National Aeronautics and Space Administration

International Coordination

Briefing to
NASA Advisory Council
Research Subcommittee

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NASA Headquarters

International Cooperation: Overview

- International Cooperation is a cornerstone principle of NASA's activities and **has been** part of NASA since its inception
  - Directed by the National Aeronautics and Space Act of 1958

- Goal of the 2010 National Space Policy: Expand international cooperation on mutually beneficial space activities to:
  - broaden and extend the benefits of space
  - further the peaceful use of space
  - enhance collection and partnership in sharing of space-derived information

International Cooperation: NASA Guidelines

- NASA international partners are generally government agencies
  - Due to the significant level of investment and legal requirements

- Each Partner funds its respective contributions
  - ‘No exchange of funds”
  - Contributions need not be equivalent

- Cooperation must be consistent with U.S. foreign policy objectives

- Projects/Partnerships:
  - Must have scientific and technical merit
  - Must demonstrate a specific benefit to NASA, support Mission Directorate activities
  - Are structured to protect against unwarranted technology transfer
  - Are structured to establish clearly defined managerial and technical interfaces to minimize complexity

International Cooperation: Engagement Mechanisms

- There are a variety of engagement mechanisms for international collaboration, depending on the collaboration envisioned:
  - Bilateral or Multilateral Working Groups (e.g. International Space Life Science Working Group, International Microgravity Strategic Planning Group)
  - Nonbinding Multilateral Expert Forums
  - Foreign Co-PI or Co-I can participate with NASA/US PI
  - Bilateral or Multilateral Cooperative Activities
  - Education and Outreach
  - Conferences and workshops

International Research Coordination: Summary

Why International Coordination?

- Benefits from leveraging partner funding and capabilities
  - Allows access to more researchers from more countries
  - Fosters cooperative research objectives between partners
  - Allows complementary research to be performed in multiple facilities
  - Facilitates wide distribution of research data
  - Avoids duplication of facilities/capabilities in the severely limited volume of the ISS
  - Reduces crew training & operations planning by re-using existing facilities/capabilities
  - Reduces overall cost of research and maximizes the facility return on investment

How

- Through International Working Groups (Multi-lateral, Bilateral)
  - Charters to define scope of working group activities
- Agreements from Bilateral Meetings
  - Used to define and implement flight projects

When

- Multi-lateral Working Groups meet once or twice a year
  - Ideally, these are held in conjunction with International research meeting
- Bilateral meetings can be held around multi-lateral meetings or scheduled between agencies

International Research Coordination

- **International Space Life Sciences Working Group (ISLSWG)**
  - NASA, ESA, JAXA, CSA, DLR, CNES, ASI
  - International Life Science Research Announcement
- **International Microgravity Strategic Planning Group (IMSPG)**
  - ASI, CSA, CNES, DLR, ESA, NASA, JAXA, Roscosmos
  - Physical Sciences
- **US/Russian Joint Working Group (JWG) on Space Biomedical and Biological Sciences**
  - Joint sub-groups: (i) Biomedical (ii) Crew Health and Medical Support (iii) Biological Sciences
- **Multilateral Human Research Panel for Exploration (MHRPE)**
  - CSA, ESA, JAXA, NASA, Roscosmos
  - ISS exploration fly-off plan for multilateral biomedical research
  - Focused on ISS One-year mission

International Space Life Sciences Working Group (ISLSWG)

International Space Life Sciences Working Group (ISLSWG)

- **Established in 1991 - Partners include Canadian, European, French, German, Italian, Japanese and U.S. Space Agencies**
  - Works to bring agencies together to provide more complete coordination of international development and use of spaceflight and special ground research facilities.
  - Identifies agencies' mutual interests and programmatic compatibilities, enhances communication, and encourages a unified effort among and between space life sciences communities around the world.
- **Shared hardware on ISS**
  - Goods and services including astronaut time bartered based on agency investment
- **International Life Sciences Research Announcements (ILSRA) 7 since 1996**
  - Process for joint recruitment, peer review and selection of scientific projects in life sciences
  - Each agency releases its own solicitation, with coordinated reviews and joint selections, and shared ISS hardware list
- **International Research Area Workshops to strengthen space research**
  - review international research progress in each research area
  - define the critical questions for future research, and
  - determine the relative importance of these questions

http://www.nasa.gov/directorates/heo/slpsra/islswg.html

Examples of International Partner Shared ISS Hardware

Hardware Available to Support Human Subject Research	Agency	Website
		http://www.esa.int/Our_Activities/Human_Spaceflight/Human_Spaceflight_Research/Pulmonary_Function_System_PFS
Portable Pulmonary Function System	ESA	http://www.esa.int/Our_Activities/Human_Spaceflight/Human_Spaceflight_Research/Pulmonary_Function_System_PFS
ECG Holter Monitor	NASA/ JAXA/ESA	http://www.nasa.gov/mission_pages/station/research/experiments/614.html http://kibo.jaxa.jp/en/experiment/jpm/holter/holter.pdf http://www.cnes.fr/web/CNES-fr/8783-cnes.php
JAXA Onboard Diagnostic Kit	JAXA	http://www.nasa.gov/mission_pages/station/research/experiments/643.html
Ultrasound 2 Doppler	NASA	http://www.nasa.gov/mission_pages/station/research/experiments/749.html
Thermolab	ESA	http://esa.spaceflight.esa.int/portal/exp/?id=9338
SKIN B H/W Kit	DLR	http://esa.spaceflight.esa.int/portal/exp/?id=9392
Space Linear Acceleration Mass Measurement Device	NASA	http://www.nasa.gov/mission_pages/station/research/experiments/640.html
Sample Collection and Stowage		
Human Sample Collection Kits	NASA	TBD
Refrigerated* Centrifuge *refrigeration function is failed	NASA	http://www.nasa.gov/mission_pages/station/research/experiments/639.html
Exercise		
Cycle Ergometer	NASA	http://www.nasa.gov/mission_pages/station/research/experiments/641.html
Treadmill	NASA	http://www.nasa.gov/mission_pages/station/research/experiments/765.html
Advanced Resistive Exercise Device	NASA	http://www.nasa.gov/mission_pages/station/research/experiments/1001.html
Muscle Strength, Torque, and Joint Angle		
Muscle Atrophy Research and Exercise System	NASA/ESA	http://www.nasa.gov/mission_pages/station/research/experiments/652.html http://www.esa.int/Our_Activities/Human_Spaceflight/Human_Spaceflight_Research/Muscle_Atrophy_Research_Exercise_System_MARES http://www.cnes.fr/web/CNES-fr/8783-cnes.php
Percutaneous Electrical Muscle Stimulator	NASA/ESA	http://www.esa.int/Our_Activities/Human_Spaceflight/Human_Spaceflight_Research/Percutaneous_Electrical_Muscle_Stimulator_PEMS
Hand Grip/Pinch Force Dynamometer	NASA/ESA	http://www.esa.int/Our_Activities/Human_Spaceflight/Human_Spaceflight_Research/Hand_grip
Activity Monitoring		
Actiwatch	NASA	http://www.nasa.gov/mission_pages/station/research/experiments/658.html
Armband monitoring	ESA	http://www.cnes.fr/web/CNES-fr/8914-energy.php

Hardware Available to Support Biology & Exobiology Research	Agency	Website
Biology		
KUBIK	ESA	http://www.esa.int/Our_Activities/Human_Spaceflight/Human_Spaceflight_Research/Kubik
EMCS	ESA	http://www.esa.int/Our_Activities/Human_Spaceflight/Human_Spaceflight_Research/European_Modular_Cultivation_System_EMCS
BIOLAB	ESA	http://www.esa.int/Our_Activities/Human_Spaceflight/Human_Spaceflight_Research/Biolab
CBEF	JAXA	http://kibo.jaxa.jp/en/experiment/jpm/cbef/
AQH	JAXA	http://kibo.jaxa.jp/en/experiment/jpm/aqh/
BRIC- PDFU	NASA	http://www.nasa.gov/mission_pages/station/research/experiments/708.html
VEGGIE	NASA	http://www.nasa.gov/mission_pages/station/research/experiments/Veggie.html
Lada-2	NASA	http://www.nasa.gov/missions/science/f_lada.html
Rodent Research Habitat	NASA	Under Development
Bone Densitometer	NASA	http://www.technbot.com/documents/BD.pdf
CGBA	NASA	http://www.nasa.gov/mission_pages/station/research/experiments/CGBA.html
BIOS	NASA	http://spacebiosciences.arc.nasa.gov/mission/bioculture-system-spacex-5
NanoLabs	NASA	http://nanoracks.com/products/nanolabs
NanoRacks facilities	NASA	http://nanoracks.com/
Advanced Plant Habitat	NASA	Under Development
Fruit Fly Lab	NASA	http://spacebiosciences.arc.nasa.gov/mission/fruit-fly-lab-ff-01-spacex-5
Microbial Cryogenic Canister Assemblies	NASA	http://spacebiosciences.arc.nasa.gov/microbial-cryogenic-canister-assemblies
JAXA microbiology kit	JAXA	
EC	NASA	http://spacebiosciences.arc.nasa.gov/plant-growth-experiment-unique-containers-ec-european-modular-cultivation-system-emcs
PDS	NASA	http://spacebiosciences.arc.nasa.gov/passive-dosimeter-system-pds
Exobiology		
EXPOSE	ESA	http://www.esa.int/Our_Activities/Human_S

International Life Sciences Research Announcement (ILSRA) History

	1996	1998	1999	2001	2004	2009	2014
ASI	0	0	0	0	0	24(7)	26
CNES	14(3)	13(2)	12(1)	3(0)	13(3)	12(6)	14
CSA	19(2)	11(3)	9(1)	3(1)	8(3)	7(4)	11
DLR	27(5)	14(4)	12(3)	12(2)	21(8)	33(14)	44
ESA	42(5)	19(7)	15(1)	24(6)	37(5)	34(12)	28
NASA	47(9)	56(13)	45(10)	52(11)	61(12)	11(6)	58
JAXA	0	41(4)	24(1)	15(6)	7(5)	21(5)	23
NSAU	0	0	0	12(0)	4(1)	1(0)	0
TOTAL	149(24)	144(33)	117(17)	121(26)	151(37)	143(60)	204

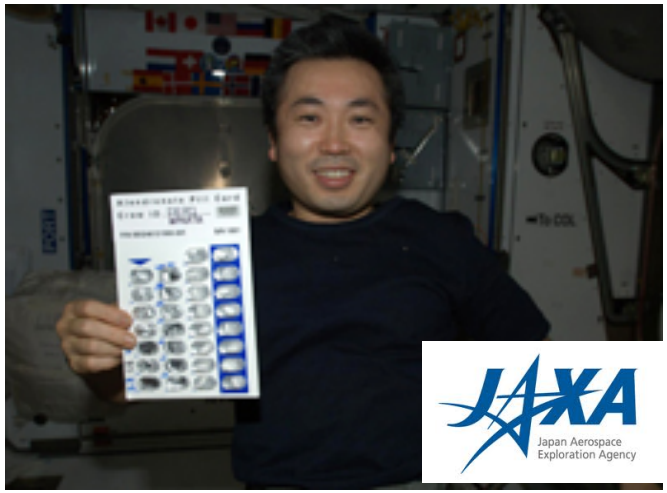
Total Proposals Reviewed (Proposals selected)

Completed/Proposed ISLSWG Discipline Workshops – Status as of September 12, 2014

	WORKSHOP TITLE	ISLSWG HOST	DATE	LOCATION	PUBLICATION
1	Int WS on Cardiovascular Space	NASA	09/12-14/1995	Dallas	Med & Science in Sports & Exercise 1996, V28(S10)
2	Plant Biology in Space	DARA/DLR	06/24-27/1996	Bad Honnef	Planta, Vol. 203, Supppl (1997)
3	Muscle Research in Space	ESA	10/13-16/1996	Bern	Intl. Journal of Sports Medicine, Vol. 18, Suppl. 4 (1997)
4	Int WS on Bone Research in Space	NASDA/ JAXA	11/11-13/1996	Tokyo	Bone, Vol. 22, No. 5 (1998)
5	Space Neuroscience Research	CNES	04/22-24/1997	Paris	Brain Research Reviews, Vol 28 (1998)
6	Fundamental & Molecular Mechanisms of Mutagenesis	CSA	11/23-26/1997	Banff	Mutation Research, Volume 430, No. 2 (1999)
7	Cellular & Molecular Biology Research in Space	ESA	??	??	FASEB Journal, Vol. 13 Suppl. (1999)
8	Integrative Physiology in Space	DLR	09/06-09/1998	Bad Honnef	European J. Physiology (2000)
9	International Workshop on Human Factors in Space	NASDA/ JAXA	07/07-09/1999	Tokyo	Aviation, Space, and Environmental Med. (2000)
10	Developmental Biology	NASA(?)			http://www.fundamentalbiology.arc.nasa.gov/ISLSWG_index.html (2000)
11	Microbial Ecology and the Space Environment	JAXA	11/??-??/2002	Japan	Microbial Ecology, (Nov '02) Nov 2003
12	ESA-ISLSWG Arabidopsis Workshop	ESA	07/01-02/2003	ESTEC	exploration.nasa.gov/documents/reports/arabidopsis_workshop_07-2003.pdf
13	New Directions in Behav Health: Integrating Research & Application	NASA	12/02/03/2003	Davis	Aviat, Space, Environm Med., (May '02) Spring 2003
14	Bone Research	CSA	5/30-6/1/2006	Toronto	Pending
15	Space Microbiology	JAXA	9/19-21/2007	Tokyo	
16	Cardiovascular Workshop	CNES/DLR	10/30-31/2008	Strasbourg	Respir Physiol Neurobiol. 2009 Apr 18
17	Microbiology	NASA/ JAXA	08/2009	Sonoma	TBD
18	Behavior & Performance	ESA	12/07-08/2009	ESTEC	TBD
19	Analogues and Simulations	ESA	12/1/2009	ESTEC/Noordwijk	Human Behaviour and Performance
20	Plant Biology in Space	DLR/CNES	08/01-03/2012	Freiborg	Plant Biology Special Issue: Plant Biology in Space 2014;16 Suppl 1 http://onlinelibrary.wiley.com/doi/10.1111/plb.2013.16.issue-s1/issuetoc
21	Space Microbiology (in planning)	NASA/ JAXA	5/30/2015	New Orleans (Annual ASM mtg)	TBD

ISS Research – *International Research Collaborations*

CSA Cardiovascular
Function Experiment



JAXA Bone Loss
Countermeasure Experiment

Russian Fluid Shift
Countermeasure Experiment

ESA Muscle
Physiology Facility

HRP ISS Investigations: International Collaborations

- **NASA/HRP provides overall coordination support for all ISS research requiring use of crewmembers as subjects:**
  - ISS Medical Projects (ISSMP) team chairs the International Human Research Complement Working Group (IHRCWG)
  - Coordinates/schedules Informed Consent Briefings
  - Coordinates/schedules pre- and post-flight Baseline Data Collection

- **HRP/International Partner Hardware Sharing for Increments 39/40-Increments 41/42:**
  - NeuroMapping/NASA – use of ESA Gamepad
  - Energy/ESA – use of NASA Pulmonary Function System
  - Airway Monitoring/ESA – use of NASA Puff Calibration Syringe
  - BP Reg/CSA – use of NASA Pulmonary Function System and Continuous Blood Pressure Device
  - Biological Rhythms 48/JAXA – use of NASA Actiwatch Reader
  - Bone/Muscle Check/ NASA/ASI – use of NASA urine and saliva sample supplies
  - Drain Brain/ NASA/ASI – use of NASA Ultrasound 2 and Pulmonary Function System

HRP ISS Investigations: International Collaborations

- **HRP/International Partner Collaborative Research (ongoing and future):**
  - Bisphosphonates – joint NASA/JAXA investigation that is ongoing
  - Straight Ahead – ESA study with NASA funded Co-I that is planned for future Increments
  - MoCISS – ESA study with NASA funded Co-I that is planned for future Increments. This study is also requesting to use the NASA Centrifuge.
  - ARED Kinematics – ESA study with NASA funded Co-I that is planned for future Increments.
  - Field Test – joint NASA/Russian study planned to start with the one year mission (Inc. 43/44)
  - Fluid Shifts – joint NASA/Russian study planned to start with the one year mission (Inc. 43/44). This study will utilize the ESA HLTA device as well as the Russian Chibis.
  - Other HRP one year mission studies are matched with Russian investigations for data sharing or cross-participation.

ISLSWG Coordination of Analog Capabilities

Bedrest Studies

- 33 studies identified by elements (HHC, BHP)
- In discussions with DLR/ESA

- **Long-duration Isolation Studies**
  - 29 studies identified by elements (BHP, HHC)
  - Developing plans/options.

- **Parabolic Flight Testing**
  - 20 studies identified by elements (ExMC, HHC, SHFH)
  - Developing plans/options.

Astronauts and Outreach-
NASA's Mission X: Train Like An Astronaut fitness challenge built off the natural admiration toward astronauts to challenge young students to get in shape and eat right. In partnership with the White House's Let's Move Initiative, over 20 countries and thousands of students focused on addressing the urgent issue of childhood obesity while getting students excited about space, exploration, and a healthy lifestyle.

US-Russian Joint Working Group

US-Russian Joint Working Group

Joint Working Group (JWG) on Space Biology and Medicine has been active for almost 40 years

- In 1970, NASA invited the Soviets to conduct a joint docking experiment in space, Apollo-Soyuz Test Project
  - Agreement was between US/NASA and USSR Academy of Sciences in January 21, 1971
  - Established 5 working groups, one of which was US/USSR Joint Working Group (JWG) on Space Biology and Medicine.
  - Initial agreement endorsed by the Agreement on Space Research Cooperation between the US and the USSR and signed by US President and Soviet Primer in Moscow on May 24, 1972.

- When the Soviet Union ceased to exist in December 1991, the JWG became the US/Russian JWG
  - Agreement Between the US and the Russian Federation Concerning Cooperation in the Exploration and Use of Outer Space for Peaceful Purposes signed by Russian and U.S. Presidents on June 17, 1992, and in the Summary of Discussions Pertaining to Cooperation in Space Exploration, July 1992.

US-Russian Joint Working Group

US/Russian JWG Relationship Has Evolved Across Four Major Programs

- Apollo-Soyuz Test Project (signed May 24, 1972)
  - Established JWG on Space Biology and Medicine focused on sharing knowledge on biomedical issues related to human space-flight.
- Russian Free-flyer research collaborations in space biological and biomedical science
  - 1974 to present including Biocosmos, Bion, Foton platforms
- Shuttle–Mir Program (1992, US/Russian Agreement on Space Cooperation)
  - Exchange of crews aboard the Russian Mir and the US Space Shuttle
  - Cooperation in medicine, biology and safety of human spaceflight activities.
- International Space Station
  - Full partnership in ISS development, including module construction, launch and landing, common docking, operational support and joint research

US-Russian Joint Working Group

- **In November 2006, the JWG under a new charter modified its title to the US/ Russian JWG on Space Biomedical and Biological Sciences Research with three joint sub-groups**
  - (i) Biomedical (ii) Crew Health and Medical Support (iii) Biological Sciences
- **Primary goal is to continue planning and developing strategies for cooperation, organization, coordination of research and development**
  - JWG reviews and plans initiatives in the research areas of space biomedical research, space biological sciences, and crew health and medical support.
  - Joint research activities are conducted on ISS, Russian Free-flyers (Biosatellites), and in ground-based analogues (i.e., bed rest studies)
- **US/Russian JWG meets once a year**
  - Sub-groups meet at least once a year
- **Implementation of Joint US/Russian space biology and medicine research**
  - NASA Biomedical & Biological Science Programs work with State Scientific Center of the Russian Federation – Institute for Bio-Medical Problems (IMBP)
  - IMBP reports to Russian Academy of Science and works closely with Roscosmos (Russian Space Agency)

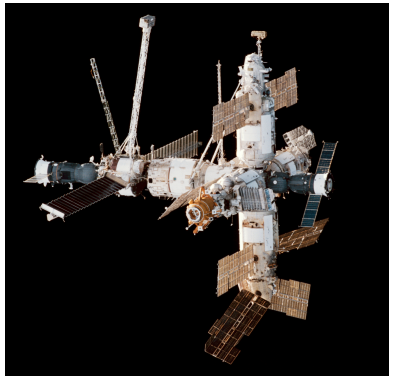
US-Russian Collaborations

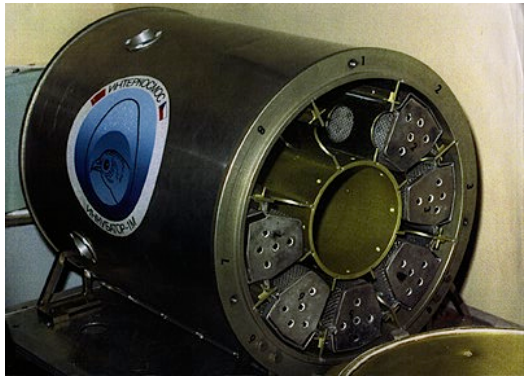
- Joint Publication of Space Biology and Medicine , a 5 volume series (by American Institute of Aeronautics and Astronautics) on
  - 1. Space and its Exploration
  - 2) Life Support and Habitability in two parts,
  - 3) Humans in Spaceflight,
  - 4) Crew Health, Performance, and Safety, and
  - 5) US and Russian Cooperation in Space Biology and Medicine (2009).
  - The series is written in both English and Russian
  - One of two collections from research under the JWG: The Foundations of Space Biology and Medicine, was published in 1975 in three volumes.

- Scholarly publications both in peer-reviewed literature and in books. The bibliography of scholarly publications constitutes a significant summary of human spaceflight.

U.S. and Russian Space Biology Cooperation

- 40-yr history facilitated by the **U.S./Russian Joint Working Group For Biomedicine and Space Biology Research**
- **Space Biology Cooperation** on Cosmos-782, 936, 1129, 1514, 1667, 1887, 2044, 2229, and Bion 11 (approx. every 2 years) 1975-1997
- SLS-1 and SLS-2 Spacelab 1991-1993
- Quail Reproduction and Plant Research on MIR 1990-1999; Lada Plant Research on ISS 2000-2004
- Foton-M3 and Foton-M3 2005 and 2007; Bion-M1 2013
- Enables leveraging of resources and crew time sharing for research





Recent Space Biology U.S./Russian Bion-M1 Mission

- **19 April 2013 – 18 May 2013 Launched from Baikonur, Kazakhstan**
- **Cooperation for rodent research while U.S. capability for long duration rodent research was still under development**
- **Male mice, all Shuttle studies are based on female mice studies**
- **Specimens: Mice, gerbils, geckos, snails, fish, plants, microbes**

- U.S. Science Program:
- U.S. side received mouse tissues to meet their primary science goals – 45 mice total launched on the mission
- U.S. side will also receive video recordings of Mongolian gerbils for analysis of in flight behavior
- U.S. involvement limited to post flight sample collection and video analysis

Isolation Analogs for Long-duration Spaceflight

Exploration missions will present crews with challenging new stressors:

- Very long exposures to isolated, confined, extreme (ICE) environments
- Long periods of delayed or absent ground communication
- Prolonged separation from family, friends, and Earth
- Limited habitable volumes and sensory stimulation
- Reduced opportunities for meaningful work and motivation
- Persistently altered day/night cycles and varying reduced gravity environments

As mission duration increases, the probability of a behavioral or psychiatric emergencies also increases.

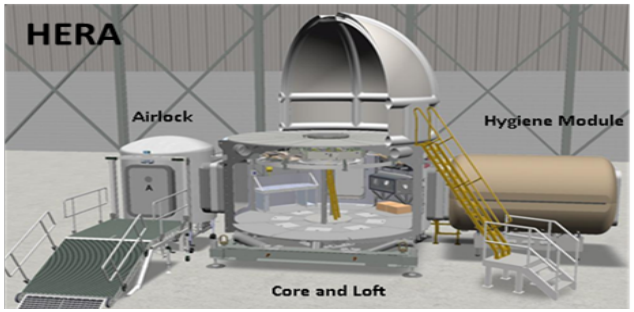
Sufficient numbers of subjects (n) will not available aboard ISS to answer all questions related to ICE risks during exploration missions.

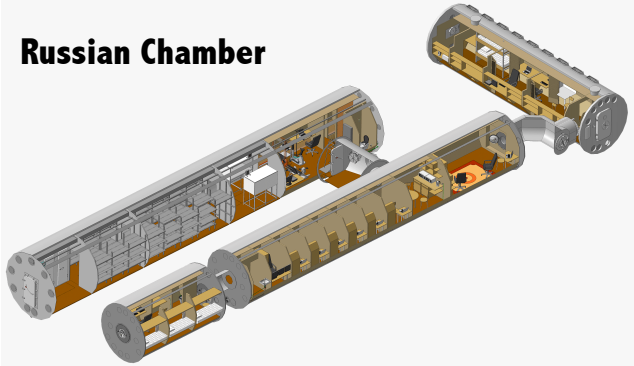
Isolation analogs are therefore required to:

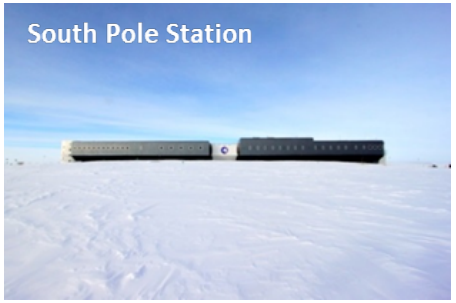
- Quantify risk,
- Test and evaluate monitoring, countermeasure, and treatment strategies
- Inform standards for exploration missions.

US/Russian Isolation Analogs Utilization

	Sleep Stages	CO2	Duration & Risk Characterization	NHV: CMS & Behavioral Assessments	Selection & Composition	Autonomous Ops	Cross- Cultural	Psychological Fidelity
HERA	√			√	√	√	√	
Russian Chamber	√	√	√	√	√	√	√	
Antarctica	√		√	Limited	Limited	Limited	√	√

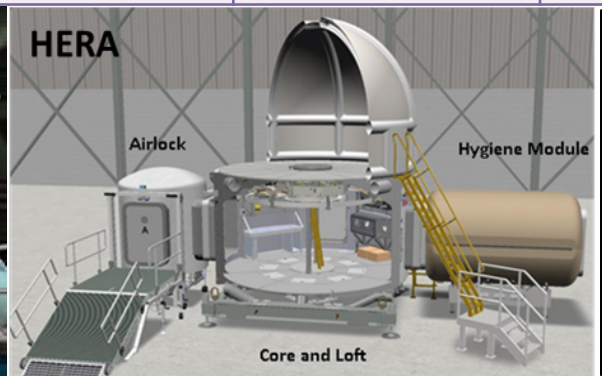


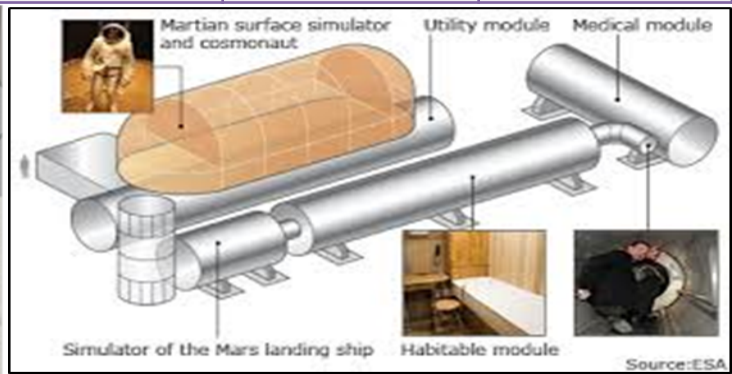




US/Russian Isolation Analogs Utilization

	Benefit	FY15	FY16	FY17	FY18
HERA	•Increase of N for validation of measures/ countermeasures •Increase of N for Team Research (each crew is N=1 for Team).	5-6 missions 14 days each	5 missions 1 mo. each	4 missions 2 mo. each	4 missions 2 mo. each
Russian Chamber	•Increased mission durations for key B-Med issues (isolation, confinement, duration, altered photoperiod, team dynamics)		1 mission at 4 mo.	1 mission at 6-8 mo.	1 mission at 12 mo.





Multilateral Human Research Panel for Exploration

Multilateral Human Research Panel for Exploration

- Problem: Limitations on future ISS-based human research
  - Growing appreciation of finite ISS end-of-availability 2024
  - Limited number of subjects (Astronauts)

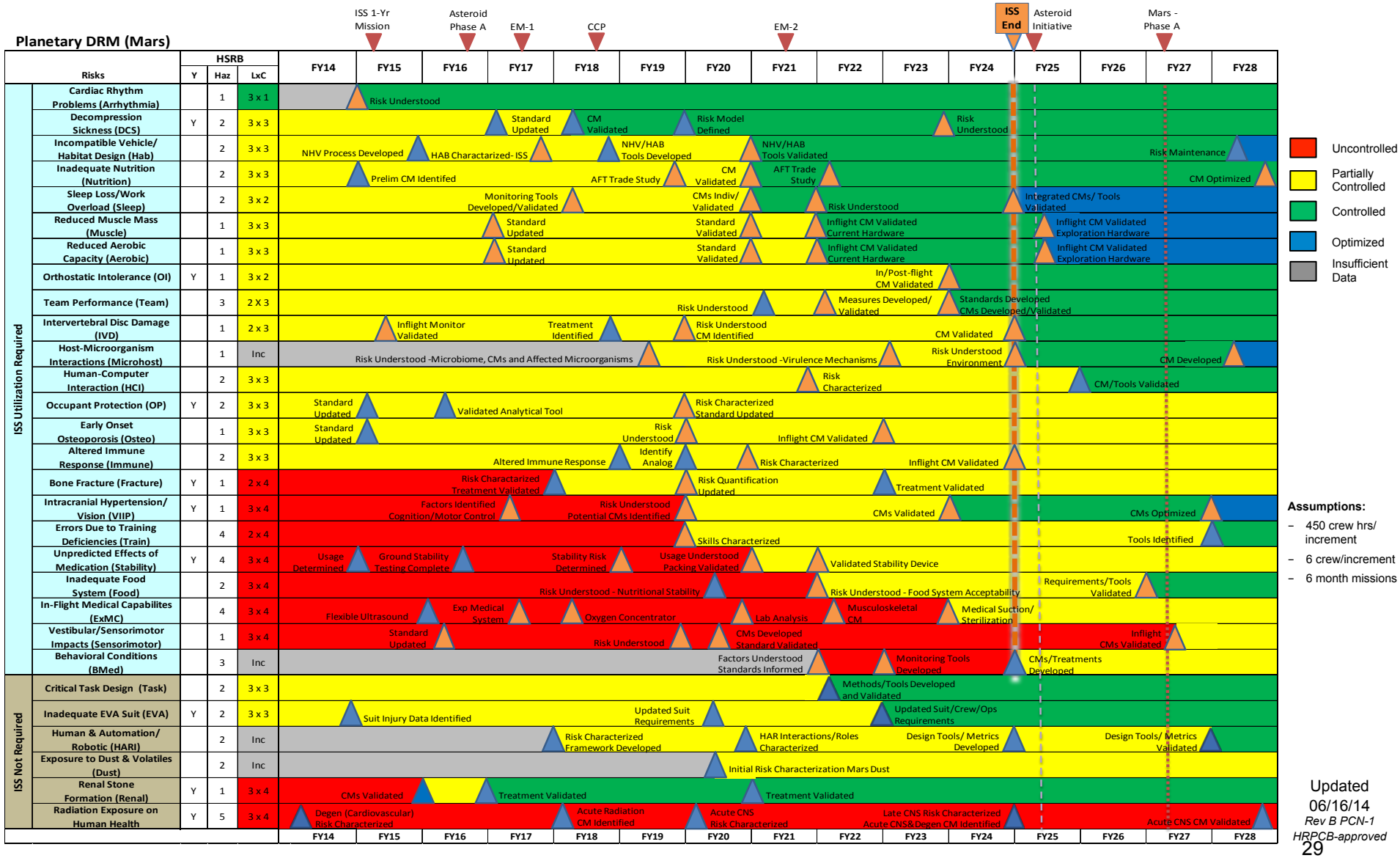
- Programmatic expectation that ISS R&D will deliver validated “Mars-ready” capabilities (countermeasure knowledge and technology) for astronaut safety, health and performance

- Chartered by Space Station Control Board, Oct. 2013
  - CSA, ESA, JAXA, NASA, Roscosmos
  - Monthly teleconferences, Semi-annual meetings, On-going interactions

- Focus: ISS Human Research For Risk Reduction Of Human Exploration Health And Performance Risks
  - Human Research Path to Risk Reduction
  - One-year Mission Research Plan

Human Research Program

Integrated Path to Risk Reduction, Revision B PCN-1 (2014)



Human System Risk Board (HSRB) Hazards: 1. Altered Gravity; 2. Hostile/Closed Environment; 3. Isolation; 4. Distance; 5. Radiation

Y - HSRB Approved

Multilateral Human Research Panel for Exploration

- All remaining ISS increments
  - Starting with One Year Mission

- Facilitates access to more resources than national programs, bilateral
  - Formulates multilateral in-flight collaborations
  - Provides recommended human research flight complement to ISS

- Provides guidance via approved high-level documents, processes
  - General agreements between international partners performing exploration risk-reduction human research on ISS
    - Hardware Sharing
    - Data Sharing/Management
    - Subject Sharing

MHRPE facilitation of multilateral in-flight investigations

MHRPE integrates national research activities across all partner space agencies

ESA	Roscosmos IBMP	NASA HRP
Immuno-2	Neyroimmunitet	Integrated Immune Salivary Markers Biochemical Profile CardiOx
EDOS	Korrektsia	Hip QCT Sprint

ESA	NASA HRP	Roscosmos IBMP
Energy	Fluid Shifts	Morze

JAXA	NASA HRP	Roscosmos IBMP
IPVI	Ocular Health	MedB 1.10
Biological Rhythms – 48 Hours	Sleep Monitoring	Pilot-T

One-Year Mission: Minimizing Mars Mission Health Risks

ISS

- Key to mitigating mars mission health risks, including spaceflight-induced intracranial hypertension/vision alteration
- Test-bed to validate technology needed for a Mars medical system

One-Year Mission

- Extended duration improves outcome projections for Mars missions
  - The longest mission ever assigned to a US astronaut
- Starts to address key question
  - "How confidently can we extrapolate our current ISS experience to a mission to Mars?"
- Leverages joint US/Russian research assets on health risks

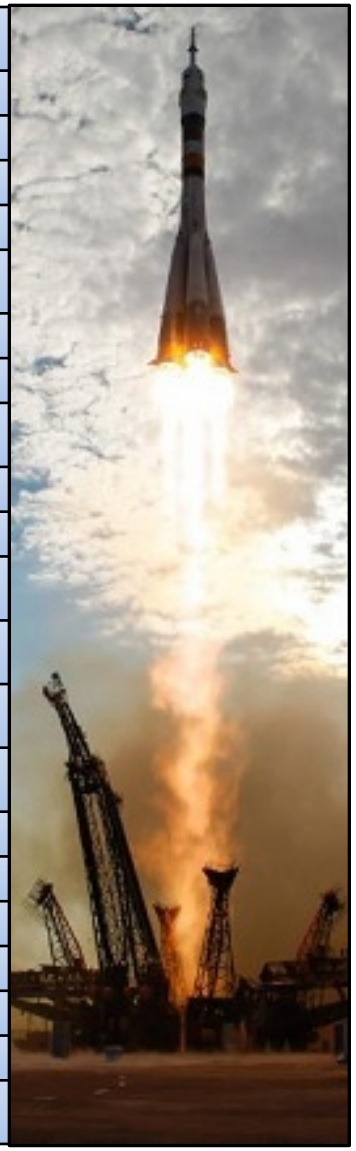
Scott Kelly
STS-103, STS-118, ISS 25/26

Mikhail Kornienko ISS 23/24

2015 One-Year Mission Biomedical Science Plan

Investigations	NASA	Roscosmos	JAXA	ESA	CSA
Functional	• Field Test • Functional Task Test				
Behavioral Health	• Cognition • Neuromapping • Sleep Monitoring • Journals • Reaction Self Test	• Pilot-T • Interactions-2 • Content	• Biological Rhythms (48 Hours)		
Visual Impairment	• Fluid Shifts • Ocular Health (MedB1.10)		• IPVI	• Energy	
Metabolism	• Biochemical Profile • CardiOx • Integrated Immune • Salivary Markers	• Morze • Neyroimmunitet		• Immuno-2	
Physical Performance	• Sprint • Hip QCT	• Korrektsia • Motokard • Profilaktika-2		• EDOS	• T-Bone
Microbial	• Microbiome		• Myco		
Human Factors	• Fine Motor Control • Habitability • Training Retention	(Russian crewmember participation only)			

JAXA, ESA, CSA: data sharing only. NASA, Roscosmos also include common (formerly “joint”) and cross-participation.

MHRPE Pre-flight Milestones for 1YM

2012	30 Nov.	L-28	✓	NASA and IBMP exchange lists of candidate investigations
2013	February	L-25	✓	Joint US / Russian human research program science complement to be identified
			✓	NASA investigators tasked to develop modified and new proposals
	March	L-24	✓	International Partner solicitation, selection
			✓	New NASA HRP proposals scientific peer review start
	June	L-21	✓	NASA IRB approves new and modified NASA investigation proposals
	August	L-19	✓	New NASA HRP investigations selected for flight
			✓	Crewmembers informed consent briefing #1
	September	L-18	✓	New NASA HRP proposals NASA IRB review completed
	November	L-16	✓	NASA HRP baseline of mission research complement
			✓	ISS Partner IRBs approve Partner investigations
	December	L-15	✓	NASA IRB approval of investigation modifications (submitted 3 weeks previously)
2014	January	L-14	✓	Crewmembers informed consent briefing #2
	February	L-13	✓	ISS Partners IRB mission complement approval
	early April	L-11	✓	NASA IRB mission complement approval (submitted 3 weeks previously)
	April	L-11	✓	HRMRB mission complement approval (submitted 3 weeks previously)
			✓	Present final proposed set of investigations to crewmembers
	June	L-9	✓	Crewmembers consent; begin crewmember training and baseline data collection
		L-9	✓	ISS Increment Research Team baseline of mission complement (ISSP milestone)
	November	L-4		Final Test Readiness Review complete (prior to training or data collection)
	…	…		*Further bilateral, multilateral milestones to be determined*
2015	30 Mar.	L-0		42S Soyuz launch, start of Expedition 43-44-45-46