INTERNATIONAL SPACE STATION STATUS
NASA Advisory Council
Human Exploration and Operations Committee
March 7, 2012

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Human Exploration and Operations Mission Directorate
National Aeronautics and Space Administration

Taken 22 Jan 2012 by the crew of Expedition 30, this photo European panorama reveals city lights from Belgium and the Netherlands at bottom center, the British Isles partially obscured by solar array panels at left, the North Sea at left center, and Scandinavia at right center beneath the SSRMS.
Recent Highlights
Systems and Vehicle O&M

- **Progress** 45P undocked from the ISS on January 23. The Chibis satellite was deployed from the open Progress hatch on January 24 prior to deorbit. **Progress** 46P launched on January 25 and docked on January 28.

- A Debris Avoidance Maneuver (DAM) was performed on Friday, January 13, to avoid a piece of Iridium debris. This was the 13th ISS DAM. Another DAM was performed on January 28, for Fengyun 1C debris.

- Preparations continue for the arrival of the commercial SpaceX-D mission, the first demonstration flight of the Falcon 9 / Dragon to rendezvous with the ISS. If all the planned demo objectives are successfully completed, the Dragon will be allowed to berth to the ISS during the mission. An exercise on January 26 simulated one of the two post-launch ISS Mission Management Team (IMMT) meetings that will be used to evaluate Dragon flight performance prior to berthing. The SpaceX-D mission is NET April 30.

- A major onboard software transition was completed after the installation of new EPIC (Enhanced Processor and Integrated Communications) cards in the multiplexer/ demultiplexers. EPIC is a faster, more capable processor card.

- The Node 3 **Major Constituents Analyzer (MCA)** was restored to full functionality when its aging mass spectrometer was replaced with an on orbit spare. The Lab MCA is still on-operational.

- The Program Risk Advisory Board (PRAB) met to assess the top program risks. The top risks are now: ISS operations budget reduction, adequate MMOD protection on the Russian segment, on-orbit intracranial hypertension, and the big 12 contingency EVAs. **MMOD protection** is no longer considered the number 1 risk due to ongoing mitigation efforts.

- The Soyuz vehicle slated for flight 30S was damaged by over-pressurization during ground testing so a subsequent flight vehicle is being accelerated for use on 30S. This resulted in a replan of Soyuz and Progress flights for the remainder of 2012. Flights 30S and 31S each slipped about 6 weeks.

- Direct Current Switching Unit (DCSU) 3B had an autonomous power on reset (POR) on February 12, consistent with other PORs that have occurred at high southern latitudes. Power was lost to all 3B loads including KU-band and Control Moment Gyroscope 3. Ground teams regained the normal configuration over the course of two shifts.

- **Russian EVA 30** on February 16 relocated the Strela-1 cargo boom from DC-1 to MRM2. The planned installation of five Service Module debris panels was not performed because the Strela work took too long.

- An average of 35 hrs/week of **research crew time** will be achieved across Increments 29-30, even with the extended periods last Fall when there were only three crew onboard the ISS. Recent weeks have achieved over 50 hours.
Recent Highlights
Research and Technology O&M

- First Space Station Research publication in *Nature*, 476: 421-424 August 2011; article contained JAXA MAXI data combined with NASA SWIFT data for first observation of relativistic x-ray burst from supermassive black hole destroying a star


- Research on bacterial biofilm formation in space showed significant differences from Earth-grown biofilms, indicating an unexpected and unexplored sensitivity of bacteria to the space environment

- A new commercial nano-scale research facility designed to make access to the ISS easy and cost-effective for scientists and educators has now implemented dozens of investigations and educational projects

- Progress on ground research in support of three National Institute of Health (NIH) funded ISS investigations, plus an additional investigation selected in 2011— the first has proposed transition to flight; studies are in areas of immuno suppression, bone loss, and gastrointestinal health

- The capillary flow experiment team released open source code that provides opportunity for anyone to calculate fluid flow in any container in microgravity conditions

- The Kids in Micro-g competition led to an unexpected discovery: the student experiment titled “Attracting Water Drops” examined static attraction in microgravity by using an statically charged rubber tubing and water droplets; unexpectedly, the droplet orbited the tubing instead of repelling as predicted
Tactical Flight Plan
As of March 2, 2012
# Increment 29-30 Summary

## Timeline

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-16 Sep</td>
<td>Soyuz 26S launch to ISS</td>
</tr>
<tr>
<td>29 Oct</td>
<td>ATV3 dock</td>
</tr>
<tr>
<td>13 Nov</td>
<td>Soyuz 27S launch to ISS</td>
</tr>
<tr>
<td>30 Oct</td>
<td>ATV3 undock</td>
</tr>
<tr>
<td>21 Nov</td>
<td>ATV3 undock</td>
</tr>
<tr>
<td>21 Dec</td>
<td>Soyuz 29S launch to ISS</td>
</tr>
<tr>
<td>23 Jan</td>
<td>ATV3 dock</td>
</tr>
<tr>
<td>45P</td>
<td>ATV3 undock</td>
</tr>
<tr>
<td>25 Jan</td>
<td>Soyuz 46P undock to ISS</td>
</tr>
<tr>
<td>46P</td>
<td>ATV3 undock</td>
</tr>
<tr>
<td>47P</td>
<td>ATV3 undock</td>
</tr>
<tr>
<td>22 Mar</td>
<td>ATV3 undock</td>
</tr>
<tr>
<td>27 Mar</td>
<td>ATV3 undock</td>
</tr>
<tr>
<td>30 Apr</td>
<td>ATV3 undock</td>
</tr>
</tbody>
</table>

## Crews

### Increment 29

- Satoshi Furukawa: Exp 29 FE5
- Michael Fossum: Exp 29 CDR
- Anatoli Ivanishin: Exp 29/30 FE2
- Dan Burbank: Exp 29 FE3/Exp 30 CDR

### Increment 30

- Sergei Volkov: Exp 29 FE4
- Anton Shkaplerov: Exp 29/30 FE1
- Oleg Kononenko: Exp 30 FE4
- Andre Kuipers: Exp 30 FE5
- Don Pettit: Exp 30 FE6

All dates are Eastern
Increment 31-32 Summary

2012

<table>
<thead>
<tr>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 Apr</td>
<td>15 May</td>
<td>1 Jul</td>
<td>15 Jul</td>
<td>Aug</td>
<td>26 Aug</td>
<td>17 Sep</td>
</tr>
<tr>
<td>28S</td>
<td>30S</td>
<td>29S</td>
<td>31S</td>
<td>RS EVA 31</td>
<td>US EVA 18</td>
<td>HTV3</td>
</tr>
<tr>
<td>NET 30 Apr</td>
<td>SpaceX-D (Demo 2/3)</td>
<td>21 Jul</td>
<td>13 Aug</td>
<td>US EVA 14 Aug</td>
<td>1 Sep</td>
<td>3 Sep</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>HTV3 undock</td>
<td>Orbital D-1</td>
<td>ATV3 undock</td>
</tr>
</tbody>
</table>

All dates are Eastern

International Space Station Status to the NAC HEO Committee – March 7, 2012
Soyuz Key Events
(dates Eastern and subject to change)

**Soyuz 28S (TMA-22) Landing**
- **Undock/landing date:** April 30 (was March 16)
- **Crew:**
  1. Anton Shkaplerov (Russia)
  2. Anatoli Ivanishin (Russia)
  3. Dan Burbank (USA)

All these landings and launches were delayed when a ground testing incident damaged the Soyuz vehicle slated for 30S

**Soyuz 30S (TMA-04M) Launch**
- **Launch date:** May 15 (was March 30)
- **Docking date:** May 17 (was April 1)
- **Crew:**
  1. Gennady Padalka (Russia)
  2. Sergei Revin (Russia)
  3. Joseph Acaba (USA)

30S is first Soyuz vehicle with enhanced MMOD protection

**Soyuz 29S (TMA-03M) Landing**
- **Undock/landing date:** July 1 (was May 16)
- **Crew:**
  1. Oleg Kononenko (Russia)
  2. Andre Kuipers (ESA/Netherlands)
  3. Don Pettit (USA)
Status of Soyuz Anomalies

- Over-pressurization during ground testing (30S)
  - Soyuz 30S - The Soyuz vehicle #704, slated for flight 30S (TMA-04M), had a problem during ground testing, prior to its shipment to Baikonur. During pressure testing of the descent module and the pressurized section of the propulsion module, the vehicle was over pressurized and as a result, it caused a leak in the area housing the hydrogen peroxide system for the thrusters that are used during descent and landing. *(see next page)*
  - Status: A Russian Commission was formed to investigate the cause of the over-pressurization and ensure it doesn’t happen again. Soyuz vehicle #704 was suspended from flight pending completion of further analysis. Soyuz vehicle #705, previously planned for flight 31S, is being accelerated for use on flight 30S. This results in a 6-week delay to the 30S launch. The crew of Soyuz 28S will remain on orbit another six weeks for a total of 168 days. Other Soyuz and Progress flights were replanned for the remainder of 2012.
Deformation and local failure SHELL CONTAINER lander spacecraft "Soyuz TMA-04M" № 704

Container for installation pnevmogidroagregata (PGA) storage of hydrogen peroxide

In the "Soyuz TMA-04M" № 704

Corrugations on the outside of the container PGA

Cracks in the shell of the container on the PGA points to the power set of welding
Automated Transfer Vehicle (ATV) Third Flight

- Launched by Ariane 5 from Kourou, French Guiana
- Docks to Russian Segment ports
- Can re-supply ISS with atmospheric gas, water, propellant, and dry goods
- Capable of performing many ISS re-boost and attitude burns
- Provides ISS waste disposal upon re-entry (no recoverable return capability)
- ATV3 vehicle designation: *Edoardo Amaldi*
- ATV3 flight milestones (all dates Eastern and subject to change)
  - Launch: March 9, 2012
  - Dock: March 18, 2012
  - Undock: September 3, 2012
SpaceX-D Demo Summary

- As with ATV and HTV, Dragon free flight demonstrations are planned for all safety critical functions before the flight phase where these functions are needed
- All demo objectives (listed below) must be completed before entering the Keep Out Sphere (KOS)
- ISS Mission Management Team (IMMT) meetings will be held on Flight Days 2 & 3 to review mission objectives and conduct a Go/No Go poll for rendezvous and berthing with the ISS

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abort</td>
<td>Demonstrate both types of abort burns, large on axis and small pulsed off axis</td>
</tr>
<tr>
<td></td>
<td>Confirm expected delta V and attitude error are within bounds</td>
</tr>
<tr>
<td>Absolute GPS (AGPS)</td>
<td>Confirm that Dragon position and velocity is accurate within error bounds (based on comparison of Dragon dissimilar navigation measurements)</td>
</tr>
<tr>
<td>Recover from Free Drift</td>
<td>Confirm that Dragon mode changes to and from Free Drift</td>
</tr>
<tr>
<td></td>
<td>Verify that required system inhibits are put in place prior to free drift and removed when Dragon recovers from free drift</td>
</tr>
<tr>
<td></td>
<td>Confirm that recovery attitude error is within bounds and Dragon remains in that attitude</td>
</tr>
<tr>
<td>Relative GPS (RGPS)</td>
<td>Confirm that Dragon distance from ISS is accurate within error bounds (based on comparison of RGPS solution with ISS and Dragon absolute positions)</td>
</tr>
<tr>
<td>Commanding from ISS</td>
<td>A strobe command is executed by the crew to test vehicle-to-vehicle communication and command capability</td>
</tr>
<tr>
<td>LIDAR</td>
<td>Confirm that Dragon position and velocity is accurate by comparing dissimilar systems, LIDAR and Thermal Imagers</td>
</tr>
<tr>
<td>Retreat</td>
<td>Confirm accurate range to ISS, expected acceleration and braking performance, and vehicle holds at completion of retreat (back at 250 m hold point)</td>
</tr>
<tr>
<td>Hold</td>
<td>Confirm accurate range to ISS at completion of Hold (~220m) and expected braking performance</td>
</tr>
</tbody>
</table>
Increment 29-30 Utilization Crew Time

OOS Allocation
Updated 29-3 Allocations
US Scheduled
OOS Allocation prior to revised 26S/28S dates
35 Hrs/Week Requirement

Week 20 of 26.0 77 % through the Increment

USOS IDRD Allocation: 1136.0 hours
USOS Actuals: 650.05 57.2% through IDRD Allocation
OOS Allocation: 1089.8 hours 59.7% through OOS Allocation

Total USOS Average Per Week: 32.5 hours/week
Major Pre-Positioned Spares - External

ELC2
- TUS-RA
- NTA #2
- PM #3
- CTC #1 (-3)
- 10 RPCMs

S6 Long Spacer
- BCDU #2
- BCDU #3

ELC3
- SPDM Arm w/OTCM
- ATA #2
- HPGT (O2)
- SASA #2
- SASA #3
- CTC #2 (-6)
- 10 RPCMs
- 1 ACU
- ExPCA

P6 Long Spacer
- PFCS #2
- PFCS #3
- PVR #1
- PVR #2

ELC1
- ATA #1
- NTA #1
- PM #4
- CMG #1
- LEE
- PCU
- BCDU #4

ESP3
- Pitch/Roll Joint
- FHRC #2
- PM #2
- LDU
- SGANT #1
- BCDU #1

ELC4
- HRS Radiator
- CTC #4 (-2)
- 3 RPCMs
- 1 CRPCM
- 1 VDU
- FHRC #3

ESP2
- DCSU #2
- DCSU #3
- MBSU #1
- MBSU #2
- FHRC #1
- UTA #1
- Yaw Joint

Z1
- SASA #1
- SGANT #2

ESP1
- DCSU #1
- PFCS #1
## Legend for Previous Page

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACU</td>
<td>Arm Computer Unit</td>
<td>NTA</td>
<td>Nitrogen Tank Assembly</td>
</tr>
<tr>
<td>ATA</td>
<td>Ammonia Tank Assembly</td>
<td>OTCM</td>
<td>ORU Tool Changeout Mechanism</td>
</tr>
<tr>
<td>BCDU</td>
<td>Battery Charge Discharge Unit</td>
<td>PCU</td>
<td>Plasma Contactor Unit</td>
</tr>
<tr>
<td>CMG</td>
<td>Control Moment Gyro</td>
<td>PFCS</td>
<td>Pump Flow Control Sub-Assembly</td>
</tr>
<tr>
<td>CRPCM</td>
<td>Canadian Remote Power Control Module</td>
<td>PM</td>
<td>Pump Module</td>
</tr>
<tr>
<td>CTC</td>
<td>Cargo Transport Container</td>
<td>PVR</td>
<td>Photovoltaic Radiator</td>
</tr>
<tr>
<td>DCSU</td>
<td>Direct Current Switching unit</td>
<td>RPCM</td>
<td>Remote Power Control Module</td>
</tr>
<tr>
<td>ELC</td>
<td>ExPRESS Logistics Carrier</td>
<td>SASA</td>
<td>S-band Antenna Structural Assembly</td>
</tr>
<tr>
<td>ESP</td>
<td>External Stowage Platform</td>
<td>SGANT</td>
<td>Space-to-Ground Antenna</td>
</tr>
<tr>
<td>ExPCA</td>
<td>ExPRESS Carrier Avionics</td>
<td>SPDM</td>
<td>Special Purpose Dexterous Manipulator</td>
</tr>
<tr>
<td>FHRC</td>
<td>Flex Hose Rotary Coupler</td>
<td>TUS-RA</td>
<td>Trailing Umbilical System Reel Assembly</td>
</tr>
<tr>
<td>HPGT</td>
<td>High Pressure Gas Tank</td>
<td>UTA</td>
<td>Utility Transfer Assembly</td>
</tr>
<tr>
<td>HRS</td>
<td>Heat Rejection System</td>
<td>VDU</td>
<td>Video Distribution Unit</td>
</tr>
<tr>
<td>LDU</td>
<td>Linear Drive Unit</td>
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<tr>
<td>LEE</td>
<td>Latching End Effector</td>
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<td></td>
</tr>
<tr>
<td>MBSU</td>
<td>Main Bus Switching Unit</td>
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</table>
International Space Station Status to the NAC HEO Committee – March 7, 2012

Graphic Source: Goddard Simulation of the Event, JAXA/Rikken, ISS Program Scientist, NASA