SSP 50260
Revision B

International Space Station Medical Operations Requirements Documents (ISS MORD)

International Space Station Program

Revision B

May 2003

National Aeronautics and Space Administration
International Space Station Program
Johnson Space Center
Houston, Texas

REVISION AND HISTORY PAGE

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	(Revision B was handled as an administrative revision in order to remove the DCN bars and date headers. The document date corresponds to Revision B, but the signatures from Revision A were retained. No technical content was altered as a result of this revision.)	

INTERNATIONAL SPACE STATION PROGRAM

INTERNATIONAL SPACE STATION MEDICAL OPERATIONS REQUIREMENTS DOCUMENT (ISS MORD)

CHANGE SHEET

May 6, 2003

Revision B

Space Station Control Board Directive No. 007768/(1-1), dated 04-19-03. (1)

CHANGE INSTRUCTIONS

SSP 50260, International Space Station Medical Operations Requirements Document (ISS MORD), has been approved by the authority of SSCD 007768. All future updates to this document will be identified on this change sheet.

INTERNATIONAL SPACE STATION PROGRAM

INTERNATIONAL SPACE STATION MEDICAL OPERATIONS REQUIREMENTS DOCUMENT (ISS MORD)

Revision B (Reference SSCD 007768, dated 04-19-03)

LIST OF EFFECTIVE PAGES

May 6, 2003

The current status of all pages in this document is as shown below:

Page	Change No.	SSCD No.	Date
i - xvi	Revision B	007768	April 19, 2003
1-1 - 1-5	Revision B	007768	April 19, 2003
2-1 - 2-4	Revision B	007768	April 19, 2003
3-1 - 3-7	Revision B	007768	April 19, 2003
4-1 - 4-8	Revision B	007768	April 19, 2003
5-1 - 5-23	Revision B	007768	April 19, 2003
6-1 - 6-9	Revision B	007768	April 19, 2003
7-1 - 7-4	Revision B	007768	April 19, 2003
8-1 - 8-4	Revision B	007768	April 19, 2003
A-1 - A-4	Revision B	007768	April 19, 2003
B-1 - B-2	Revision B	007768	April 19, 2003
C-1 - C-3	Revision B	007768	April 19, 2003

SSP 50260
Revision B

INTERNATIONAL SPACE STATION PROGRAM

INTERNATIONAL SPACE STATION MEDICAL OPERATIONS REQUIREMENTS DOCUMENT (ISS MORD)

MAY 2003

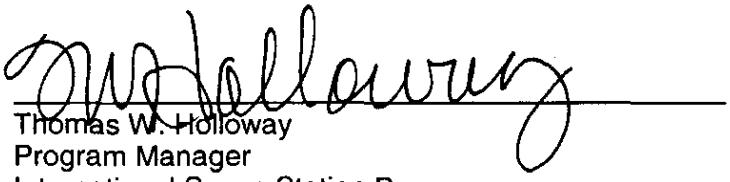
PREFACE

INTERNATIONAL SPACE STATION MEDICAL OPERATIONS REQUIREMENTS DOCUMENT (ISS MORD)

Efficient management of the International Space Station Program (ISSP) dictates that effective controls for Program activities be established. Requirements, directives, procedures, interface agreements, and information regarding system capabilities will be documented, baselined, and subsequently controlled by the proper management level.

The requirements necessary to perform medical operations applicable to the ISSP are defined and controlled herein. This document delineates the medical operations requirements for all phases of ground, flight, and payload/experiment-related activities. These requirements are in accordance with responsibilities assigned by applicable NASA Policy Directives (NPDs), Code of Federal Regulations (CFRs), ISSP office charters, and Memoranda of Understanding (MOU).

The contents of this document are intended to be consistent with the tasks and products to be prepared by Program Participants. This International Space Station Medical Operations Requirements document (ISS MORD), will be specific to the ISSP office. Control of this document is delegated to the Multilateral Medical Operations Panel (MMOP) with coordination through the Multilateral Medical Policy Board (MMPB) and concurrence by the Space and Life Science Directorate (SLSD), Flight Crew Operations, Mission Operations, and ISSP directors.



Thomas W. Holloway
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INTERNATIONAL SPACE STATION PROGRAM

INTERNATIONAL SPACE STATION MEDICAL OPERATIONS REQUIREMENTS DOCUMENT (ISS MORD)

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MAY 2003

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INTERNATIONAL SPACE STATION PROGRAM

INTERNATIONAL SPACE STATION MEDICAL OPERATIONS REQUIREMENTS DOCUMENT (ISS MORD)

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MULTILATERAL MEDICAL OPERATIONS PANEL APPROVAL NOTICE

INTERNATIONAL SPACE STATION PROGRAM

INTERNATIONAL SPACE STATION MEDICAL OPERATIONS REQUIREMENTS DOCUMENT (ISS MORD)

MAY 2003

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INTERNATIONAL SPACE STATION PROGRAM

INTERNATIONAL SPACE STATION MEDICAL OPERATIONS REQUIREMENTS DOCUMENT (ISS MORD)

CONCURRENCE

MAY 2003

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INTERNATIONAL SPACE STATION MEDICAL OPERATIONS REQUIREMENTS DOCUMENT (ISS MORD)

CONCURRENCE

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INTERNATIONAL SPACE STATION MEDICAL OPERATIONS REQUIREMENTS DOCUMENT (ISS MORD)

CONCURRENCE

MAY 2003

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INTERNATIONAL SPACE STATION PROGRAM

INTERNATIONAL SPACE STATION MEDICAL OPERATIONS REQUIREMENTS DOCUMENT (ISS MORD)

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MAY 2003

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INTERNATIONAL SPACE STATION PROGRAM

INTERNATIONAL SPACE STATION
MEDICAL OPERATIONS REQUIREMENTS DOCUMENT (ISS MORD)

LIST OF CHANGES

MAY 2003

All changes to paragraphs, tables, and figures in this document are shown below:

SSCB	Entry Date	Change	Paragraph(s)
	September 1998	Baseline	All
	January 2001	Revision A	All
	July 2002	DCN 001	
	October 2002	DCN 002	
	October 2002	DCN 003	
	December 2002	DCN 004	
	May 2003	Revision B	All

TABLE OF CONTENTS

APPENDIX

TABLE

FIGURE

1.0 INTRODUCTION

The International Space Station (ISS) will be a platform requiring continuous human occupancy on long duration spaceflight missions. Ensuring overall health and safety of the crew to optimize human performance throughout all mission phases is the joint responsibility of the medical support offices of each International Partner (IP) contributing crewmembers to the ISS. Requirements will be developed and concurred upon for formal input into the International Space Station Program (ISSP) office by a multilateral medical management structure, which will have input to the ISSP based at the National Aeronautics and Space Administration (NASA) Johnson Space Center (JSC).

1.1 PURPOSE

The purpose of this document is to establish requirements for the ISSP relating to Medical Operations in accordance with the responsibilities assigned by applicable NASA Policy Directives (NPDs), Code of Federal Regulations (CFRs), ISSP office charters, and international Memoranda Of Understanding (MOUs). These requirements shall pertain to the operational implementation of medical selection and certification standards, countermeasures development and implementation, medical monitoring, response capability for in-flight medical events, support of individual and crew behavioral health and performance, environmental monitoring, Emergency Medical Services (EMS) support, and post-flight activities and rehabilitation.

1.2 SCOPE

This document delineates the Medical Operations requirements for all phases of ground, flight, and payload/experiment-related activities.

The requirements in JSC 26882, Spaceflight Health Requirements Document, are levied on individual NASA programs via separate requirements documents. This document, SSP 50260, International Space Station Medical Operations Requirements Document (ISS MORD) will be specific to the ISSP. Subordinate documents to the ISS MORD will outline specific implementations, such as the JSC 24834, Astronaut Medical Evaluations Requirements Document, JSC 27050, Post-flight Rehabilitation Plan, JSC 48522, International Space Station Medical Checklist, SSP50470, Crew Health Care System (CHeCS) Government Furnished Equipment (GFE) Hardware Specification, SSP 50480 Joint Medical Operations Implementation Plan, and others, including selected International Partner analog documents relating to ISS operations. Similarly, ISS MORD requirements are implemented at NASA sites via site-specific Medical Operations Support Implementation Plans (MOSIPs) and on International Partner sites via specific implementation plans as appropriate. The ISS MORD and its subordinate documents contain references to SSP 50005, International Space Station Flight Crew Integration Standard, as well as SSP 41000, System Specifications for the International Space Station, which contain standards and guidelines governing implementation of medical and habitability requirements. Module-specific specifications and standards for the Russian Segment of the ISS are in SSP 50094, NASA/RSA Joint

Specifications Standards Document for the ISSA Russian Segment, and SSP 41163, Russian Segment Specification. Actual procedures and details of the processes for operational medical support of ISS are described in the SSP 50480, ISS Joint Medical Operations Implementation Plan (JMOIP).

1.3 PRECEDENCE

The Program level medical operations requirements for the ISSP office are contained herein. This document has been developed in compliance with the specification documents, therefore any deviations from the specifications is possible only as a result of analysis of specific scenarios. In the event of conflicting statements regarding medical operations between this document and SSP 50261-01, 02 Generic Groundrules and Constraints, Volumes 1 and 2 or the SSP 54101 series, Increment Definition and Requirements Documents, the requirements in SSP 50261-01, 02 and SSP 54101 series shall take precedence.

1.4 AUTHORITY

The specific provision of medical services is authorized by NPD 8900.1, Medical Operations Responsibilities for Manned Space Flight Programs; NPD8900.3, Astronaut Medical and Dental Observation, Study, and Care Program; NPD1800.2, NASA Occupational Health Program; JSCI 1830.1, Medical Examination of Flight Control Team Members; and SSP 50200-01, Station Program Implementation Plan, Volume 1: Station Program Management Plan; and the International MOUs pertaining to ISS.

1.4.1 REVISIONS

Updates and refinements to operational medical requirements will arise during the early ISS years and will drive a need for periodic reviews. The Multilateral Medical Operations Panel (MMOP) will coordinate reviews of the ISS MORD, initiating changes as needed. Reviews will be conducted by the MMOP annually for the first five years of ISS operations and as needed thereafter. This shall occur in conjunction with JSC 24834, Astronaut Medical Evaluations Requirements Document (AMERD) reviews by the same groups following the same time requirements. Changes to the ISS MORD will be authorized by the MMOP and coordinated with the Multilateral Medical Policy Board (MMPB), with concurrence by the Director, Space and Life Sciences Directorate (SLSD); Director, Flight Crew Operations; Director, Mission Operations; and Manager, Space Station Program Office.

1.4.2 MEDICAL AUTHORITY STRUCTURE

The multilateral medical management groups are established by the MOU's between NASA of the United States of America, the Canadian Space Agency (CSA), the European Space Agency (ESA), the Russian Space Agency (RSA), the Government of Japan Concerning Cooperation On The Civil International Space Station, and by the charters developed for the MMOP, MSMB, and MMPB. In general, active participation of medical representatives on ISS mission increments will be reflective of crew

representation on that increment. However, all IPs will have insight and inputs into activities affecting overall Medical Operations policies and procedures for the ISS.

A. Multilateral Medical Policy Board

The MMPB will be responsible for top-level medical policy and oversight. Each IP will endorse a single medical representative as a member of the MMPB. Selected products of subordinate medical working groups will be submitted to the MMPB for approval. During the ISS Assembly Phase, the MMPB will be co-chaired by the NASA and RSA representatives. Following Assembly Complete, chairpersonship will rotate among the MMPB members on an annual basis. The MMPB also receives findings and recommendations from the MMOP.

B. Multilateral Space Medicine Board

The Multilateral Space Medicine Board (MSMB) has the responsibility for crew medical certification for ISS mission increment training and flight. An IP designated physician from each IP will comprise MSMB membership, which will operate on the principle of consensus. A prime member and an alternate will be endorsed by each IP for MSMB participation. Ad hoc, non-voting consultative members may be added as required for the purposes of specialty consultation. During the ISS Assembly Phase, the MSMB will be co-chaired by a NASA and an RSA representative. Following Assembly Complete, chairpersonship will rotate among the MSMB members on an annual basis. Results of IPs' independent medical boards will be presented to the MSMB. The MSMB also receives findings and recommendations from the MMOP. Decisions and findings are forwarded to the MMPB and to the Multilateral Crew Operations Panel (MCOP) as appropriate. The MSMB will also ensure mission assigned flight surgeons endorsed/selected by the MMOP have completed established credentialing standards. Following any action which alters crew eligibility for flight or training activities, the MSMB may function autonomously for a period of six months in efforts to resolve crewmember flight or training status. After six months, the MSMB must report this action to the MMPB.

C. Multilateral Medical Operations Panel

The MMOP develops common medical standards, certification criteria, medical care requirements, preventive medicine guidelines, operational countermeasures, medical hardware responsibilities, environmental monitoring requirements, and operational procedures. In addition, the MMOP will develop training certification guidelines for ISS credentialed flight surgeons and endorse mission-assigned flight surgeons to the MSMB who will ensure they meet the training certification guidelines established by the MMOP. MMOP membership consists of medical representatives from all IPs. The MMOP coordinates specialty subgroups as appropriate and assigns working level action items on ISS biomedical issues. The MMOP presents its findings and recommendations to the MMPB and MSMB as required and interfaces with the ISSP office through the Multilateral Operations and Utilization Control Board. The MMOP operates on the principle of consensus. During the ISS Assembly Phase, the MMOP will be co-chaired by the NASA and RSA

representatives. It will be the responsibility of the MMOP to coordinate approved operational medical requirements and inputs from the various groups and bring these forward to the Multilateral Operations and Utilization Control Board in compliance with standard formats and procedures. Following Assembly Complete, chairpersonship will rotate among the MMOP members on an annual basis.

An MMOP Implementation Team will function under the auspices of the MMOP. The Implementation Team is based at JSC and works within the Medical Operations Branch (MOB) to implement and integrate MMOP approved requirements and input into medically relevant protocols and procedures, training and logistics flows, timeline inputs, and mission planning and support. The Implementation Team is also tasked with answering questions relevant to medical operations based on MMOP and ISSP office approved policy, providing a mechanism for timely resolution of medical operations issues on a routine basis. The Chair is designated by the Chief, MOB.

D. ISS Medical Operations Management Structure

Medical Operations management structure is depicted below in Figure 1.4.2-1. Further explanation of how Medical Operations Management Structure relates to the ISSP office structure can be found in the SSP 50200-01, Station Program Implementation Plan, Volume 1: Station Program Management Plan.

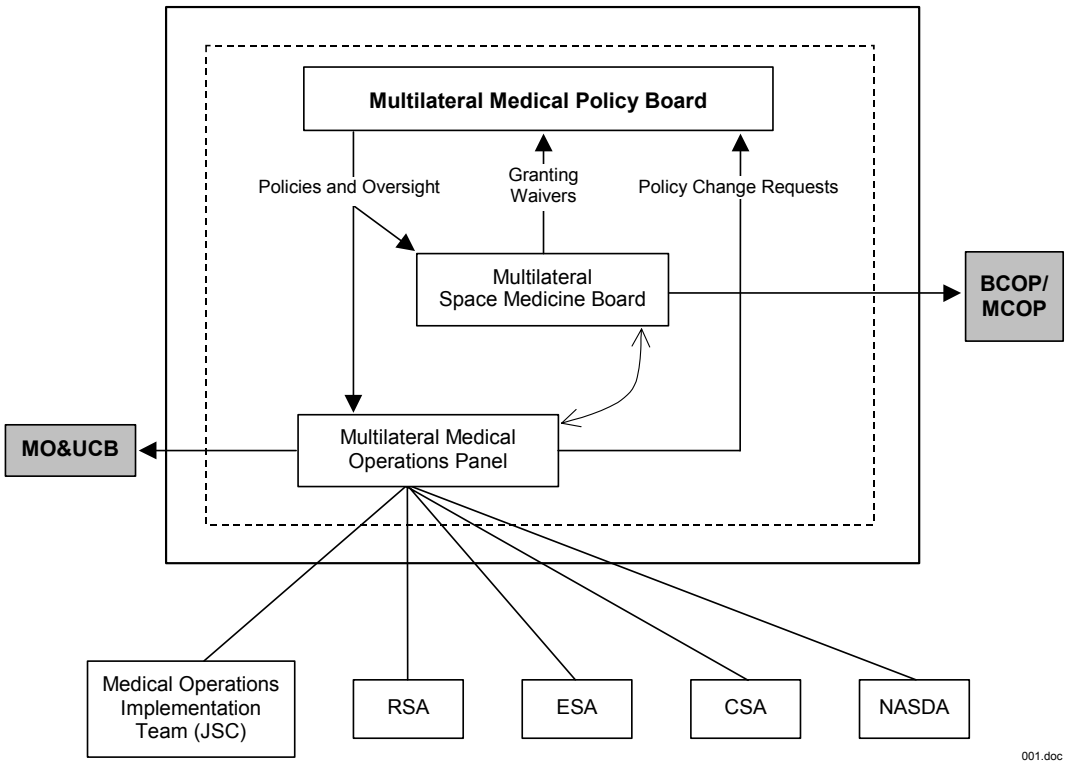

FIGURE 1.4.2-1 ISS MEDICAL OPERATIONS MANAGEMENT STRUCTURE

1.5 APPLICABILITY

Medical Operations requirements baselined in this document are applicable to all ISS and ISS-related flight activities, including those involving Shuttle, Soyuz, and other vehicles which may conduct ISS flight operations.

1.6 PRIVACY OF MEDICAL INFORMATION

Provisions of the Privacy Act of 1974 as regarding control of records, information exchange, and release of crewmember health information to the public shall be strictly followed. International Partners may levy supplemental requirements regarding handling of medical information on their crewmembers. These constraints must be presented to and approved by the MSMB and MMPB prior to the IP's crewmember beginning training. Communications pertaining to an individual's health care shall be private as regulated by the controls, regulations, provisions, and penalties of the Privacy Act of 1974.

1.6.1 HANDLING AND RELEASE OF MEDICAL DATA

Preflight, in-flight, and post-flight operational and research medical data collected on all space flight crewmembers will be managed according to the amended Privacy Act of 1974 and JSCMD 1382.5, Maintaining the Privacy of Biomedical Research Data.

Requests for crewmember health status information from outside the nominal working-level medical support or management chain will be coordinated, per crewmember informed consent and agreement, with the JSC Chief, Medical Operations Branch (MOB), and appropriate representative of International Partner medical management as determined by the MMOP.

Public release of biomedical information or data concerning any flight crewmember shall be made only with the prior approval of the individual in accordance with the provisions of the Privacy Act of 1974 as amended. Release of medical data concerning any flight crewmember shall be prepared following **<TBD 1-4>** process and guidelines.

2.0 DOCUMENTS

2.1 APPLICABLE DOCUMENTS

The following documents include specifications, models, standards, guidelines, handbooks, and other special publications. The current issue of the following documents is identified in the Program Automated Library System (PALS) (http://issa-www.jsc.nasa.gov/cgi-bin/dsql+/ORAP?-h+palshome). The documents listed in this paragraph are applicable to the extent specified herein. Inclusion of applicable documents herein does not in any way supersede the order of precedence identified in Paragraph 1.3 of this document.

SSP 41000	System Specifications for the International Space Station
SSP 50200-01	Station Program Implementation Plan, Volume 1: Station Program Management Plan
SSP 50261-01	ISS Generic Groundrules, Requirements, and Constraints Part 1: Strategic and Tactical Planning
SSP 50261-02	ISS Generic Groundrules and Constraints Part 2: Execute Planning
SSP 54101 (Series)	Increment Definition and Requirements Documents
NSTS 12820	ISS Generic Operational Flight Rules
JSC 13956	Shuttle Medical Operations Requirements Document (MORD)
JSC 20584	Spacecraft Maximum Allowable Concentrations for Airborne Contaminants
JSC 24834	Astronaut Medical Evaluations Requirements Document
JSC 26546	Medical Operations Flight Support Training and Certification Plan
JSCI 1830.1	Medical Examination of Flight Control Team Members
JSCI 8610.1	Space Transportation System Personnel Reliability Program
JSCMD 8610.3	Space Shuttle In-flight Health Care and Reporting Policy
IEEE-C95.1-1991, Rev ANSI C95.1-1982	IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz

NHB 1700.1, Volume 1	NASA Safety Policy and Requirements Document
NHB 8060.1	Flammability, Odor, Offgassing and Compatibility Regulations and Test Procedures for Materials in Environments that Support Combustion
CFR 1214.5	Mission Critical Space Systems Personnel Reliability Program
NPD 8900.1	Medical Operations Responsibilities for Human Space Flight Programs
S683-29521	Prime Item Development Specification for Habitation Element A (HAB A)
SD-T-0251	Space Flight Programs General Specification: Microbiological Specification and Testing Procedures for Foods Which Are Not Thermostabilized
SE-S-0073	Space Shuttle Specification Fluid Procurement and Use Control
No Number	Privacy Act of 1974

2.2 REFERENCE DOCUMENTS

The following documents contain supplemental information to guide the user in the application of this document. These reference documents may or may not be specifically cited within the text of this document.

SSP 41163	Russian Segment Specification
SSP 41172	Qualification and Acceptance Environmental Test Requirements
SSP 42014	Crew Health System (CHeCS) to Lab Interface Control Document
SSP 50005	International Space Station Flight Crew Integration Standard
SSP 50094	NASA/RSA Joint Specifications Standards Document for the ISSA Russian Segment
SSP 50261-02	Generic Groundrules, Requirements, and Constraints, Part 2: Execute Planning

SSP 50470	Crew Health Care System (CHeCS) Government Furnished Equipment (GFE) Hardware Specification
SSP 50480	ISS Joint Medical Operations Implementation Plan
JSC 16299	Medical Operations Support Implementation Plan - White Sands
JSC 18288	Medical Operations Support Implementation Plan - Dryden
JSC 22538	Health Stabilization Program for the Space Shuttle Program
JSC 22944	Medical Operations Support Implementation Plan - Ben Guerir
JSC 22945	Medical Operations Support Implementation Plan - Moron
JSC 22946	Medical Operations Support Implementation Plan - Zaragoza
JSC 22947	Medical Operations Support Implementation Plan - Banjul
JSC 26882	Spaceflight Health Requirements Document
JSC 27050	Post-flight Rehabilitation Plan
JSC 27099	Flight Crew Operations Concept Document
JSC 27404	U.S./Russian Program Emergency Medical System (EMS) Plan
JSC 48522	International Space Station Medical Checklist
JSCMD 1382.5	Maintaining the Privacy of Biomedical Research Data
ANSI Z136.1 - 1986	American National Standard for the Safe Use of Lasers
KBM-PL-1.1	Medical Operations Support Implementation Plan (MOSIP), KSC
NASA-STD-3000	Man-Systems Integration Standards
NPD 1382.17	Privacy Act – Internal NASA Direction in Furtherance of NASA Regulation
NPD 1800.2	NASA Occupational Health Program
NPD 8900.3	Astronaut Medical and Dental Observation, Study, and Care Program

SD-T-0252	General Specification: Microbiological Specification and Testing Procedure for Thermostabilized Food
WG-8/NASA/RSC E/8000	U.S./Russia Phase 1 Program Medical Support Requirements
<TBD 7-2>	ISS Medical Operations Crew Training Guide
<TBD 7-3>	ISS Medical Operations Crew Medical Officer Training Guide
<TBD 7-4>	ISS Medical Operations Environmental Control and Life Support System Training Guide
<TBD 7-5>	ISS Medical Operations On-Orbit Maintenance Training Guide
<TBD 3-2>	ISS Medical Privacy Policy Document
<TBD 4-6>	MMOP approved Rehabilitation Document

3.0 MEDICAL EVALUATION, CERTIFICATION, AND MONITORING

3.1 FLIGHT CREWMEMBER MEDICAL EVALUATIONS AND CERTIFICATION

The AMERD, JSC 24834, as applicable to ISS crewmembers by the MMOP, will provide specific medical evaluation and certification requirements for all ISS flight crewmembers. AMERD requirements residing in Appendix B, Selection, Preflight, and Post-flight Medical Evaluation Requirements, will constitute common, "core" operational medical standards and serve as a basis for crew health certification and monitoring. These requirements will be reviewed by the International Partners through appropriate working groups appointed by the MMOP.

3.2 SELECTION

Each IP endorsing crewmembers to the ISSP will conduct the initial medical screening, testing, and certification required for crewmember selection into the ISSP according to the AMERD, JSC 24834, Appendix B. Alternatively, one IP may arrange with another IP to assist in selection evaluations. International Partners may at their discretion levy supplemental requirements for selection on their crewmembers, so long as the basic standards as outlined in the AMERD are not compromised. Once approved by an IP's medical selection board, crewmembers proposed for ISS mission increments will then be presented to the MSMB by the MSMB member representing that IP. The MSMB may require additional medical information or evaluations to be performed. The MSMB will determine the medical certification of a crewmember and report the certification status to the Bilateral Crew Operations Panel/Multilateral Crew Operations Panel (BCOP/MCOP).

3.3 ANNUAL CERTIFICATION REQUIREMENT

Each IP will be responsible for conducting annual medical certification exams on their crewmembers in training for or assigned to ISS mission increments. Alternatively, one IP may arrange with another IP to assist in annual evaluations. Flight crewmembers assigned to the ISSP will be examined and certified annually according to JSC 24834, AMERD, Appendix B. International Partners may at their discretion levy supplemental requirements for annual certification on their crewmembers, so long as the basic standards as outlined in the AMERD are not compromised. Results of annual certification examinations for crewmembers in training for ISS mission increments will be presented to the MSMB by the MSMB member representing that IP. The MSMB may require additional medical information or evaluations to be performed. The MSMB will determine the medical certification for a crewmember in training for ISS or assigned to ISS and report the certification status to the BCOP/MCOP on an annual basis, or as required if there is a permanent change in certification status.

3.4 OPERATIONAL MEDICAL ASSESSMENT TEST

The MMOP will coordinate collection and documentation of health risk information pertaining to crewmembers during in-flight and ground-based medical evaluations.

From this data, medical risks of space flight will be identified, quantified, and tracked. The information will be used to assist in health risk management by recommending selection and certification standards, medical capabilities for space flight, and research areas.

3.5 PREFLIGHT MEDICAL EVALUATIONS

To evaluate and certify medical fitness for flight, preflight medical evaluations shall be conducted on all flight crewmembers according to the ISS Program specific schedule of examination. The scope of these examinations is outlined in the AMERD, JSC 24834, Appendix B. Near-flight exams (Launch - 10 days or less) may be conducted at JSC or Kennedy Space Center (KSC) for United States launches, or at the Gagarin Cosmonaut Training Center or Baikonur Launch Complex for Russian launches. Other preflight evaluations may be performed at any of the above sites or other MSMB-approved IP medical facilities.

Examinations will be coordinated and performed by mission-assigned flight surgeons and specialists designated by IPs on their respective crewmembers assigned to a given flight increment. Host country facilities will be made available to accommodate these examinations. Alternatively, one IP may arrange with another IP to assist in preflight evaluations. International Partners may at their discretion levy supplemental requirements for preflight medical evaluation on their crewmembers, so long as the basic standards as outlined in the AMERD are not compromised. Findings of each IP's preflight medical evaluation shall be presented to the MSMB by the MSMB member representing that IP. The MSMB may require additional medical information. The MSMB will have final responsibility for crewmember preflight medical certification, and will report its findings to the BCOP/MCOP.

3.6 IN-FLIGHT MEDICAL EVALUATIONS

Periodic in-flight medical evaluations will include crew conferences with ground specialists, in-flight examinations by designated Crew Medical Officers (CMOs), and monitored medical evaluations. The in-flight timeline for crewmember activities is controlled by the Operations Planner (OPS Planner). The OPS Planner will lead the coordination, development, and maintenance of the Integrated Short Term Plan (STP). Constraints for the in-flight timeline for flight crewmember activities are outlined in the Space Station Crew Planning and Scheduling Groundrules and Constraints, subsection of SSP 50261-02, ISS Generic Groundrules and Constraints, Part 2: Execute Planning.. Rules governing real-time medical operations are contained in NSTS 12820, ISS Generic Operational Flight Rules, Volume B, Section 13, Aeromedical.

3.6.1 PRIVATE MEDICAL CONFERENCES

A Private Medical Conference (PMC) may be requested at any time by the Crew Commander, Flight Surgeon (FS), Flight Director (FD) or any crewmember. PMC information shall be handled in accordance with JSCMD 8610.3, Space Shuttle In-flight

Health Care and Reporting Policy. For the ISSP, scheduled PMCs shall be timelined as follows:

A. Daily for the first seven flight days (15 minutes for entire crew)

B. Weekly after the first seven flight days (15 minutes each crewmember)

C. Prior to each Extravehicular Activity (EVA); conducted within 24 hours of EVA suit donning

D. Following each EVA; conducted within 24 hours following EVA suit removal

E. Daily beginning two days prior to entry and on the morning of entry/landing

3.6.1.1 PRIVATE PSYCHOLOGICAL CONFERENCES

Private Psychological Conferences (PPCs) will be scheduled and conducted between ISS crewmembers and representatives of the Psychological Support Group. These will address personal psychological and group dynamics issues as well as crew-ground interactions. Elements of psychological support, such as family conferences, personal letters, e-mail, and personal resupply items will be coordinated in part through these conferences.

A. For the ISS Program, scheduled PPCs shall be timelined as follows:

   1. Every two weeks following launch with a minimum time allotment of 10 minutes per crewmember

   2. Every other session shall occur in conjunction with the Periodic Health Status Evaluation

B. A Private Psychological Conference may be requested at any time by the Crew Commander, Crew Surgeon (CS), FD, or any crewmember.

C. PPCs shall be conducted on two-way private voice or video communication between each individual ISS crewmember and a designee of the crewmember's home agency behavioral health and performance group, preferably in the crewmember's native language.

D. In support of the CS, the PPC will provide one of the key elements of in-flight monitoring and countermeasures to maintain the crewmember's behavioral health and performance, see Section 6.2.6, Behavioral Health and Performance.

3.6.1.2 FIRST DAILY COMMUNICATION

The first daily crew communication shall occur in a semi-private regime, consisting of the Flight Director, Capsule Communicator (CAPCOM) and Flight Surgeon as the only monitoring ground stations. This regime shall be terminated at the discretion of the Flight Director.

3.6.1.3 RETURN OF IN-FLIGHT MEDICAL RECORDS

All crewmembers' medical records, including medical monitoring, fitness evaluation, behavioral health and performance evaluation, biomedical investigation data and medical assessment test data, and contingency medical event data shall be returned to the ground with the crewmember. This applies to hardcopy, computer records, or any other such stored information. This data shall be received by appropriate medical personnel as approved by the MMOP.

3.6.2 PRIVATE MEDICAL CONFERENCE COMMUNICATION

Two-way private voice and video communication shall be provided for PMCs.

3.6.3 PRIVACY OF PRIVATE MEDICAL CONFERENCE INFORMATION

Medical information discussed during PMCs and PPCs will be managed in accordance with the **<TBD 3-2>** ISS Medical Privacy Policy Document accepted by all IPs and based on the provisions of the Privacy Act of 1974 and respective legislation of IP countries. Audio/video medical and psychological conferences shall make use of private communication methods from ISS to the ground control center. International Partners may levy supplemental requirements regarding handling of medical information on their crewmembers.

3.6.4 EXTRAVEHICULAR ACTIVITY MEDICAL REQUIREMENTS

All EVAs shall be preceded by an assessment of medical fitness requiring concurrence by ground medical support personnel. For EVAs occurring on or before flight day 21, preflight medical examinations and routine PMCs will suffice. For EVAs occurring beyond flight day 21, this assessment shall include a review of countermeasure performance and an in-flight medical exam performed by the trained CMO within 48 hours of suit donning. In addition, a brief post-EVA medical assessment shall be performed after each EVA occurring after flight day 21, to be performed within 24 hours of suit doffing. The extent of pre- and post- EVA evaluations is outlined in JSC 24834, AMERD, Appendix C. At the discretion of the flight surgeon, the post-EVA medical evaluation may be substituted for the pre-EVA evaluation of a subsequent near-term EVA.The MOB is responsible for ensuring that proper EVA prebreathe protocol and safety measures are followed as referenced in the Flight Rules. For EVA crewmembers using RSA Orlan EVA suits, the Russian prebreathe protocol will be followed.

3.6.4.1 EXTRAVEHICULAR ACTIVITY MONITORING

The NASA Extravehicular Mobility Unit (EMU) and RSA Orlan EVA suit shall provide monitoring of suit parameters, physiological variables, and external environmental variables.

The "Egress" Medical Support Subgroup specialists at Mission Control Center - Moscow (MCC-M) will provide medical support for ISS EVA in Orlan suits. In case of participation by non-Russian IPs utilizing the Orlan suit, the corresponding IP crew surgeons will

participate in medical support and be accommodated by the Russian “Egress” team. The "Egress" Medical Support Subgroup lead will be responsible for maintaining health and safety during EVA operations.

Medical support for Shuttle-based or ISS EVA using the EMU will be provided by the lead CS and other Mission Control Center - Houston (MCC-H) Medical Operations personnel. In case of participation by IP's crewmembers in EVA utilizing the EMU, one or more of that IP's corresponding CSs and select other EVA support personnel shall be accommodated within the MCC-H medical support infrastructure.

3.6.4.2 BIOMEDICAL DATA AVAILABILITY

EVA biomedical data shall be available to the MCC-H and/or the MCC-M medical group support personnel. For prolonged periods of Loss Of Signal (LOS), EVA biomedical data obtained using the EMU will be recorded and downlinked to MCC/H during subsequent available communication coverage.International FSs shall monitor their respective crewmembers’ biomedical data using onsite resources made available by the MCC controlling the suit used by the crewmember.

3.6.4.3 BIOMEDICAL MONITORING PARAMETERS

EVA biomedical monitoring parameters shall include the following:

A. Oxygen consumption rate (real-time)

B. Electrocardiogram (EKG) and derived heart rate (real-time)

C. Suit pressure (real-time)

D. Suit carbon dioxide partial pressure (real-time)

E. Radiation exposure

F. Body temperature insight (Russian EVA suit)

Procedures governing loss of monitoring capability for specific parameters are covered in the mission flight rules.

3.6.5 NOMINAL HEALTH AND FITNESS EVALUATIONS

In-flight health and fitness evaluations will be performed by a designated CMO in coordination with the mission CS under the auspices of the MOB in the MCC-H and/or the Medical Support Group (MSG) in the MCC-M. These evaluations will be conducted routinely during flight to assess crew health and fitness; validate and adjust countermeasures; predict tolerance for physical challenges, such as EVA and entry/landing; and provide a basis for in-flight medical certification.

The results of the periodic health and fitness evaluations shall be evaluated by the CS(s) and appropriate medical support personnel with analysis/assistance provided by subject experts/consultants as needed (under Privacy Act). The conclusions and

recommendations from the evaluation shall be communicated back to the individual crew member(s) by the CS(s) at the next scheduled PMC. Should the crewmember/CMO have issues and questions arising from the periodic evaluations or should the CS have urgent results to communicate back to the crewmember, an unscheduled PMC may be requested.

A daily crew health status report will be generated for each crewmember consisting of relevant environmental data, countermeasures activity, investigational participation, workload and work rest schedule observance and deviations, and other information pertinent to health and performance. The JSC MOB is responsible for generating this report for flights controlled primarily by the MCC-H; the MCC-M MSG is responsible for generating this report for flights controlled primarily by the MCC-M. The contents of this daily report will be coordinated between JSC MOB and the MCC-M MSG and medical personnel from any other actively participating IP flight control center with crewmembers on-board and jointly concurred upon prior to finalizing. Non medically sensitive summary information will be transferred to the **<TBD 3-1>** Mission Management Team (MMT). A weekly medical management conference will be held to review general biomedical, environmental, exercise, work/rest, and other relevant issues sufficient to adjust crew countermeasures and make habitability recommendations to the ISSP office. Detailed medical information will not be discussed in this forum. Participation in this weekly conference shall be determined by the MSMB for each mission increment.

3.6.5.1 PERIODIC HEALTH STATUS EVALUATION

A health status evaluation shall be conducted on each crewmember every 30 days of flight elapsed time with a window period of plus or minus three days. The extent of this evaluation is outlined in JSC 24834, NASA AMERD, Appendix C. Duration of this exam will be 1 to 1.5 hours per crewmember, following the AMERD schedule. An additional two hours will be timelined for the CMO to monitor, measure, conduct examinations, and process samples as needed. In addition, IPs may levy supplemental in-flight medical evaluation requirements on their own crewmembers so long as JSC 24834 standards are not compromised.

3.6.5.2 PERIODIC FITNESS EVALUATION

In-flight Periodic Fitness Evaluations shall be performed on all crewmembers every 30 days, with a window period of plus or minus three days, staggered by two weeks from the Periodic Health Status Evaluation. The first in-flight Fitness Evaluation will be scheduled approximately two weeks into the flight. This evaluation shall require 70 minutes per crewmember. The extent of the Fitness Evaluation is outlined in JSC 24834, AMERD, Appendix C. In addition, IPs may levy supplemental in-flight fitness evaluation requirements on their own crew.

3.6.5.3 TESTING REQUIREMENT

With regard to daily Countermeasure System (CMS) activity, nominal exercise should not be performed on the day of the 30-day Health Status or Periodic Fitness Evaluations until these evaluations are complete.

3.6.5.4 PRELANDING MEDICAL EVALUATION

A prelanding medical evaluation will be conducted within two weeks of de-orbit/landing for prognosis of landing and post-landing performance to implement appropriate countermeasures. If the periodic medical evaluation is conducted within this time frame, it will suffice for the prelanding medical evaluation.

3.7 POST-FLIGHT MEDICAL EVALUATIONS

Post-flight health monitoring and care shall be provided by the JSC MOB for Shuttle landings and Russian Medical Support Group for Soyuz landings with appropriate international representatives at each site. The immediate post-flight crew examination shall be conducted at the landing site.

3.7.1 EXAM SCHEDULE

The schedule and scope of post-flight examinations is outlined in JSC 24834, AMERD, Appendix B.

3.7.2 DAILY EXAMS

Daily, 15-minute health status checks will be scheduled into the post-landing activities timeline. These exams will be conducted daily for the first week by the designated CS at the beginning of the crew duty day. If needed, additional exams will be determined by the Crew Surgeons' and host country medical support personnel.

3.7.3 REHABILITATION MILESTONES

Travel to the rehabilitation site will occur as soon as possible after landing. The CS will oversee post-flight rehabilitation activities, which will have priority over other post-flight activities. Daily team meetings will be held at the rehabilitation site to assess each crewmember's fitness to proceed in post-flight rehabilitation, science, debriefs, PAO events, and other activities. Appropriate modifications will be recommended to the rehabilitation plan following team meetings. Return-to-flight status and other rehabilitation milestones will follow criteria outlined in JSC 24834, AMERD and JSC 27050, Postflight Rehabilitation Requirements Document.

4.0 MEDICAL INTERVENTION AND CARE

4.1 MEDICAL INTERVENTION AND CARE

Medical intervention and care shall be managed by mission-assigned CSs and coordinated through the medical support group of the lead training center for preflight cases, lead Mission Control Center (MCC) for in-flight cases, and site of post-flight rehabilitation and data collection for post-flight cases. To maintain the behavioral health and performance of the crewmembers, the CS is assisted by a behavioral health and performance group. Crew surgeons act on behalf of medical management and specialists groups, providing a point of contact for coordinated input to the Flight Director on issues concerning crew health and safety.

4.1.1 CREW SURGEON RESPONSIBILITY

For each expedition, a designated lead CS and deputy CS will be identified by the MMOP and certified to training standards developed by the MMOP. The MSMB will review the training and ensure the CS and deputy CS have completed the required training. Each IP represented in a given mission's crew may assign a mission-specific CS if not already represented by the lead or deputy CS to participate in all phases of training, in-flight operations, and post-flight activities. As crewmembers are assigned to missions, the CSs designated to those missions shall be responsible for the flight crewmembers health during preflight, in-flight, and post-flight phases. The lead and deputy CS have the authority and responsibility to intervene in any situation that may be deleterious to the flight crewmembers' health.

4.1.2 CREW SURGEON DUTIES

Duties of the lead and deputy CS include, but are not limited to, participation and oversight of the following:

A. Medical care of crewmembers during all flight phases

B. Medical certification

C. Medically hazardous training events

D. Biomedical baseline data collection

E. Development and implementation of in-flight countermeasures

F. Review of mission payload activities

G. Development of in-flight timeline and scheduling constraints

H. Development of mission-specific aeromedical flight rules

I. Medical support of launch and landing

J. MCC staffing during flight phase

Additional IP flight surgeons assigned to a mission increment will also participate in these activities.

4.1.3 CREW SURGEON TRAINING

CS training will follow guidelines developed by the MMOP and, when complete, CS training will be reviewed by the MSMB to ensure compliance. (CSs operating at JSC will complete training as specified in the JSC 26546, Medical Operations Flight Support Training and Certification Plan: Volume II). Medical training for IP flight surgeons working in a host country will be made available by the host country within a timeframe sufficient to allow one or more IP flight surgeon(s) full participation in mission medical preparation and crew health activities through all flight phases.

4.1.4 BIOMEDICAL FLIGHT CONTROLLER ROLE AND RESPONSIBILITY <TBD- 4-7>

4.2 PREFLIGHT

Preflight medical intervention and care shall be available to all crewmembers. Medical support and contingency medical care shall be the primary responsibility of the country hosting the training activity for that phase.

4.2.1 ACCOMMODATION OF INTERNATIONAL PARTNER CREW SURGEONS

The host country's medical support infrastructure shall accommodate one or more IP flight surgeon(s) from the crewmember's country to follow crew training, respond to medical contingencies, monitor any hazardous activities, and participate in medical evaluations and baseline biomedical data collection.

4.2.2 HAZARDOUS TRAINING AND/OR TESTING FOR CREWMEMBERS

The CS or designee shall monitor flight crewmember training and testing that could be hazardous to flight crewmember health. Medical evaluation following the schedule outlined in JSC 24834 shall suffice to qualify crewmembers for all aspects of hazardous training. Advanced Cardiac Life Support (ACLS) and Advanced Trauma Life Support (ATLS) capabilities will be provided. First response to medical contingencies during hazardous training will utilize host country resources and procedures agreed to by the MSMB. In addition, an identified procedure, approved by the MSMB, will be in place to transport an ill or injured crewmember to a higher level medical care center, if required.

4.2.3 HAZARDOUS TRAINING AND ACTIVITIES FOR NON-CREWMEMBERS

Hazardous training, testing, and development activities of non-increment assigned astronauts, cosmonauts, and support personnel for ISS operations will require appropriate medical certification and monitoring. Activities include but are not limited to winter and water survival training, diving operations, vacuum chamber operations, and centrifuge training. For active astronauts and cosmonauts, standard annual medical certification shall suffice. For other support personnel, the sponsoring country will determine and provide medical certification. The country hosting the activity is

recognized as having overall medical authority and is responsible for providing appropriate medical support and supervision. First response to medical contingencies will utilize host country resources and procedures. The host country will accommodate one or more sponsoring country physicians to monitor such activity and participate in all aspects of medical care of their personnel in the event of medical mishap.

4.3 IN-FLIGHT

In-flight medical (including behavioral health and performance as noted in Section 6.2.6) intervention and care shall be available to all flight crewmembers. In-flight care shall include routine care, first aid, and advanced life support. Primary responsibility for response to in-flight medical events will reside with the mission's lead FCC (host country). The host country's in-flight medical support infrastructure shall accommodate one or more IP flight surgeon(s) from each crewmember's country represented in the ISS crew to actively participate in medical monitoring, countermeasures implementation, periodic medical crew communication, contingency medical response, and all other aspects of crewmember health. The formal interaction between IP flight surgeons and host country medical support systems is outlined in the SSP 50480, JMOIP.

4.3.1 IP ACCESS TO INFLIGHT CREWMEMBER MEDICAL OPERATIONS DATA

IP medical organizations shall have full access to any records and downlinked medical operations data on their respective crewmembers. Remote access shall also be made available by the lead MCC on **<TBD 4-4>** conditions.

4.3.2 TERMINATION OF A FLIGHT FOR MEDICAL REASONS

Early flight termination or crew return may be required for the onset of any condition which adversely affects crew safety or health and performance in accordance with NSTS 12820, ISS Generic Operational Flight Rules, Section 13, Aeromedical Flight Rules. Any flight termination decision related to crew health will be made real-time and will only be considered if acceptable on-orbit treatment is not available. If time critical, the recommendation to terminate a flight on medical grounds may be made by mission assigned FSs.

4.3.3 JOINT ACCESS TO MEDICAL CAPABILITY

All medical equipment and consumables onboard the ISS will be available to all crewmembers for response to medical contingencies. Documentation of all medical items, including hardware, capabilities, indications, operating procedures, and formulary contents, will be available to all in-flight crewmembers and all ground personnel charged with responsibility for medical support.

4.3.3.1 MEDICAL ACCESS TO NON-MEDICAL HARDWARE

All hardware items manifested on ISS, such as those supporting life science experiments or other support and payload hardware, shall be accessible and available

to all crewmembers if clinically useful for support of contingency response to medical events.

4.3.4 MINIMUM LEVEL OF MEDICAL INTERVENTION AND CARE

The minimum level of in-flight medical intervention and care onboard the ISS will include first aid, routine care of minor medical problems, Basic Life Support (BLS), and Advanced Life Support (ALS) for stabilization and transport of a seriously ill or injured crewmember.

4.3.4.1 FIRST AID

The capability to manage minor in-flight trauma shall be provided.

4.3.4.2 ROUTINE MEDICAL CARE

The capability to diagnose and treat anticipated routine medical and dental problems shall be provided.

4.3.4.3 BASIC LIFE SUPPORT

The capability to provide Cardiopulmonary Resuscitation (CPR), basic airway management, and crew immobilization shall be provided.

4.3.4.4 ADVANCED LIFE SUPPORT

ALS capabilities shall include the following:

A. Defibrillation and cardiac monitoring

B. Airway management, suction, and ventilator support

C. Intravenous fluid and medication administration

D. Immobilization and restraint (patient, CMO, equipment)

4.3.4.5 DECOMPRESSION SICKNESS

A plan will be in place to respond to decompression sickness and other decompression related disorders. This will include diagnostic and therapeutic procedures, and will be documented in the JSC 48522, International Space Station Medical Checklist.

4.3.4.6 IN-FLIGHT DIAGNOSTICS

In addition to the physical examination, in-flight diagnostics shall include the following:

A. Blood analysis, including hemoglobin, hematocrit, and select chemistries

B. Urinalysis

C. 12 lead EKG

D. Transcutaneous oximetry

E. Microbiology, including culture and antibiotic susceptibility of potential pathogenic microorganisms

F. Measurement of vital signs, including pulse, blood pressure, and body temperature

G. Medical imaging capabilities, including digital photography of skin and mucosal surfaces

H. Medical imaging capabilities, including real-time 2-Dimensional (2D)-ultrasound imaging

I. Behavioral health and performance assessment

4.3.4.7 MEDICAL RESOURCE NEEDS

Medical intervention and care operations shall utilize ISS power, data, oxygen, refrigeration, and water resources as necessary to support the health and safety of an ill or injured crewmember. Detailed resource requirements for medical intervention and care operations are documented in **<TBD 4-1>** document.

4.3.4.8 MEDICAL HARDWARE CHECKOUT

Onboard medical equipment shall follow a schedule of checkout and maintenance according to **<TBD 4-5>** documents.

4.3.4.9 RESUPPLY REQUIREMENTS

The medical intervention and care supplies shall be resupplied every 90 days or as required to support in-flight medical intervention and care operations. Detailed resupply requirements are specified in **<TBD 4-2>** document.

4.3.4.10 CREW HEALTH CARE SYSTEMS HARDWARE ENVIRONMENTAL REQUIREMENTS

Select medical hardware items and support materials will require specialized storage conditions to optimize shelf life to ensure operability for nominal and contingency operations.

4.3.4.11 CREW HEALTH CARE SYSTEMS HARDWARE TEMPERATURE CONSTRAINTS

Pharmaceuticals and medical equipment shall be stored at temperatures between 15°C and 30°C (59°F and 86°F), unless otherwise specified by Medical Operations.

4.3.4.12 CREW HEALTH CARE SYSTEMS HARDWARE REFRIGERATION REQUIREMENTS

Selected pharmaceuticals, analytical reagents, culture media, and other support items will require refrigeration storage at temperatures between 2°C and 8°C (35°F and 46°F).

4.3.4.13 CREW HEALTH CARE SYSTEMS RACK CONSTRAINTS

Due to the emergency nature of the Crew Health Care Systems (CHeCS) hardware stored in the CHeCS Rack, no equipment shall be deployed over the face of the CHeCS rack, except the emergency equipment itself. Detailed requirements for the CHeCS rack equipment deployed location and time constraints are documented in SSP 42014, Crew Health System (CHeCS) to Lab Interface Control Document, and SSP 50470.

4.3.5 STABILIZATION AND TRANSPORT

Medical intervention and care shall include the capability to stabilize and transport an ill or injured crewmember. For ISS missions, medical return transport shall not exceed 24 hours. Transportation time begins when the crewmember is medically stable and a decision is made to transport and ends at delivery to a Definitive Medical Care Facility (DMCF), defined as a tertiary care hospital with trauma surgery and intensive care capabilities. See Section 8 for EMS requirements.

4.3.5.1 CREW SURGEON PARTICIPATION IN CONTINGENCY RETURN

In the event of a contingency return from ISS for any reason, medical or otherwise, one or more flight surgeon(s) from each crewmember's country or agency will be accommodated in the landing and recovery team, including transport to the landing site, by the host country.

4.3.6 TOXIC EXPOSURE PROTECTION AND TREATMENT

Personal protection and treatment of crewmembers who are exposed to toxic substances shall be included as part of the in-flight medical intervention and care.

4.3.7 CREW BIOMEDICAL MONITORING

Crew biomedical monitoring shall be performed during such activities as monthly exercise evaluations, Lower Body Negative Pressure (LBNP), selected medical tests, EVA, medical contingencies, and other events as determined by the MMOP, MOB and Human Research Multilateral Review Board (HRMRB).

4.3.7.1 BIOMEDICAL MONITORING PARAMETERS

Crew biomedical monitoring may include but is not limited to EKG/pulse rate, respiratory rate, pulse oximetry, and blood pressure. Specific monitoring requirements may be found in the AMERD, JSC 24834.

4.3.7.2 ENTRY MONITORING

During the entry and return phase for Soyuz crewmembers flying missions of 30 days or greater, entry monitoring is performed. This consists of real-time pulse, EKG waveform, and respiratory rate monitored by MCC-M during launch, landing, and other flight phases as determined by the MSG. Entry monitoring is not required for crewmembers returning on the Shuttle.

4.3.8 PRIVATE MEDICAL CONFERENCES

PMCs may be requested at any time during the mission by the FD, Mission Commander or other crewmember, or FS to manage in-flight medical contingencies or any other time when private medical communication is required.

4.3.9 EVALUATION RESULTS

The CS will report results of PMCs to the lead control center's FD; general information only will be reported and focus on impact to mission activities. If no mission impact results from the PMC, the outcome will be reported as such with no further information. Details of PMCs resulting in significant mission impact will be reported to Medical Management personnel determined by the MSMB, and will be strictly held as private medical data. The MSMB will provide coordinated input to the MMT for medical events significantly impacting crew activities or mission fulfillment.

4.4 POST-FLIGHT

4.4.1 REHABILITATION

The MMOP shall task and oversee planning, coordination, and implementation of a post-flight crew rehabilitation program for each mission increment. This plan will follow the guidelines in JSC 27050 or **<TBD 4-6>** MMOP approved document, and shall be approved by the MSMB and MCOP. The post-flight rehabilitation starts with crew egress at landing and includes a guided, phased reconditioning protocol. The individualized rehabilitation program will be specific to mission type, duration, and individual crew factors. The goals of the rehabilitation program are:

A. Ensure health and safety of returning crew

B. Actively assist the crew's return to flight status

C. Actively assist in the return to preflight fitness

4.4.1.1 POST-FLIGHT CARE

Post-flight medical intervention and care, as outlined in JSC 24834, Appendix B and JSC 27050, shall be available to all flight crewmembers, including:

A. Physical examinations

B. Clinical laboratory tests

C. Physical and behavioral re-adaptation (health stabilization)

D. Treatment capabilities

4.4.1.2 CREW SURGEON PARTICIPATION IN POST-FLIGHT ACTIVITIES

Medical support, rehabilitation activities, and contingency medical care shall be the primary responsibility of the country containing the landing operations and hosting the early post-flight activities. For as long as an IP crewmember resides in the host country, the host country's medical support infrastructure shall accommodate one or more IP flight surgeon(s) from the crewmember's country to participate in rehabilitation activities, medical monitoring, contingency medical care, and all other aspects of crewmember health.

4.4.2 HAZARDOUS TRAINING AND/OR TESTING FOR CREWMEMBERS

The CS or designee shall monitor flight crewmember post-flight training, such as rehabilitation activities, and testing, such as post-flight data collection, that could be hazardous to flight crewmember health.

5.0 ENVIRONMENTAL HEALTH

5.1 ENVIRONMENTAL HEALTH

An environment suitable for human habitation shall be provided and maintained within all pressurized elements of the ISS and will meet the requirements of this document for respirable atmosphere, drinking water, surfaces, lighting, noise, vibration, radiation exposure, hygiene, and habitability. The capability for in-flight monitoring of critical environmental health parameters shall be provided by using methods approved by the MMOP, its groups and subgroups.

In addition, measures will be taken during the preflight processing phase to ensure that modules and hardware launched to the ISS will be free of hazardous microbial or toxic contaminants. Monitoring schedules may be amended if experience shows new requirements to be reasonable or required, or on a flight by flight basis.

Modules processed at or launched from NASA-controlled and non-NASA-controlled facilities shall follow a pre-launch process approved by the ISSP office and MMOP to ensure safe crew habitation parameters. Monitoring schedules may be amended if experience shows new requirements to be reasonable or required, or flight by flight.

5.1.1 DATA SHARING OF ENVIRONMENTAL IN-FLIGHT MONITORING ACTIVITIES

A Data Sharing Plan will be established whereby all in-flight environmental monitoring data is actively transmitted to the lead FCC and ground representatives of International Partners who have crewmembers aboard ISS. This data-sharing plan will be developed by the MMOP. All International Partners shall have access to all environmental data generated from ISS monitoring.

5.1.2 DATA SHARING OF ENVIRONMENTAL ARCHIVE-SAMPLES

Archive samples of ISS atmosphere, water, microbiological cultures of surfaces, water, and air, and other samples assessing environmental conditions that are returned for ground-based analysis shall be analyzed by JSC and/or RSA facilities and others as approved by the MMOP. Approval is contingent on an acceptable quality control and assurance program being present at the facility. Exchange of microbial isolates between facilities shall be included. Results shall be actively transmitted to ground representatives of International Partners who have crewmembers aboard ISS. All International Partners shall have access to all environmental data generated from ISS monitoring.

5.2 WATER QUALITY

The NASA/JSC Water Quality Manager is responsible for assuring that water delivered by the U.S. side or recovered onboard the ISS using U.S. hardware meets water quality standards.

The RSA/IBMP Water Quality Manager is responsible for assuring that water delivered by the Russian side or recovered onboard the ISS using Russian hardware meets water quality standards.

Water quality is assessed by ground analysis of water samples that are collected prior to launch during the ground-based water preparation process and by inflight and ground analysis of water samples collected inflight during the water reclamation and consumption process onboard the ISS. Water sample analysis will be performed using hardware belonging to authorized NASA or RSA organizations or others as concurred with the Multilateral Medical Operations Panel (MMOP).

The results of the testing shall be provided directly to the Multilateral Medical Operations Panel (MMOP) and to Russian and U.S. water systems experts, as well as to ground-based representatives (International Partners) for those crews that will be onboard the ISS. All International Partners shall have access to all water quality monitoring data both during the ground-based preparation process and onboard the ISS. If necessary the national space agencies may request water samples from one another for subsequent analysis by their own research organizations.

These data will also be used to confirm that all necessary system procedures have been performed. Onboard water quality will be monitored throughout the ISS vehicle life. In addition, water samples will be collected periodically for ground-based chemical and microbial analyses. In all cases, water quality shall meet the water quality standards specified in Table 5.2-1, Water Quality Requirements for the ISS Russian Segment, and in SSP 41000, Table XXXII, Water Quality Requirements, for the U.S. On-orbit Segment.

5.2.1 WATER QUALITY SPECIFICATIONS

Water intended for crew use and consumption onboard ISS shall meet the standards specified in Table 5.2-1, Water Quality Requirements for the ISS Russian Segment, and in SSP 41000, Table XXXII, Water Quality Requirements, for the U.S. On-orbit Segment.

5.2.2 WATER QUALITY MONITORING REQUIREMENTS

Water quality monitoring shall be performed during ISS preflight and in-flight periods in accordance with the list of parameters presented in Table 5.2-1, Water Quality Requirements for the ISS Russian Segment, and in SSP 41000, Table XXXII, Water Quality Requirements, for the U.S. On-orbit Segment.

5.2.2.1 PREFLIGHT WATER QUALITY MONITORING REQUIREMENTS

During the process of preparing water and water supply systems for flight, the Russian and U.S. sides use national (government) standards, documents, and engineering specifications that regulate this technological process.

Ground-supplied potable water delivered to ISS by the Russian side is certified by RSA/IBMP laboratories on the basis of the documentation used in Russia. In this case, the Russian side uses ГОСТ Р 50804-95 standard “Cosmonaut Environment in a Manned Space Vehicle”, and the engineering specification “Rodnik System Fill Assembly”, ЭН 3218-064 1000-0 ТУ, and engineering specification “Preserved Potable Water”, Хт. 0.045.019 ТУ.

Ground-supplied potable water delivered to ISS by the U.S. side is certified by NASA/JSC laboratories on the basis of the documentation used in the U.S. Potable water loaded on the Shuttle for use on ISS shall meet the minimum requirements specified in SE-S-0073, “Space Shuttle Fluid Procurement and Use Control” and shall be sampled and analyzed at the time of servicing, and 15 days and 3 days before launch.

Russian and U.S. components for ISS water supply systems shall undergo pre-flight testing to verify compliance with design requirements and engineering specifications. U.S. components for ISS water supply systems are monitored by NASA/JSC laboratories, and Russian components by RSA/IBMP laboratories by collecting and analyzing water samples to check compliance with physical, chemical and microbial requirements. Based on the results of these analyses, the side in question then issues a certificate clearing the hardware for use onboard the ISS.

5.2.2.2 IN-FLIGHT WATER QUALITY MONITORING REQUIREMENTS

ISS in-flight water quality monitoring parameters and capabilities shall include, at a minimum, the following:

A. In-flight archival water sample collection from the Russian and U.S. On-orbit Segments for post-flight analysis (chemical and microbial).

B. In-flight assessment of water quality performed by analyzing for the following parameters:

- total organic carbon, total inorganic carbon, total carbon, conductivity, and pH in water samples from the Russian Segment; and

- 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.

C. In-flight microbial analysis of water samples from the Russian and U.S. On-orbit Segments.

In-flight water quality monitoring for the Russian Segment shall be performed with the frequency specified in Table 5.2-2, ISS Russian Segment Water Sampling and Analysis Schedule, and Table 5.2-3, ISS Russian Segment Detailed Water Sampling and Analysis Schedule. In-flight water quality monitoring for the U.S. On-orbit Segment shall be performed with the frequency specified in Table 5.2-4, ISS U.S. On-orbit Segment Water Sampling and Analysis Schedule. Real-time changes to the sampling schedule

and frequency depending upon real-time flight necessities and water systems operability shall be made from recommendations of the team of U.S. and Russian water experts. Inflight analysis shall be performed by the crew and archived sample analysis by the ground-based medical team. The respective NASA/JSC and RSA/IBMP laboratories will analyze the returned (archived) water samples to check their compliance with the chemical and microbial requirements.

5.2.3 WATER DECONTAMINATION REQUIREMENTS

The level of chemical and microbial contaminants present in potable and hygiene water supplied and used onboard ISS shall meet the standards specified in Table 5.2-1, Water Quality Requirements for the ISS Russian Segment, and in SSP 41000, Table XXXII, Water Quality Requirements, for the U.S. On-orbit Segment.

In the event that preflight or in-flight analyses of ISS water samples indicate that minimum water quality requirements are not being met, corrective actions to be taken will be developed by the ISS ECLS Team with the assistance of the team of Russian and US water experts to remove the chemical and microbial contaminants and restore water quality.

5.2.3.1 PREFLIGHT WATER DECONTAMINATION REQUIREMENTS

Capabilities shall be provided for functional checkout and testing of water supply systems during the flight preparation stage.

If preflight water sample analyses indicate that specified water quality limits are being exceeded, then steps shall be taken by the appropriate U.S. or Russian Launch Support Team with the assistance of the team of Russian and US water experts to restore water quality. After such steps have been taken, follow-up samples shall be collected and subsequently analyzed prior to launch, as required, to ensure that the corrective actions were successful.

5.2.3.2 IN-FLIGHT WATER DECONTAMINATION REQUIREMENTS

In-flight water processing and storage systems shall be suitable for water decontamination. If in-flight or ground-based analyses of water samples indicate that water quality limits are being exceeded, then steps shall be taken by the ISS ECLS Team with the assistance of the Water Experts Team to restore water quality. After action has been taken to restore water quality, follow-up samples shall be collected and subsequently analyzed, as required, to ensure that the corrective actions were successful.

TABLE 5.2-1, WATER QUALITY REQUIREMENTS FOR THE ISS RUSSIAN SEGMENT

Water Parameter	Units	Russian Ground-Supplied potable, SVO-ZV	Regenerated Potable, SRV-K	Hygiene	Shuttle-Supplied Potable, CWC	Shuttle-Supplied Technical, CWC
Total Dissolved Solids	mg/L	1000	100, 1000 (1)	1000	4, 1000 (1)	4
Color	degree	20	20	20	20	20
Taste	grade	2	2	N/A	2	2
Odor	grade	2	2	2	2	2
pH	pH units	5.5 - 9.0	5.5 - 9.0	5.5 - 9.0	5.5 - 9.0	5.5 - 9.0
Turbidity	mg/L	1.5	1.5	1.5	1.5	1.5
Total Gas @ 1 atm, 20degC	%	5	5	N/A	5	5
Ammonia (NH_3-N)	mg/L	2	2	10	2	0.2
Arsenic	mg/L	0.01	0.01	N/A	0.01	0.01
Barium	mg/L	1	1	N/A	1	1
Cadmium	mg/L	0.005	0.005	N/A	0.005	0.005
Calcium	mg/L	100	100	N/A	100	0.2
Chloride	mg/L	250	250	350	250	0.3
Chromium	mg/L	0.1	0.1	N/A	0.1	0.1
Copper	mg/L	1	1	N/A	1	1
Fluoride	mg/L	1.5	1.5	N/A	1.5	1
Iodine-total	mg/L	0.05	0.05	N/A	0.05	0.05
Iron	mg/L	0.3	0.3	N/A	0.3	0.3
Lead	mg/L	0.05	0.05	N/A	0.05	0.05
Magnesium	mg/L	50	50	N/A	50	0.05
Manganese	mg/L	0.05	0.05	N/A	0.05	0.05
Mercury	mg/L	0.002	0.002	N/A	0.002	0.002
Nickel	mg/L	0.1	0.1	N/A	0.1	0.1
Nitrate (NO_3-N)	mg/L	10	10	N/A	10	0.1
Selenium	mg/L	0.01	0.01	N/A	0.01	0.01
Silver	mg/L	0.5	0.5	2	0.5	0.5
Sulfate	mg/L	250	250	N/A	250	0.2
Zinc	mg/L	5	5	N/A	5	5
Total Hardness (2)	meq/L	7	7	N/A	7	0.01
Ethylene Glycol	mg/L	N/A	12	N/A	N/A	N/A
Cyanide	mg/L	0.2	0.2	N/A	N/A	N/A
Phenol	mg/L	1	1	N/A	N/A	N/A

Total Organic Carbon [3]	mg/L	20	20	40	20	10
Chemical Oxygen Demand	mg/L	50	100	250	N/A	N/A
Total Bacteria	CFU/mL	100[4]	100[4]	1000	100[4]	100[4]
Coliform Bacteria	CFU/100mL	<1	<1	<1	<1	<1
Virus	PFU/100mL	<1	<1	<1	<1	<1

The table consists of maximum allowable concentrations, with the exception of pH, which is an allowable range.

NOTE:

[1] The 100 and 4 mg/L limits apply to the water before mineralization. Following mineralization this parameter will not exceed 1000 mg/L.

[2] Total hardness is calculated as the sum of Ca and Mg concentrations in meq/L.

[3] This limit does not include the mineral counter-ion, formate (excludes CWC technical water).

[4] If this value is exceeded, consumption of the water will cease. If the count exceeds 1 CFU/mL technical discussions will be held but water consumption will continue.

N/A = not applicable

TABLE 5.2-2, ISS RUSSIAN SEGMENT WATER SAMPLING AND ANALYSIS SCHEDULE

	Samples for TOCA Analysis			Chemical Archive Samples			Samples for WMK Analysis			Micro Archive Samples			SRV-K Condensate		
	SRV-K hot	**SRV-K cold**	**SVO-ZV CWC**	**SRV-K hot**	**SRV-K cold**	**SVO-ZV CWC**	**SRV-K hot**	**SRV-K cold**	**SVO-ZV CWC**	**SRV-K hot**	**SRV-K cold**	**SVO-ZV CWC**	**U.S.H/W**	**Russ. H/W**	
RS Water Supply Systems Start-up (Weeks 0 - 13)	Start-up* + one per 2 weeks	Start-up* Week 6 Week 13	Start-up* Week 6 Week 13	Week 1 Week 4 Week 8 Week 13	Week 13	Week 6 Week 13	Start-up* + one per 2 weeks	Start-up* Week 6 Week 13	Start-up* Week 6 Week 13	Week 13		Week 13	Start-up* Week 13	Start-up* 13	Week
Mature Phase II Operations (Weeks 13 and Beyond)	One per month + after MFU change-outs	One per two months + after MFU change-outs	One per three months	One per month	One per three months	One per six months	One per month + after MFU change-outs	One per two months + after MFU change-outs	One per three months	One per three months	One per six months	One per twelve months	One per MFU change-out	One per MFU change-out	

NOTES:

*Start-up implies the sampling of recycled water at the first opportunity when processed water is

available (approximately 30-days after initial crew arrival).

-Collection times of SRV-K hot samples for TOCA and WMK analyses will be adjusted to provide a sample before MFU changeouts and 2 weeks after changeouts.

-Collection times of microbiological archival samples will be adjusted to minimize the time between collection and recovery of samples on the ground.

-Microbiological and chemical water samples will be collected at the same time from a given port and coordinated with the collection of microbiological and toxicological air samples to the degree possible.

-Real-time changes to the sampling schedule and frequency depending upon real-time flight necessities and water systems operability

Shall be made from recommendations of the team of U.S. and Russian water experts.

TABLE 5.2-3, ISS RUSSIAN SEGMENT DETAILED WATER SAMPLING AND ANALYSIS SCHEDULE

Sample	Samples for TOCA Analysis			Chemical Archive Samples			Samples for WMK Analysis (2)			Micro Archive Samples			SRV-K Condensate	
Collection Date	SRV-K hot	SRV-K cold	SVO-ZV CWC	SRV-K hot	SRV-K cold	SVO-ZV CWC	SRV-K hot	SRV-K cold	SVO-ZV CWC	SRV-K hot	SRV-K cold	SVO-ZV CWC	U.S.H/W	Russ. H/W
SRV-K Initial Production	100mL	100mL	100mL	750mL			125mL	125mL	125mL				X	X
End week 1														
End week 2	100mL						125mL							
End week 3														
End week 4	100mL			750mL			125mL							
End week 5														
End week 6	100mL	100mL	100mL			750mL	125mL	125mL	125mL					
End week 7														
End week 8	100mL			750mL			125mL							
End week 9														
End week 10	100mL						125mL							
End week 11														
End week 12														
End week 13 (1)(a)	100mL	100mL	100mL	750mL	750mL	750mL	125mL	125mL	125mL	1000mL		1000mL	X	X
End week 15 (b)	100mL	100mL					125mL	125mL						
End month 4 (1)	100mL			750mL			125mL				1000mL			
End month 5	100mL			750mL			125mL							
End week 26 (1)(a)	100mL	100mL	100mL	750mL	750mL	750mL	125mL	125mL	125mL	1000mL			X	X
End week 28 (End month 7)(b)	100mL	100mL		750mL			125mL	125mL						
End month 8	100mL			750mL			125mL							
End week 39 (a)	100mL	100mL	100mL	750mL	750ml		125mL	125mL	125mL				X	X
End week 41 (End month 10)(b)(1)	100mL	100mL		750mL			125mL	125mL		1000mL				
End month 11	100mL		100mL	750mL			125mL		125mL					
End week 52 (1)(a)	100mL	100mL	100mL	750mL	750mL	750mL	125mL	125mL	125mL	1000mL		1000mL	X	X
End week 54 (b)	100mL	100mL					125mL	125mL						

(a) To be performed just prior to multifiltration bed changeout, if feasible

(b) To be performed two weeks after multifiltration bed changeout, if feasible

(1) To be scheduled during Shuttle docking with ISS or so as to minimize time between collection and recovery of micro archive samples on the ground

(2) Assuming 1 MCD/sample

*Start-up implies the sampling of recycled water at the first opportunity when processed water is available (approximately 30-days after initial crew arrival).

NOTES:

-Real-time changes to the sampling schedule and frequency depending upon real-time flight necessities and water systems operability shall be made from recommendations of the team of U.S. and Russian water experts, as approved by the MMOP.

-Samples of opportunity will also be collected during contingency operations and close to scheduled return of vehicles to earth. Therefore, the WS&A, WMK, and TOCA Supply Kit will include spares to cover at least 30% more sampling activity than what is shown in this table.

TABLE 5.2-4 ISS U.S. ON ORBIT SEGMENT WATER SAMPLING AND ANALYSIS SCHEDULE

ISS Period	Micro from Storage Tanks	Micro from Use-Points	Total Water Micro. Inflight Analyses		Chem from Storage Tanks	Chem from Use-Points	Total Water Chem. Inflight Analyses		Water Micro. Archive Samples	Water Chem. Archive Samples
Node 3 Launch of U.S. Water System (20A) and subs.:										
First 90 days	17 /90 days*	13 /90 days*	30 /90 days		1 every day	1 every 2 days	135 /90 days		1/Shuttle Undock	1 /week
After 90 days	1 /month	1 /month	6 /90 days		1 /week	1 /week	26 /90 days		1/Shuttle Undock	1 /month

* One sample to be collected every 3 days from a storage tank or use-point

NOTE: When water micro. analyses are performed and water micro. archive samples are collected they are always done at the same time as the water chem. analyses and archive samples.

5.3 AIR QUALITY

The parameters for pO_2, pN_2, pCO_2, total pressure, and changes in humidity and air temperature, which will be maintained in the American and Russian segments, are defined in (SSP 41162 and SSP 41163 respectively). A toxicological assessment of air quality shall be based upon the Russian maximum allowable concentrations used as a zero-risk criterion for crew health and the American SMACs used to define “acceptable” risk for crew health in terms of trace contaminants. In order to calculate the combined effect of a mixture of contaminants on crew health, the method should be used as defined by the Russian State Standard GOST R 50804-95 and the American standard set forth in document NASA JSC 20584. This method and the list of defined contaminants are contained in Table 5.3-1. The list of substances to be monitored may change by joint agreement among the Air Quality Subgroup’s members.

TABLE 5.3-1 METHOD OF TOXICOLOGICAL ASSESSMENT OF AIR QUALITY

Compounds found in air analyses will be assessed in toxicological groups according to the following equation:

$$T_g = C_1/L_1 + C_2/L_2 + \ldots C_n/L_n ,$$

where “C” is the average concentration during the mission and “L” is the applicable exposure limit for “n” compounds in the group. The atmosphere is considered acceptable if the T values for each type of toxic effect are <1.

There will be 2 toxicological levels for interpretation of archival sampling data. These levels will be called the "no risk" level and the "acceptable risk" level. The 360-day limiting permissible concentrations in table 3 of the Russian GOST shall be used to define the "no risk" level and the spacecraft maximum allowable concentrations in JSC 20584 shall be used to define the "acceptable risk" level. The following compounds shall be included in each assessment.

Compound[a]	Russian 360-d[b]	U.S. 180-d[c]
	LPC (mg/m^3)	SMAC (mg/m^3)
hydrogen[d]	1600	340
methane[d]	3300	3800
pentane	10	590 (7d)
hexane	5	180 (7d)
heptane	10	200 (7d)
formaldehyde	0.05	0.05
acetaldehyde	1.0	4.0
aliphatic aldehydes (benzaldehyde)	1.0	4.0 to 8.0
propenal	0.02	0.03
methanol	0.2	9.0

ethanol	10.0	2000
2-propanol	1.5	150
1-butanol	0.8	40
acetone	2.0	50
2-butanone	0.25	30
benzene	0.2 (180d)	0.2
toluene	8.0	60
xylenes	5.0	220
styrene	0.25	43 (7d)
isopropyl benzene[d]	0.5	49 (7d)
furan	0.05	0.025
ammonia	1.0	7.0
ethyl acetate	4.0	---
carbon monoxide	5.0	10.0
polymethylcyclosiloxanes	0.2	9-15
dichloromethane	5.0	10.0
1,2-dichloroethane	0.5	1.0
Freon 218	150	85,000

[a] Compounds are grouped by structural classes
[b] Russian limits listed in GOST P 50804-95
[C] U.S. limits documented in Spacecraft Maximum Allowable Concentrations for Selected Airborne Contaminants (V1 to V4, 1994-2000 and in JSC 20584)
[d] Monitored for engineering operations only

5.3.1 VERIFICATION FOR OFFGASSING OF MATERIALS AND EQUIPMENT

All materials and equipment which may cause contamination of the inhaled atmosphere shall be accepted for use in spacecraft only after having successfully passed Test 7 in NHB 8060.1 or the tests listed in the appropriate documents of the Russian Ministry of Public Health dated 2 September 1982. After the international method of assessing offgassing has been adopted, this method shall supersede the American and Russian methods currently used.

5.3.2 TOXICOLOGICAL ASSESSMENT OF POTENTIALLY HAZARDOUS SUBSTANCES

Potentially toxic substances (gases, liquids, or particles), which may be released into the American Segment's atmosphere from experiments, from batteries while the space station is in operation, or from equipment, shall first be assessed by the JSC Toxicological Group in accordance with the methods set forth in JSC 26895 (October 1997). The assessment shall be based on data provided to the JSC Toxicology Group in compliance with JSC 27472 (March 1999). Potentially toxic substances which may emerge in the Russian Segment's atmosphere should first be assessed by Russian

experts in accordance with State Standard GOST R 50804-95, Attachment B. These assessments shall be based on data meeting the requirements of JSC 27472. After preliminary toxicological assessment data have been exchanged, a final assessment should be conducted by MMOP Air Quality Subgroup experts. Hardware developers should be warned that the use of extremely hazardous chemical substances is unacceptable. The results of the final assessment of the chemical substances' toxic hazard should be stored in the computer database in order to make the data accessible to the station's crew and MCC medical personnel.

5.3.3 REQUIREMENTS FOR THE QUALITY OF REPLENISHED (DELIVERED) AIR

The quality of the air which is supposed to replenish the air in the space station should meet the requirements in SSP 30573 Rev. A, table 4.1-2.2.

5.3.4 PRE-FLIGHT MONITORING OF THE MODULES AND FIRST ENTRY SAFETY

Before launch, a pressurized module which is designed to accommodate humans shall undergo monitoring of the atmosphere with collection of air samples for offgassing products. The quantity and frequency of collection of the air samples, as well as the analysis of these samples, shall provide an accurate prediction of the equilibrium concentrations at the time that the crew first enters the module. Detailed information about methods and procedures should be submitted to the MMOP Air Quality Subgroup for review. The results of the tests should be submitted to the Subgroup early so that the crew's first entry procedures may be developed. In order to ensure safety of first entry in flight, the module should be purged before the flight after the last time that ground personnel enter the module. It may be necessary to cleanse the module's atmosphere immediately before the crew's first entry in flight or to protect the crew with alternate sources of breathing. The plan to ensure safety of the crew's first entry should contain procedures for pinpointing any possible spill or fire which may have occurred in the pressurized module. Procedures are also needed for safety of the crew's first entry into the module in the event of off-nominal situations.

5.3.5 IN-FLIGHT MONITORING OF THE ATMOSPHERE'S CONTAMINATION

The quality of the air for crew respiration shall be monitored during all flight phases to ascertain that it meets the standards listed in Table 5.3-1. Monitoring should also include major non-targeted compounds and products that the crew is exposed to during accidental pollution of the atmosphere. Monitoring should provide for collection of archival air samples as well as real-time analysis of trace contaminants on board by methods approved by the Air Quality Subgroup.

5.4 MICROBIOLOGY

The NASA/JSC and RSA/IBMP Microbiologists are responsible for ensuring a microbiologically safe environment aboard the ISS.

A database of crew, environment, payloads, and food microbiological findings shall be maintained and available to NASA/RSA microbiologists, flight surgeons, the MMOP, and International Partners (IPs). IPs shall have access to microbiology environmental monitoring data during ground-based preparation processes and in-flight monitoring of the ISS, as well as crew and cargo transport vehicles. These data will also be used to confirm that all necessary measures such as Health Stabilization Programs and Contamination Control Plans have been performed to reduce the risk of infection to ISS crewmembers.

5.4.1 ENVIRONMENTAL MICROBIOLOGY SPECIFICATIONS AND MONITORING REQUIREMENTS

Air, surfaces, and water shall meet specifications and requirements as specified in Table 5.4-1, Preflight Microbial Specifications and Monitoring Requirements, Table 5.4-2, In-flight Microbial Specifications and Monitoring Requirements, Russian State Standard GOST R 50804-95, Table 5.2-1, Water Quality Requirements for the ISS Russian Segment, SSP 41000, Table XXXII, Water Quality Requirements, for the US On-orbit Segment, SSP 41172 (Section **<TBD 5-4>)**, Qualification and Acceptance Environmental Test Requirement, and RSA/IBMP XT-4.160.001, Regulations for Sanitary-Hygienic and Anti-Epidemic Support for Spaceflight at Prelaunch and Postflight Operation Stages.

Air and surface monitoring shall be performed during ISS preflight and in-flight periods in accordance with Tables 5.4-1 and 5.4-2. Water monitoring shall be performed as described in the Water Quality Section 5.2.

Air and surface monitoring shall be performed in Shuttle crew transport vehicles as specified in JSC 16888, Microbiology Operations Plan for Spaceflight. Surface monitoring shall be performed in Soyuz crew transport vehicles and Progress cargo transport vehicles as specified in RSA/IBMP XT-4.160.001, Regulations for Sanitary-Hygienic and Anti-Epidemic Support for Spaceflight at Prelaunch and Postflight Operation Stages.

Sampling will be performed using hardware authorized by NASA or RSA organizations or others as concurred with the Multilateral Medical Operations Panel (MMOP).

5.4.1.1 PREFLIGHT MONITORING REQUIREMENTS

Preflight microbiological analyses of interior surfaces and air of flight elements shall be performed in accordance with Table 5.4-1, Preflight Microbial Specifications and Monitoring Requirements, SSP 41172, (Section **<TBD 5-5>**), Qualification and Acceptance Environmental Test Requirements, JSC 16888, Microbiology Operations Plan for Spaceflight and RSA/IBMP XT-4.160.001, Regulations for Sanitary-Hygienic and Anti-Epidemic Support for Spaceflight at Prelaunch and Postflight Operation Stages. Preflight microbiological analyses of water shall be performed in accordance with Section 5.2, Water Quality. The quantitation and identification of bacteria and fungi shall be determined.

Air and surface samples shall be taken inside the flight element before final element closure. The environmental samples shall be returned to JSC or IBMP Microbiology Laboratories for analysis.

The flight element shall be, to the greatest extent possible, in its fully outfitted configuration for this test. Systems, subsystems and components of the element shall be powered to the greatest extent practicable during the tests. Sample sites will be selected based on the hardware present in the module. The environmental samples will be returned to JSC or IBMP Microbiology Laboratories for analysis. Analyses will be performed using standard methods of culture of heterogeneous bacteria and fungi. Flight Elements and acceptability limits are specified in Table 5.4-1. If bacterial or fungal levels exceed those stated in Table 5.4-1, appropriate remediation will be performed.

Any payloads or associated hardware for ISS habitable modules, which have been assessed by the NASA/RSA Payloads Safety Review Panels and identified as a potential microbiological hazard, shall be evaluated as specified by the Panels.

TABLE 5.4-1 PREFLIGHT MICROBIAL SPECIFICATIONS AND MONITORING REQUIREMENTS

SPECIFICATIONS		
	Maximum for Bacteria	**Maximum for Fungi**
Air	300 CFU/m^3	50 CFU/m^3
Internal Surfaces	500 CFU/100 cm^2	10 CFU/100 cm^2
MONITORING REQUIREMENTS		
	US Modules	**Russian Modules**
	Node 1	FGB
	Node 2	Service Module
	Node 3	Docking Compartment-1 (DC-1)
	US Laboratory	Universal Docking Module (UDM)
	US Habitation	Docking Compartment-2 (DC-2)
	Centrifuge Accommodation Module (CAM)	Docking and Stowage Module (DMS) Research Module 1
	Multi-Purpose Logistics Module (MPLM)	Research Module 2
	Spacehab Double Cargo Module	
	US Airlock	
	Crew Return Vehicle	

5.4.1.2 IN-FLIGHT MONITORING REQUIREMENTS

In-flight microbiological monitoring shall be performed throughout the life of the ISS to assure the condition and compliance of cabin air, internal surfaces, and water as specified in Tables 5.4-2, 5.2-1, and Section 5.2. Interior surface materials and metals shall be evaluated for the possible contributions and effects of microorganisms in causing the destruction or corrosion of these materials.

Monitoring shall include two levels of sample analysis:

First Level - Real-time assessment of the microbial load and dynamics on the basis of total bacterial and fungal counts

Second Level – Ground-based assessment of species composition, properties, and characteristics of archived samples which were collected in-flight, as well as samples that are collected 1-2 days before crew return (to be performed by RSA/IBMP only, as specified in RSA/IBMP XT-4.160.001).

TABLE 5.4-2 IN-FLIGHT MICROBIAL SPECIFICATIONS AND MONITORING REQUIREMENTS

SPECIFICATIONS		
	Maximum for Bacteria	Maximum for Fungi
Air	1000 CFU/m^3	100 CFU/m^3
Internal Surfaces	10,000 CFU/100 cm^2	100 CFU/100 cm^2
IN-FLIGHT MONITORING REQUIREMENTS*		
Sampling Location	**Surface Monitoring: # of Locations/Frequency**	**Air Monitoring: # of Locations/Frequency**
Node 1 Service Module US Laboratory Node 2 Research Module 1 Node 3 Research Module 2 US Habitation	2 sample sites/module once/month for the first 90 days that module is in flight, then once/90 days *US supplied Surface Sampler Kit (SSK)	1 sample site/module once/month for the first 90 days that module is in flight, then once/90 days
IN-FLIGHT MONITORING REQUIREMENTS**		
Sampling Location	**Surface Monitoring: # of Locations**	**Air Monitoring: # of Locations**
FGB	2 sample sites/module	1 sample site/module
Node 1	2 sample sites/module	1 sample site/module
Service Module	8 sample sites/module	6 sample sites/module
US Laboratory	**<TBD 5-6>**	**<TBD 5-6>**
Node 2	**<TBD 5-6>**	**<TBD 5-6>**
Research Module 1	**<TBD 5-6>**	**<TBD 5-6>**
Node 3	**<TBD 5-6>**	**<TBD 5-6>**
Research Module 2	**<TBD 5-6>**	**<TBD 5-6>**
US Habitation	**<TBD 5-6>**	**<TBD 5-6>**
	**Russian supplied surface sampling kit	

5.4.2 MICROBIOLOGY IN-FLIGHT DECONTAMINATION/REMEDIATION REQUIREMENTS

AIR

If air quality exceeds the microbial specification in Table 5.4-2:

1. A request for contingency video/digital photography downlink of the sample shall be requested. NASA/JSC and RSA/IBMP microbiologists shall evaluate, by visual inspection, the microbial risk.
2. The NASA/JSC and RSA/IBMP microbiologists will notify the Increment Flight Surgeon of their evaluation.

3. An attempt to identify the source of the contamination shall be performed. Resampling of the affected module shall be performed, including the air inlet source of the module.
4. Coordination of all appropriate personnel (Microbiology specialists, Medical Operations, ECLSS) shall occur to determine appropriate remediation operations.

SURFACES

If surface contamination exceeds the microbial specification in Table 5.4-2:

1. A request for contingency video/digital photography downlink of the sample shall be requested. NASA/JSC and RSA/IBMP microbiologists shall evaluate, by visual inspection, the microbial risk.
2. The NASA/JSC and RSA/IBMP microbiologists will notify the Increment Flight Surgeon of their evaluation.
3. The contaminated surface shall be cleaned with the housekeeping detergent or biocide wipes as appropriate.

WATER

Refer to Section 5.2, Water Quality.

5.5 IONIZING RADIATION

Flight crew ionizing radiation exposures shall be maintained As Low As Reasonably Achievable (ALARA) and shall not exceed specified limits. Radiation environmental monitoring shall be provided to document crew exposures and to provide data for dose management. Detailed real-time rules governing crew exposure to ionizing radiation are contained in the ISS Generic Operations Flight Rules, Volume B, Section B14, Space Environment.

5.5.1 RADIATION PROTECTION REQUIREMENTS

5.5.1.1 CONSENSUS DOSE LIMITS

ISS crew exposures SHALL not exceed the dose values given in table 5.5-1.

TABLE 5.5-1 CURRENT IONIZING RADIATION EQUIVALENT DOSE LIMITS

Organ Specific Equivalent Dose Limits			
Exposure Interval	**BFO (Sv)**		
30 Days	0.25		
Annual	0.50		

- Crew exposures are managed in adherence to the ALARA principle, which directs that exposures always be maintained As Low As Reasonably Achievable.

- Current career limits for each agency are documented in the AMERD (JSC 24834) and AMERD matrix.

5.5.1.2 ADMINISTRATIVE LIMITS

Administrative limits will be maintained as a tool for implementing the principle that astronaut exposures must be maintained ALARA (As Low As Reasonably Achievable) (ref. NSTS-12820 ISS Generic Operational Flight Rules, v. B, sec. B14.2.4-2). These limits represent the expected upper bound on exposures during nominal operating conditions, and are employed as conservative action levels at which management of exposures becomes more aggressive. The administrative limits will be updated periodically by the MRHWG (MMOP Radiation Health Working Group) to reflect changes in the space radiation environment due to the solar cycle.

5.5.1.3 EXPOSURE DURING EXTRAVEHICULAR ACTIVITY

EVA's will be planned or scheduled in such a way that cumulative radiation exposure, including that obtained during passes through the South Atlantic Anomaly (SAA) or other regions containing elevated levels of radiation, is maintained as low as reasonably achievable (ALARA).

5.5.2 CREWMEMBER RADIATION MONITORING AND DOSIMETRY

Each individual crewmember shall be monitored for radiation exposure.

5.5.2.1 CREW PERSONAL DOSIMETERS

Each crewmember shall be supplied with a personal dosimeter for continuous use while on orbit. Dosimeters should be worn at all times, during both intravehicular and extravehicular operations. The Crew Personal Dosimeter SHALL serve as the dosimeter of record for each individual country or organization. Crew personal dosimetry shall provided sufficient information to evaluate the crewmember's exposure. Each individual country or organization will have the responsibility for arranging their crew dosimetry.

5.5.2.2 LONG DURATION CREWMEMBERS

The ISS personal dosimeters nominally will remain with the crewmember throughout the mission. However, crew dosimeters may be changed out during an expedition, depending on the mission length, the observed behavior of the radiation environment during the mission, and the expected crew exposure for the longer expeditions following certain radiation events. Biodosimetry for long duration crews is outlined in JSC 24834, AMERD.

5.5.3 RADIATION AREA MONITORING

Radiation dosimeters will be deployed throughout the pressurized volume to assess the exposure rates throughout the ISS.

5.5.3.1 PASSIVE RADIATION AREA MONITORING

Passive radiation area monitors will be deployed at designated fixed locations within each pressurized module. It is anticipated that four to six monitoring points will be used in each module and three or four in each node. These monitors will be capable of measuring integral absorbed dose, and estimating the average radiation quality factor ($\bar{Q}$). U.S Radiation area monitors will be exchanged on approximately quarterly consistent with crew rotation and shuttle flight schedules. Passive radiation area monitors will only be exchanged on shuttle flights and require late stow (Launch Minus (L-) 10 days for launch, and early retrieval (Return Plus (R+) 48 hours upon return). Russian area monitors shall be exchanged on a mission basis together with the crew personal dosimeters.

5.5.3.2 ACTIVE RADIATION AREA MONITORING

Active radiation area monitoring on ISS is necessary to provide real-time information to ground controllers and to the crewmembers for the purpose of maintaining crew exposures ALARA.

5.5.3.2.1 INTERNAL ACTIVE RADIATION AREA MONITORING

Internal active area monitors will be capable of monitoring the environment in all habitable volumes of the ISS and provide information for estimating organ doses.

5.5.3.2.1.1 LET SPECTRUM

Internal active monitoring equipment will have the ability to measure the time resolved Linear Energy Transfer (LET) spectrum. If necessary, the Lineal Energy spectrum (y spectrum) will be measured and used as a surrogate for LET in order to determine the dose and dose equivalent rates. Accumulated dose and dose equivalent data shall be continuously transferred to the ground for operational evaluation. Detailed time-resolved (Δt approximately one minute) LET spectral data shall be downlinked at least weekly for ground analysis. More frequent downloads may be necessary during periods of enhanced exposure.

5.5.3.2.1.1.1 LET SURVEY REQUIREMENTS

Instrumentation capable of measuring LET or y information shall be capable of surveying the majority of each module. This may be accomplished by deploying a single mobile instrument, or by deploying multiple instruments at fixed locations. Approximately every five to seven days, mobile instrumentation shall be relocated to a

new location in order to facilitate survey of the entire habitable volume. Complete surveys will be performed every three months.

5.5.3.2.1.1.2 ALARM CAPABILITY

Onboard instrumentation will have the ability to alert the crew in cases where exposure rates exceed set point values. These set point values will be set such that in extreme situations, or during times of degraded communications ability, the crew will have the ability to take autonomous action based on the on-board dosimeter data if necessary.

5.5.3.2.1.2 CHARGED PARTICLE MONITORING

Particle fluxes (by species) shall be monitored as a function of time and recorded. Dose rate from charged particle monitoring equipment shall be continuously transferred to the ground for operations evaluation. Detailed time resolved particle spectra shall be downlinked at least daily for analysis.

5.5.3.2.1.2.1 CHARGED PARTICLE SURVEY REQUIREMENTS

Time resolved charged particle measurements shall be made in each habitable module. Instrumentation shall be capable of surveying the majority of each module. Mobile instruments shall be relocated to a new location approximately every five to seven days. Complete surveys shall be performed every three months.

5.5.3.2.2 EXTERNAL ACTIVE RADIATION AREA MONITORING

External active radiation area monitoring shall be employed to monitor the time-resolved (Δt approximately one minute) particle spectra immediately exterior to the vehicle. Dose rates shall be continuously transferred to the ground for operations evaluation. Detailed time resolved particle spectra shall be downlinked at least daily for evaluation.

5.5.4 RADIATION CONTINGENCY MONITORING

High range, high rate self-reading dosimeters shall be stored on board in order to measure high dose rate contingency events. These monitors shall be exchanged approximately twice annually if necessary.

5.5.5 NEUTRON MONITORING

Neutron monitoring hardware shall provide the capability to characterize neutron contribution to crew exposures. Instruments used for these measurements shall have demonstrated their capabilities to yield the required results by ground based performance verification and calibration.

5.5.6 CREW HEALTH RISK ASSESSMENT AND EXPOSURE RECORDS

Preflight, crew exposure histories shall be assembled and the current mission exposures and risks shall be predicted based on planned mission activities to aid in maintaining crew exposures ALARA. Based on these projections, recommendations to minimize crew exposures will be made where appropriate. In flight radiation exposures and health risk assessments shall be evaluated, and when possible forecasted, in order to monitor and minimize exposure. Postflight, exposures from each mission and accumulated exposure shall be used for health risk assessment and recorded in crewmembers' medical records. Crew personal dosimeters shall serve as the primary measurement for crew absorbed dose. LET spectral data shall be used to provide an estimate of average quality factor for the mission duration. Crew dosimeter measurements and charged particle spectral data, and data from other applicable instruments, shall be used in conjunction with computer models to calculate organ specific dose equivalents. Biodosimetry results (when available) shall also be documented in each individual crewmember's medical record.

5.6 NON-IONIZING RADIATION

Exposure to non-ionizing radiation, including radio frequency, electromagnetic fields, optical laser radiation, and incoherent ultraviolet optical radiation, shall not exceed the published recommended limits of the following standards.

5.6.1 RADIO FREQUENCY AND ELECTROMAGNETIC FIELDS

Exposures to radio frequency and electromagnetic fields shall not exceed the maximum permissible exposure limit for "uncontrolled environments" specified by IEEE-C95.1 - 1991, Revision ANSI C95.1 - 1982, IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

5.6.2 LASER RADIATION

Exposures to laser radiation shall not exceed the limits specified in ANSI Z136.1 - 1986, American National Standard for the Safe Use of Lasers.

5.6.3 ULTRAVIOLET RADIATION

Exposure to ultraviolet radiation shall not exceed the Threshold Limit Values (TLVs) specified by the American Conference on Industrial Hygienists (ACIH), (1992).

5.7 HABITABILITY

Environmental and occupational factors contributing to crew habitability and performance will be monitored, conforming to established limitations, where applicable.

5.7.1 TEMPERATURE, HUMIDITY, AND VENTILATION

The atmospheric temperature, humidity, and ventilation rates shall meet the requirements specified in SSP 41000 and the applicable SSP 50005 paragraphs as invoked by SSP 41000.

5.7.2 LIGHTING

The level of lighting within all habitable volumes shall conform to SSP 41000.

5.7.3 NOISE EXPOSURE AND MONITORING

In-flight noise exposure shall be monitored to conform with the specifications in SSP 41000, which dictate that overall environmental noise shall not exceed the sound pressure levels described by the NC-50 (Noise Criteria) curve. The schedule of acoustics monitoring will be determined by the MMOP Environmental Subgroup and be outlined in the <TBD 5-7>. In the event noise levels exceed specified limits, crew actions will include deactivating noise generating payloads and systems and/or the use of Hearing Protection Devices in accordance with Aeromedical flight rule B13.2.4-2.

5.7.3.1 HEARING PROTECTION

JSC-approved hearing protection devices shall be provided at all times, and will be used when in-flight noise levels exceed the published specification. Their use shall provide noise attenuation that results in at-ear levels that do not exceed the NC-50 guidelines for work and the NC-40 guidelines for sleep, as referenced in SSP 50005 and SSP 41000. Their optional use will be encouraged, and will become mandatory in the specific circumstances detailed in NSTS 12820, ISS Generic Operational Flight Rules, B13.2.4-2.

5.7.4 VIBRATION CONTROL

Vibration generation and penetration must meet the specifications in SSP 41000. Vibration energy must be controlled to avoid personnel injury or degraded crew performance.

6.0 CREW COUNTERMEASURE IMPLEMENTATION

Countermeasures to weightlessness and other environmental and social factors of long-duration space flight shall be provided at all mission phases to ensure crew health, safety, performance, and safe return to Earth. Crew biomedical and behavioral health and performance monitoring is required to adjust the countermeasure prescription to ensure maximum health benefits and crew productivity.

6.1 PREFLIGHT COUNTERMEASURES

6.1.1 CREW SELECTION AND ASSIGNMENT

When operationally feasible, crew selection and mission assignment shall incorporate information and MSMB input concerning crewmember candidate behavioral mission and performance information and its impact on crew composition. This information will be forwarded to the BCOP/MCOP by the MSMB; methods of validation of this information are **<TBR 6-1>**.

6.1.2 BEHAVIORAL HEALTH AND PERFORMANCE TRAINING

Preflight briefings and/or training shall be differentially provided to the crew commander, CMO, crewmembers, key ground personnel, and crew families concerning significant behavioral and health performance and social phenomena throughout all phases of the mission.

Standard programs and a behavioral health and performance (as noted in Section 6.2.6) training plan shall be prepared to reflect the psychophysiological, social, psychological, and cultural aspects of ISS crew training. Training shall be provided to the complete crew on compatibility and in-group interactions.

6.1.3 PREFLIGHT EXERCISE

A supervised preflight physical conditioning regimen coordinated and approved by the CS will be available to all space flight crewmembers. This regimen will be designed to provide both cardiovascular and resistance training to crewmembers during each preflight training period.

6.1.3.1 PREFLIGHT EXERCISE TIME ALLOCATION

Beginning one year prior to launch date for crewmembers assigned to long duration flights, training timelines shall accommodate a minimum of three periods of two hours of scheduled physical training per week.

6.1.4 PREFLIGHT BASELINE DATA COLLECTION

Participation in in-flight assessment activities, such as monitored exercise, shall be preceded by appropriate preflight ground control sessions to determine a crewmember's physiological baseline. In addition, behavioral health and performance baseline data

shall be collected to ensure routine in-flight crew behavioral health and performance support with consideration of individual crewmember features. The schedule of Countermeasures Baseline Data Collection (BDC) activities is outlined in JSC 24834, Appendix B.

6.1.5 HEALTH STABILIZATION PROGRAM

A Health Stabilization Program (HSP) shall be implemented to minimize crew exposure to preflight illness.

For crewmembers launching on the Shuttle, the MOB will provide requirements ensuring implementation of the HSP as outlined in JSC 22538, Health Stabilization Program for the Space Shuttle Program. Crewmembers launching on the Soyuz will follow established Russian Space Agency procedures for preflight control of infectious disease.

6.1.5.1 HEALTH AWARENESS CAMPAIGN

A Health Awareness Campaign shall be initiated 30 days prior to launch with the flight crewmembers, families, and co-workers to guard against the spread of infectious disease during the HSP period.

6.1.5.2 HEALTH STABILIZATION PROGRAM PROCEDURES

The mission CSs and other designated personnel shall perform the following duties leading up to and including the HSP:

A. Performs all crew preflight physical examinations

B. Notifies the directors of Flight Crew Operations Directorate (FCOD), SLSD, ISSP office, and appropriate International Partners of any crew illness that develops during the HSP period, which may affect a crewmember's eligibility for the mission

HSP prelaunch activities conducted at JSC include:

A. Managing the HSP as it applies to crewmembers and Group A Primary Contacts (PCs)

B. Obtaining the proper badges for Group A PCs

C. Conducting examinations of crewmember's families three to five days prior to the HSP period

D. Reporting any illnesses or exposures to infectious diseases to the CS

6.1.6 CREW SCHEDULE SUPPORT OPERATIONS

Appropriate circadian entrainment, if required by the mission, shall be provided with lighting systems, work/rest schedules, special activity schedules, and selected pharmacological agents.

6.1.6.1 CIRCADIAN SHIFTING OPERATIONS

All circadian shifting activities require CS approval. Circadian shifting support operations responsibilities include the following:

A. Determining required circadian shifting for each flight;

B. Providing circadian shifting options with recommendations to timelining personnel, mission planners, the flight crew and subsequent selection of the optimal shifting option;

C. Advising ISSP office and appropriate International Partners on schedule needs to accommodate shifting operations;

D. Analyzing effectiveness of circadian entrainment procedures;

E. Advising Program Management of circadian shifting options, results, and recommendations.

Detailed groundrules and constraints for sleep and circadian shifting are contained in the crew scheduling groundrules and constraints section of SSP 50261-02, ISS Generic Ground Rules and Constraints, Part 2: Execute Planning.

6.1.7 CREW ROTATION AND DUTY CYCLES

Mission durations and crew duty rotations will be planned with consideration to biomedical as well as behavioral health and performance factors. Limitations to cumulative radiation exposure outlined in Section 5, Table 5.5-1, Current Ionizing Radiation Exposure Limits, shall be strictly observed.

6.1.7.1 MISSION INTERVAL LIMITATIONS

Crewmembers flying a long duration mission will be certified for another space flight of any duration only after a minimum ground interval of one year. This minimum interval may be extended depending on environmental exposure limitations and medical rehabilitation milestones.

6.2 IN-FLIGHT COUNTERMEASURES

Provisions shall be made to implement, monitor, and validate operational in-flight countermeasures to mitigate undesirable physical, physiological, as well as behavioral health and performance effects of space flight upon crewmembers and crews.

6.2.1 MISSION DURATION DEFINITIONS

Working definitions of mission durations are:

A. Short duration: Less than 30 days

B. Long duration: 30 days or greater

6.2.2 MISSION DURATION LIMITATIONS

Duration of a crewmember's duty on-orbit for nominal ISS missions shall not exceed 180 days. Missions beyond 180 days must be considered by the MOB and MSMB on a case by case basis. Sustained crewmember participation in long-duration missions is critically dependent on the implementation of the entire infrastructure of requirements as outlined in this document and other documents regarding crew support and habitability.

6.2.3 CREW IN-FLIGHT WORK DAY REQUIREMENTS

The general crew workday shall be timelined as follows:

A. 8.5 hours Sleep

B. 1.5 hours Postsleep

C. 0.5 hours Planning and Coordination

D. 8.0 hours System Operations and Payload Operations

E. 1.0 hours Midday Meal

F. 2.5 hours Exercise Period (1.5 hours for setup, stowage, cleaning, etc.)

G. 2.0 hours Presleep

The Space Station Crew Planning and Scheduling Groundrules and Constraints will be strictly followed and monitored real-time during in-flight operations by the CS and OPS Planner in the MCC-H and by their Russian counterparts in the MCC-M.

6.2.4 PHYSICAL/PHYSIOLOGICAL IN-FLIGHT COUNTERMEASURES

The ability to define and monitor acceptable in-flight physical and physiological parameters, while providing physical and pharmacological countermeasures to maintain these parameters, shall be provided and follow a schedule as outlined in the AMERD. The following in-flight countermeasures shall be made available to all ISSP crewmembers for selection and use, including adequate training, equipment, and schedule for implementation. The program and application of the in-flight countermeasures shall be prescribed by appropriate medical specialists in an individualized manner based on unique mission needs and specific crewmember considerations.

A. In-flight (General)

1. Exercise (including treadmill, cycle ergometer, resistive)
2. Lower Body Negative Pressure (Chibis, Human Research Facility (HRF), LBNP)
3. Loading suits (Penguin)
4. Thigh cuffs (Brazlet)
5. Pharmacologic preparations

6. Electromyostimulation

B. In-flight (End Of Mission)

1. Fluid/salt loading
2. Anti-G garment (pneumatic G-suit, Kentaver)
3. Active cooling (Liquid Cooling Garment)
4. Recumbent seating for flights greater than 30 days
5. Pharmacologic preparations

(A program of operational monitoring and validation of the countermeasures shall be implemented.) Additional countermeasures may be added to the program based on need and scientific verification.

6.2.4.1 IN-FLIGHT EXERCISE

Daily physical exercise shall be scheduled for each ISS crewmember, consisting of 1.5 hours daily of actual exercise time with varying amounts of resistive and aerobic exercise. Exercise prescriptions will be individualized, and will follow a basic schedule as outlined preflight by ground exercise and medical specialists.

6.2.4.2 END OF MISSION EXERCISE

During periods of handover when the transport vehicle (Shuttle or Soyuz) is docked to the ISS, crewmembers completing long duration missions shall have full access to all ISS exercise countermeasures facilities for daily utilization during this period.

6.2.4.3 SHUTTLE-BASED END OF MISSION COUNTERMEASURES

Methods and opportunity for prescribed exercise shall be provided on Shuttle for crewmembers returning from long duration space flight. The exact exercise prescription and hardware shall be coordinated in advance on a mission-by-mission basis by the CS. Exercise equipment shall include as a minimum a cycle ergometer and resistive exercise device.

6.2.5 GENERAL HEALTH AND WELL-BEING

Countermeasures shall be provided which address issues of human factors, general crew health, and well being. These countermeasures shall include considerations for hygiene, privacy, nutrition, crew schedule, workload, Earth observation, and entertainment.

6.2.5.1 NUTRITION

Food operations during the assembly of the International Space Station (ISS) will be in accordance with the ISS Assembly Food Plan. An ISS Assembly Complete Food Plan will be generated with inputs from all International Partners.

6.2.5.1.1 NUTRIENT REQUIREMENTS

During the assembly of the ISS, planned menus must meet the nutritional requirements in JSC 28038, Nutritional Requirements for International Space Station Missions Up To 360 Days. After assembly complete, the ISS menus shall meet nutritional requirements as defined by the MMOP-Nutrition Working Group.

These requirements may be modified by consensus of the MMOP-Nutrition Working Group as additional information becomes available.

6.2.5.1.2 TASTE TESTING

A preflight testing of all individual food items (i.e., food familiarization session) shall be made available to each crewmember to obtain their recommendation for development of an initial inflight menu. This food tasting session shall be conducted no less than 12 months prior to launch of the food for a particular crew.

In addition, crewmembers may participate in food training consisting of food items from the complete 8-day menu cycle (i.e., approbation). The results of the approbation session are to be used to complete a final menu. These sessions shall be conducted at such a time that the results may influence menu selection, specifically , no less than 8 months prior to launch of the food for a particular crew. If approbation is not conducted during the time period described here, the final menu will be based on the food familiarization session. Participation in approbation will be based on crew preference, prior flight experience, and consultation with appropriate nutritional and medical specialists. This activity will be coordinated by the Nutrition Working Group of the MMOP.

6.2.5.1.3 FOOD LIST/MENU COMPOSITION/MENU APPROVAL/FOOD PACKAGING

Nourishment shall be provided in a food ration that comprises approximately 50% Russian and 50% American products. If provided by the International Partner, Russian/American food will be supplemented with the national food of that country when they are on board ISS. As a basis for the ISS menu development, the current eight-day cycle will be used. All parties agree to evaluate the possibility of extending the length of this cycle for ISS flights. In addition, the U.S. will provide condiments (including salt) with the American products. Empty beverage packages will also be provided by the American side that can be used by the crew to drink water.

Menu planning will be achieved with crew participation. During ISS Assembly, the final menu for each crew will be jointly approved by food specialists from Russia and the U.S. After ISS Assembly Complete, final menu approval will be done by US and

Russian representatives, as well as representatives from International Partner countries with crewmembers assigned to the mission.

6.2.5.1.4 REFRIGERATOR/FREEZER CAPABILITY

Refrigerator/freezer capability for food stowage shall be available no later than Assembly Complete to facilitate a wider variety of foods supporting nutritional requirements and for its positive habitability influence.

6.2.5.1.5 NUTRITIONAL STATUS ASSESSMENT

The NASA JSC Nutritional Status Assessment protocol shall serve as the initial plan for nutritional assessment for long-duration missions (as described in JSC #28566). The plan is subject to modification as issues arise, or as additional information is obtained.

Each International Partner may modify the protocol for their own crewmembers.

6.2.5.1.6 MICROBIOLOGICAL AND TOXIN STANDARDS FOR FOOD

Each country's food certification for flight including microbiological safety analysis shall be accepted by the other without further testing or evaluation. However, all foods must meet the quality requirements and standards of the food supply system by which it is stowed (Russian or U.S.). Each country has the right to occasionally sample the others food products for research purposes.

6.2.5.1.7 CREW TRAINING

Crew training will include the basic (health) rationale for consuming the foods on the planned menus as described for each of the nutrient requirements. Food preparation instructions for the food items on the menu will be reviewed. This activity will be coordinated by the country or international partner supplying the food items. Crewmembers will be trained on techniques for performing on-orbit inventory of food.

6.2.6 BEHAVIOR AND PERFORMANCE

Provisions shall be made to implement individually tailored behavioral and health performance countermeasures for the crew members, key ground personnel, and crew families throughout the mission. Monitoring and countermeasures shall include, but not be limited to, the following:

A. Provisions shall be made to monitor, assess, and provide interventions for behavioral health and performance, as defined in JSC 24834 and this document.

B. Review and Recommendations on Psychological Adaptation:

    1. Psychological training as preparation for flight, including periodic behavioral observations of the astronaut during professional training.

2. Psychological countermeasures of individual and crew adaptation (concerning issues of motivation, individual and group behavior, crew-ground interactions).

3. Psychosocial Support, which shall include, but not be limited to:

    a. Weekly Private Family Conferences (PFCs) of a minimum duration of 15 minutes, preferably with two-way voice and video communication will be scheduled for each crewmember. Audio/video medical and psychological conferences shall make use of private communication encryption methods from ISS to the ground control center. These conferences will be private in that no one will monitor the communication loops. No one will remain in the room without crewmember and family approval.

    b. Regular delivery of personal packages to the crewmembers in the form of one package from the family members and one from the behavioral health and performance group. Transportation regularly provided on resupply vehicles at a suggested frequency of one package every three months.

    c. Access to an onboard amateur radio for recreational ham radio contacts.

    d. Uplink of audio news in native language no less than once per week.

    e. Uplink of written news summaries, not less than every other day.

    f. Uplink of video for recreational and leisure purposes, such as sports, news or cultural events.

    g. Materials for a wide variety of individually determined leisure activities, such as videotapes, books, recorded music, and recreational software.

    h. Family support will be provided as necessary (such as preflight meetings with the crewmembers and family support services provided during the mission).

    i. Daily electronic mail uplink for family and friends, preferably in the native language.

C. Review and Recommendations on Human-System Interface Issues.

1. Workload, task sequence, and impact on personal performance.

2. Work environment, habitability, and impact on personal performance.

D. Review and Recommendations on Sleep and Circadian Issues.

1. Work rest schedules impact on circadian/sleep cycles.

2. Personal countermeasures for fatigue and sleep problems.

E. Review and Recommendations on Behavioral Health Issues.

1. Personal countermeasures for maintenance of effective cognition, mood, and behavioral health.

6.2.7 ACCELERATION/IMPACT

Flight Crew acceleration exposure shall comply with SSP 50005, Section 5.

6.2.7.1 RECUMBENT SEATING

Recumbent seating to achieve minimum crewmember G force in direction of z axis (Gz) shall be provided during reentry for all crewmembers of missions 30 days or greater. This configuration shall limit sustained body + Gz forces to 0.5.

6.2.7.2 ANTI-G GARMENT

Anti-G garments shall be available under all circumstances to returning crewmembers from ISS, including nominal Shuttle and Soyuz returns, as well as contingency returns on these vehicles or other Crew Return Vehicles (CRVs).

6.2.7.3 ACTIVE COOLING DURING ENTRY/LANDING

Active cooling in the form of a Liquid Cooling Garment (LCG) shall be provided for all returning crewmembers of 30 days or greater, unless returning on the Soyuz.

6.3 POST-FLIGHT RE-ADAPTATION COUNTERMEASURES

Re-adaptation countermeasures to assist each crewmember's return to preflight health and functional status will be included in JSC 27050. Refer to Section 3.

Incremental milestones for rehabilitation will be established. These milestones will include return to home environment, driving, and return to flight status. Each crewmember's status will be monitored. The rehabilitation schedules will be adjusted to accommodate individual progress. The rehabilitation plan will be coordinated with and supervised by the CS.

6.3.1 BEHAVIOR AND PERFORMANCE

After each mission, provisions shall be made to implement appropriate psychological debriefings and support programs as needed for the crew, key ground personnel, and crew families.

6.3.2 PHYSIOLOGICAL FUNCTION

Post-flight programs shall be implemented to rehabilitate the crewmembers to preflight physical conditioning and physiological parameters. These programs shall include scheduled and supervised physical therapy.

6.3.3 MAXIMUM POST-FLIGHT CREW DUTY DAY <TBD 6-1>

7.0 MEDICAL MANAGEMENT

7.1 GROUND SUPPORT

Ground support operation requirements addressing planning, training, launch, in-flight, landing, and postflight support will be provided by the JSC MOB for NASA-controlled operations and by the **<TBD 7-1>** Russian group for RSA-controlled operations.

7.1.1 LAUNCH PHASE STAFFING

The MOB shall provide staffing requirements for medical personnel during launch in accordance with Shuttle plans for U.S. launches and Russian Soyuz plans for launches with U.S. crewmembers.

7.1.2 IN-FLIGHT PHASE STAFFING

The MOB will provide staffing requirements for medical personnel during all in-flight activities. This includes MCC-H staffing and MCC-M staffing (within the existing Russian Medical Support Group) when this is the prime FCC or when otherwise needed.

7.1.3 LANDING PHASE STAFFING

The MOB shall provide staffing requirements for medical personnel during landing in accordance with Shuttle plans for U.S. landings and Russian Soyuz plans for Russian landings with U.S. crewmembers.

7.1.4 FLIGHT CONTROL TEAM

In accordance with JSCI 1830.1, medical examinations of the Flight Control Team members (FCT) and U.S. controllers supporting at MCC-M will be provided. Flight controllers and other key personnel shall be examined biennially to ensure compliance with flight controller physical examination standards. Russian flight controllers will be medically certified within RSA program requirements; other IP control centers will certify flight controllers based on host country guidelines.

7.1.5 HAZARDOUS DUTY AND TOXIC MATERIAL HANDLING CERTIFICATION

Physical examinations and certifications are required for personnel involved with hazardous duty or toxic materials handling per NHB 1700.1, Volume 1, NASA Safety Policy and Requirements Document, and as further defined by site Safety Officers. Physical examinations necessary for certification shall be performed by site Occupational Medical Clinics.

7.1.6 PERSONNEL RELIABILITY PROGRAM

In accordance with the Personnel Reliability Program, established byCFR 1214.5, Mission Critical Space Systems Personnel Reliability Program and JSCI 8610.1, Space

Transportation System Personnel Reliability Program, for operations at MCC-H, the MOB is responsible for monitoring personnel to assure proper medical certification and flight-specific training. ISS flight surgeons will be certified according to MMOP developed and MSMB approved guidelines. Other IP support personnel working within their country's infrastructure will be certified according to their own country's guidelines and procedures.

7.1.7 TEST SITES AND FACILITIES

Testing, training, and human subject experiments shall be supported with qualified medical personnel in accordance with NPD 8900.1.

7.1.8 MEDICAL SUPERVISION OF PREFLIGHT AND POST-FLIGHT LIFE SCIENCES EXPERIMENTS ON FLIGHT CREWMEMBERS

All human experiments and tests involving flight crewmembers which present risks to their health and safety will be monitored. Decisions on which activities require monitoring will be made by the MOB, MMOP, and HRMRB. In addition to individual investigation acceptance by the HRMRB, the integrated timeline must be accepted by the HRMRB prior to flight. Any in-flight change or potential changes and additions to experiments involving crewmembers as subjects will be discussed with the crew prior to flight to obtain approval and informed consent. Efforts will be made to minimize new and unexpected changes to life sciences human experiments during missions because it may be difficult to obtain real informed consent and proper consideration under these circumstances. A Test Readiness Review shall occur prior to any human testing. The responsible physician will determine the readiness of the flight crewmember for testing and may terminate any test based on an assessment of flight crewmember health.

7.1.9 MEDICAL CONSULTANTS

Access to specialized medical, dental, and psychological consultation services to support flight crewmember health shall be provided for all mission phases.

7.1.10 GROUND OCCUPATIONAL MEDICAL SERVICES

Medical services for mission-critical personnel shall be provided on a priority basis. Physicians and nurses noting symptoms suggestive of infectious disease or conditions that may adversely affect job performance will immediately report such findings to the HSP Medical Officer or CS.

All primary launch and landing sites shall continually operate clinical facilities for routine treatment and EMS. Operational support will comply with local institutional policies and instructions. Personnel assigned to launch and landing sites will be provided medical care, which will be administered by the local site medical facilities and staffs.

Counseling and advice for circadian adjustments for shift work personnel will be provided upon request.

7.2 TRAINING

7.2.1 FLIGHT CREW MEDICAL TRAINING

All crewmembers will receive basic medical training, including space physiology, toxicology, CPR, first aid, CHeCS hardware, and psychological training as described in JSC-**<TBD 7-2>**, ISS Medical Operations Core Training Guide. Two crewmembers per flight shall be designated as CMOs and receive additional hands-on training in diagnostic and therapeutic techniques, operating procedures for in-flight medical hardware, dental procedures, ACLS, and clinical psychology as described in the **<TBD 7-3>**, ISS Medical Operations Crew Medical Officer Training Guide. Designated crewmembers will receive medical training on activities specific to their duties as described in JSC-**<TBD 7-4>**, ISS Medical Operations Environmental Control and Life Support System Training Guide, and JSC-**<TBD 7-5>**, ISS Medical Operations On-Orbit Maintenance Training Guide.

The MOB will provide requirements and implementation procedures for CMO medical training based on CHeCS equipment and procedures. Additional medical training as appropriate to the mission or crew may be provided by the MOB or other IP group as approved by MMOP. CMOs will learn to manage in-flight medical problems through a familiarization with the most probable medical occurrences and their therapeutic treatments. An onboard medical contingency drill is scheduled for each ISS crew. For in-flight medical problems beyond the scope of the medical training, CMOs are trained to communicate with, and act as an extension of, the FS on console. **<TBD 7-6>**

7.2.2 MEDICAL OPERATIONS FLIGHT CONTROLLERS: SURGEON AND BIOMEDICAL ENGINEER TRAINING

All medical personnel staffing the MCC-H shall be required to undergo training and certification according to the MOB training plan as specified in JSC 26546. MOB and other IP medical operations personnel staffing MCC-M and other IP MCCs will undergo training and certification in accordance with established agreements with the IPs.

All Biomedical Engineers (BMEs) staffing the Biomed MPSR will be required to complete Appendix C of JSC 26546. The training plan consists of self-study documents, classroom, console, and Part Task Trainer lessons. Trainees will complete the United Space Alliance Training Academy course designed to provide ISS system, hardware, software, and subsystem/Orbital Replacement Unit (ORU) training with an operational emphasis. The Medical Operations Advanced Training summary flows will follow with training in space medicine, MCC-H console, self-study, HMS, EHS, CMS, emergency egress, simulation training, and station systems.

Tests derived from the training objectives of each lesson will be used to evaluate the BME's comprehension of the material. Additionally, the BME will be required to accumulate 200 hours of console training time, including both integrated training time and missions.

7.2.3 EMERGENCY MEDICAL SERVICES PERSONNEL TRAINING REQUIREMENTS

EMS personnel training requirements will be in accordance with established procedures to train personnel to provide the level of care required and the respective landing vehicle documents. Personnel supporting the MCC-H shall meet the requirements outlined in JSC 26546.

8.0 EMERGENCY MEDICAL SERVICES

EMS are required to provide immediate medical care to flight crewmembers, preventing aggravation of physical or psychological conditions and/or loss of life during contingency launch/landing scenarios. The NASA JSC MOB administers the program for the SLSD. Level of care determinations shall be made with identified requirements levied on various support organizations. The EMS forces shall be made up of personnel who render medical care, facilitate communications, and transfer the crewmember(s) to medical facilities. EMS also includes the necessary supplies and equipment to provide stabilization and treatment at the scene and en route to the hospital.

8.1 GENERAL

Since EMS refers to launch and landing contingencies as defined in this document, this section will reference the EMS sections of other Program documents. ISS crewmembers launched on the Shuttle will come under the EMS requirements detailed in JSC 13956, Shuttle Medical Operations Requirements Document (MORD). For ISS crewmembers launching on the Soyuz, requirements are outlined in **<TBD 8-1>** Russian documents and JSC 28262, International Space Station (ISS) Emergency Medical System (EMS) plan.

The host country for launch/landing shall be responsible for providing EMS, including rescue, recovery, and transport for nominal and contingency events during all mission phases. In the event of an early mission termination or contingency mission abort, the host country shall include the FS from the sponsoring country in all phases of crew recovery and transport. The host country will include transportation for the sponsoring country's FS to the landing site and to the standard destination or emergency treatment site in planning efforts. The sponsoring country's FS will accompany the crewmembers at all times, if present.

8.1.1 EMERGENCY MEDICAL SERVICES TRAINING

Refer to Section 7.

8.2 STAFFING

The following staffing requirements detail ISS support, including Russian launches with American astronauts.

8.2.1 LAUNCH/LANDING OPERATIONS IN RUSSIA

MCC-M will accommodate other IP medical personnel for Soyuz launches of their crewmembers to ISS. A JSC CS and BME will support contingencies during launch. For a planned landing, the CS will deploy to the landing site with the recovery forces. The BME or another JSC surgeon will support in the TsUP.

8.2.2 LAUNCH/LANDING OPERATIONS IN U.S.

Staffing will be in accordance with the Shuttle MORD.

8.2.3 ON-ORBIT OPERATIONS

During the early phase of the ISSP, the JSC MOB shall support from the Russian TsUP. Staffing will be in accordance with that required during the Phase 1 Program, consisting of at least one CS and BME. When the MCC-H is activated, the JSC MOB will ensure staffing of the Multipurpose Support Room (MPSR) to monitor activities, command CHeCS equipment, and initiate and/or support EMS procedures. The CS will be notified immediately of any contingency scenario requiring the use of EMS forces. If not on console, the CS will be recalled to the MCC-H.

8.3 COMMUNICATIONS

An EMS communications system shall be required to facilitate the coordination and deployment of EMS personnel at launch and landing sites. The EMS communication and control center located in the MCC-H is responsible for establishing communications channels and allocating resources to provide effective and efficient EMS management. In the event of a contingency, JSC MOB shall be required to establish procedures for contacting the Department of Defense (DoD) and State Department. Communication will be in accordance with the plans for the intended landing vehicle.

8.3.1 JOHNSON SPACE CENTER

The JSC Surgeon shall have the capability to communicate with the spacecraft, medical consultants, and medical personnel coordinating support at a potential landing site through other EMS representatives or direct contact.

The JSC EMS Coordinator (Surgeon) in the MCC-H shall have communications in accordance with the EMS plans for the return vehicle.

8.4 EMERGENCY MEDICAL SERVICES TRANSPORTATION

Transportation shall be provided in accordance with the EMS plans for Shuttle or Soyuz. Transportation in Russia will be provided by the host country to a designated site. Medical Evacuation (MEDEVAC) of U.S. astronauts will be in concordance with JSC 28262, International Space Station (ISS) Emergency Medical System (EMS) plan. MEDEVAC of other astronauts will be coordinated between the host country and the astronaut's home country. The landing vehicle site EMS implementation plan shall include a list of hospitals which may be used as DMCFs, Intermediate Medical Care Facility (IMCF), or other applicable medical facilities with helicopter landing capability.

8.5 LEVEL OF CARE

EMS services and transportation used to transport ill or injured flight crewmembers from the recovery site to a medical care facility shall be capable of en route emergency medical stabilization. One litter shall be available for each flight crewmember.

Stabilization shall include, but is not limited to, standard ACLS and ATLS capabilities.

8.6 ACCESSIBILITY TO CARE

An ill or injured flight crewmember or support person shall be transported from the recovery scene to a DMCF unless:

A. The on-scene physician determines that the transport time to the DMCF is too long for a particular patient and initial stabilization and preparation for transfer must be carried out at an IMCF or other appropriate medical facility

B. An IMCF is the only available medical facility

The on-scene physician shall determine the triage priorities for medical care and shall determine the mode of transport for each ill or injured flight crewmember or support person.

The site EMS Coordinator shall plan, coordinate, and direct site EMS personnel to assure prompt treatment for each ill or injured flight crewmember. Prior arrangements (by agreement, contract, etc.) shall ensure access to DMCFs/IMCFs. Site implementation plans submitted to the JSC Chief, MOB, shall include copies of all agreements with DMCFs/IMCFs. Site plans shall specify transport time(s) to medical care facilities, including hyperbaric chambers, via air and ground transportation.

8.7 MEDICAL RECORD KEEPING

The records of all medical services provided to any flight crewmember shall be maintained as follows:

A. MCC-H or MCC-M Surgeon - Surgeon’s Log

B. Site physician EMS Coordinator - EMS Operations Log

C. Site EMS Personnel - Patient’s Emergency Record

D. MCC-H or MCC-M BME - BME Log

Medical records generated by the DMCF/IMCF shall remain in the custody of these facilities. The CS shall have access to review and obtain copies of DMCF/IMCF records, as necessary.

Medical records shall contain the following:

A. Patient’s condition on delivery to DMCF/IMCF;

B. History and physical findings relevant to illness or injury;

C. Medical diagnosis and recommendations;

D. Complete list of any treatment, including date, time, and description;

E. Signature of responsible EMS support personnel and on-scene physician.

All medical records maintained at JSC Flight Medicine Clinic, as well as medical records of U.S. astronauts maintained by a different host country, shall be subject to the provisions of the Privacy Act of 1974 as amended.

All flight crewmember data accessed from the JSC Life Sciences Medical Operations Computer (LSMOC) shall be under the direction and control of the Chief, MOB, and subject to the Privacy Act of 1974 as amended.

8.8 EVALUATION

After delivering EMS to flight crewmembers, the site EMS Coordinator shall evaluate the services with recommendations for future operations. The evaluation report shall be submitted to the JSC Chief, MOB.

APPENDIX A

ACRONYMS AND ABBREVIATIONS

APPENDIX A - ACRONYMS AND ABBREVIATIONS

2D	2-Dimensional
ACIH	American Conference on Industrial Hygienists
ACLS	Advanced Cardiac Life Support
ALARA	As Low As Reasonably Achievable
ALS	Advanced Life Support
AMERD	Astronaut Medical Evaluations Requirements Document
ANSI	American National Standard Institute
ATLS	Advanced Trauma Life Support
BCOP/MCOP	Bilateral Crew Operations Panel/Multilateral Crew Operations Panel
BDC	Baseline Data Collection
BLS	Basic Life Support
BME	Biomedical Engineer
CAPCOM	Capsule Communicator
CFR	Code of Federal Regulations
CFU	Colony Forming Unit
CHeCS	Crew Health Care Systems
CM^2	Centimeters Squared
CMO	Crew Medical Officer
CMS	Countermeasure System
CPR	Cardiopulmonary Resuscitation
CRV	Crew Return Vehicle
CS	Crew Surgeon (increment assigned flight surgeon)
DMCF	Definitive Medical Care Facility
DoD	Department of Defense
ECLSS	Environmental Control and Life Support System
EHS	Environmental Health System
EKG	Electrocardiogram
EMS	Emergency Medical Service Emergency Medical System
EMU	Extravehicular Mobility Unity
EVA	Extravehicular Activity
FCC	Flight Control Center
FCOD	Flight Crew Operations Directorate
FCT	Flight Control Team
FD	Flight Director
FS	Flight Surgeon
GFE	Government Furnished Equipment
GHz	Giga Hertz
Gz	G force in direction of z axis
HAB	Habitation Module
HMS	Health Maintenance System
HRF	Human Research Facility
HRMRB	Human Research Multilateral Review Board

HSP	Health Stabilization Program
ICD	Interface Control Document
IEEE	Institute of Electrical and Electronic Engineers
IMCF	Intermediate Medical Care Facility
JSC	Johnson Space Center
JSCI	Johnson Space Center Instruction
kHz	kilo Hertz
KSC	Kennedy Space Center
L-	Launch Minus
LAB	Laboratory Module
LBNP	Lower Body Negative Pressure
LCG	Liquid Cooling Garment
LET	Linear Energy Transfer
LOS	Loss Of Signal
LSMOC	Life Sciences Medical Operations Computer
m^3	Milligrams per Cubic Meter
MCC	Mission Control Center
MCC-H	Mission Control Center - Houston
MCC-M	Mission Control Center - Moscow
MCOP	Multilateral Crew Operations Panel
MD	Management Directive
MEDEVAC	Medical Evacuation
MET	Mission Elapsed Time
MF	Membrane Filtration
mg	Milligram
ml	Milliliter(s)
MMOP	Multilateral Medical Operations Panel
MMPB	Multilateral Medical Policy Board
IP	International Partner
ISS	International Space Station
ISSP	International Space Station Program
MMT	Mission Management Team
MOB	Medical Operations Branch
MORD	Medical Operations Requirements Document
MOSIP	Medical Operations Support Implementation Plan
MOU	Memoranda Of Understanding
MPLM	Mini-Pressurized Logistics Module
MPSR	Multipurpose Support Room
MSG	Medical Support Group
MSMB	Multilateral Space Medicine Board
NASA	National Aeronautics and Space Administration
NC	Noise Criteria
NCRP	National Council on Radiation Protection and Measurements
NHB	NASA Handbook
NPD	NASA Policy Directive
OPS Planner	Operations Planner

ORU	Orbital Replacement Unit
PC	Primary Contact
PFC	Private Family Conference
PMC	Private Medical Conference
PPC	Private Psychological Conference
$ppCO_2$	Partial Pressure of Carbon Dioxide
ppO_2	Partial Pressure of Oxygen
ppN_2	Partial Pressure of Nitrogen
R+	Return Plus
RM	Research Module
RSA	Russian Space Agency
SAA	South Atlantic Anomaly
SLSD	Space and Life Sciences Directorate
SM	Service Module
SSK	Surface Sampler Kit
STP	Short Term Plan
SVO-ZV	Hygiene Station Water Port
TLD	Thermo-luminescient Dosimeter
TOCA	Total Organic Carbon Analyzer
TsUP	Center for Controlled Guided Flight
U.S.	United States
WMK	Water Microbiology Kit

APPENDIX B

GLOSSARY OF TERMS

APPENDIX B - GLOSSARY OF TERMS

DEFINITIVE MEDICAL CARE FACILITY

An inpatient medical care facility capable of comprehensive diagnosis and treatment of a flight crewmember's injuries or illness without outside assistance, including care of Category I, II, and III trauma patients. (American College of Surgeon's classification - usually a Level I trauma center, but may be a Level II trauma center, depending on regional resources)

EMERGENCY MEDICAL SERVICES

Services required to provide immediate medical care to flight crewmembers, preventing aggravation of physical or psychological conditions and/or loss of life. This service includes personnel, facilities, and equipment for the immediate and coordinated delivery of health care services.

INTERMEDIATE MEDICAL CARE FACILITY

An inpatient medical care facility capable of initial stabilization and treatment of a flight crewmember's injuries or illness. Category I and some Category II trauma patients will be transferred to a DMCF, and some Category II and Category III trauma patients may remain in an IMCF.

APPENDIX C

OPEN WORK

APPENDIX C - OPEN WORK

C.1 MATRIX OF ISSUES TO BE RESOLVED

Table C-1 lists To Be Resolved (TBR) issues in the document. Each issue is given a TBR number using the section of the document that contains the issue as the first digit and a consecutive number for the second digit. The TBR number is listed along with the affected section and a description of the issue. As each TBR issue is resolved, the correct text is inserted in place of the TBR in the document and the entry is removed from this table.

TABLE C-1 TO BE RESOLVED ISSUES

TBD	Section	Description
5-1	5.3-1	Should ethylene glycol be on list or is it not a component of ISS? Replacement Fluid?
6-1	6.1.1	MSMB methods of validation for crew selection and assignment.

C.2 MATRIX OF ISSUES TO BE DETERMINED

Table C-2 lists To Be Determined (TBD) items in the document. Each item is given a TBD number using the section of the document that contains the item as the first digit and a consecutive number for the second digit. The TBD number is listed along with the affected section and a description of the item. As each TBD item is resolved, the correct text is inserted in place of the TBD in the document and the entry is removed from this table.

TABLE C-2 TO BE DETERMINED ITEMS

TBR	Section	Description
1-4	1.6.1	Process for release of medical data concerning any flight crewmember
2-1	2.2, 3.2	ISS Medical Privacy Policy Document
3-1	3.6.5	The MMT that will receive non medically sensitive summary information
3-2	3.6.3	ISS Medical Privacy Policy Document
4-1	4.3.3.7	The Document which will contain resource requirements for medical intervention and care operations
4-2	4.3.3.9	Detailed resupply requirements are specified in this document
4-4	4.3.1	Conditions for remote access to downlinked Medical Operations data
4-5	4.3.4.8	Documents to specify checkout and maintenance if of medical hardware
4-6	4.4.1	MMOP approved rehabilitation document
4-7	4.1.4	Biomedical Flight Controller Role and Responsibility
5-4	5.4.1	SSP 41172 US segment water quality requirements section
5-5	5.4.1.1	SSP 41172 preflight microbial monitoring requirements section
5-6	T5.4-2	In-flight microbial sampling numbers and locations
5-7	5.7.3	Document to specify acoustics monitoring
6-1	6.3.3	Max post-flight crew duty day
7-1	7.1	Russian group for RSA-controlled ground support operations

7-2	7.2.1	Document number for ISS Medical Operations Core Training Guide
7-3	7.2.1	Document number for ISS Medical Operations Crew Medical Officer Training Guide
7-4	7.2.1	Document number for ISS Medical Operations Environmental Control and Life Support System Training Guide
7-5	7.2.1	ISS Medical Operations On-Orbit Maintenance Training Guide
7-6	T7.2.1-1	Generic Template of Medical Training for ISS Crewmembers
8-1	8.1	Document to specify EMS requirements for crew launching on Soyuz