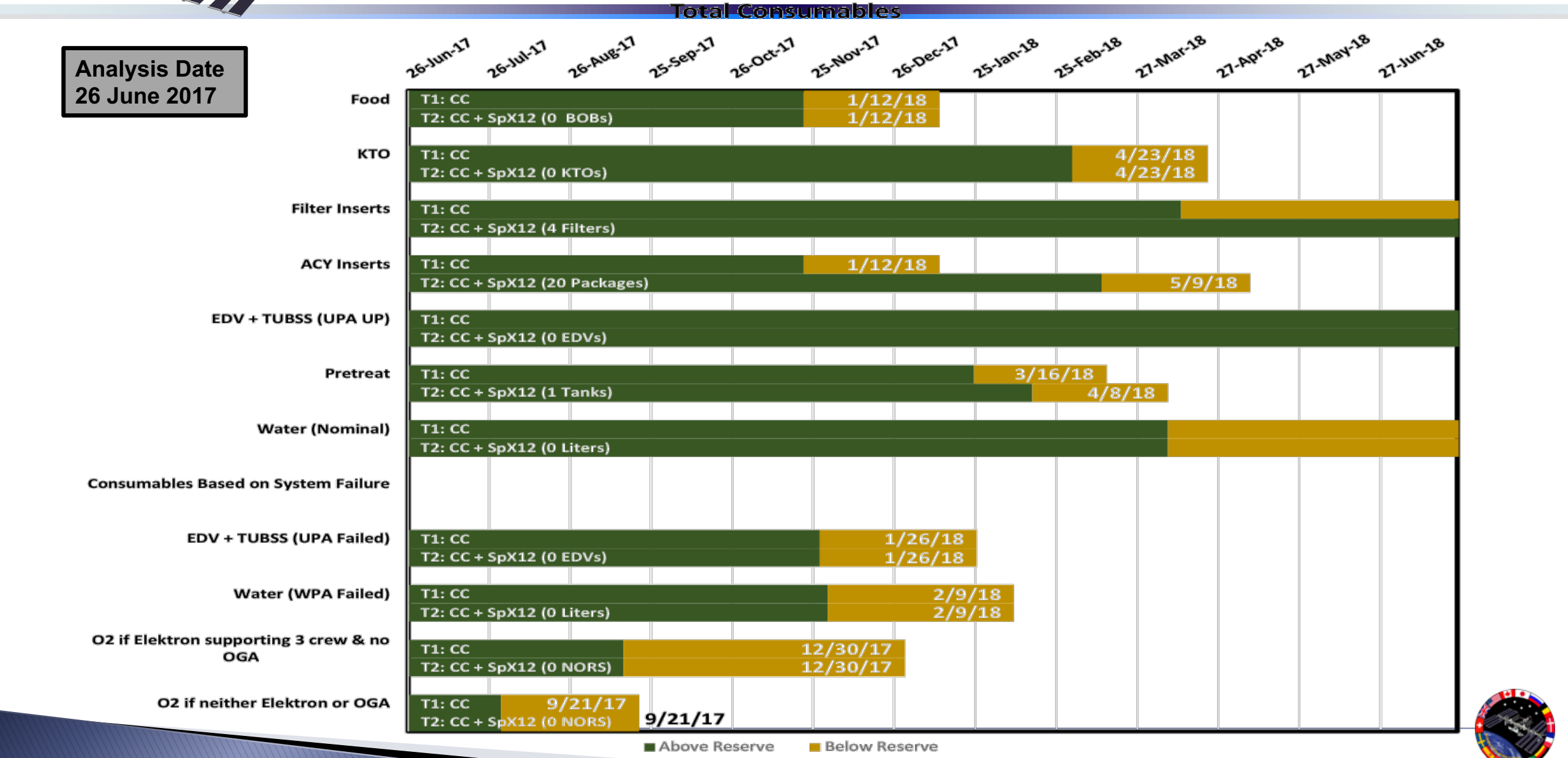


Upcoming EVA Plan

- **Next US EVA's tentatively being planned for Fall 2017, preliminary Tasks:**
  - **Node 3 External Wireless Communications (EWC) EVA:**
    - Node 3 EWC antennas
    - CP13 R&R with External High Definition Camera (EDHC)
    - CP3 EHDC Installation
    - Lab EWC antennas
    - ESP2 Nadir MBSU MLI Removal and torque release (allows Robotics ops) – Part 1
  - **CP9 ETVCG EVA:**
    - CP9 R&R with EHDC swap
    - ESP2 Nadir MBSU MLI Removal and torque release (allows Robotics ops) – Parts 2 & 3
    - NH3 Flexhose removal (With option to defer if not needed)
    - MBS MAST Camera Lens Cover R&R and POA Imagery
    - HPGT latch handle (With option to defer if not needed)

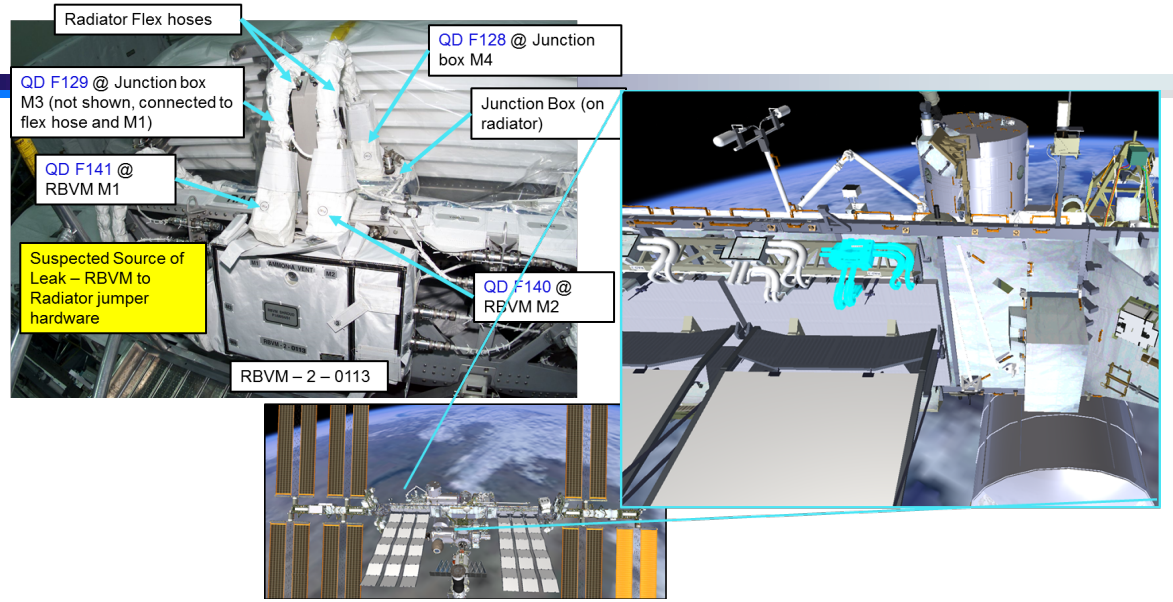
Total Consumables

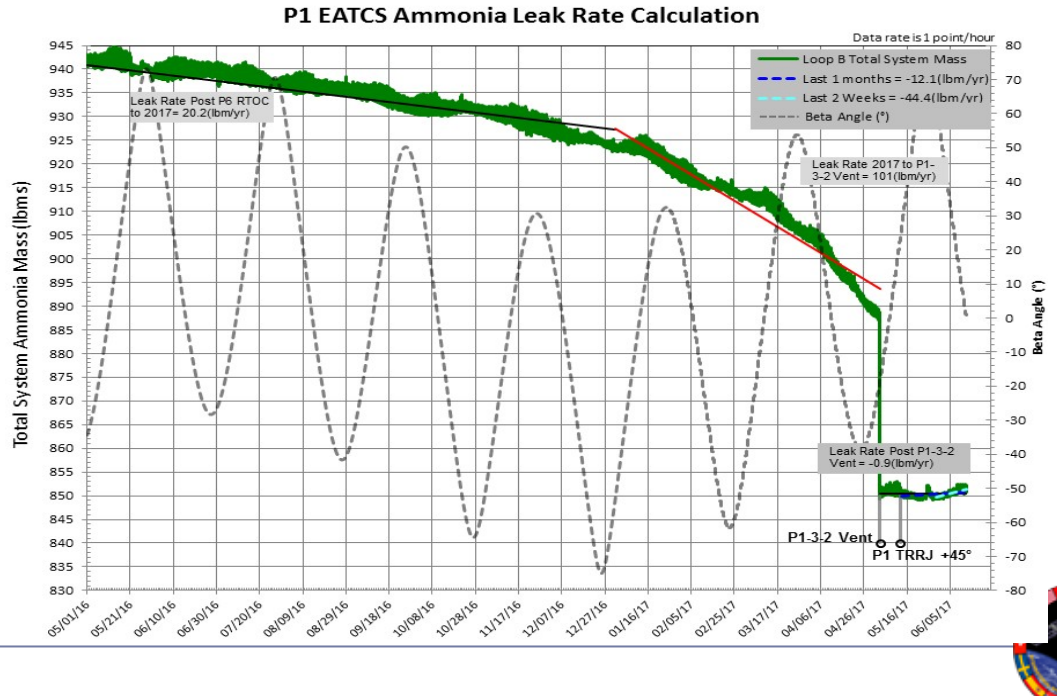
Analysis Date
26 June 2017

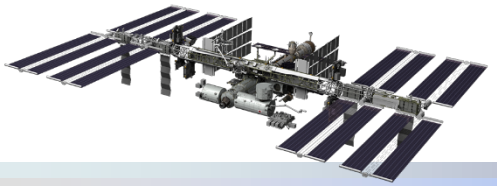


EATCS Loop B Leak

- External Active Thermal Control System (EATCS) Loop B has had a trending leak since ~2013
- Current Loop B leak rate was in the range of 75 – 115 lbs/year NH3 (Not a gross leak)
  - Leak considered small but rate was accelerating
- Radiator flex line region around RBVM P1-3-2 hardware appear to have ammonia leakage.
  - Robotic External Leak Locator (RELL) operations in November 2016 indicated elevated ppNH3 in vicinity of P1-3-2 and February 2017 operations indicated elevated ppNH3 in vicinity of radiator jumpers from P1-3-2 RBVM.
  - Inc 50 EPIC SPDM Lube EVA performed close up inspections of the suspect RBVM hardware in this area for evidence of ammonia.
    - GoPro video showed flakes that appeared to come from near F128/M4 3/4 inch QD
- RBVM P1-3-2 isolated and vented on May 3, 2017.
  - Post P1-3-2 isolation and vent, the leak rate has decreased to ~0.9 lbm/year. Teams continue to trend data
    - Note: Loop A leak rate is steady at 1.4 lbm/year following the Pump Module R&R in late 2013.
  - Forward work to assess root cause and replacement flex line hardware options.







OA-7 Mission Success

- Mission Planning
  - Launched on 4/18/17
  - Berthed on 4/22/17
  - Unberth on 6/4/17
  - Post Flight Review – Mission successfully completed 6/15/17
- Pressurized Cargo – 3459 kg upmass; 1936 kg disposal
  - 4 Polars transferred to ISS on 4/23/17
  - Saffire-III payload operations completed successfully post unberth
  - RED Data-2 payload did not receive data; OATK sending Cygnus telemetry during re-entry to aid in investigation
- Unpressurized Cargo
  - NanoRacks CubeSat Deployer (NRCSD) successful post unberth above ISS (4 CubeSats)
- Cygnus Status
  - Successful re-entry 6/11/17
- Atlas Status
  - Preliminary Post Flight Review held on 4/28/2017

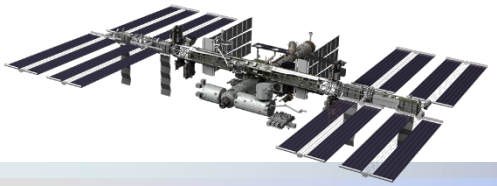
SpaceX-10 Mission Success

- Release and Re-Entry occurred on 3/19/17
  - Pressurized Cargo – 1533 kg upmass, 1666 kg return
    - Launch: 2 Animal Transporters, 1 Polar, 1 GLACIER
    - Return: 3 Polars, 1 GLACIER
  - Unpressurized Cargo –1157 kg upmass, 811 kg disposal estimated
    - Launch: Stratospheric Aerosol and Gas Experiment (SAGE) Instrument Payload (IP), SAGE Nadir Viewing Platform (NVP), and Space Test Program – Houston 5 (STP-H5)
    - Disposal: Optical Payload for Lasercomm Science (OPALS), Robotic Refueling Mission (RRM), and Materials on ISS Experiment (MISSE)-8
- First time to robotically insert payloads into the trunk for disposal

SpX-10 at Pad 39A just before launch on 2/19/17

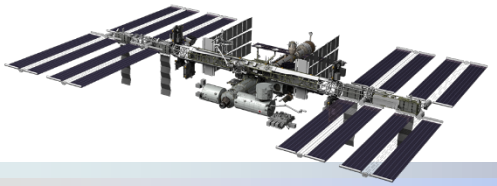
SpX-10 First Stage successful landing at KSC

SpX-10 Dragon captured and berthed to ISS on 2/23/17



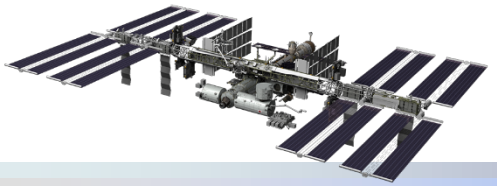
SpaceX-11 Mission Success

- Mission Planning
  - Launched on 6/3/17
  - Berthed on 6/5/17
  - Release and re-entry successful on 7/3/17
- Pressurized Cargo – 1550 kg; 1700 kg return
  - Launch: 2 Animal transporters, 2 Polars
  - Return: 1 Animal transporter, 4 Polars
- Unpressurized Cargo – 1179 kg upmass; 317 kg disposal
  - Neutron star Interior Composition ExploreR (NICER), Multiple User System for Earth Sensing (MUSES) and Roll Out Solar Array (ROSA)
  - ROSA was jettisoned from ISS due to inability to re-engage latches after completion of science, ROSA FRAM was disposed in the trunk
- Dragon Status
  - Dragon 6 was the first re-use of a Dragon capsule and select components (D6 flew on SpaceX-4)
- Falcon 9 Status
  - Successful static fire occurred 5/28/17



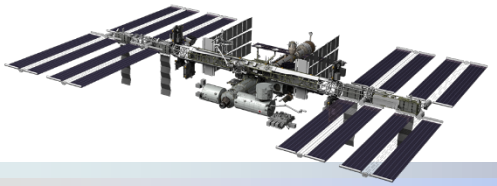
SpaceX-12 Mission Status

- Mission Planning
  - Post Qualification Review (PQR) successfully completed on 6/29/17
  - Stage Operations Readiness Review (SORR) scheduled on 7/14/17
- Pressurized Cargo – 2052 kg planned; 1900 kg return estimated
  - Launch: 3 Polars, 1 AEM-T, 1 JAXA Mouse Habitat Unit (MHU)
  - Return: 4 Polars, 1 AEM-T, 1 JAXA MHU
- Unpressurized Cargo – 1258 kg planned
  - Cosmic Radiation Effects and Activation Monitor (CREAM) payload will be installed on the JEM-EF
  - Latch-X FSE integration into trunk successfully completed 6/19/17
- Dragon Status
  - A new Dragon vehicle build is planned for this mission (last new build for Dragon)
  - Capsule and trunk will be shipped to the Cape in July
- Falcon 9 Status
  - Stage 1 and Stage 2 ATP in Texas planned for mid July



OA-8 Mission Status

- Mission Planning
  - Cargo Integration Review (CIR) completed successfully on 5/11/17
  - Post Qualification Review is planned on 8/3/17
  - Mission Readiness Review (MRR) planned for 8/17/17
- Pressurized Cargo -3350 kg upmass capability; TBD kg disposal (manifest in work)
  - 2 Polar
- Unpressurized Cargo
  - NanoRacks CubeSat Deployer (NRCSD) is planned for installation in Aug 2017
- Cygnus Status
  - Solar Array deployments completed successfully
  - Service Module in storage until required for launch preparation
  - Modifications to support pathfinder for ISS Lab Extension completed in May
- Antares Status
  - Vehicle is ready for transfer to Transport Erector Launcher (TEL)



Commercial Resupply Services CRS-2 Status

- ISS Integration Review (IR) Milestones
  - IR #1, Kickoff, #2, System Requirements Review, and #3 Preliminary Design Review (PDR) for all three contracts were successfully completed
- ISS IR Milestone – #4 Critical Design Reviews (CDR)
  - Reviews have begun and are expected to complete in mid-2018
    - SpaceX IR#4 Part A successfully completed on 6/13/17
    - Orbital-ATK IR#4 Systems delta CDR successfully completed 6/28/17
- CRS-2 missions are planned for launch beginning in 2019

EXPANDING HUMAN PRESENCE IN PARTNERSHIP

CREATING ECONOMIC OPPORTUNITIES, ADVANCING TECHNOLOGIES, AND ENABLING DISCOVERY

Now

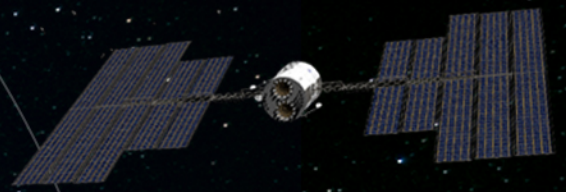
Using the International Space Station

2020s

Operating in the Lunar Vicinity (proving ground)

After 2030

Leaving the Earth-Moon System and Reaching Mars Orbit



Phase 0

Continue research and testing on ISS to solve exploration challenges. Evaluate potential for lunar resources. Develop standards.

Phase 1

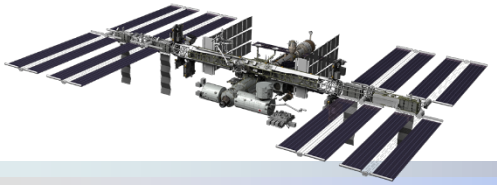
Begin missions in cislunar space. Build Deep Space Gateway. Initiate assembly of Deep Space Transport.

Phase 2

Complete Deep Space Transport and conduct yearlong Mars simulation mission.

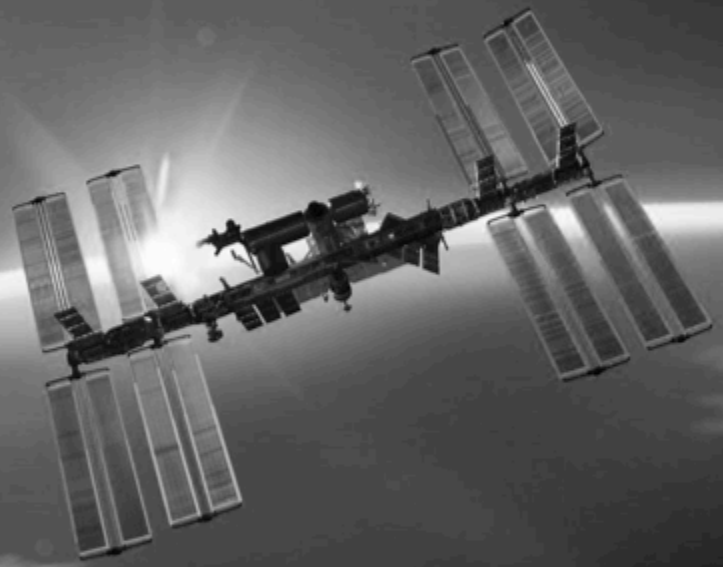
Phases 3 and 4

Begin sustained crew expeditions to Martian system and surface of Mars.

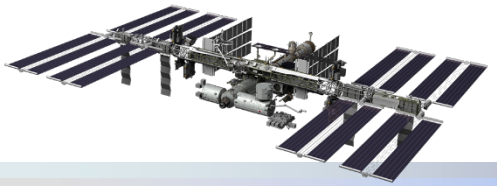


Phase 0: Utilizing the ISS

Focus on realizing long-term deep space human missions beyond the Earth-Moon System



- Human health and performance research and countermeasure development
- Long-term deep space life support systems development and demonstrations
- Sustaining human existence beyond LEO
- Relevant exploration technology development and demonstration
- Development and demonstration of standards



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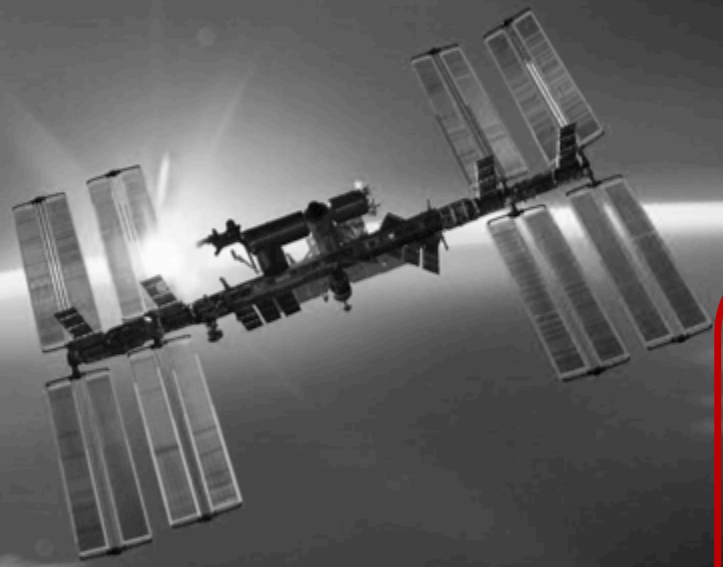

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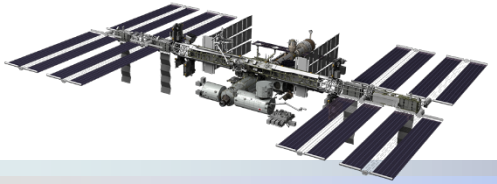
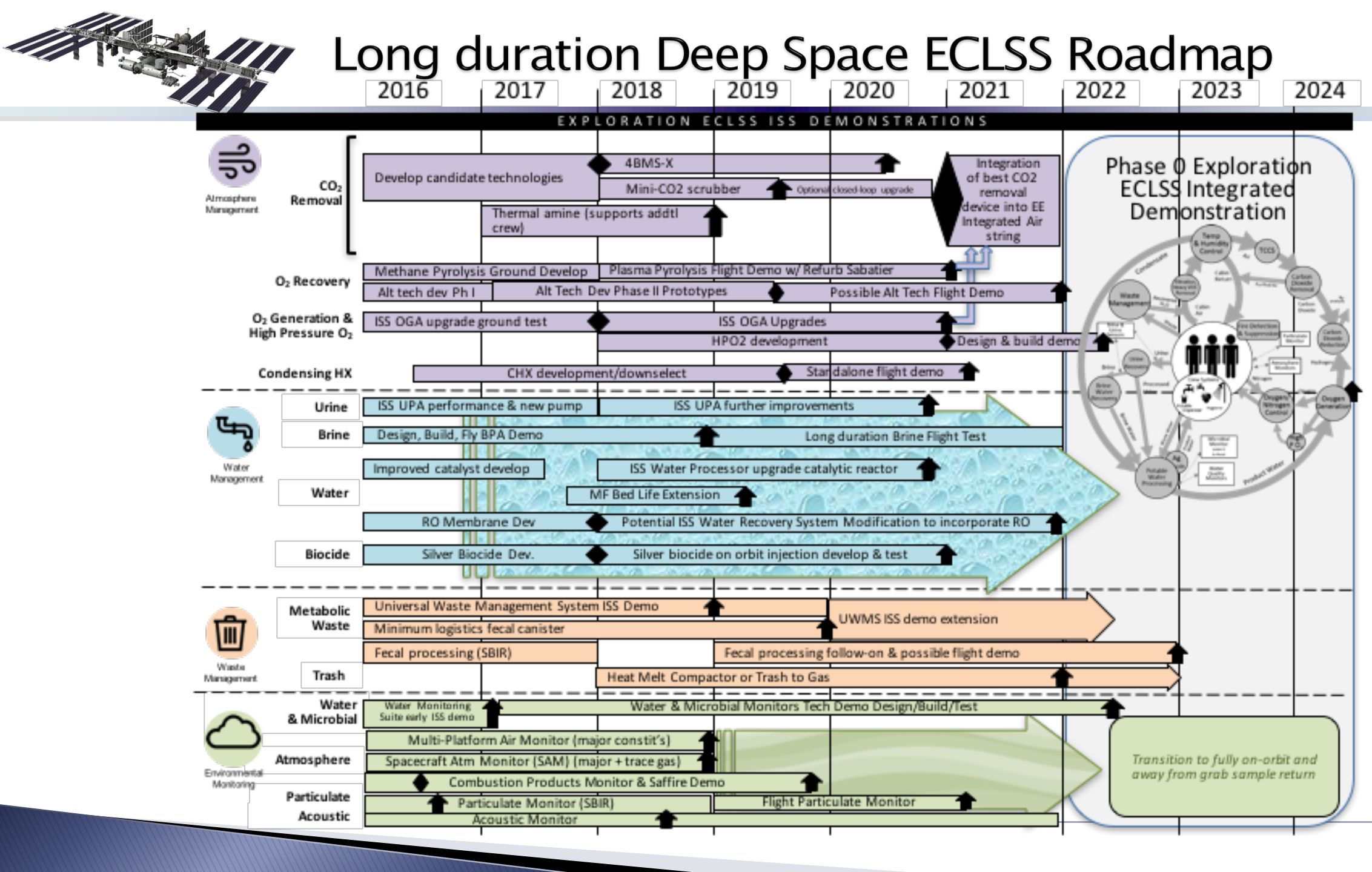
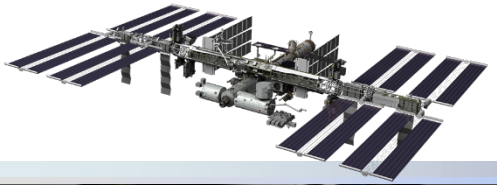


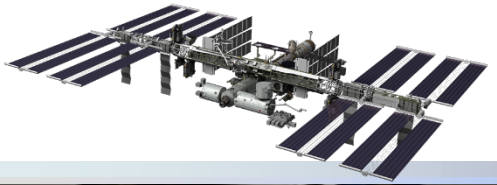
Demonstrate the life support and monitoring systems that will take us beyond the Earth–Moon system

Long duration Deep Space ECLSS Roadmap



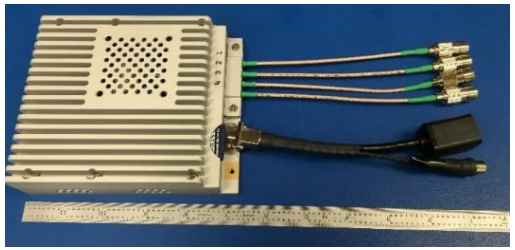


Sustaining human existence beyond LEO
(Logistics, crew health monitoring, ground-to-crew communications, etc.)



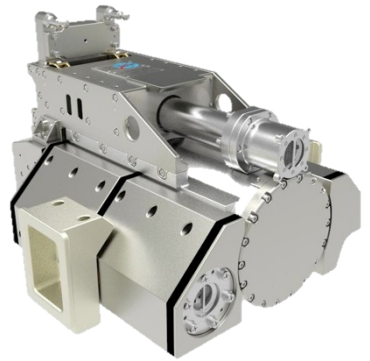
Learn how to break the bonds to the earth

(Logistics, crew health monitoring, ground-to-crew communications, etc.)

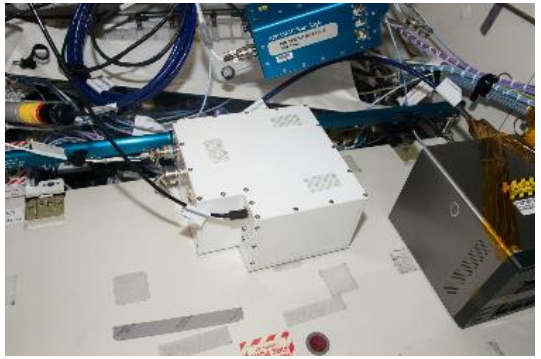


REALM-1 flight reader

Plant growth modules



Leak detection

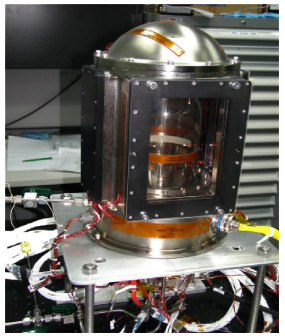


Fast Neutron Spectrometer

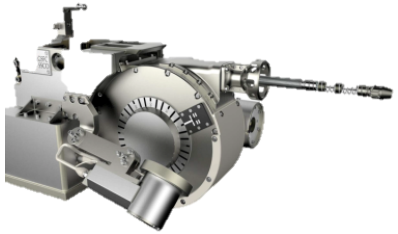
Crew autonomy tools

Trash compactor

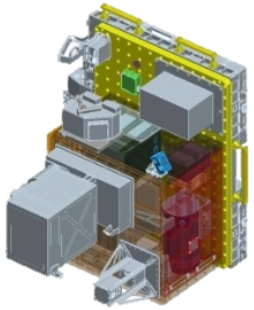
Demonstrate exploration related systems and technologies



Zero boil-off cryo demonstration

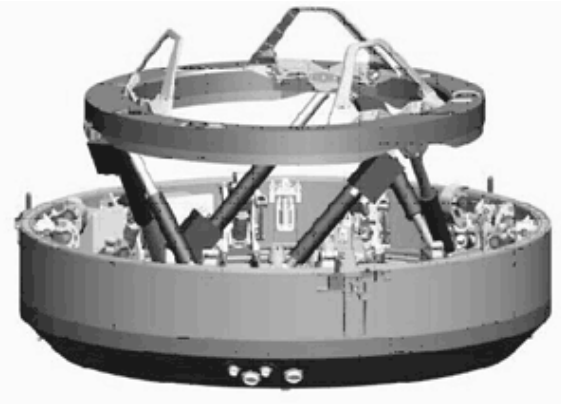


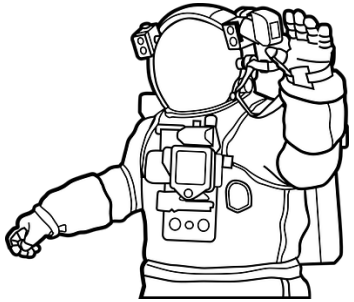
Refueling



Rendezvous sensors

NASA Docking System





Exploration EVA Systems

Habitation structures

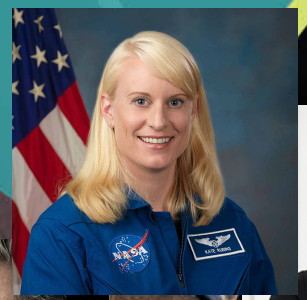
Re-entry data recorder

From the ISS to ends of the Universe

NICER and SEXTANT

Installed 6 weeks ago on ISS and now operational

- Neutron Star Interior Composition Explorer (NICER) instrument will study the physics of neutron stars (pulsars), providing new insight into their nature and behavior.
  - Neutron stars emit X-ray radiation, enabling the NICER technology to observe and record information about their structure, dynamics and energetics.
- SEXTANT – instrument will use 56 telescopes to detect X-ray photons from pulsar beams of light to estimate their arrival times. With these measurements, the system will stitch together an on-board navigational solution using specially developed algorithms – GPS for the cosmos.

INNOVATION BEYOND BOUNDARIES

Held last week in Washington DC

~1035 Participants; 147 Sponsorships

~80 Technical Sessions ranging from rodent research, STEM education, and commercial capabilities

~12 Panel Sessions ranging from relationship with National Academies, Benefits to Humanity, Space Policy, developing LEO commerce, and Innovation

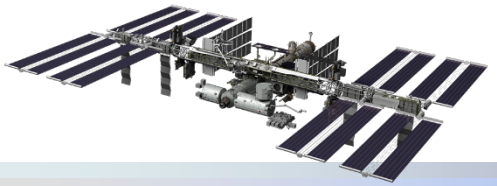
Next year in San Francisco at the Marriott Marque, July 23-26

ISS R&D CONFERENCE 2017

1954 2017 American Astronautical Society

NASA

CASIS



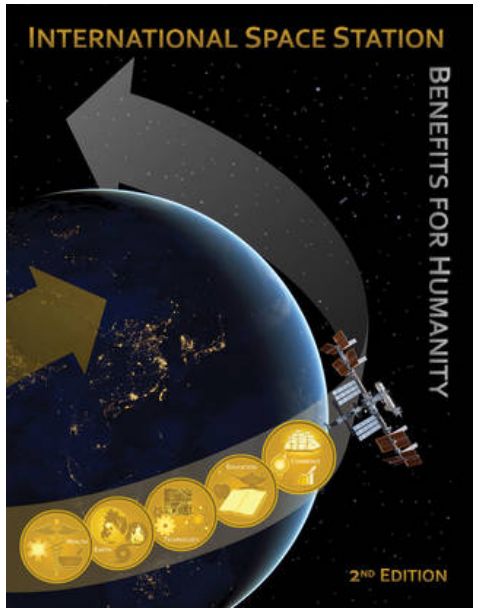
ISS Stakeholder Workshop – Wednesday August 9

- Marriott Marque in Washington DC
- Will address issues and policies related to future of ISS – among them: US presence in LEO, LEO commercialization, maturity and prospects for the commercial supply and demand for LEO
- All day event with plenary presentation in the morning
  - 4 breakout sessions discussions in the afternoon
- Open to industry, academia, government and interested public

https://www.nasa.gov/content/iss-transition-workshop

Find the ISS and learn more on the web

Spot the Station



NASA – ISS – Benefits

NASA – ISS