ISS STATUS

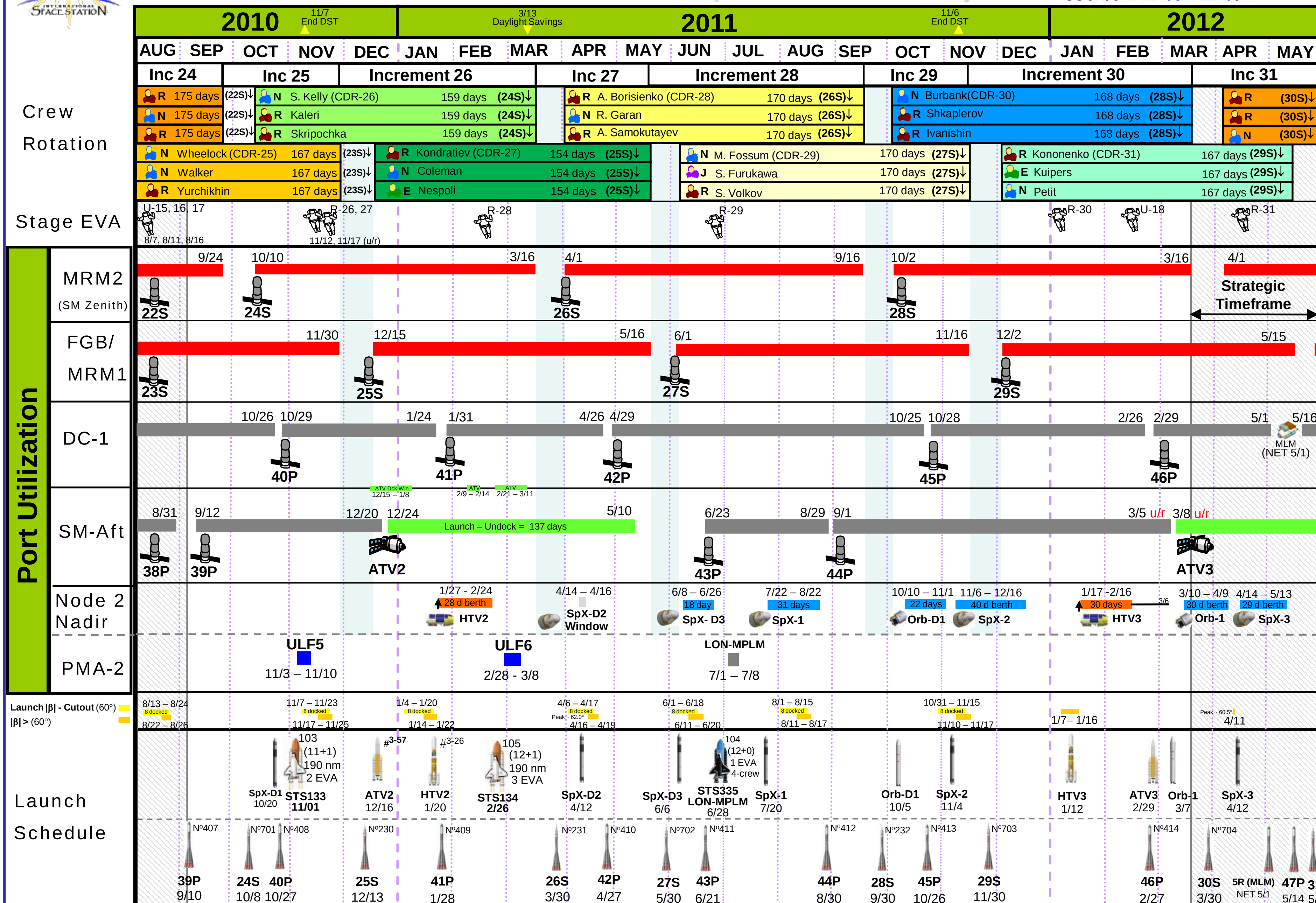
Michael Suffredini
Manager, ISS Program
NAC Space Operations Committee
September 13, 2010

For current baseline refer to SSP 54100 IDRD Flight Program

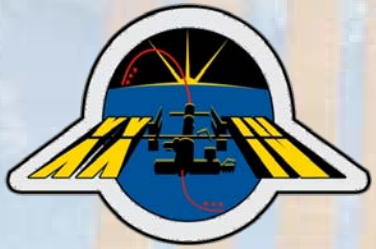
Flight Program Working Group (FPWG)

Crew Rotation and Port Utilization Graphic – For Reference Only

NASA Official: Sean Fuller
Prepared by: Scott Paul
Chart Updated: Sept. 8th, 2010
SSCN/CR: 12498 + 12465A



23 Soyuz/Expedition 24 Launch



Vehicle: 23 Soyuz, TMA-19

Launch: June 15, 2010

Docking: June 17, 2010

Undock/Landing: November 30, 2010

Fyodor Yurchikhin
Soyuz Commander/ISS Flight Engineer

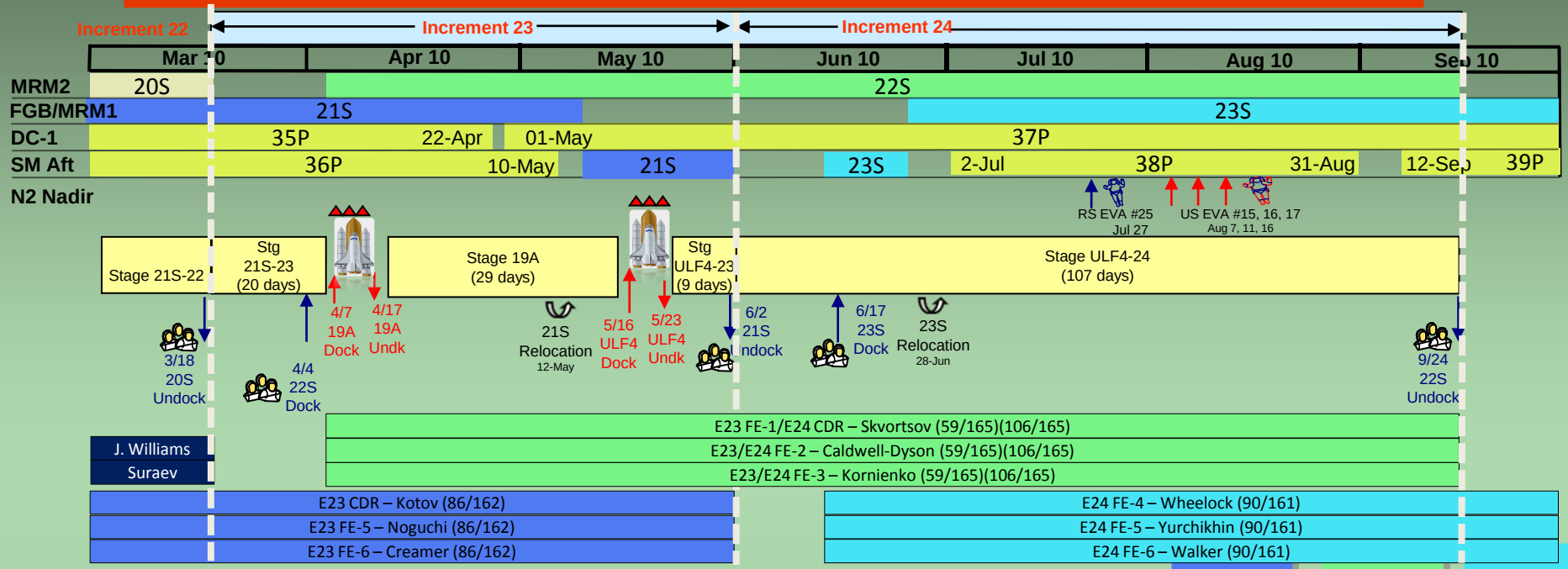
Douglas Wheelock
ISS Flight Engineer/Exp 25 Commander

Shannon Walker
ISS Flight Engineer

22 Soyuz/Expedition 23 crew launched April 2, 2010
Alexander Skvortsov Expedition 24 Commander/
Soyuz Commander/ISS Flight Engineer
Tracy Caldwill ISS Flight Engineer
Mikhail Kornienko ISS Flight Engineer

INCREMENTS 23 & 24

FP SSCN 12326B, CSRD Chit 8789



	21S-23 Stage	19A Stage	ULF4-23 Stage	ULF4-24 Stage	
Vehicle Traffic	✓20S undock previous stage ✓Dk 22S	✓Undk/ load 35P ✓Undk/ load 36P ✓Dk/unload 37P ✓ 21S Relocation	✓Undk 21S	✓Dk 23S •Undk /load 37P ✓Dk /unload 38P ✓23S Relocation	•22S Undk at the end of stage • Dk / unload 39P
Assembly & Maint.	✓Prep for 19A / 22S	✓22S H/O ✓Prep for ULF4 ✓Prep for 21S return ✓T2 relo ✓CQ#2 C/O ✓TVIS Annual MNT	✓Prep for 21S undk ✓MRM1 ACO	•Prep for 23S dk / H/O •US EVA #15 – FGB PDGF install - Deferred ✓US EVA #15, 16, 17 – Pump Module R&R •JEM CQ relo	•Sabatier Activation ✓RS EVA # 25 •Prep for 22S return •ARS racks swap ✓OGA H2 dome R&R
Software Xtions		✓SM 8.04		✓CCS R9 ✓PCS R13 ✓PEP R9 ✓NCS R4	•MSS 6.3

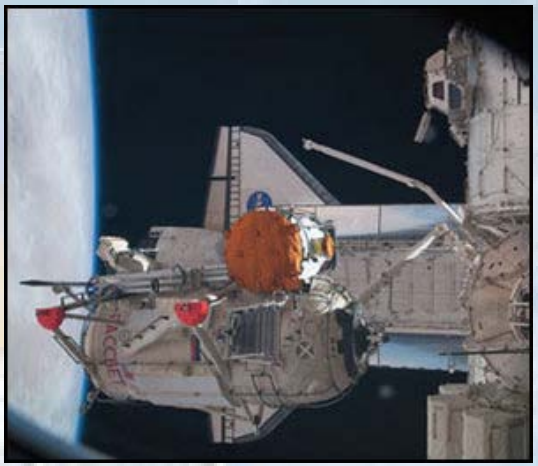
21 Soyuz Crew

22 Soyuz Crew

23 Soyuz Crew

Expedition 24 Mission Objectives

- Launch and dock 23Soyuz **- Complete**
- Perform Expedition crew familiarization for Expedition 24 **- Complete**
- Relocate 23Soyuz from Russian Service Module to mini research module (MRM1**) - Complete**
- Conduct one Russian EVA **– Complete**
- Conduct one US EVA (FGB PDGG**) – Def erred due to Pump Module (PM) Contingency EVAs**
- Three contingency EVAs (Pump Module Changeout) **– New/Complete (additional EVA required in the future to stow the old PM on ELC-2)**
- Continue MRM1 outfitting and hardware configuration **– Continuing**
- Continue checkout of new utilization racks – MELFI-3 and WORF **(Complete)**, ER7 **(Deferred – lower priority),** MARES **(Scheduled)**
- Transfer Crew Quarters 3 from the Japanese lab to Node 2 – **(Scheduled – pending completion of alternate installation procedure)**
- Perform backup Ku-Band antenna (SGANT) activation and checkout **– Deferred (priority lowered)**
- Continue installation and checkout of Sabatier water generation system **- Deferred due to PM Contingency EVAs**
- Perform a major software upgrade **- Complete**
- Perform preparation tasks for STS-133/ULF5 delivery of the permanent multipurpose module (PMM) and the EXPRESS Logistics Carrier (ELC4) **– Deferred due to launch delay from Sep to Nov**
- Return 22Soyuz and crew **– Landing at 11:55pm CDT on Sep 23, 2010**



Russian MRM1 delivered on STS132/ULF4, May 2010

Expedition 24 Crew on ISS

Expedition 24 Research Program

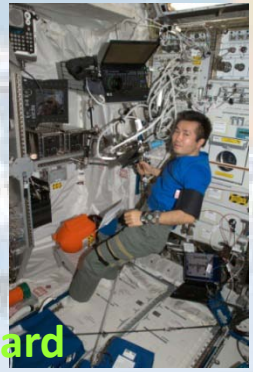
- Plans for Expedition 24 include operation of 127 integrated experiments in biology and biotechnology, Earth and space science, educational activities, human research, physical and materials sciences and technology.
  - Two are planned for operation by the Canadian Space Agency (CSA)
  - Twenty-seven are planned for operation by the European Space Agency (ESA)
  - Twenty-five are planned for operation by the Japan Aerospace and Exploration Agency (JAXA)
  - Fifteen are ready for operation, but designated as “reserve” and will be performed if crew time available
  - Sixteen are planned for sortie experiments to be conducted by Space Shuttle crewmembers
- Experiments on this Expedition will support the work of more than 400 scientists
- Four new facilities have been delivered to the ISS
  - EXpedite the PRocessing of Experiments to Space Station Rack 7 (EXPRESS Rack 7)
  - Muscle Atrophy Research and Exercise System (MARES)
  - Minus Eighty-Degree Laboratory Freezer for ISS – 3 (MELFI-3)
  - Window Observational Research Facility (WORF)
- The ISS currently has 23 research facilities
  - Advanced Biological Research System (ABRS), Biological Experiment Laboratory (BioLab)
  - Combustion Integrated Rack (CIR), Fluids Integrated Rack (FIR), Materials Science Research Rack-1 (MSRR-1), Fluid Science Laboratory (FSL)
  - Two Human Research Facility Racks (ultrasound, refrigerated centrifuge, pulmonary function system, etc.
  - Six EXPRESS Racks (provide power, communications and vibration isolation for experiments)
  - European Modular Cultivation System (EMCS) – located within EXPRESS Rack 3A
  - Microgravity Sciences Glovebox (MSG)
  - Two Minus Eighty degree Laboratory Freezer for the International Space Station (MELFI)
  - European Drawer Rack (EDR), European Physiology Modules (EPM), European Transportation Carrier
  - Sun Monitoring on the External Payload Facility of Columbus (Solar)
  - Ryutai Experiment Rack (Ryutai), Saibo Experiment Rack (Saibo)

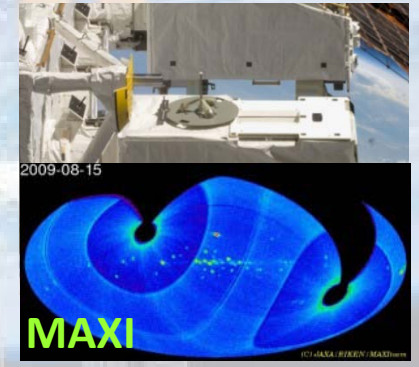
ISS Utilization in 2010

Since December 1, 2009

- 29 NASA experiments
- 49 IP experiments
- 349 Crew utilization hours*
  - NASA = 152 h (have other breakdowns)
  - IPs = 197 h
- 5 Publications

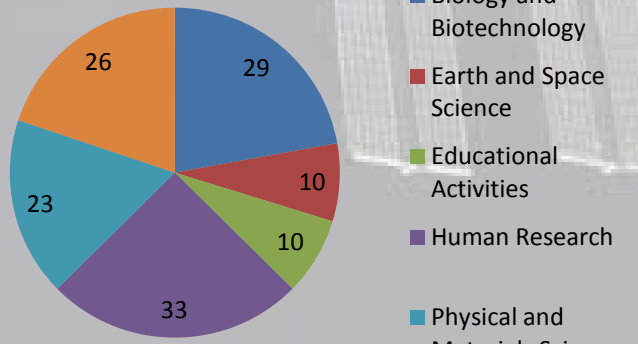
* Does not include 21.4 hrs of docked ops from 2/9-2/19/10





Planned for Expedition 23/24 - 133

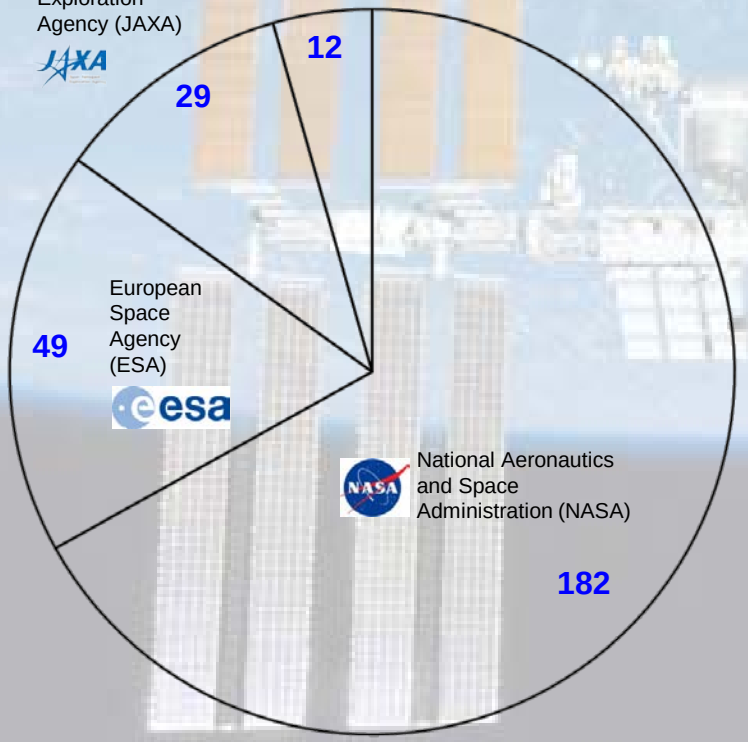
- 72 NASA experiments
- 61 IP experiments
- 1065 Crew utilization hours
  - NASA = 479 h
  - IPs = 587 h



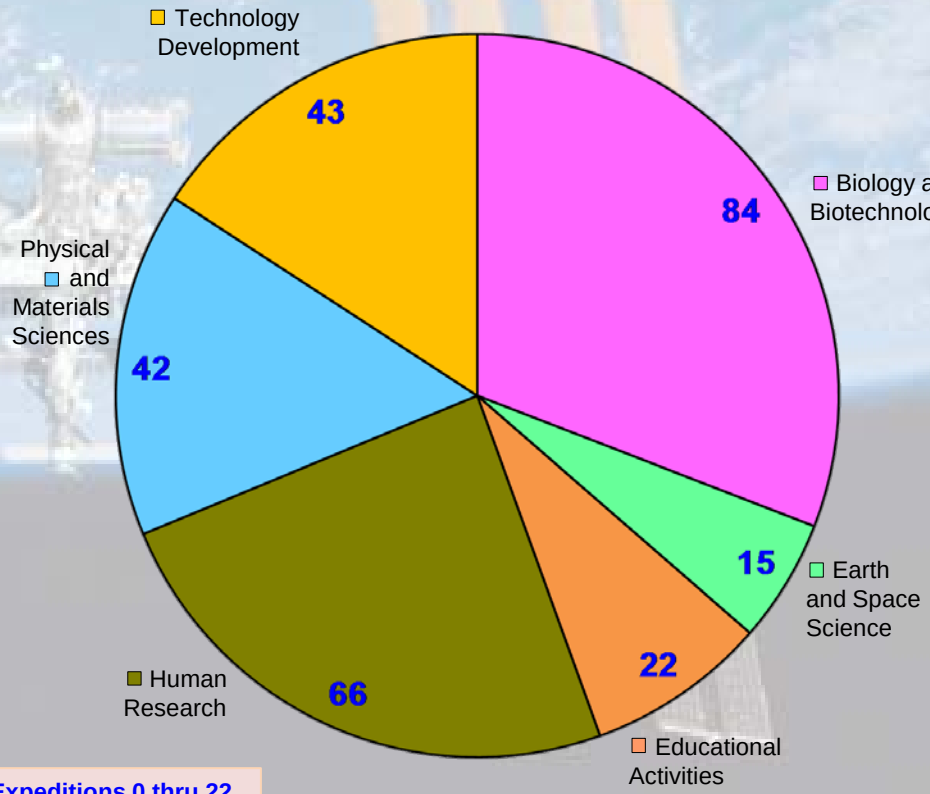
ISS Research Accommodations Status (History)

16 July 2010 (Data through 30 June 2010) [POC: Rod Jones/OZ]

Number of New USOS Research Investigations Operated in Expeditions 0 through 22 by International Partner and Scientific Discipline Category



By International Partner



By Scientific Discipline Category

Cumulative for Expeditions 0 thru 22

272 New USOS Investigations
182 NASA, 90 Int'l Partner
26 Nat'l Lab, 153 Completed
> 985 Scientists

24 Soyuz/Expedition 25 Launch

Vehicle: 24 Soyuz, TMA-20

Launch: Oct 8, 2010

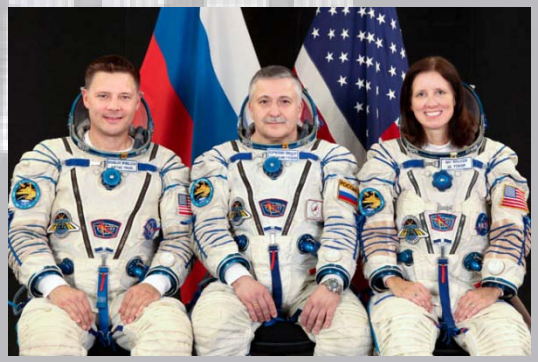
Docking: Oct 10, 2010

Undock/Landing: March 16, 2011

Alexander Kaleri
Soyuz Commander/ISS Flight Engineer

Scott Kelly
ISS Flight Engineer/Exp 26 Commander

Oleg Skripochka
ISS Flight Engineer

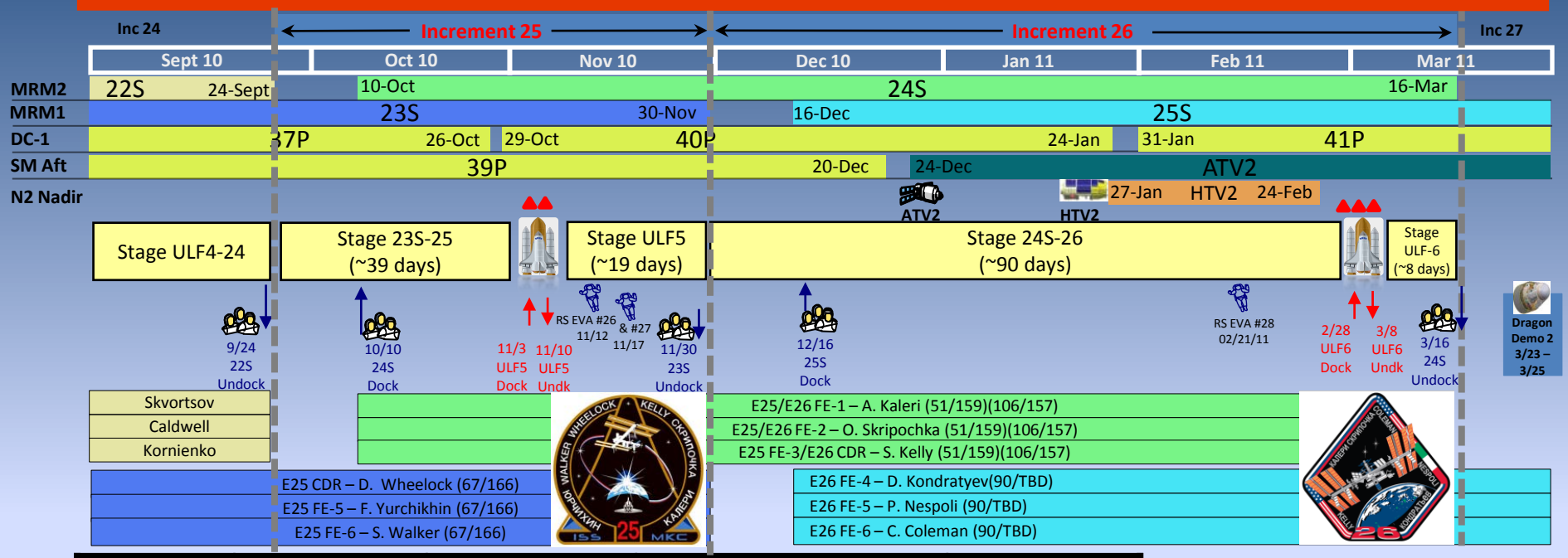


23 Soyuz/Expedition 24 crew launched June 15, 2010
Douglas Wheelock Expedition 25 Commander
Shannon Walker ISS Flight Engineer
Fyodor Yurchikhin Soyuz Commander/ISS Flight Engineer

INCREMENTS 25 & 26

Updated 3 September 2010

FPWG CR SSCN 12326B, IDRD Rev A CR 12385



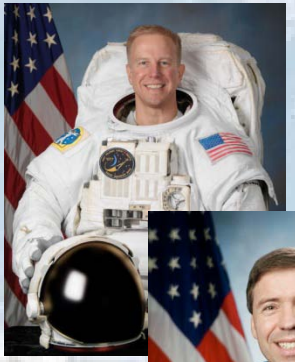
	Stage 23S-25	Stage ULF5	Stage 24S-26	Stage ULF6
Vehicle Traffic	• 24S Dock (10/10) • 37P Undock (10/26) • 40P Dock (10/29) • ULF5 Docked Ops (11/3 – 11/8)	• 23S Undock – End of Inc 25 (11/30)	• 25S Dock (12/16) • 39P Undock (12/20) • ATV2 Dock (12/26) • 40P Undock (1/24) • 41P Dock (1/31) • HTV2 Berth/Unberth (1/27 – 2/24) • ULF6 Docked Ops (2/28 – 3/8)	• 24S Undock - End of Inc 26 (3/16)
Assembly & Maintenance	• ULF5 Mission Prep • CHeCS RSR relocation for ER8 installation • MSG and MELFI rack relocation	• Prep for 23S undock • PMM Reconfiguration • RS Double EVA #26 & 27 (12 & 17 Nov) • Relocate ER8 • FGB PDGF C/O	• RS EVA #28 (Feb 2011) • HTV2 Prep • Install & C/O JAXA Payload Racks MSPR & KOBAIRO • FHRC & CTC from HTV-2 EP to ELC4 • ULF6 Mission Prep • CUCU C/O • MARES Commissioning	• Prep for 24S return • Prep for Dragon Demo 2 (3/23 – 3/25)
Software Transitions			• S0 R2 to R3 • Node 3 SYS1 R2 to R3 • Node 3 SYS2 R3 to R4 • CUCU Software Update	

ULF5 (STS-133) Astronauts

Steven Lindsey
Commander
Fifth spaceflight

Eric Boe
Pilot
Second spaceflight

Alvin Drew
Mission Specialist 1
Second spaceflight



Timothy Kopra
Mission Specialist 2
Second spaceflight

Michael Barratt
Mission Specialist 3
Second spaceflight

Nicole Stott
Mission Specialist 4
Second spaceflight

Discovery will deliver and install the Permanent Multipurpose Module, the Express Logistics Carrier 4 and provide critical spare components to the International Space Station. This will be the 35th shuttle mission to the station..

Space X Progress

Accomplishments

- **Demo Flights**
  - C1 - Dragon arrived at KSC on August 5 for October 20 launch.
  - C2/C3 - Completed MSS 6.3 Formal Stage Test on August 6.
  - C2/C3 - Completed in-rush current check out test on August 23 at SpaceX.
  - C2 - Merlin engines (first stage) – five of the nine engines have completed acceptance test firing (fifth engine completed both static fire tests on 8/17).
- **CRS**
  - Completed Quarterly Review on July 21 at SpaceX.
  - COTS/CRS Internal JOP completed August 24.
  - ATP received for CRS Mission 4.

Launched Maiden Flight on 06/04/2010

C1: F9-002 First and Second Stages

Near Term Activities:

- C2 - Merlin engines (first stage) – Engine 6 is at Texas, preparing for test firing. Engines 7, 8, and 9 are being built at Hawthorne.
- Javad GPS Qualification testing planned for September 10-30.
- CRS Quarterly Review planned for October 12 at SpaceX.
- COTS/CRS Internal JOP planned for September 14.
- CRS 4 FRAM manufacturing planned to start in October
- CRS 4 Preliminary external cargo complement planned for November.

Orbital Progress

Accomplishments

- **Demo Flight**
  - PROX FEU and PLS EDU have been shipped from JAXA and are on-site at Orbital
  - Taurus II Stage 1 Yuzhmash Production Readiness Review successfully completed on July 27
  - Stennis Facility Readiness/Activation completed on July 22
  - Demo flight launch date moved to 9/27/11
  - SW Joint Test 2 held August 23 – September 3
- **CRS**
  - Established 90 day launch window of January 1 – March 31, 2011 for ORB-1
  - ORB-3 ATP completed June 30
  - COTS/CRS Internal JOP completed August 3

Taurus II Fairing

Pressurized Cargo Module (PCM)

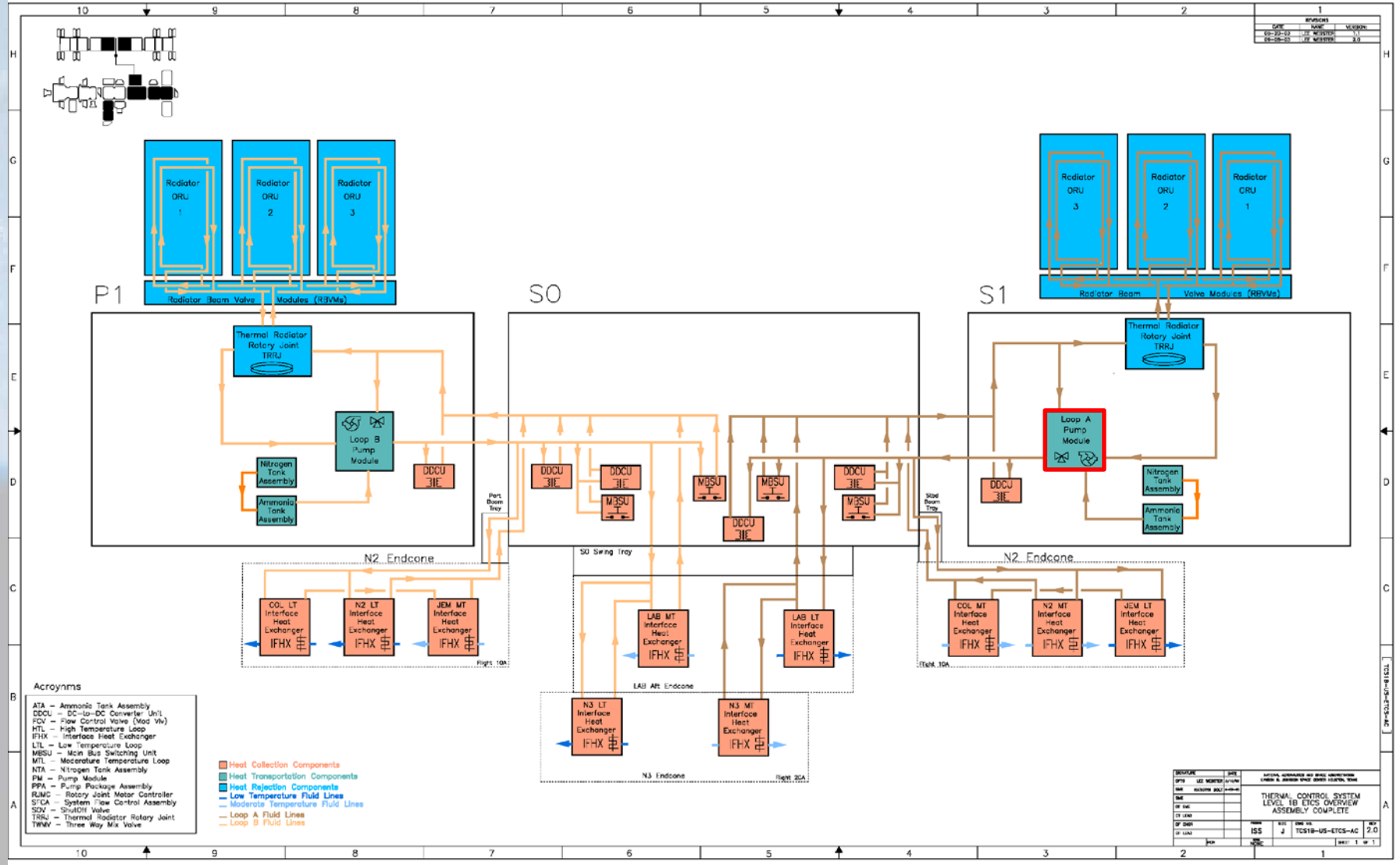
Near Term Activities:

- **Demonstration Flight**
  - Delivery of first AJ-26 engine to Stennis scheduled for September 24.
  - First AJ-26 Engine short duration hot fire at Stennis planned for mid-October.
  - PROX Ops TIM #6 at JAXA planned for October 2010
  - Joint Test 4, 5 planned for November 2010
  - PROX Checkout planned for December 2010
- **CRS**
  - ORB-2 VBR scheduled for October 2010
  - Launch/processing Facilities are still in the early part of the construction process

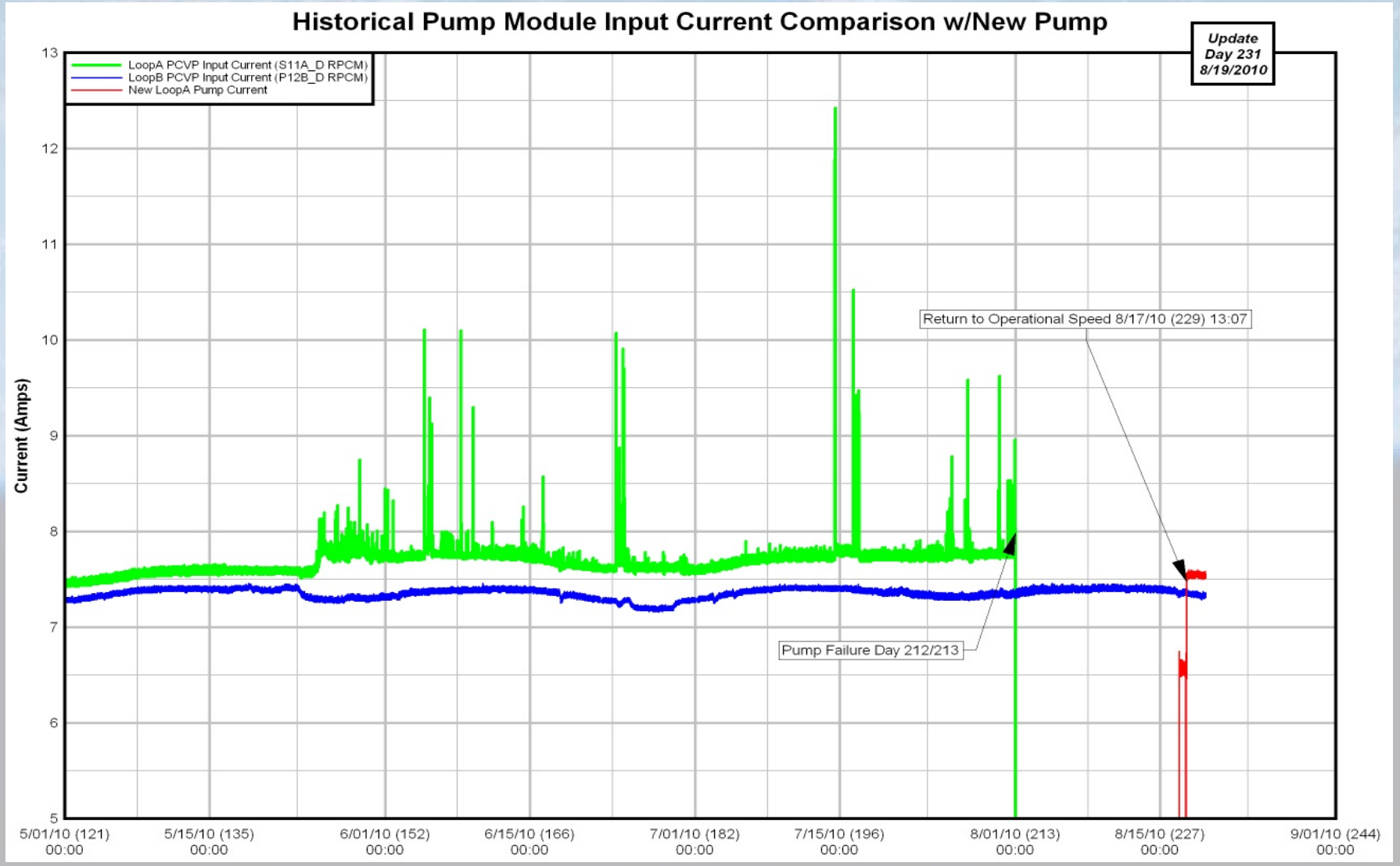
EATCS Loop A Status

- Loop A PM Failure occurred 7/31 at 6:48 CDT
  - Subsequent restart attempts unsuccessful
- Cooling lost to about half of the USOS systems.
  - Channels 1 and 4 MBSUs and DDCUs
  - Two of four coolant loops in the lab and three of six in Node 2.
- Two EVAs planned to R&R failed pump with pump S/N 04 from ESP2
- QD issues during EVA 1 resulted in an additional EVA
- Loop A system pressure was lowered through innovative GPRV use to allow for easier QD operations on EVAs 2 and 3
- Modified QD procedures implemented based on EVA 1 to reduce risks
- Successful R&R of the pump on EVA 3
- Loop A was repressurized and restarted following crew ingress
- Pump was run overnight and performance monitored prior to shutdown for reconfiguration
- Pump is performing well. Current signatures are on par with pump operation prior to beginning of anomalous behavior

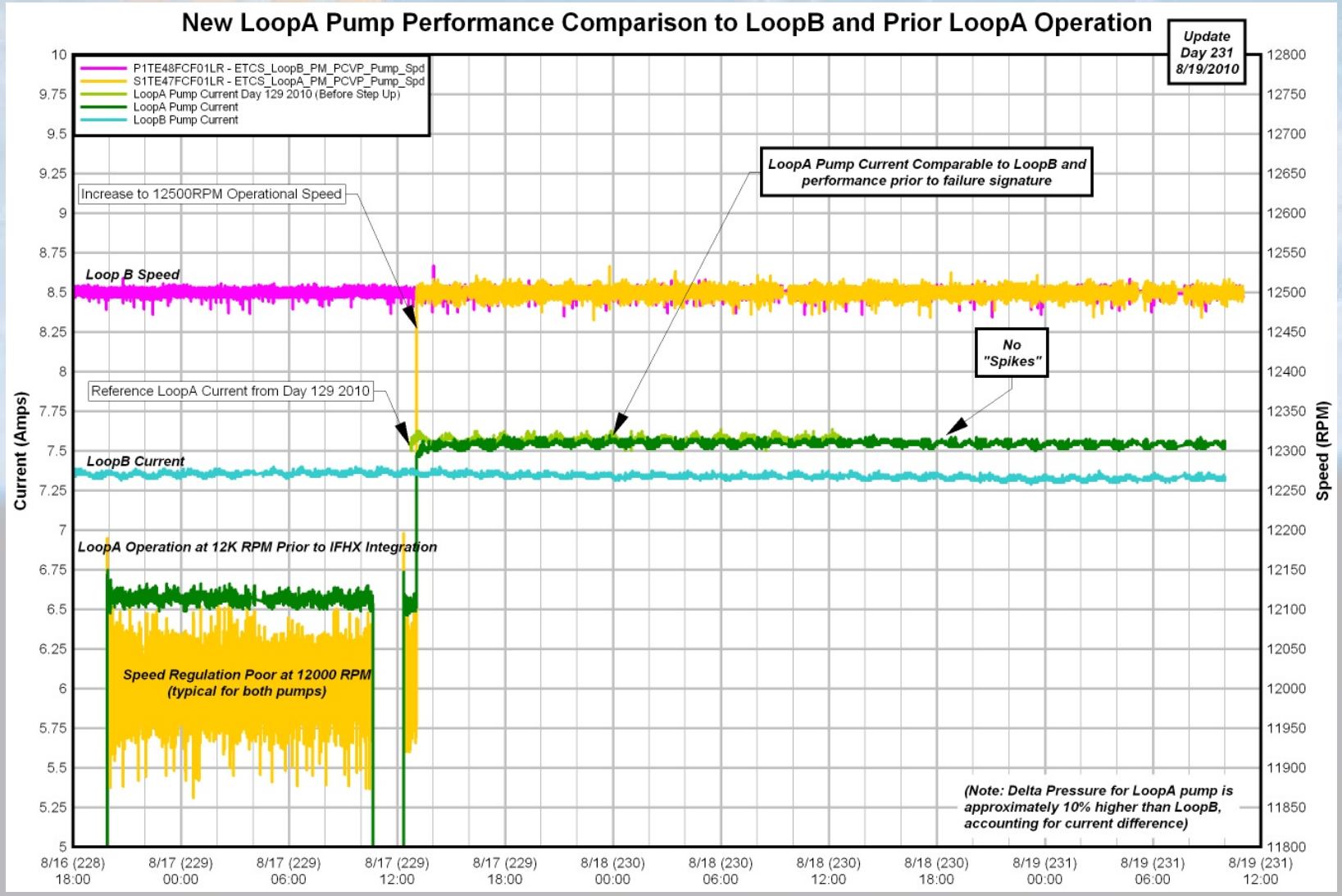
External Active Thermal Control System



Loop A Historical Data



Current Data Pump Comparison



Ongoing and Forward Work

- Fault Tree team working to understand failure mechanism with daily data reviews
- No smoking gun has been identified to date
- Team has identified no recommendations for modifications to standard operation of either Loop A or Loop B pumps
- ASTRO team has begun monitoring current data along with system parameters
  - Daily exceedence scripts to scan for spikes over 7.75 amps
  - Pump current will be added to MER ADM Process
- ASTRO team will work to optimize pump operation as system performance is monitored

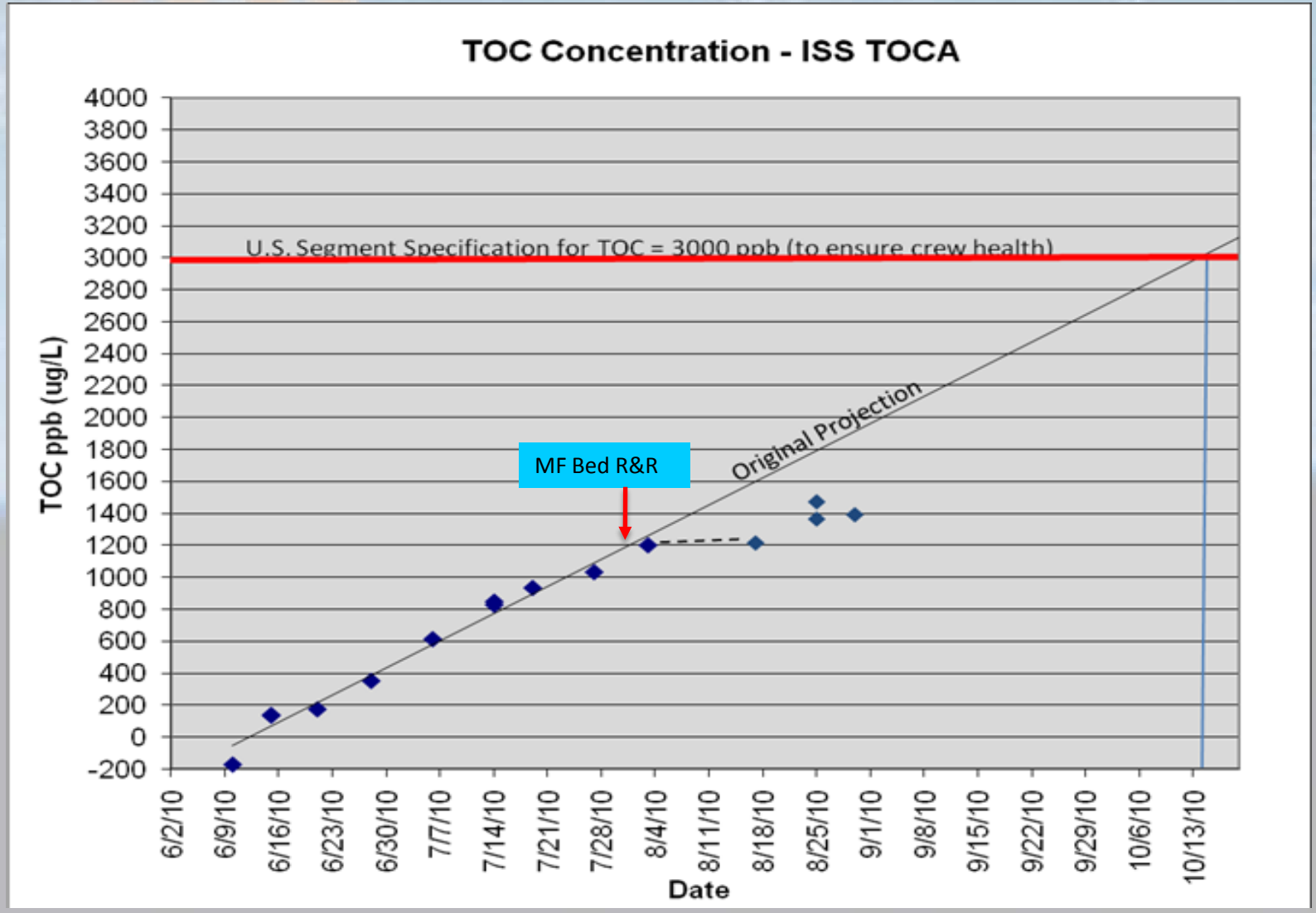
Water Processor Assembly Status

- Observation/Discussion:
  - Low Pump/Sep Inlet Pressure
    - Installation of External Filter Assembly (EFA) filter is providing acceptable performance with minimal impact on pressure drop
    - If performance deteriorates to degraded ops, next steps will be to change out the EFA and solenoid valve
      - 5 Spare External Filter Assemblies currently on ISS
  - Elevated TOC in Product Water
    - Recent Total Organic Carbon Analyzer (TOCA) analysis of WPA product water shows TOC is increasing. TOC Analysis on 30 August was 1393 ug/L. Though TOC specification is 3000 ug/L, this trend could only occur due to anomalous WPA performance.
    - PWD TOC analyses have been consistent with WPA, indicating the source of the TOC increase is due to the “volatile” organics
      - WPA is not effectively removing “volatile” organics (polar, low molecular weight, e.g. ethanol). These organic are also not effectively removed by ACTEX (includes adsorbent that will remove non-volatile organics) at PWD inlet
      - TOCA calibration check on 23 July verified accuracy of TOC data
    - Both Multi Filtration Beds were R&R’d on 29 July to address the possibility of organic breakthrough or reactor poisoning

Water Processor Assembly Status

- Status/Forward Work:
  - WPA is OPERATIONAL
  - Continuing to work with SF in characterizing on-orbit air quality in regards to TOC
  - Investigating how leakage from SM Coolant Loop (triol) could impact WPA performance
  - FIT held on 01 Sept 10 to determine next step for elevated TOC in product water
    - Recommendation to not change WPA operations and continue to trend TOC
  - Spares status:
    - Gas/Liquid Separator spare on-orbit
    - Cat Reactor (S/N 01) up on ULF5
    - Ion Ex Bed up on ULF5
    - Spare MF Beds up on ATV2

TOCA Data Summary



Oxygen Generator Assembly Status

- Observation/Discussion:
  - Recirculation Loop High delta Pressure
    - Water ORU (with higher flow capacity mesh filter) was installed on 19 May
    - ΔP returned to nominal levels
    - Low pH in recirc loop water is a concern for long term system health
  - delta Pressure Sensor failed on 22 May
    - Pump ORU was R&R'd on 10 Jul, however spare Pump ORU (S/N 002) failed to operate
    - Pump ORU (S/N 001) with failed ΔP sensor was reinstalled with ΔP sensor inhibited
      - ΔP is being trended utilizing pump current data
  - OGA failed on 5 July due to high voltage on cells 18 and 27
    - Hydrogen dome was R&R'd on 22 July along with recirc loop flush to recover pH
    - Spare Hydrogen Dome ORU delivery has been accelerated to May 2011

Oxygen Generator Assembly Status

- Status/Forward Work:
  - OGA is OPERATIONAL
  - Pump ORU I-Level maintenance and sparing strategy:
    - S/N 001 will remain installed without I-level maintenance of dP sensor
    - S/N 002 will return on ULF5 for TT&E
    - S/N 003 will launch on ULF5 and remain as on-orbit spare
  - Determine Recirc Loop water quality remediation strategy
    - Launching high accuracy pH strips on 39P
    - Single Cell pH test on going at Hamilton to characterize pH changes in recirc loop
    - Conduct TT&E on Hydrogen dome returned on ULF5 and analysis of water returned in dome
    - Determine frequency of loop flushing and pH testing
    - Effort to launch ACTEX filter and adapter hoses on ULF5

Carbon Dioxide Removal Assembly Status

- AR racks were relocated to their permanent locations the week of 6 Sept 10
  - AR1 in Lab; two -3 Desecant/Absorbent beds (DABs)
  - AR2 in Node 3; two -2 beds
- Two additional -3 CDRA DABs will fly on ULF5 & ULF6 to replace -2 DABs in AR2 CDRA
  - Four -3 DABs on-orbit will bridge time to -4 DAB deliveries w/o CDRA ops limitations
  - Dash 2 beds will be returned to ground prior to Shuttle retirement to support -4 deliveries

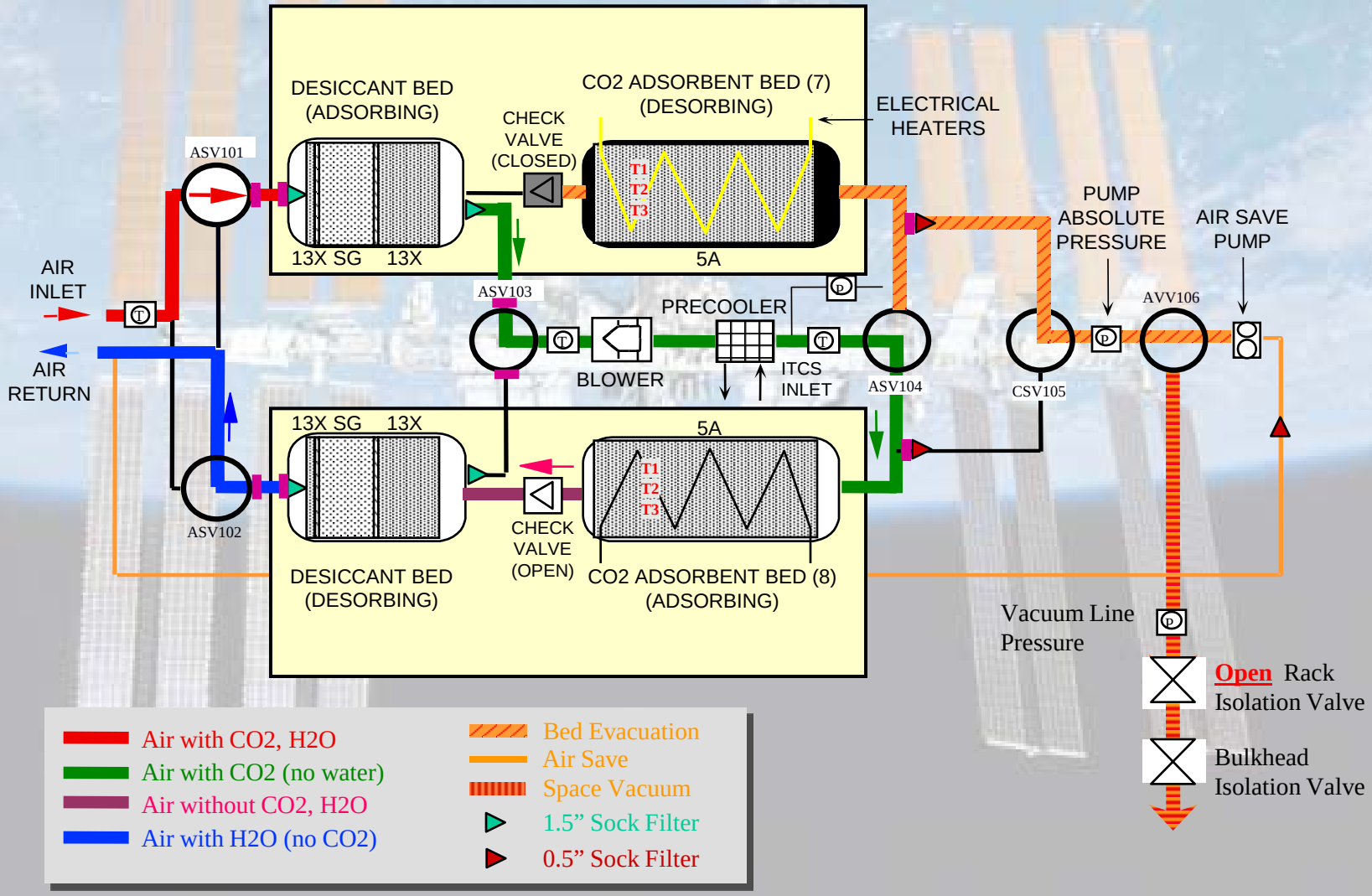
Carbon Dioxide Removal Assembly Status

- AR1 (Lab) issues following rack installation
  - Initial activation failed due to an unmated electrical connector
    - Connector was mated and latched fault was cleared
  - Subsequent activation failed due to an inability to pump down the 201 bed circuit
    - Signature was consistent with leakage of a hydraflow fitting
    - Troubleshooting was performed on 9/13, a leaking hydraflow was identified and fixed
    - Bed 201 was successfully pumped down
  - Current Status: AR1 CDRA is available for dual bed operations

Carbon Dioxide Removal Assembly Status

- AR2 (Node 3) issues following rack installation
  - Initial activation failed due to no response from Air Vent Valve (AVV) 106
    - Most likely cause believed to be a loose electrical connection at the Rack Interface Panel (RIP)
    - AVV 106 was subsequently recovered with a power cycle
    - Should AVV 106 have further problems, the connector at the RIP will be inspected.
  - During operation, CDRA failed due to the Air Save Pump not operating
    - Apparent cause is the perceived state of the Pump Motor Controller did not match the actual state
    - With the controller state out of synch, proper commanding could not be provided to the Air Save Pump
    - Pump was commanded off and then on to re-synch the correct states, at which point CDRA was returned to nominal operation
    - Further investigation is required to determine the cause of the controller state disagreement, but the CDRA is operating nominally at this time.
  - Current Status: AR2 CDRA is available for dual bed operations

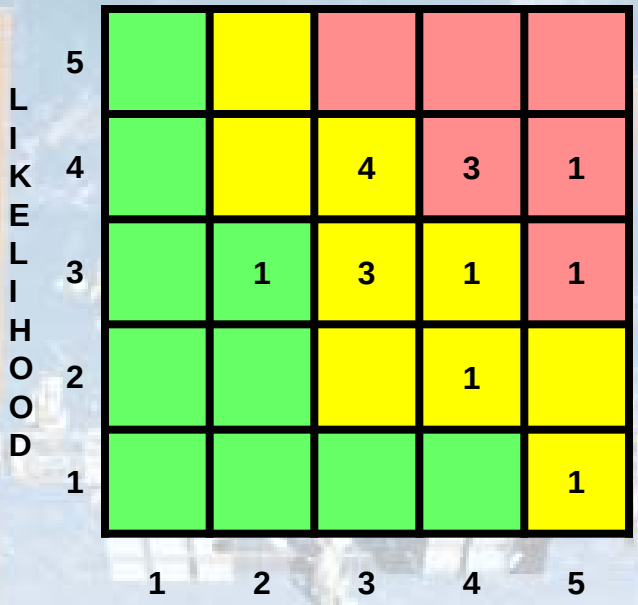
CDRA Schematic



ISS Top Program Risk Matrix
August 18, 2010 PRAB

Risks (L x C) Continued

Score: 1 x 5
▲ 6028 - Positive voltages on the ISS Truss elements at high latitudes represent a shock hazard to EVA crew - (OM) - (C,S,T,Sa)



Low	Medium	High	
C – Cost	S – Schedule	T – Technical	Sa – Safety
▲ – Top Program Risk (TPR)			
△ – Proposed Top Program Risk (TPR)			

Corrective/Preventative Actions

None

Continual Improvement

None

Risks (L x C)

Score: 4 x 5
▲ 2810 - Russian Segment (RS) capability to provide adequate MM/OD protection - (OM) - (C,S,T,Sa)

Score: 3 x 5
▲ 5688 - ISS Solar Array Management Operations Controls and Constraints - (OM) - (C,S,T,Sa)

Score: 4 x 4
▲ 5456 - ISS Budget and Schedule - (OH) - (C,S,T)
▲ 6137 - GCTC Transition Resulting in Loss of Quality Soyuz and Russian Segment Instructors - (CA) - (C,S,T,Sa)
▲ 6169 - On-Orbit Intracranial Hypertension - (SA) - (C,S,T,Sa)

Score: 4 x 3
▲ 6093 - Oxygen Processing Function - (OB) - (T)
▲ 6096 - Urine Processing Function - (OB) - (T)
▲ 6032 - On-Orbit Stowage Short-Fall (Pressurized Volume) - (OC) - (T,Sa)
▲ 6141 - Water Processing Assembly (WPA) Function - (OB) - (T)

Score: 3 x 4
▲ 5733 - COTS Integration Impact on ISS Program Resources - (ON) - (C,S,T,Sa)

Score: 3 x 3
▲ 6116 - Regen ECLSS Functional Availability - (OB) - (T)
▲ 5184 - USOS Cargo Resupply Services (CRS) Upmass Shortfall - 2010 through 2015 - (ON) - (C,S,T)
▲ 6039 - Carbon Dioxide Removal Assembly (CDRA) Function - (OB) - (C,T,Sa)

Score: 3 x 2
▲ 5871 - Potential Sharp Edge Sources on ISS Truss and Elements - (OB) - (C,S,T,Sa)

Score: 2 x 4
▲ 6167 - Vulnerability of CCS Tier 1 MDMs - (OD) - (C,S,T,Sa)