Inc 23 &24 - CRR
GGR&C/Gr&C

Space Medicine Mission Support

Presenter	Date
SD24/Michael Ellis	4 February 2010

Expedition 23 & 24 – Critical Readiness Review

Generic Groundrules, Requirements and Constraints/ Groundrules & Constraints (GGR&C/Gr&C)

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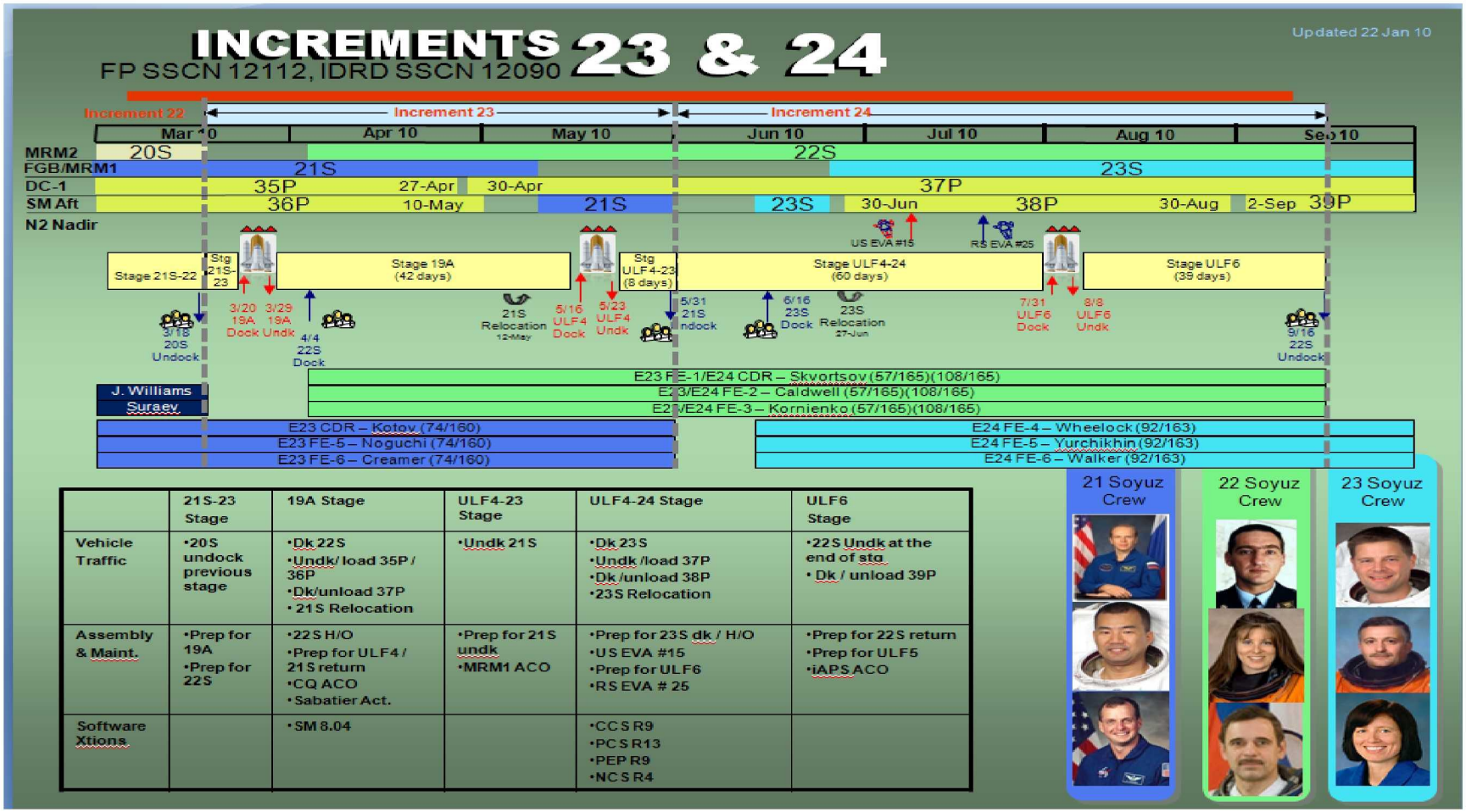

	21S-23 Stage	19A Stage	ULF4-23 Stage	ULF4-24 Stage	ULF6 Stage
Vehicle Traffic	•20S undock previous stage	•Dk 22S •Undk/ load 35P / 36P •Dk/unload 37P • 21S Relocation	•Undk 21S	•Dk 23S •Undk /load 37P •Dk /unload 38P •23S Relocation	•22S Undk at the end of sta • Dk / unload 39P
Assembly & Maint.	•Prep for 19A •Prep for 22S	•22S H/O •Prep for ULF4 / 21S return •CQ ACO • Sabatier Act.	•Prep for 21S undk •MRM1 ACO	•Prep for 23S dk / H/O •US EVA #15 •Prep for ULF6 •RS EVA # 25	•Prep for 22S return •Prep for ULF5 •iAPS ACO
Software Xtions		•SM 8.04		•CCS R9 •PCS R13 •PEP R9 •NCS R4	

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(GGR&C) SSP 50261-01: Requirements & Constraints

Purpose of Part 1 is to state basic rules and sets the boundaries for vehicle traffic, crew rotation and resource planning, manifesting and the development of ISS Strategic and Tactical planning documents.

Requirements & Constraints violations require a waiver documented in Increment IDRD Section 3.4 GGR&C Requirement & Constraint

#1 (Requirement Violation):

Periodic Sampling: GGR&C #4.3.1.8 - Periodic in-flight sampling of ISS atmosphere, water, microbiological cultures of surfaces, water, and air, and other return-samples assessing environmental data shall be performed to ensure safety of the crew.

ISS MORD Section 7.2.2.2 "ISS In-flight assessment of water quality"
The ISS MORD, SSP 50260, Section 7.2.2.2 requires monitoring of iodine and total iodine in water samples collected from the US on-orbit segment.

Inc 23 & 24 Annex 4, CR# 11916): Requirement Not Met – Iodine Monitoring

There is currently no hardware on the ISS capable of meeting in-flight iodine monitoring requirement. Once US WRS is activated and water to be consumed (6-months post WRS activation), this requirement will be unmet. There is a proposed SDTO experiment #15012-U, "Near Real-time Water Quality Monitoring Demonstration for ISS Biocides Using Colorimetric Solid-Phase Extraction (C-SPE) that will evaluate the ability of current technology to generally monitor water quality, and specifically for monitoring iodine. (Flt 17A).

Until hardware is flown to the ISS, ground analysis of returned archive water will be used for insight into iodine presence in the WRS water.

Waiver #20259: "Request for Waiver: ISS MORD Requirement for In-Flight Monitoring of Iodine in U.S. On-Orbit Segment Potable Water" is in EDMS with approval "pending IP".

Note: SDTO C-SPE has request 9 additional sample sessions and is in the Inc 23 & 24 IDRD.

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SSP 54023_54024-ANX 4
Baseline

TABLE E-1 MEDICAL OPERATION ACTIVITIES SUMMARY - REQUIREMENTS NOT MET

IDRD Annex 4 Activity	Flt or Exp	ISS MORD Requirement/MRID	Reason Activity Deleted	Forward Work/Work Around
CMS				
No Activity Identified for Deletion				
EHS				
Potable Water Collection for Chemical In-Flight (from PWD) (Iodine Monitoring)	Inc 23 and 24	SSP 50260 Rev C, Section 7.0 Environmental Health, Sec. 7.2.2.2 In-Flight Water Quality Monitoring: The ISS Program shall ensure that in-flight water sampling and analysis is performed with the frequency specified in Table D-2, ISS Russian Segment Water Sampling and Analysis Schedule, for the ISS Russian Segment and Table D-3, ISS U.S. On Orbit Segment Water Sampling and Analysis Schedule, for the ISS U.S. On-Orbit Segment. A. In-flight archival water sample collection from all ports used for drinking purposes in the Russian and U.S. On-orbit Segments for post-flight analysis. B. In-flight assessment of water quality performed by analyzing samples collected in flight for the following parameters: Total organic carbon, total inorganic carbon, total carbon, conductivity, and pH in water samples from the Russian Segment. Total organic carbon, total inorganic carbon, total carbon, conductivity, pH, turbidity, color, iodine, iodide, and iodine compounds in water samples from the U.S. On-orbit Segment. *MR054L ISS Potable Water Quiality Monitoring*	The ISS MORD, SSP 50260, Section 7.2.2.2 requires monitoring of iodine and total iodine in water samples collected from the U.S. on-orbit segment. Once U.S. WRS is activated and water to be consumed (6-months post WRS activiation), this requirement will be unmet. There is currently no hardware on the ISS capable of meeting in-flight iodine monitoring requirement.	There is a proposed SDTO experiment #15012-U, "Near Real-time Water Quality Monitoring Demonstration for ISS Biocides Using Colorimetric Solid-Phase Extraction (C-SPE) that will evaluate the abiliyty of current technology to generally monitor water quality, and specifically for monitoring iodine. Until hardware is flown to the ISS, ground analysis of returned archive water will be used for insight into iodine presense in the WRS water. Waiver # 20259 was initiated by SF2/Turin McCoy on 042909 and approved by the MIOCB on May 7, 2009.
HMS				
No Activity Identified for Deletion				

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(GGR&C) SSP 50261-01: Requirements & Constraints (cont)

(Requirement: IDRD 23 & 24 Baseline, Rev A – CR12090, Section 3.4)

- None Identified

(Constraints: IDRD 23 & 24 Baseline, Rev A – CR12090, Section 3.4)

- None Identified

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(GGR&C) SSP 50261-01: Groundrules Violations

Groundrule violations only require a deviation statement to be briefed at CR approval & posted on ISS web site

#1: (Groundrule Violation: Crew Time Allocation)

- Violations for med ops, PAO and Utilization have been listed on the Inc 23 & 24 website

GGR&C 3.3.2.2.5 Med Ops Crew Time Allocation is 10 hrs/week for 3-crew and 18 hrs/week for crew.

IMT 23 & 24 IDRD Baseline & Rev A CR's identified 3-crew time 9hrs (TBD 6-27) and 6-crew time 18 hrs. TBD resolution pending Preliminary OOS results.

- **IMT 23 & 24 IDRD CR12090 TCM (012110):**
  - **Med Ops crew time evaluation response per scheduled Annex 4 activity in the Preliminary OOS was:**
    - **9.41 hrs for Stage 19A 3-crew and 13.16 hrs for Stage ULF4-24 3-crew**
  - **TCM CR12090 Action was levied on med ops to met with Crew Time engineer to review OOS and determine if we could accept 9 hrs/week for 3-crew.**
  - **TCM CR12090 Modification by IMT23& 24 changed med ops 6-crew time allocation (18 hrs to 14 hrs)**
  - **Results (012210): Med Ops will be responding that we can accept 9 hrs (3-crew) and 14 hrs (6-crew) based on OOS scheduling inputs for Annex 4 activity with a note identifying there may be a risk for needing additional crew time pending any vehicle traffic delays (i.e. impacts to 19A water sampling (6.5 hrs) and Russian scheduling of MO14 (6hrs for 2 CM)**

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Increments 23&24 GGR&C Violations

GGR&C Section	GGR&C Wording	Violation	IMT 23-24 Assessment
3.3.2.2.5 MEDICAL OPERATIONS	Crew time planning will include a requirement of an average of 10 hours per week for 3-crew operations and 18 hours per week for 6-crew operations for medical operations performed during the work shift and will include Environmental Health System (EHS), Countermeasures System (CMS), and Health Maintenance System (HMS) activities. Additional information can be found in Appendix E.	During 3-crew indirect handover, Med Ops has been allocated 9 hours/week (vs. 10 hours/week GGR&C requirement and vs. 7 hrs allocated in previous CR). Med Ops has been asked to assess this allocation.	Med Ops assessment in work in conjunction with Annex 4 and pending OOS confirmation that the requirements can be satisfied.. The IMT believes this proration honors the intent of the GGR&C based on past 3-crew increment data.
3.3.2.2.6 PUBLIC AFFAIRS OFFICE	PAO groundrule for ISS in-flight activity will not exceed an average of 4.5 hours per week for 3-crew operation and 9 hours per week for 6-crew operations. For 6-crew operations, this equates to at least four and up to six PAO event opportunities per week being equally divided for both the U.S. and Russian side with as much simultaneous Ku-band video and S-band audio as possible, or in the case of the Russian side, when available, Russian ground station coverage, for each opportunity.	During 3-crew timeframe, PAO has been allocated 0 hours/week (vs. 4.5 hours/week).	PAO evaluation of this allocation is in work. The IMT believes this allocation is acceptable during the two 3-crew time periods during Inc's 23&24. These 3-crew time frames are 15 days long and contain Shuttle Flights 19A and ULF4. US PAO events will occur during these time frames but will count as joint mission time.
3.3.2.2.9 UTILIZATION OPERATIONS	Crew time planning will include an average of at least 20 hours per week for 3-crew and an average minimum of 70 hours per week for 6-crew (total USOS and RS) for utilization operations performed during the work shift.	During the 3-crew indirect handover timeframes, the IDRD allocation is equal to 15 hrs for USOS utilization. There will be 15 hours of USOS utilization time allocated during the 19A and ULF-4 joint missions which occur during the 3-crew indirect handover times.	The IMT believes this proration honors the intent of the GGR&C. The Increments 23 & 24 payload research plan was just baselined at the MPCB on 7/29. The IMT will work any crew time striations to facilitate high priority utilization in the next CR.

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#2: (Groundrule Violations: FPWG - CR12112)

This CR recognizes the following SSP 50261-01 (Generic Groundrules, Requirements and Constraints (GGR&C) violations with the acknowledgement of forward work:

Groundrule 3.1.14: Open Days Between Orbiter Undock and the Next Docking of a Vehicle to ISS (a minimum of 7 open days should be planned; 4 days for Shuttle launch opportunities, 1 day for an Orbiter undock contingency, and 2 days for rendezvous phasing)

19A undock (03/29/2010) and 22S launch (04/02/2010) then 22S dock (04/04/2010) (5 Open Days)

Groundrule 3.1.16: Open Days Between Vehicle Undock and Next ISS Shuttle Launch (a minimum of 3 open days should be planned; 3 days to allow for Shuttle launch countdown start following undocking)

20S undock (03/18/2010) and 19A launch (03/18/2010) (0 Open days)

22S undock (09/16/2010) and ULF5 launch (09/16/2010) (0 open days)

Groundrule 3.1.35.7: Soyuz/Progress Undocking and Subsequent ATV Docking Spacing (Minimum 2 open days: 1 day docking/undocking cont. & 1 day of Post-undocking (PU) operations and ATV docking preparations)

39P undock on 12/15/2010 and ATV2 dock on 12/17/10 (1 open day)

Groundrule/Constraint (TBD)

38P undock on 08/30/10 and Space-X Demo-3 undock on 08/29/10 (0 Open days) (GGR&C CR to add SpaceX Dragon GGR&C's is in-work)

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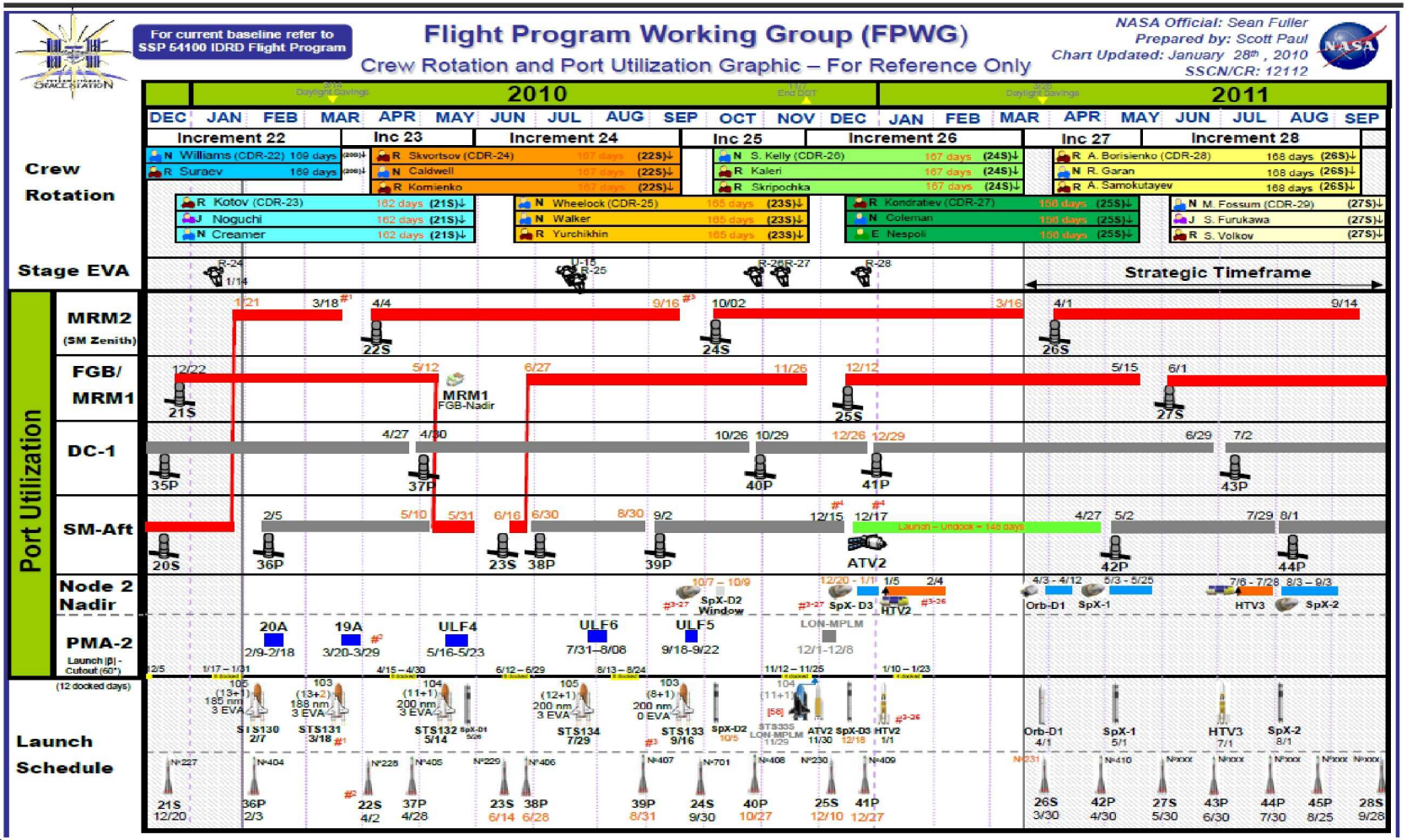

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For current baseline refer to SSP 54100 IDRD Flight Program

Flight Program Working Group (FPWG)

Crew Rotation and Port Utilization Graphic – For Reference Only

NASA Official: Sean Fuller
Prepared by: Scott Paul
Chart Updated: January 28th , 2010
SSCN/CR: 12112

Each Space Shuttle launch date is expressed as target dates until the mission-specific SSP FRR.
A TBR/TBD is associated with this vehicle traffic event date.
◊ Vehicle traffic ground rule acceptance has been requested or accepted for this event.

Ground Rule Acceptance and TBR Summary

1. <TBR 3-8> #3-8 Russian Flight Program is under review.
2. <TBD 3-26> HTV2: Launch, grapple/berth, and un-berth dates are under review.
3. <TBR 3-27> Space-X demo dates are not-earlier-than (NET) and based on production schedules and GGR&C spacing guidelines. These schedules will be revisited in the future to select actual mission dates.
4. NOTE [58]: LON (Launch-on-Need) Flight is shown for reference only. This flight would be flown if a contingency is declared during the ULF5 mission requiring the ULF5 crew rescue from the ISS.
5. <TBR 3-7> Dates are under review to resolve GGR&C conflicts
   - **GGR&C 3.1.14 Open Days Between Orbiter Undock and Next Vehicle Docking:** A minimum of 7 open days should be planned. Launch Slip (4), Undocking Contingency (1), and VV Rendezvous & Docking (2).
     - #2: 19A (STS-131) undock on 03/29/10 and 22S dock on 04/04/10 (5 Open Days)
   - **GGR&C 3.1.15 Open Days Between Orbiter Undock and Visiting Vehicle Undocking:** A minimum of 6 open days should be planned. Launch Slip (4), Undocking Contingency (1), and Traj. Measurement (1).
     - N/A
   - **GR 3.1.16: Open Days Between a Vehicle Undock and Next ISS Shuttle Launch:** A minimum of 3 open days should be planned to protect for Shuttle launch countdown start following undocking.
     - #1: 20S undock on 03/18/10 and 19A (STS-131) launch on 03/18/10 (0 Open Days)
     - #3: 22S undock on 09/16/10 and ULF5(STS-133) launch on 09/16/10 (0 Open Days)
   - **GR 3.1.17: Open Days Between RS Vehicle Launch and Next ISS Shuttle Launch:** A minimum of 6 open days should be planned. Count down commit (3), R&D (2), Docking Contingency (1).
     - N/A
   - **GR 3.1.35.7: Soyuz/Progress Undocking and Subsequent ATV Docking Spacing** (Minimum 2-open days: 1-day docking/undock cont. & 1-day 1 day of Post-Undocking (PU) operations and ATV docking preparations)
     - #4: 39P undock on 12/15/10 and ATV2 dock on 12/17/10 (1 Open Day)
   - **GR 3.1.29: Dynamic and Extravehicular Activity Operations Scheduling** (No more than one dynamic operation or EVA will be scheduled for the same day. A dynamic operation is defined as a vehicle launch, docking, undock/redock, or ISS reboost.
     - 20S Undock (3/18/10) and 19A Launch (3/18/10)
     - 22S Undock (9/16/10) and ULF5 Launch (9/16/10)

References/Notes:

1. Crew Rotation: Proposed Crew Rotation Plan: MCOP Oct 19th , 2009
2. Flight Assignment Working Group (FAWG) Planning Manifest: 11-Jan, 2010
3. Event dates reflect GMT day unless otherwise noted.
4. Solar Beta Angle launch cut-outs based on the Sep-2009 ISS Reference Trajectory

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(Gr&C) SSP 50261-02: Groundrules and Constraints (Gr&C) – Execute Planning

Purpose of Part 2 is to provide a single integrated source of ISS Crew Planning and scheduling constraints for use in the development of planning products such as the OOS, STP, and OSTP that support increment operations and execution.

- **No violations identified as of CRR**

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#1: Inc 23 & 24 Specific Gr&C: 6-Crew Exercise

(Gr&C) 3.16.6.1: Exercise Scheduling (EXERCISE-RED, EXERCISE-CEVIS, EXERCISE-TVIS, EXERCISE-TVIS+CEVIS, EXERCISE-VELO+RED, EXERCISE-VELO+HC1)

- **In 2009, MMOP approved a temporary change to Inc 19/20 Specific Gr&C to allow limited excursions into Pre/Post Sleep & meal for exercise to accommodate 6-person crews.**
- **Metrics were captured by Inc 19/20 BME for a CMS review to approve a more permanent change to GGR&C/Gr&C Exercise Scheduling groundrule.**
- **Has exercise excursions been extended past Inc 19 & 20 and was Inc 23 & 24 Preliminary OOS developed with them? If so, we should identify this in Inc 23 & 24 Specific Gr&C.**

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Gr&C: 3.16.6.1 Exercise Scheduling (Inc 19 & 20)

- 2 hours 30 minutes of exercise will be scheduled for each crewmember 7 days a week. The exercise equipment includes Resistance Exercise Device (RED) in Node 1, Treadmill Vibration Isolation and Stabilization (TVIS) in the Service Module, Cycle Egrometer with Vibration Isolation System (CEVIS) in the U.S. Lab, and Russian bicycle ergrometer (VELO) and Russian force loader (HC1) in the Service Module.
- Exercise time may be scheduled as two exercise periods, one for 1 hour 30 minutes and one for 1 hour, or scheduled as a single 2 hour 30 minute block depending on individual crewmember preference.
- *Rationale: Work activities should not interfere with scheduled crew exercise periods. To ensure the health and safety of the crew, a dedicated time will be allotted on a daily basis for crew exercise, the scheduled time of 2 hours 30 minutes should include hardware setup, crew cool-down, hygiene, stow and cleanup.*
- The following exceptions to this rule are limited to no more than two (2) consecutive days:
- (Update): If an activity is required that necessitates the participation of three or more crew and/or causes the available time to schedule exercise to be less than 6 hours (Flight Rules, etc), then it is acceptable to exceptionally waive exercise or existing exercise constraints pending concurrence from Crew Surgeon in consultation with the IMG and the affected crewmember.
- *Rationale: Time lining six crewmembers each 2 hours 30 minutes of exercise in a workday of 8 hours 30 minutes leaves very few opportunities where more than two crewmembers are available for more than 2 hours. It is understood that in order to meet mission objectives there are activities like Emergency Drills and Soyuz Decent Training that require multiple crewmember participation. It is in these cases where approval from the Crew Surgeon in consultation with the IMG and the affected crewmember can allow the waiver of exercise or existing exercise constraints in order to meet these mission objectives*
- *The ISS medical community is in agreement that in order to protect crew health, under contingency scenarios, all Countermeasure capabilities will be shared equally among all ISS crews for durations in accordance with GGR&C 4.3.1.41 and flight rule B13-113. For ARED, this assumes that the required pre-flight training has been successfully completed.*

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#2: Inc 23 & 24 Specific Gr&C:

3.1 Aeromed/Crew Health

3.1.1 Invasive Procedure Constraint (Current – Blood Draw Only)

- **The scheduling or initiation of Invasive Life Science or Medical Procedures on ISS crew members shall be constrained during the following ISS activities:**
- **Blood Draw Events: During any blood draw activity on a crew member, there shall be a waive off after two unsuccessful attempts to draw blood and the lead ISS flight surgeon shall be consulted as to the next available time for a repeat blood draw.**
- **Rationale: *Pending***

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#2: Inc 23 & 24 Specific Gr&C (cont):

3.1 Aeromed/Crew Health

3.1.1 Invasive Procedure Constraint (Past Agreement)

1. The scheduling or initiation of Invasive Life Science or Medical Procedures on ISS crew members shall be constrained during the following ISS activities:

   a) EVA: Invasive life science or medical procedures shall not be scheduled nor initiated on EVA crew or IVA crew support for EVA inside of two weeks prior to any scheduled EVA, but this constraint can be reduced to 10 days for low risk blood draws per lead ISS flight surgeon approval

   b) Docking Event: Invasive life science or medical procedures shall not be scheduled or initiated for all ISS crew members within 2 hours of any ISS vehicle docking/undocking event.

   c) **Blood Draw Events: During any blood draw activity on a crew member, there shall be a waive off after two unsuccessful attempts to draw blood and the lead ISS flight surgeon shall be consulted as to the next available time for a repeat blood draw.**

2. Invasive procedures include the following: blood collection (**arterial - high risk**, venous **- low risk** or fingerstick), catheter insertion, injection of tracers, antigens, or other substances, and any similar procedure involving skin / mucous membrane, contact or puncture.

3. A medical procedure during this time may be considered as indicated in event of a contingency or for medical/life sciences as approved and supervised by the lead ISS Flight surgeon or his/her designee.

Rationale:

- **EVA: The EVA constraint update is required due to a previous Expedition situation in which numerous invasive procedures were performed on a crewmember up to the current baselined Gr&C 1-week constraint prior to an EVA. The human body requires more time to recover after injury while in space and numerous invasive procedures performed prior to an EVA can impact crew performance during an EVA or on IVA crew support. Placing a 2-week constraint on invasive procedures allows for more time for a crew member to heal prior to an EVA.**
- **Docking Event: There is also a similar need to constrain Invasive Procedures during vehicle docking events as there is a potential risk of injury to the crewmember. Previous mission experience has shown that large vehicle movements affect medical procedures. Execution of an invasive medical operation performed during large vehicle movements has been shown to have potential deleterious affects on the crewmember. While thruster firings are no longer a concern for station movement due to station size and use of CMGs, docking is still a major concern. Constraints regarding contingency thruster firing can be found in ISS Flight Rules B13-151.**

- Source: ISS Flight Surgeon (SD/Dave Alexander) and SK/Clarence Sams

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Forward Work:

- **Inc 23 & 24 Specific Gr&C :**
  - Determine if Update needed for "Invasive Procedure Constraint" and possible addition of "Exercise Excursion".
- **GGR&C "Mission Termination" Update** - MMOP Approved Modification with CR Pending
  - No change to 30 day or 60 day CMS Hardware repair clock, but cleans up medical requirement for Mission Termination.
  - Details on hardware removed and referenced in ISS Flight Rule B13-113
- **GGR&C "Vehicle Traffic Spacing Considerations for Sleep Shift"** – Med Ops & CB draft is under review with Circadian Subgroup of the Spaceflight Behavioral Health and Performance Working Group
- **GGR&C "Crew Day/Week"** – Currently only the 6.5 hrs work day listed in the GGR&C.
  - Med Ops has proposed update to reflect entire MORD crew day. Intense back-n-forth review with ISS Program. Basic ISS concern is violation of crew day during real-time replanning and paper work to track those deviations.
  - To resolve ISS & Med Ops concerns, there may be a need to update Gr&C to have a requirement that crew time balance over one week and time off over one month.

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Crew Day Compo-sition	Nominal ISS crew day	Returning crew during the 2 weeks before dock	Returning crew day after dock	New crew day during first 2 days on ISS	New crew day after 2 days on ISS	New crew day after 4 days on ISS	New crew day for 2 weeks after undock	Visiting crew during first 2 days on ISS	Visiting crew after 2 days on ISS
Exercise period	2.5 h	2.5 h	2.0 h	2.5 adaptation		1.0 h	2.5 h	2.5 adaptation	
Available work hours assembly, systems, inventory and utilization ops	6.5 h	5.5 h 1.0 h prep for return	7.0 h	6.5 h	8.0h 1.0 h adaptation	8.0 h	5.5 h 1.0 h adaptation	6.5 h	9.0 h

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