3.2 Medical Requirements Overview

TABLE 3.2: MEDICAL REQUIREMENTS OVERVIEW

MEDB# and Title:	MEDB 6.1 and MEDB 6.2 EVA Medical Monitoring
Sponsor:	Medical Operations
Discipline:	Extravehicular Activity (EVA)
Category:	Medical Requirements (MR)
References:	SSP 50260 ISS Medical Operations Requirements Document (MORD),SSP 50667 Medical Evaluation Document (MED) Volume B
Purpose/Objectives:	To assess the medical health status of the EVA crewmembers pre/post EVA
Measurement Parameters:	Preflight: Neutral Buoyancy Lab (NBL) EVA training Metabolic Rates with Major Task Analysis (estimated) and In-Suit Light Exercise (ISLE) Training. In-flight, Pre- and Post EVA: Medical evaluation In-flight, during EVA: Metabolic Rate (estimated), ECG and heart rate, suit pressure, suit CO_2 partial pressure, radiation exposure, body temp (Russian Orlan suit only).
Deliverables:	Preflight, NBL EVA training Metabolic Rates with Major Task Analysis (estimated) and ISLE Training data reported to the Crew Surgeon, Biomedical Flight Controller (BME), and upon request, Flight Operation Directorate (FOD) leads, Extravehicular Mobility Unit (EMU) Original Equipment Manufacturer (OEM) Systems Group leads and crewmember. Non-attributable data may also be utilized in the EVA Physiology Lab (EPL) for reports, presentations, and publications supporting the Human Health and Performance Directorate. Crew Surgeon will deliver a flight note to the Flight Director regarding crewmember readiness for EVA. EPL will receive EVA heart rates and metabolic rates from BME.
Flight Duration:	$\geq$ 30 days
Number of Flights:	All ISS flights requiring an EVA
Number and Type of Crew Members Required:	All long-duration EVA crewmembers
Other Flight Characteristics:	N/A

3.3 Preflight Training

TABLE 3.3: PREFLIGHT TRAINING

Preflight Training Activity Description:	Classes will be conducted to educate the EVA crew on medical monitoring required pre and post EVA.			
	Duration:	**Schedule:**	**Flexibility:**	**Personnel Required:**
Schedule:	Experienced Crewmember: CMO Skills I: 2 hours CMO Skills III: 2 hours	L-15/12 months	+/- 6 weeks	Johnson Space Center (JSC) Instructors / CMOs
	Inexperienced Crewmember: CMO Skills I: 3 hours CMO Skills III: 3 hours	L-15/12 months	+/- 6 weeks	JSC Instructors / CMOs
	Med. Evaluation of Decompression Sickness: 1 hour	L-11 months	+/- 6 weeks	JSC Instructors / EVA crew and CMOs
Schedule:	Russian medical and hardware training: 2 hours	Approx. L-6 months	+/- 2 months	Gagarin Cosmonaut Training Center (GCTC) Trainers / EVA crew and CMOs
Ground Support Requirements Hardware/Software	**Preflight Hardware:**	**Preflight Software:**		**Test Location:**
	Station Support Computer (SSC)	SSC Data Collection Tool (DCT) software		U.S.
	Urisys and accessories	Russian medical & hardware training will be scheduled by and trained by the GCTC personnel in Star City		Russia
Training Facilities	**Minimum Room Dimensions:**	**Number of Electrical Outlets:**	**Temperature Requirements:**	**Special Lighting:**
	Standard room, 8 ft. x 10 ft.	4 (U.S. 110V, Russia 220V)	Normal, 20° – 25° C.	Normal lighting
	Hot or Cold Running Water:	**Privacy Requirements:**	**Other:**	
	Hot and cold water for hand washing.	Private room required	Enough chairs and tables to accommodate the crew and instructors.	
Constraints/Special Requirements:	N/A			
Launch Delay Requirements:	Refresher training to be scheduled at Crew Surgeon request			
Notes:	Training procedures: 1. US Systems Operations Data File (SODF): Med C/L (Medical Checklist), EVA (EVA Systems) 2. Russian Operations Data File (RODF): Service Module Medical Operations, Book 2			

3.4 Preflight Activities

TABLE 3.4: PREFLIGHT ACTIVITIES

Preflight Activity Description:	Metabolic rate (estimated) of the crewmember will be recorded during a minimum of two training sessions in the NBL in order to establish a baseline metabolic rate. This is a passive test that requires zero additional crew time during their EVA training sessions. Low, high, and average met rates for major EVA tasks will be determined. In addition, decrement in O2 tank pressure will be calculated based on total O2 consumption for each major EVA task. If task timeline is unavailable, 30-minute intervals will be used instead. The EPL is responsible for scheduling this session.			
Schedule:	**Duration:**	**Schedule:**	**Flexibility:**	**Personnel Required:**
	Metabolic rate (estimated): 6 hours	During at least two NBL training sessions per crew member.	See schedule	EPL personnel EVA crewmember Environmental Control System Technician
Ground Support Requirements Hardware/Software	**Preflight Hardware:**	**Preflight Software:**	**Test Location:**	
	AEI Technologies CO2 Analyzer Laptop computer Environmental Control System (ECS) National Instruments Universal Bus (USB) - 612	Data collection software using LabVIEW (made by National Instruments)	JSC / NBL	
Testing Facilities	**Minimum Room Dimensions:**	**Number of Electrical Outlets:**	**Temperature Requirements:**	**Special Lighting:**
	JSC NBL Topside A or B	2	Normal	N/A
	Hot or Cold Running Water:	**Privacy Requirements:**	**Vibration/Acoustic Isolation:**	**Other:**
	N/A	N/A	N/A	N/A
Constraints/Special Requirements:	N/A			
Launch Delay Requirements:	N/A			
Notes:	N/A			
Data Delivery	NBL EVA training metabolic rates and task analysis will be prepared and delivered to the Crew Surgeon and BME. L-3/1 month Cycle Ergometer test (MEDB 4.1) will be available on the SharePoint server. Data will be delivered prior to launch in order to compare with in flight EVA results.			

3.5 In-Flight Activities

TABLE 3.5.1: IN-FLIGHT ACTIVITIES

In-Flight Activity					
Description:	Pre- and Post EVA: Within 48 hours of suit donning and 24 hours of suit doffing the medical evaluation/Periodic Health Status (PHS) will consist of a review of systems (ROS) by the expedition crew surgeon, a brief skin and extremity examination by the CMO, and as clinically indicated urinalysis. For Orlan only, and as part of nominal suit check-out on day of EVA, vital signs (Blood Pressure & temperature) and ECG-DS will be done. The crew surgeon may direct a specific medical exam based on ROS findings.				
Schedule:	▪ During the EVA, the following measurements will be taken (real-time except for radiation exposure) MEDB 6.2: ECG; O_2 consumption; Body temperature (Russian Orlan suit only) Heart rate; Suit CO_2 partial pressure Suit pressure; Radiation exposure				
	Activity:	**Duration:**	**Schedule:**	**Flexibility:**	**Personnel Required:**
	Pre-EVA Periodic Health Status (PHS)	Setup: 10 minutes Exam: 15 minutes/CM CMO: 5 minutes/CM Stow: 10 minutes	Within 48 hours of suit donning	≤ 48 hours before EVA	Flight Surgeon (FS) + CMO + EVA crew
	Post-EVA PHS	Setup: 10 minutes Exam: 15 minutes/CM CMO: 5 minutes/CM Stow: 10 minutes	Within 24 hours of suit doffing	≤ 24 hours after EVA	FS+ CMO + EVA crew
	EVA monitoring	Up to 8 hours	Every EVA	N/A	FS + EVA crew + Ground control

Procedures:	In-flight procedures can be found within these books: US SODF: MED OPS, ISS MED CL (Medical Checklist) RODF: Service Module Medical Operations Book 2 BME Console Handbook
Constraints / Special Requirements:	• If requested, urinalysis should be performed and reported to Flight Surgeon on day of EVA. • If a medical contingency occurs post EVA that is non-DCS related, schedule 1 additional hour for the PHS. • EVA monitoring is performed per MEDB 6.2 • For double and triple EVAs, the pre and/or post EVA PHS exam may be waived, per surgeon discretion.
Photo / TV Requirements:	N/A
Mission Extension Requirements:	N/A
Data Delivery	MEDB 6.1: In-flight PHS discrete values are recorded in the DCT and will be saved along with PHS Otoscope images on the Station Support Computer (SSC) File Server. PHS data will be provided by the Med Ops Data Specialist to the Flight Surgeon within 24 hours of receipt. PHS data is archived within the Mission Extended Medical Enterprise (MEME) environment. The ROS deliverable is included as part of the PMC [MEDB 1.3] in the Electronic Medical Record. MEDB 6.2: ECG, heart rate, and metabolic rate data obtained during the EVA is processed by the Advanced ECG Monitoring System (AEMS) and monitored real-time. An ECG holter monitor report and summary of each EVA crewmember's ECG data is provided to the Flight Surgeon on console within 3 hours after every EVA or at designated time agreed upon by the Flight Surgeon. Heart rate and metabolic rate logs are securely sent via the MEME network to the EPL after the conclusion of the EVA. ECG, heart rate, and metabolic rate data is archived on the MEME FTP server.

TABLE 3.5.2: IN-FLIGHT HARDWARE

Hardware/Software Name
Space Station Computer (SSC)
Data Collection Tool (DCT)
Medical Diagnostic Pack
Medical Supply Pack

3.6 Postflight Activities – No Postflight Activities

3.7 Summary Schedule

TABLE 3.7: SUMMARY SCHEDULE

ACTIVITY	DURATION	SCHEDULE	FLEXIBILITY	PERSONNEL REQUIRED	CONSTRAINTS
Preflight Training					
Experienced Crewmember: CMO Skills I: CMO Skills III:	2 hours	L-15/12 months	+/- 6 weeks	JSC Instructors / CMOs	N/A
Inexperienced Crewmember: CMO Skills I: CMO Skills III: Med. Evaluation of Decompression Sickness	3 hours 1 hour	L-15/12 months L-11 months	+/- 6 weeks +/- 6 weeks	JSC Instructors / CMOs JSC Instructors / EVA crew and CMOs	N/A
Russian medical and hardware training	2 hours	Approx. L-6 months	+/- 2 months	GCTC Trainers / EVA crew and CMOs	N/A
Preflight Activities					
Preflight, NBL EVA training Metabolic Rates with Major Task Analysis (estimated)	6 hours	During at least two NBL sessions per crewmember.	Schedules permitting, data will be collected for a minimum of two training sessions. If either session terminates early or the data is questionable, another session will be used to collect data.	EPL personnel EVA crewmember Environmental Control System Technician	N/A

MEDB 6.1 and 6.2 EVA Medical Monitoring

ACTIVITY	DURATION	SCHEDULE	FLEXIBILITY	PERSONNEL REQUIRED	CONSTRAINTS
In-Flight Activities					
Pre-EVA Periodic Health Status (PHS)	Setup: 10 minutes Exam: 15 minutes/CM CMO: 5 minutes/CM Stow: 10 minutes	Within 48 hours of suit donning	≤ 48 hours before EVA	FS+ CMO + EVA crew	If requested, urinalysis should be performed and reported to Flight Surgeon on day of EVA. If a medical contingency occurs post EVA that is non-DCS related, schedule 1 additional hour for the PHS.
EVA monitoring (MEDB 6.2)	Up to 8 hours	Every EVA	N/A	FS + EVA crew + Ground Control	None
Post-EVA PHS	Setup: 10 minutes Exam: 15 minutes/CM CMO: 5 minutes/CM Stow: 10 minutes	Within 24 hours of suit doffing	≤ 24 hours after EVA	FS+ CMO + EVA crew + Ground control	If a medical contingency occurs post EVA that is non-DCS related, schedule 1 hour additional for the PHS.
Postflight Activities – N/A					