International Space Station Status
HEO NAC

“Buona notte” Kelly at 180 days

Sam Scimemi/Director, ISS
March 2016
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)

<table>
<thead>
<tr>
<th>Crew Rotation</th>
<th>Soyuz Lit Landing</th>
<th>Stage EVAs</th>
<th>Port Utilization</th>
<th>Docking/Berthing</th>
<th>External Cargo</th>
<th>Launch Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>N. E. Kaley (CDR-49)</td>
<td>173 days</td>
<td>3/19</td>
<td>44S</td>
<td>1/8</td>
<td>SpX-8: BEAM</td>
<td>OA-6-6P</td>
</tr>
<tr>
<td>R. M. Komolko (1 Yr Crew)</td>
<td>173 days</td>
<td>46S</td>
<td>44S</td>
<td>4/1</td>
<td>SpX-8: IDA 2</td>
<td>OA-8</td>
</tr>
<tr>
<td>R. Y. Volkov (CDR-47)</td>
<td>173 days</td>
<td>3/19 (Early GMT)</td>
<td>45S</td>
<td>4/1</td>
<td>SpX-10: STP-H5, SAGE IP, SAGE NVP</td>
<td>OA-7</td>
</tr>
<tr>
<td>N. G. Purkin (46S)</td>
<td>173 days</td>
<td>6/5</td>
<td>46S</td>
<td>6/26</td>
<td>HTV6: 6 x Li-Ion Batt + AP [direct mount]</td>
<td>OA-5</td>
</tr>
<tr>
<td>R. V. Kopra (CDR-47)</td>
<td>173 days</td>
<td>6/23 (Mission rendezvous)</td>
<td>47S</td>
<td>6/27</td>
<td>HTV6: BEAM Deploy</td>
<td>OA-6</td>
</tr>
<tr>
<td>J. T. Onishi</td>
<td>129 days</td>
<td>5/19</td>
<td>47S</td>
<td>7/1</td>
<td>ISS Flight Plan</td>
<td>OA-5</td>
</tr>
<tr>
<td>N. K. Rubins</td>
<td>129 days</td>
<td>5/1</td>
<td>46S</td>
<td>7/2</td>
<td>Issue 043</td>
<td>OA-5</td>
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<tr>
<td>J. T. Kopra (CDR-48)</td>
<td>129 days</td>
<td>5/10</td>
<td>47S</td>
<td>7/1</td>
<td>Landing 9/7 early GMT</td>
<td>OA-5</td>
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<tr>
<td>R. A. Ivanishin</td>
<td>129 days</td>
<td>5/10</td>
<td>47S</td>
<td>7/1</td>
<td>HTV6: 6 x Li-Ion Batt + AP [direct mount]</td>
<td>OA-5</td>
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<tr>
<td>R. S. Volkov</td>
<td>172 days</td>
<td>5/10</td>
<td>47S</td>
<td>7/1</td>
<td>HTV6: 6 x Li-Ion Batt + AP [direct mount]</td>
<td>OA-5</td>
</tr>
<tr>
<td>R. M. Kornienko (1 Yr Crew)</td>
<td>172 days</td>
<td>5/10</td>
<td>47S</td>
<td>7/1</td>
<td>HTV6: 6 x Li-Ion Batt + AP [direct mount]</td>
<td>OA-5</td>
</tr>
</tbody>
</table>

**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**

**All flight dates beyond the Tactical Planning period should be considered preliminary and will be updated in future CRs**
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)

Tim Kopra
CDR Inc 47 (US) - 45S

Yuri Malenchenko
FE (R) – 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)

Oleg Skripochka
FE (R) – 45S

Alexey Ovchinin
FE (R) – 46S
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
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**

**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)

**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
94.94% through IDRD Allocation
94.15% through OOS Planned Total

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

<table>
<thead>
<tr>
<th>Bone &amp; Muscle Physiology</th>
<th>Cardiovascular &amp; Respiratory Systems</th>
<th>Habitability &amp; Human Factors</th>
<th>Human Microbiome</th>
<th>Nervous &amp; Vestibular Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bisphosphonates (Control), Sprint, Marrow, Tbone (P), Brain-DTI (P), CARTILAGE (P), EDOS-2, Muscle Biopsy (P)</td>
<td>Cardio Ox, Vascular Echo, Airway Monitoring, IPVI</td>
<td>Body Measures, Fine Motor Skills, Habitability</td>
<td>Microbiome</td>
<td>NeuroMapping, Field Test (P)</td>
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<tr>
<td></td>
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<td></td>
<td>Immune System</td>
<td>Space Headaches, Straight Ahead in Microgravity (P)</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>Salivary Markers, IMMUNO-2, Multi-Omics</td>
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</tbody>
</table>

### Human Behavior & Performance

- Cognition, At Home in Space, Circadian Rhythms
- Synergy (P)

### Integrated Physiology & Nutrition

- Biochem Profile, Telomeres (P), Repository, Dose Tracker, Energy, MARES
- Biological Rhythms 48hrs

### Biology and Biotechnology

#### Animal Biology
- Rodent Research-3
- Space Pub 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

### Physical Sciences

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

#### Fluid Physics
- MARANGONI-UVP, Two-Phase Flow, ZBOT, PBRE 2 Microchannel Diffusion
- DOSIS-3D

### Earth & Space Science

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

#### Near-Earth Space Environment
- CATS (E), HICO-RAIDS (HREP) (E), ISS-RapidScat (E)

### Technology Development and Demonstration

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

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

### 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

#### Classroom Versions of ISS Investigations
- Windows on Earth

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**Key:**
- NASA
- NatLab
- CSA
- ESA
- JAXA
- To Be Defined
- Payload Card-X, JAXA Commercial, JAXA EFU Adapter and HDTV
- Ascent/Descent, (P) Pre/Post only, * Added by CEF, (E) External Payload
## Total ISS Consumables Status

<table>
<thead>
<tr>
<th>Consumable – based on current, ISS system status</th>
<th>T1: Current Capability</th>
<th>T2: Current Capability + OA-6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Date to Reserve Level</td>
<td>Date to zero supplies</td>
</tr>
<tr>
<td>Food – 100%</td>
<td>June 24, 2016</td>
<td>August 10, 2016</td>
</tr>
<tr>
<td>KTO</td>
<td>August 05, 2016</td>
<td>September 27, 2016</td>
</tr>
<tr>
<td>Toilet (ACY) Inserts</td>
<td>August 06, 2016</td>
<td>September 29, 2016</td>
</tr>
<tr>
<td>Water (Nominal Usage)</td>
<td>September 05, 2016</td>
<td>December 28, 2016</td>
</tr>
<tr>
<td>Consumable - based on system failure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>O₂ if Elektron supporting 3 crew &amp; no OGA</td>
<td>February 28, 2016</td>
<td>July 26, 2016</td>
</tr>
<tr>
<td>O₂ if neither Elektron or OGA</td>
<td>February 09, 2016</td>
<td>April 15, 2016</td>
</tr>
<tr>
<td>LiOH (CDRAs and Vozdukh off)</td>
<td>~0 Days</td>
<td>~14 Days</td>
</tr>
<tr>
<td>Consumable – based on current, ISS system status</td>
<td>U1: Current Capability</td>
<td>U2: Current Capability + OA-6</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Food – 100%</td>
<td>Date to Reserve Level</td>
<td>Date to zero supplies</td>
</tr>
<tr>
<td></td>
<td>July 27, 2016</td>
<td>September 21, 2016</td>
</tr>
<tr>
<td>KTO</td>
<td>October 17, 2016</td>
<td>December 12, 2016</td>
</tr>
<tr>
<td>Filter Inserts</td>
<td>&gt; January 31, 2017</td>
<td>&gt; January 31, 2017</td>
</tr>
<tr>
<td>Toilet (ACY) Inserts</td>
<td>&gt; January 31, 2017</td>
<td>&gt; January 31, 2017</td>
</tr>
<tr>
<td>EDV + TUBSS (UPA Operable)</td>
<td>June 28, 2016</td>
<td>January 18, 2017</td>
</tr>
<tr>
<td>Pre-Treat Tanks</td>
<td>December 17, 2016</td>
<td>&gt; January 31, 2017</td>
</tr>
<tr>
<td>Water (Nominal Usage)</td>
<td>&gt; January 31, 2017</td>
<td>&gt; January 31, 2017</td>
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<tr>
<td>Utilization</td>
<td>&gt; January 31, 2017</td>
<td>&gt; January 31, 2017</td>
</tr>
<tr>
<td>Consumable - based on system failure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EDV + TUBSS (UPA Failed)</td>
<td>March 17, 2016</td>
<td>May 12, 2016</td>
</tr>
<tr>
<td>Water, if no WPA (Ag &amp; Iodinated)</td>
<td>April 05, 2016</td>
<td>May 30, 2016</td>
</tr>
<tr>
<td>O₂ if neither Elektron or OGA</td>
<td>February 10, 2016</td>
<td>April 26, 2016</td>
</tr>
<tr>
<td>LiOH (CDRAs and Vozdukh off)</td>
<td>~0 Days</td>
<td>~13.3 Days</td>
</tr>
</tbody>
</table>
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
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

#### Planetary DRM (Mars) Risks

<table>
<thead>
<tr>
<th>Risk</th>
<th>FY14</th>
<th>FY15</th>
<th>FY16</th>
<th>FY17</th>
<th>FY18</th>
<th>FY19</th>
<th>FY20</th>
<th>FY21</th>
<th>FY22</th>
<th>FY23</th>
<th>FY24</th>
<th>FY25</th>
<th>FY26</th>
<th>FY27</th>
<th>FY28</th>
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<tbody>
<tr>
<td>Cardiac Rhythm Problems (Arrhythmia)</td>
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<td>Sleep Loss/Work Overload (Sleep)</td>
<td>3x3</td>
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<td>Reduced Muscle Mass (Muscle)</td>
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<td>Reduced Aerobic Capacity (Aerobic)</td>
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<td>Orthostatic Intolerance (OI)</td>
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<td>Exploration Atmospheres (ExAtm)</td>
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<tr>
<td>Team Performance (Team)</td>
<td>3x4</td>
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<td>Host-Microorganism Interactions (Microhost)</td>
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<td>Occupant Protection (OP)</td>
<td>3x3</td>
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<td>Altered Immune Response (Immune)</td>
<td>3x3</td>
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<td>Exposure to Dust &amp; Volatiles (Dust)</td>
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<td>Radiation Exposure on Human Health</td>
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**Legend:**
- **ISS Required**: Red
- **ISS Not Required**: Brown
- **Milestones Requires ISS**: Yellow
- **Milestone Shift**: Green

### 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**

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<tr>
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<td>Acute and Chronic Carbon Dioxide</td>
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<td>Cognitive or Behavioral Conditions</td>
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<td>Team Performance Decrements</td>
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<td>Cardiac Rhythm Problems- Under Review</td>
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<td>Reduced Muscle Mass, Strength</td>
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<td>Reduced Aerobic Capacity</td>
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<td>Injury due to EVA Operations</td>
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<td>Decompression Sickness</td>
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<td>Toxic Exposure</td>
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<td>Hypobaric Hypoxia</td>
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<td>Space Adaptation Back Pain</td>
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<td>Electrical shock</td>
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**Concerns:**
- 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

**Colors:**
- **Green** – low/very low consequence
- **Yellow** – low to medium consequence
- **Red** – high consequence

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**Notes:**
- Concern of Intervertebral Disc Damage upon and immediately after re-exposure to Gravity
- Concern of Medication PK/PD
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
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
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
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