International Space Station Status
HEO NAC

Sam Scimemi/Director, ISS
March 2016


300
DAYS IN SPACE

On the Ground After One Year in Space

Picture of Scott and Mikhail on the ground

ISS Flight Plan

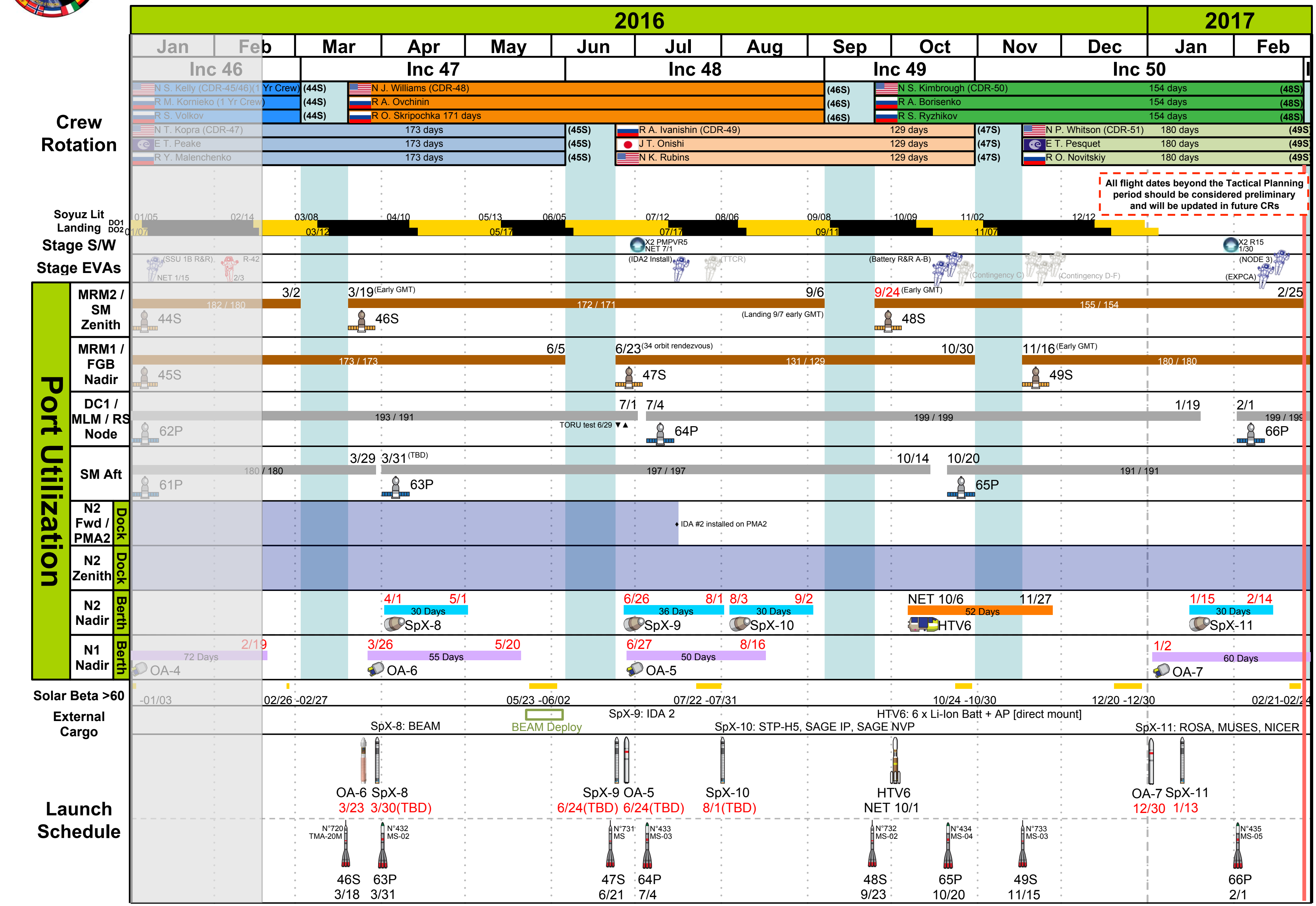
Flight Planning Integration Panel (FPIP)

(Pre-decisional, For Internal Use, For Reference Only)

For current baseline refer to SSP 54100 Multi-Increment Planning Document (MIPD)

NASA: *OC4/John Coggeshall*
MAPI: *OP/Randy Morgan*

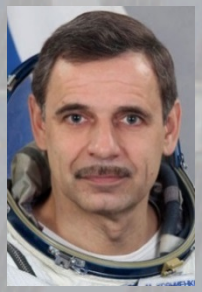
Chart Updated: *February 18th, 2016*



Increment 46 Overview: Crew

Scott Kelly
CDR– 42S↑ / 44S↓

Yuri Malenchenko
FE (R) – 45S



Mikhail Kornienko
FE (R) – 42S↑ / 44S↓

Sergei Volkov
FE (R) – 44S

Tim Peake
FE (E) – 45S

Increment 47 Overview: Crew

45S Dock 12/15/15
45S Undock 6/5/16 (“in work” FPIP)

Yuri Malenchenko
FE (R) – 45S

Tim Kopra
CDR Inc 47 (US) - 45S

Tim Peake
FE (E) – 45S

46S Dock 3/19/16 (“in work” FPIP)
46S Undock 9/7/16 (“in work” FPIP)

Jeff Williams
FE (US) – 46S
(CDR Inc. 48)

Alexey Ovchinin
FE (R) – 46S

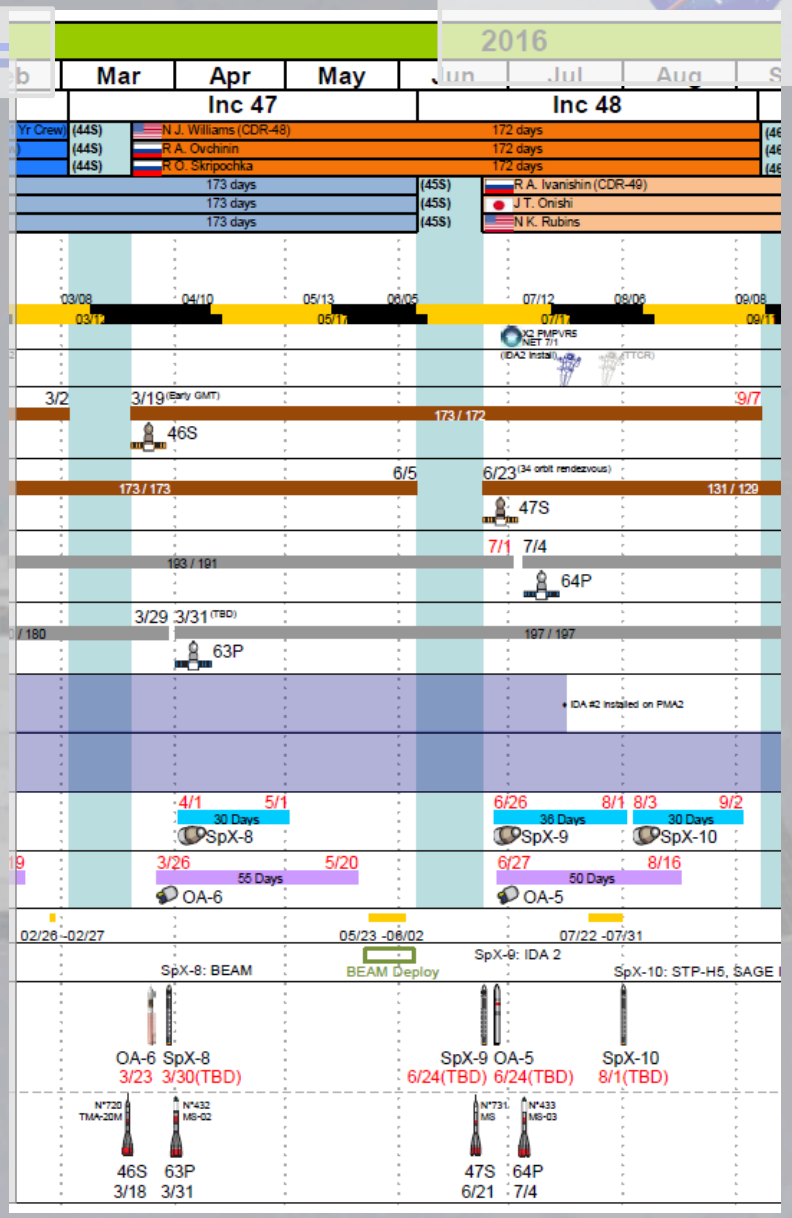
Oleg Skripochka
FE (R) – 45S

Increment 47 Overview: Major Stage Objectives

- Increment 47: 96 Days
  - Stage 47-3: 44S Undock to 46S Dock: 17 days
  - Stage 47-6: 46S Dock to 45S Undock: 79 days
  - Cargo vehicles:
    - *OA-6 Berth/Capture (3/26) / Unberth (5/20)
    - *61P Undock (3/29)
    - *63P Launch/Dock (3/31)
    - *With above Progress dates, SpX-8 Capture/Berth would occur ~4/6 and Unberth ~5/6

*Dates under review

  - Science/Utilization:
    - Rodent Research 3 (SpX-8↑, SpX-9↓)
    - J-SSOD M1, NRCSD Cubesat deploys
    - BEAM deployment
  - EVAs:
    - No planned EVAs
  - Stowage Ops:
    - Dual berthed visiting vehicle operations
  - Maintenance/Outfitting:
    - USOS reconfig (e.g., vestibule depress connections), C2V2, galley rack as time and priorities allow



EVA 35 SEMU 3011 Anomaly

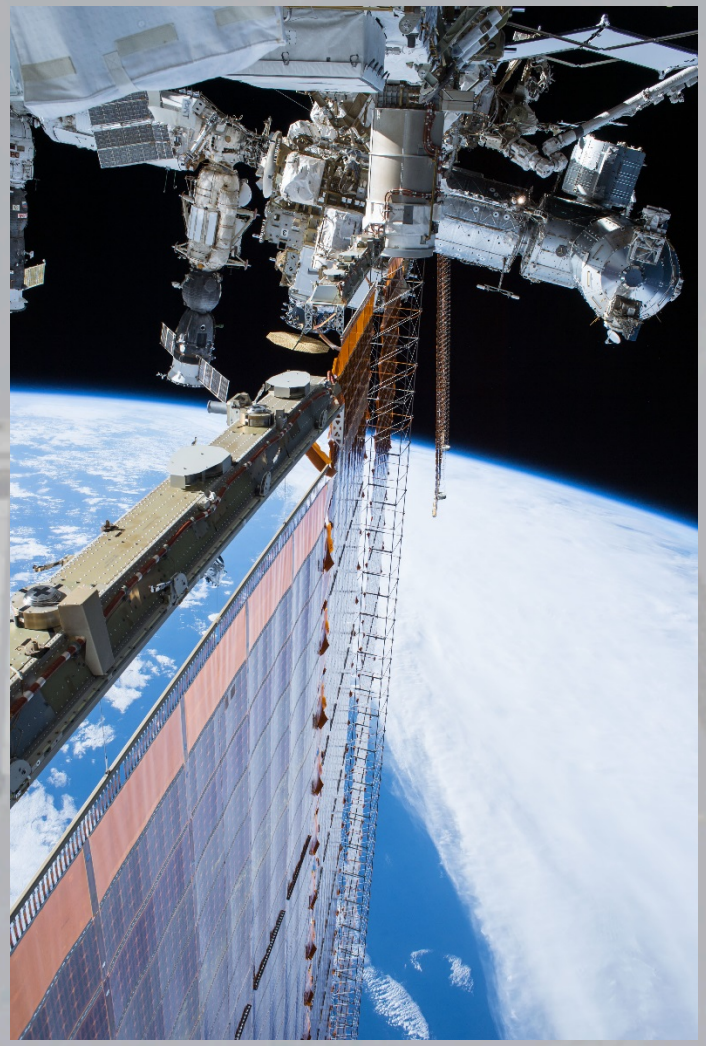
- During EVA 35 on 1/15/16, EV1/Kopra reported water in his EMU helmet at PET 4:07 and the decision was made to terminate the EVA
  - Decision to terminate was made based on procedures and other operational products implemented after EVA 23
  - Following airlock repress the crew assessed the water in EV1's helmet
    - Rough estimate of total water is 200– 250 cc as compared to 1000-1500 cc on EVA 23
  - On-orbit troubleshooting was performed in order to learn more about the failure mechanism
    - Troubleshooting results indicated that the Fan/ Pump/Separator (which was the cause of the EVA 23 anomaly) was performing nominally during the test
    - Troubleshooting also indicated that other parts of the EVA system were not leaking
      - Test results do not rule out an intermittent failure which could have occurred during EVA 35 and then cleared
      - Troubleshooting continues

Forward Plan

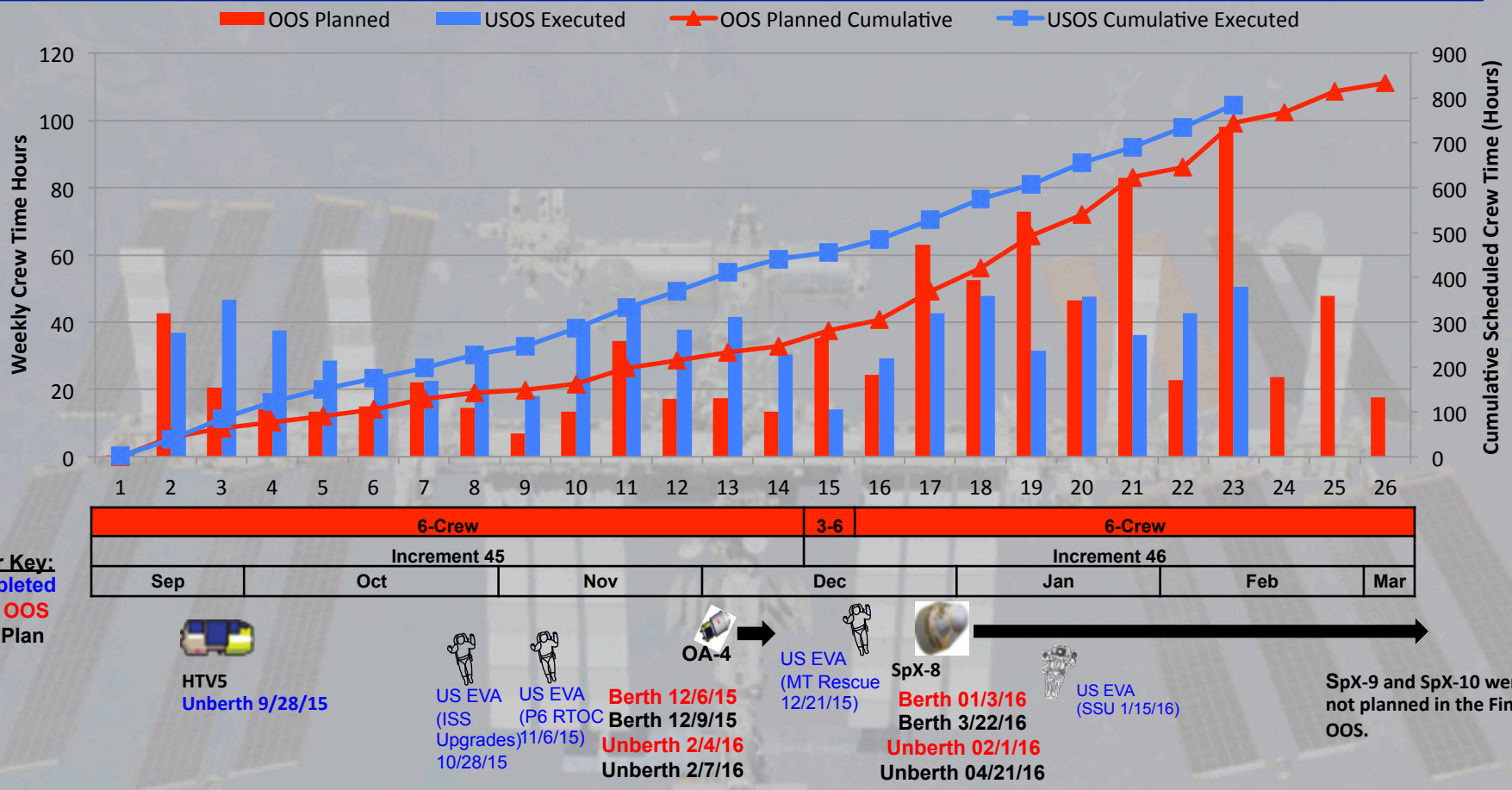
- A Problem Resolution Team has been established which will be co-chaired by ESOC and XX
  - Weekly meetings will start on Thursday 2/11/16 and will include reps from all stakeholders (Engineering, FOD, Safety, etc.)
  - Splinter meetings will be scheduled as required for in depth technical topics and results will be briefed to the PRT
  - Fault tree closures will be taken to the EVA CCB for formal approval and status briefing will be brought to the SSPCB
- Investigation task list includes the following
  - Review of ground and on-orbit SEMU performance data for trending
    - Data for all suits will be reviewed again in an effort to identify any early indicators of degraded performance
  - Fault tree analysis
    - Work through formal closure as data becomes available
  - TT&E plans
    - Hardware and water samples on 44S
    - SEMU 3011 on Spx-8
    - SEMU 3005 (returned once SEMU 3006 is on-orbit)

Forward Plan (cont.)

- Investigation tasks (cont.)
  - Review all operational products related to vent loop flooding (including water separator performance verification via pump priming valve) and determine if any changes, additions, or clarifications are required
  - Analyze the EVA 35 environments and latent heat load transients and compare to other EVAs
    - May be able to quantify the contribution of latent heat loads and environment to the anomaly



Inc 45 - 46 Utilization Crew Time



Color Key:
Completed
Final OOS
FPIP Plan

HTV5
Unberth 9/28/15

US EVA (ISS Upgrades) 10/28/15

US EVA (P6 RTOC 11/6/15)

Berth 12/6/15
Berth 12/9/15
Unberth 2/4/16
Unberth 2/7/16

OA-4

US EVA (MT Rescue 12/21/15)

SpX-8
Berth 01/3/16
Berth 3/22/16
Unberth 02/1/16
Unberth 04/21/16

US EVA (SSU 1/15/16)

SpX-9 and SpX-10 were not planned in the Final OOS.

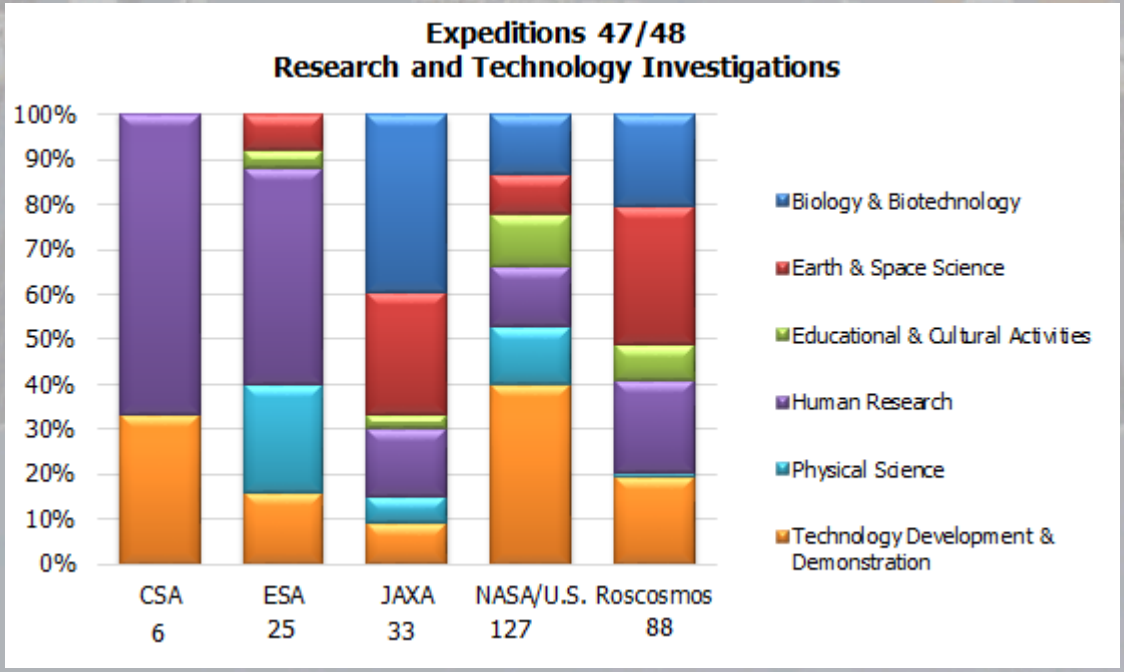
Executed through Increment Wk (WLP Week) 23 =	21.0 of 23.6	work weeks 88.98% through Increment
USOS IDRD Allocation:	826	hours
OOS USOS Planned Total:	832.91	hours
USOS Actuals:	784.17	hours
	94.94%	through IDRD Allocation
	94.15%	through OOS Planned Total
Total USOS Average Per Work Week:	37.34	hours/work week
Voluntary Science Totals to Date:	3.5	hours (Not included in the above totals or graph)
RSA/NASA Joint Utilization to Date:	49.33	Hours (not included in the above totals or graph)

ISS Research Statistics

Working data as of January 31, 2016

Number of Investigations for 47/48: 279

- 127 NASA/U.S.-led investigations
- 152 International-led investigations
- 60 New investigations
  - 1 CSA
  - 3 ESA
  - 5 JAXA
  - 48 NASA/U.S.
  - *3* Roscosmos (Preliminary Data)
- Over 800 Investigators represented
- Over 1200 scientific results publications (Exp 0 – present)



Estimated Number of Investigations Expedition 0-48: 2119* ***Pending Post Increment Adjustments**

Increments 47 & 48 Research Plan - Investigation List

Human Research

Bone & Muscle Physiology
Bisphosphonates (Control), Sprint, Marrow, Tbone (P), Brain-DTI (P), CARTILAGE (P), EDOS-2, Muscle Biopsy (P)

Cardiovascular & Respiratory Systems
Cardio Ox, Vascular Echo, Airway Monitoring, IPVI

Crew Healthcare Systems
Skin-B

Habitability & Human Factors
Body Measures, Fine Motor Skills, Habitability

Human Behavior & Performance
Cognition, At Home in Space, Circadian Rhythms
Synergy (P)

Human Microbiome
Microbiome

Immune System
Salivary Markers, IMMUNO-2, Multi-Omics

Integrated Physiology & Nutrition
Biochem Profile, Telomeres (P), Repository, Dose Tracker, Energy, MARES
Biological Rhythms 48hrs

Nervous & Vestibular Systems
NeuroMapping, Field Test (P)
Space Headaches, Straight Ahead in Microgravity (P)

Vision
Fluid Shifts, Ocular Health

Biology and Biotechnology

Animal Biology
Rodent Research-3
Space Pup, Mouse Epigenetics-1

Cellular Biology
Micro 9, Micro 10, NanoRacks Mod-28, Heart Cells*, WetLab-2
Stem Cells, Cell Mechanosensing-3
Spheroids, Cytoskeleton

Macromolecular Crystal Growth
CASIS PCG 4, NanoRacks PCG, PCG Crystal Hotel, JAXA PCG Demo 2, JAXA PCG

Microbiology
Microbe-IV, Myco, BRIC-NP*, BRIC-23*
Microbial Observatory-2

Plant Biology
Auxin Transport
Plant RNA Regulation*
Veg-03
NanoRacks Mod -33 (Agar)
Plant Gravi Sensing-3

Physical Sciences

Combustion Science
Cool Flame Investigation (CFI), FLEX 2*

Complex Fluids
ACE H2*, ACE T-1
ACE T-9*

Fluid Physics
Marangoni-UVP, Two-Phase Flow, ZBOT, PBRE*
Microchannel Diffusion

Fundamental Physics
DOSIS-3D

Materials Science
EML Batch – 1 & 2, MSL 2b, SODI
DSC Mix*, Manufacturing Device, Synthetic Muscle*, NanoRacks Module -40*, ELF Batch #3,4

Earth & Space Science

Astrobiology/Astrophysics/Heliophysics
AMS-02 (E), Meteor, NanoRacks Mod-24*, Solar-SOLACES/SOLSPEC (E)
CALET (E)[4], MAXI (E)

Earth Remote Sensing
CATS (E), HICO-RAIDS (HREP) (E), ISS-RapidScat (E)
NREP Inserts

Near-Earth Space Environment
SEDA-AP (E), Ex-HAM #1 (E), #2 (E)

Technology Development and Demonstration

Characterizing Experiment Hardware
ESA-Haptics-1,-2*, IN SITU (ASI), Biomolecular Sequencer, NanoRacks Mod-29*, MVIS Microcontroller -1

Communications & Navigation
METERON, Vessel ID System, Maritime Awareness*, Scan Testbed, OPALS

Fire Suppression and Detection
Saffire I/II

Multipurpose
Programmable Isolation Mount*

Power and Thermal Management Systems
Phase Change HX, Universal Battery Charger.

Radiation Measurements & Shielding
Area PADLES, PS-TEPC, Radi-N2, REM

Avionics & Software
SNFM, Telescience Resource Kit*

Life Support and Habitation
Mini Exercise Device-2, UBNT

Air, Water and Surface Sampling
Personal CO2 Monitor*

Robotics & Imaging
HDEV (E), Gecko Gripper*, Robonaut, RRM Phase 2 (E)

Spacecraft and Orbital Environments
Strata-1, REALM, SPHERES Halo*
SPHERES Tether*

Space Structures and Materials
BEAM, Manufacturing Device, REBR-W

Small Satellites & Control Technologies
NanoRacks NRCSD ext*, JSSODM-1, JSSOD#5, EFU Adapter RTcMISS, SPHERES UDP*, SPHERES Slosh*

Educational Activities

Educational Competitions
SPHERES-Zero-Robotics

Educational Demos
ESA-EPO-PEAKE, ISS Ham Radio, Story Time Demo*
JAXA EPO
Sally Ride EarthKAM

Student-Developed Investigations
CASIS Edu 3, NR Modules-16, -18, -20, -21, -22, -51
NanoRacks Module-9, Mod-48*, NR SMiLE*, Genes in Space*

Classroom Versions of ISS Investigations
Windows on Earth

To Be Defined
Payload Card-X, JAXA Commercial, JAXA EFU Adapter and HDTV

Key: NASA, NatLab, CSA, ESA, JAXA

↓Ascent/Descent, **(P)** Pre/Post only, * Added by CEF, **(E)** External Payload

Total ISS Consumables Status

	T1: Current Capability		T2: Current Capability + OA-6	
Consumable – based on current, ISS system status	**Date to Reserve Level**	**Date to zero supplies**	**Date to Reserve Level**	**Date to zero supplies**
Food – 100%	June 24, 2016	August 10, 2016	August 18, 2016	October 14, 2016
KTO	August 05, 2016	September 27, 2016	September 17, 2016	November 09, 2016
Filter Inserts	January 18, 2017	> January 31, 2017	> January 31, 2017	> January 31, 2017
Toilet (ACY) Inserts	August 06, 2016	September 29, 2016	October 04, 2016	November 26, 2016
EDV + TUBSS (UPA Operable)	December 10, 2016	> January 31, 2017	December 27, 2016	> January 31, 2017
Pre-Treat Tank	August 31, 2016	> January 31, 2017	August 31, 2016	> January 31, 2017
Water (Nominal Usage)	September 05, 2016	December 28, 2016	September 05, 2016	December 28, 2016
Consumable - based on system failure				
EDV + TUBSS (UPA Failed)	July 31, 2016	September 25, 2016	August 09, 2016	October 04, 2016
Water, if no WPA (Ag & Iodinated)	June 25, 2016	August 29, 2016	June 25, 2016	August 29, 2016
O_2 if Elektron supporting 3 crew & no OGA	February 28, 2016	July 26, 2016	March 31, 2016	August 10, 2016
O_2 if neither Elektron or OGA	February 09, 2016	April 15, 2016	February 09, 2016	April 23, 2016
LiOH (CDRAs and Vozdukh off)	~0 Days	~14 Days	~0 Days	~14 Days

USOS Consumables Status

	U1: Current Capability		U2: Current Capability + OA-6	
Consumable – based on current, ISS system status	**Date to Reserve Level**	**Date to zero supplies**	**Date to Reserve Level**	**Date to zero supplies**
Food – 100%	July 27, 2016	September 21, 2016	December 10, 2016	January 30, 2017
KTO	October 17, 2016	December 12, 2016	January 11, 2017	> January 31, 2017
Filter Inserts	> January 31, 2017	> January 31, 2017	> January 31, 2017	> January 31, 2017
Toilet (ACY) Inserts	> January 31, 2017	> January 31, 2017	> January 31, 2017	> January 31, 2017
EDV + TUBSS (UPA Operable)	June 28, 2016	January 18, 2017	August 26, 2016	> January 31, 2017
Pre-Treat Tanks	December 17, 2016	> January 31, 2017	December 17, 2016	> January 31, 2017
Water (Nominal Usage)	> January 31, 2017	> January 31, 2017	> January 31, 2017	> January 31, 2017
Utilization	> January 31, 2017	> January 31, 2017	> January 31, 2017	> January 31, 2017
Consumable - based on system failure				
EDV + TUBSS (UPA Failed)	March 17, 2016	May 12, 2016	April 04, 2016	May 30, 2016
Water, if no WPA (Ag & Iodinated)	April 05, 2016	May 30, 2016	April 05, 2016	May 30, 2016
O_2 if neither Elektron or OGA	February 10, 2016	April 26, 2016	February 10, 2016	May 11, 2016
LiOH (CDRAs and Vozdukh off)	~0 Days	~13.3 Days	~0 Days	~13.3 Days

One Year Crew Research

And

Human Research Program

ISS One-Year Mission

- Completed One-year Mission on March 1
  - Mission Successful and Benefits of US/Russian Collaborative Work Realized
  - Astronaut Scott Kelly set the record for the longest duration American space mission (340 days)
  - Research Data Collection to Continue Over the Next Year
  - Future One-year Missions Currently Under Study

- One-year Mission Joint Research Plan Completed
  - Physical and Functional Performance Assessments
  - Behavioral Health Studies and Ocular Health Monitoring
  - Metabolic and Immune System Studies
  - Microbial Population Changes
  - Long-Duration Mission Human Factors Studies

- US/Russian Fluids Shift Experiment
  - Most complex biomedical experiment implemented on ISS
  - Experiment could only be undertaken using both US and Russian hardware, subjects, and crew time
  - Studies body fluids redistribution during long-duration missions that may cause the visual changes in crewmembers

One-Year Mission: Research Objectives

Functional: assess changes in crew member performance (strength/endurance/ coordination/balance) using operational functional tasks after one-year in a low-gravity environment

Behavioral Health: study psychological effects of long-duration spaceflight on crew members by conducting cognition tests, neuromapping studies, sleep monitoring, journaling analyses and a reaction self-test

Visual Impairment: examine ocular health changes using ultrasound and high-fidelity optical coherence tomography imaging

Metabolic: study immune system function, salivary markers, biochemical profiles, and biological markers of oxidative/inflammatory stress.

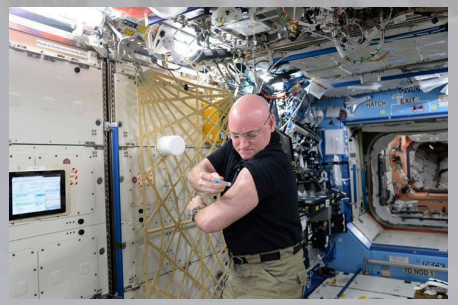
Physical Performance: assess exercise effectiveness focusing on changes to bone density and structure, muscle strength, and the cardiovascular output over time in a weightless environment

Microbial: investigate changes in the microbiome of crewmembers.

Human Factors: examine how astronauts interact with their environment aboard the International Space Station focusing on fine motor performance, habitability, and training.

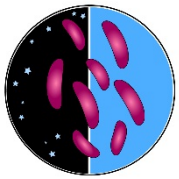
Twins Study

- Twins Study (Scott and Mark Kelly)
  - ISS Sample Collection Completed
  - Post Flight Sample Collection to Continue Over the Next Year
- Objective was to Begin Examining Next Generation Genomics Solutions to Mitigating Crew Health and Performance Risks
  - Personalized countermeasures approaches
- Twins Study National Research Team will Examine
  - Genome, telomeres, epigenome
  - Transcriptome and epitranscriptome
  - Proteome, Metabolome, Microbiome
  - Physiology and Cognition
- Significant Privacy and Ethics Issues
  - NASA is developing new genomics policy (modeled after NIH policy) that addresses informed consent, data privacy approaches, and genetic counseling on consequences of discovery (individual, family)



Twins Study: Research Objectives

Molecular/Omics: investigations will look at the way genes in the cells are turned on and off as a result of spaceflight; and how stressors like radiation, confinement and microgravity prompt changes in the proteins and metabolites gathered in biological samples like blood, saliva, urine and stool.



Microbiology/Microbiome: explore the brothers' dietary differences and stressors to find out how both affect the organisms in the twins' guts.

Human Physiology: investigations will look at how the spaceflight environment may induce changes in different organs like the heart, muscles or brain.

Behavioral Health: characterize the effects spaceflight may have on perception and reasoning, decision making and alertness.

Human Exploration and Operations
Human Research Program: Overview

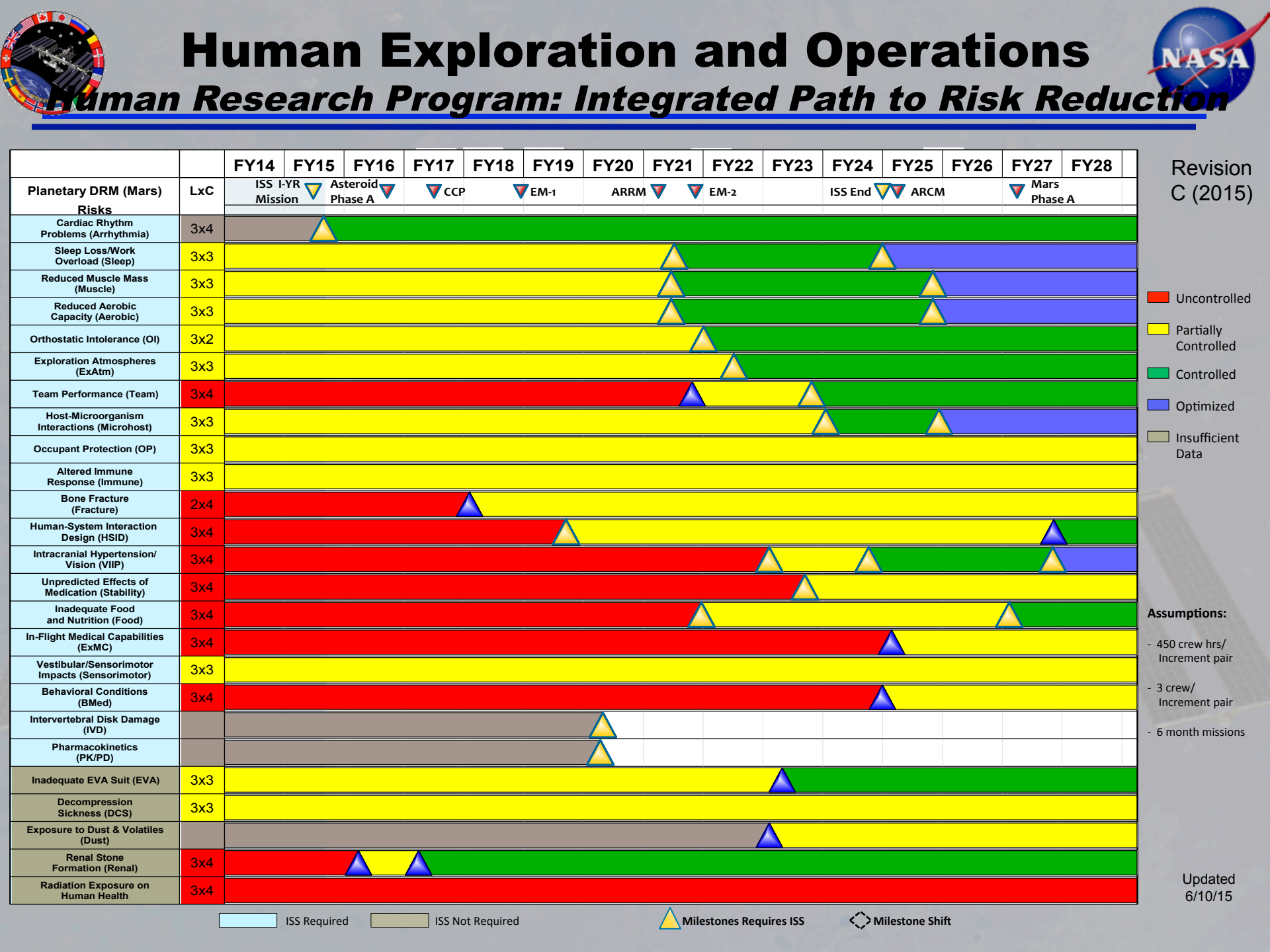
- Develop human health and performance standards, countermeasures, knowledge, technologies, and tools across various disciplines to enable safe, reliable, and productive human space exploration on the path to Mars
  - ISS Medical Project: provide planning, integration and implementation services for HRP research studies aboard ISS and in spaceflight analog environments
  - Space Radiation: ensure crewmembers can safely live and work in space without exceeding acceptable radiation health risks
  - Human Health Countermeasures: responsible for understanding normal physiologic effects of spaceflight and developing countermeasures to those with detrimental effects
  - Exploration Medical Capability: develop medical technologies for in-flight diagnosis and treatment, as well as data systems to protect private medical data
  - Behavioral Health and Performance: conduct and support research to reduce risk of behavioral and psychiatric conditions induced by spaceflight environment
  - Space Human Factors and Habitability: study interaction of the human system with hardware, software, procedures, and the spacecraft environment; understand existence of and exposure to contaminations and toxins; deliver improvements in food and technologies for storage and preparation
- Require ISS utilization to mitigate human health space exploration risks to an acceptable level

Human Exploration and Operations
Human Research Program: Overview (continued)

- Enable NASA human exploration goals by conducting flight and ground research to mitigate highest risks to human health and performance on current and future exploration missions
- Establish research priorities consistent with recommendations from the National Academies and validate them through external independent reviews
- Implement open competitive solicitation process and independent, external scientific review using NASA Research Announcements to ensure highest quality research
- Enable continued collaboration with other NASA organizations, other agencies and international partners, including
  - Research on vision impairment and intracranial pressure and astronaut health in coordination with Crew Health and Safety
  - Coordinate close-out of the NSBRI and USRA cooperative agreements, develop final reports on accomplishments and begin transition to a new single cooperative agreement
  - Mitigate exploration biomedical risks with ISS Program
  - Study microbial alterations and space grown food with Space Biological Sciences
  - Advance space radiation understanding with AES on shielding and monitoring technology
  - Develop exercise and food storage systems with Orion

Human Exploration and Operations

Human Research Program: Integrated Path to Risk Reduction



Revision C (2015)

- Uncontrolled
- Partially Controlled
- Controlled
- Optimized
- Insufficient Data

Assumptions:

- 450 crew hrs/ Increment pair
- 3 crew/ Increment pair
- 6 month missions

Updated 6/10/15

Human Exploration and Operations

Human Research Program:

Human Risks Disposition for all Design Reference Missions

	In Mission Risk - Operations						Post Mission Risk - Long Term Health					
Human System Risks 07/01/15	Low Earth Orbit	Low Earth Orbit	Deep Space Sortie	Lunar Visit/Habitation	Deep Space Journey/Habitation	Planetary	Low Earth Orbit	Low Earth Orbit	Deep Space Sortie	Lunar Visit/Habitation	Deep Space Journey/ Habitation	Planetary
	6 Months	12 Months	30 Days	1 year	1 Year	3 years	6 Months	12 Months	30 Days	1 year	1 Year	3 years
VIIP	A	A	A	A	RM	RM	A	A	A	A	RM	RM
Renal Stone Formation	A	A	A	A	RM	RM	RM	RM	RM	RM	RM	RM
Inadequate Food and Nutrition	A	A	A	A	A	RM	A	A	A	A	A	RM
Space Radiation Exposure	A	A	A	A	A	TBD*	A	A	A	RM	RM	RM
Medications Long Term Storage	A	A	A	A	A	RM	A	A	A	A	A	RM
Acute and Chronic Carbon Dioxide	A	A	A	A	RM	RM	A	A	A	A	A	A
Inflight Medical Conditions	A	A	A	RM	RM	RM	A	A	A	RM	RM	RM
Cognitive or Behavioral Conditions	A	RM	A	RM	RM	RM	A	A	A	A	A	RM
Bone Fracture	A	A	A	A	A	RM	A	A	A	A	A	A
Human-System Interaction Design	A	A	A	RM	RM	RM	A	A	A	A	A	A
Team Performance Decrements	A	A	A	A	RM	RM	A	A	A	A	A	A
Cardiac Rhythm Problems- Under Review	A	A	A	A	RM	RM	A	A	A	A	A	A
Reduced Muscle Mass, Strength	A	A	A	A	A	RM	A	A	A	A	A	RM
Reduced Aerobic Capacity	A	A	A	A	A	RM	A	A	A	A	A	RM
Sensorimotor Alterations	A	A	A	RM	RM	RM	A	A	A	A	A	RM
Injury from Dynamic Loads	A	A	RM	RM	RM	RM	A	A	RM	RM	RM	RM
Sleep Loss	A	A	A	A	RM	RM	A	A	A	A	RM	RM
Altered Immune Response	A	A	A	A	A	RM	A	A	A	A	A	RM
Celestial Dust Exposure	N/A	N/A	TBD	A	TBD	TBD	N/A	N/A	TBD	A	TBD	TBD
Host-Microorganism Interactions	A	A	A	A	A	RM	A	A	A	A	A	RM
Injury due to EVA Operations	A	A	A	RM	A	RM	A	A	A	RM	A	RM
Decompression Sickness	A	A	RM	A	RM	A	A	A	A	RM	A	RM
Toxic Exposure	A	A	A	A	A	A	A	A	A	A	A	A
Hypobaric Hypoxia	RM	RM	A	RM	RM	RM	RM	RM	A	RM	RM	RM
Space Adaptation Back Pain	A	A	A	A	A	A	N/A	N/A	N/A	N/A	N/A	N/A
Urinary Retention	A	A	A	A	A	A	A	A	A	A	A	A
Hearing Loss Related to Spaceflight	A	A	A	A	A	A	A	A	A	A	A	A
Orthostatic Intolerance	A	A	A	A	A	A	A	A	A	A	A	A
Injury from Sunlight Exposure	A	A	A	A	A	A	A	A	A	A	A	A
Electrical shock	A	A	A	A	A	A	A	A	A	A	A	A
Concern of Intervertebral Disc Damage upon and immediately after re-exposure to Gravity												
Concern of Medication PK/PD												

A - Accepted based on current standards & countermeasures

RM - Requires Mitigation

TBD* - Disposition to be officially determined by the HSRB in the near future

TBD - DRMs have not been assessed to provide rating and disposition

Green – low/very low consequence Yellow – low to medium consequence Red – high consequence

OA-4 (Orb-4) Mission

OA-4 Mission successfully launched on 12/6/15

Cygnus on-orbit during rendezvous and capture phases

Cygnus hatch opening

OA-4 Mission on-orbit with Soyuz

Photo Credit: NASA

OA-4 Mission Status – Successfully Completed !!

- **Mission Planning**
  - First use of Atlas V401 with the Cygnus spacecraft
  - Cargo Integration Review (CIR) was completed on 7/29/15
  - SRP Phase 3 was conducted on 10/1/15 and 10/13/15
  - All Joint Multi-Segment Trainings (JMSTs) were completed by 10/28/15
  - Stage Operations Readiness Review (SORR) was conducted on 11/9/15
  - Flight Readiness Review (FRR) was conducted on 11/16/15
  - Successfully launched on 12/6/15; Unberthed and re-entered on 2/19/16
- **Pressurized Cargo –** 3513 kg planned; 1403 kg disposal
- **Cygnus Status**
  - First enhanced Cygnus with a longer Pressurized Cargo Module (PCM)
  - Service Module (SM) accommodated changes to the TriDAR/LIDAR configuration
  - Initial cargo completed loading into the PCM on 10/21/15
  - SM mate to PCM was completed on 10/23/15
  - Cargo late load was completed on 11/9/15
  - Cygnus mate to the launch vehicle completed on 11/20/15
- **Atlas V 401 Status**
  - Booster was shipped to CCAFS on 10/30/15
  - Launch Vehicle Assessment reviewed by ISS Program on 11/10/15

Atlas V 401 launch vehicle planned to carry Cygnus in OA-4 mission

OA-4 Pressurized Cargo Module (PCM)

Photo Credit: Orbital

OA-6 Mission Status

- **Mission Planning**
  - ULA Mission Integration Table Top Review (MITTR) #2, Ground Operations Readiness Review (GORR), and Integrated Systems Review (ISR) were conducted on 12/16/15, 1/11/16, and 1/14/16
  - Post Qualification Review (PQR) was conducted on 1/28/16
  - Safety Review Panel (SRP) Phase 3 reviews were completed on 2/16/16
  - Stage Operations Readiness Review (SORR) is planned for 3/3/16
  - ULA President's Mission Readiness Review (MRR) is planned for 3/8/16
- **Pressurized Cargo –** 3513 kg planned; 1726 kg disposal (*estimated)*
  - Final ISS cargo manifest was delivered on 10/14/15 in support of CIR
  - Spacecraft Fire Experiment (Saffire) #1 integrated into Cygnus on 1/25/16
- **Unpressurized Cargo**
  - Nanoracks cubesat deploy planned post unberth
- **Cygnus Status**
  - Pressurized Cargo Module (PCM) testing was completed on 1/21/16
  - Final Service Module(SM)/PCM mate was completed on 2/15/16
  - Late cargo load is planned from 3/2/16 – 3/4/16
- **Atlas V 401 Status**
  - 2nd Stage arrived at KSC on 1/23/16 and booster arrived on 2/4/16

OA-5 Mission Status

- **Mission Planning**
  - Software Stage Test was conducted from 2/15/16 – 2/26/16
  - Cargo Integration Review (CIR) is planned for 3/8/16
  - Safety Review Panel (SRP) Phase 3 review is planned for 3/23/16
  - Mission Readiness Review (MRR) is currently planned for 4/7/16
- **Pressurized Cargo** – 3200 kg planned; 1802 kg disposal (*estimated)*
  - Saffire #2 payload planned to be integrated into Cygnus
- **Unpressurized Cargo**
  - Nanoracks cubesat deploy planned post unberth
- **Cygnus Status**
  - Service Module (SM) in storage having completed integrated testing
  - SM regression testing was conducted from 2/9/16 – 2/29/16
  - PCM is planned to arrive at WFF on 3/9/16
- **Antares Status**
  - Planned launch vehicle is the Antares (0000.7 Core with Engines 4A and 5A)
  - RD-181 Certification Review was conducted from 1/12/16 – 1/13/16
  - Engines 4A and 5A were mounted to Stage 1 on 1/28/16
  - Main Engine Controller (MEC) delivery to WFF on 2/24/16
  - RD-181 Quality Audit was conducted from 2/24/16 – 2/26/16
  - Stage Test Article (0000.6 Core with Engines 2A/3A) is at WFF preparing for hot fire test on 4/25/16

SpaceX-8 Mission Status

- **Mission Planning**
  - Safety Review Panel (SRP) Phase 3 Parts 1 & 2 were conducted on 11/5/15 and 11/13/15, respectively
  - Post Qualification Review (PQR) was conducted on 11/19/15
  - SORR is planned for 3/3/16
- **Pressurized Cargo –** 1732 kg planned; 1850 kg return (*estimated)*
  - 1 Animal Enclosure Module-Transporter, 2 Polar, NORS O2/N2 tank, and cold bags
  - Nominal press cargo load planned on 3/9/16; late load is planned for 3/29/16
- **External Cargo** – *1578 kg*
  - Bigelow Expandable Activity Module (BEAM) was integrated into the trunk on 2/24/16
- **Dragon Status**
  - Capsule to trunk mate is planned for 3/1/16
  - Mate to Falcon 9 is planned for 3/16/16
- **Falcon 9 Status**
  - First CRS Falcon flight with full thrust capability (3rd F9 flight with full thrust)
  - M1D and MVacD qualification was completed in Nov 2015
  - 1st Stage arrived in TX on 1/28/16; 2nd Stage shipped to TX on 2/2/16

SpaceX-9 Mission Status

- **Mission Planning**
  - Software Stage Test is planned in Mar prior to PQR
  - Post Qualification Review (PQR) planning date is planned for 5/19/16 (under review)
  - Stage Operations Readiness Review (SORR) is planned for 6/2/16 (under review)
- **Pressurized Cargo –** 2100 kg planned; 1900 kg return *estimated*
  - 1 JAXA Rodent Module (potential first flight), 1 Bioculture, 3 Polar, Short Extravehicular Mobility Unit (SEMU), NORS O2 tank, and coldbags
  - Pressurized cargo Interface Control Documents (ICDs) are currently out for review and baseline signature
- **External Cargo –** 550 kg
  - International Docking Adapter (IDA) #2
- **Dragon Status**
  - Capsule and trunk stacking at Hawthorne for integrated checkouts was completed on 1/26/16
  - Electromagnetic Interference/Compatibility (EMI/EMC) testing was conducted the week of 2/8/16
  - Trunk is planned to be ready for shipment to the Cape in early Mar
- **Falcon 9 Status**
  - 1st Stage welding/painting/inspection completed in Jan
  - 2nd Stage welding/painting/inspection completed in Feb
  - Engines will begin ATP in Mar

Commercial Resupply Services CRS-2 Status

- **CRS-2 Contract award was announced on 1/14/16**
  - Awardees are Orbital-ATK, SpaceX, and Sierra Nevada Corporation
  - Contract post award briefings will be conducted in Mar/Apr
  - A minimum of six missions will be ordered from each provider
  - CRS-2 missions are planned for launch beginning in 2019
  - To bridge the launch gap, the current CRS contracts were extended to provide ordering through Dec 2018

ISS Integration Status of Crew Vehicles

- **Mission Planning**
  - Plans for vehicle certification are in work
  - Development of operational products commenced
- **ISS On-orbit Readiness**
  - Common Communications for Visiting Vehicles (C2V2) activation is in work
  - International Docking Adapter (IDA-2) installation planned with SpaceX-9 mission
- **Joint Integration Activities**
  - Phase 2 Safety Review Panel in progress
  - Baseline of provider Verification and Validation (V&V) Plans and Joint Integration and Verification Test Plans (JIVTP) with expected completion the first week of Mar
  - Providing delivery of NASA Docking System (NDS) for Boeing CST-100 and completed 6-DOF testing of the SpaceX built docking system