

3.2 Medical Requirements Overview

TABLE 3.2: MEDICAL REQUIREMENTS OVERVIEW

MEDB# and Title:	MEDB 5.2 On-Orbit Strength & Conditioning Monitoring
Sponsor:	Medical Operations
IPT:	Bone, Muscle and Exercise
Category:	Medical Requirements
References:	SSP 50260 ISS Medical Operations Requirements Document (MORD) SSP 50667 Medical Evaluations Document (MED) Volume B
Purpose/Objectives:	To fulfill the medical requirement that all crewmembers shall participate in a program of prescribed and scheduled exercise during flight. The exercise prescription shall be recorded and adherence to the prescription will be evaluated. This information will be used to assess crew readiness for in-flight duties and EVA, assess countermeasure effectiveness, and provide a historical record of the exercise program performed during flight.
Measurement Parameters:	The following information will be collected: For All Exercise Modalities: Number of training sessions/week. For Treadmill with Vibration Isolation and Stabilization (TVIS) and Treadmill 2 (T2): Speed of walking/running, subject load device settings, heart rate, exercise duration For T2: Ground reaction forces and impact loading For Cycle Ergometer with Vibration Isolation System (CEVIS): Work rate (Watts), pedaling speed, heart rate, exercise duration, arm or leg session For Resistive Exercise Device (RED): Exercises performed, number of sets and repetitions, load settings
Deliverables:	<ol style="list-style-type: none"> 1. Exercise prescriptions for each crewmember, updated as the mission progresses. 2. Reports to the surgeon regarding the exercise activities conducted during flight for each crewmember will be delivered every other week. 3. A final summary report detailing all exercise conducted during flight and outcome measures from ground testing.
Flight Duration:	≥30 days
Number of Flights:	Every Expedition
Number and Type of Crew Members Required:	All prime and back-up crewmembers for preflight training.
Other Flight Characteristics:	N/A

3.3 Preflight Training:

TABLE 3.3: PREFLIGHT TRAINING

Preflight Training Activity	Description:	<u>Countermeasures Systems Operations 1 (for all crewmembers):</u> This lesson introduces crewmembers to initial CMS hardware components, stowage locations, operating procedures, and interfaces. The first part of the lesson concentrates on the purpose and operation of the components. This is followed by hands-on procedures using the hardware, including checkout and stowage procedures.		
		<u>Countermeasures Systems Operations 2 (for all crewmembers):</u> This lesson introduces crewmembers to remaining CMS hardware components, stowage locations, operating procedures, and interfaces. The first part of the lesson concentrates on the purpose and operation of the components. This is followed by hands-on procedures using the hardware, including checkout and stowage procedures.		
	Schedule:	Duration:	Schedule:	Personnel Required:
	CMS Ops 1: 2 hrs CMS Ops 2: 2 hrs	L-1 year L-1 year	+/- 5 days +/- 5 days	Trainers/Crew Trainers/Crew
Ground Support Requirements Hardware/Software	Preflight Hardware:	Preflight Software:	Test Location:	
	Flight Training CEVIS Flight Training TVIS and T2 Flight Training RED Medical Equipment Computer (MEC)	CEVIS Logging Software TVIS and T2 Logging Software RED Logging Software	U.S.	
Training Facilities	Minimum Room Dimensions:	Number of Electrical Outlets:	Temperature Requirements:	Special Lighting:
	Approximately 15 ft. x 15 ft.	One 110 V AC (USA)	20 -25°C	N/A
	Hot or Cold Running Water:	Privacy Requirements:	Other:	
	N/A	N/A	N/A	
Constraints/Special Requirements:	N/A			
Launch Delay Requirements:	N/A			
Notes:	N/A			

3.4 Preflight Activities:

TABLE 3.4: PREFLIGHT ACTIVITIES

Preflight Activity	Description:	Exercise Prescription The ASCR/ExPC team will develop aerobic and strength exercise prescriptions for each crewmember. This prescription will utilize the individual crewmember’s medical history and current physical condition. Once developed, the individual prescriptions will be reviewed by the crew surgeon and updated as needed. Exercise sessions using high fidelity training equipment identical to that presently on ISS will be made available at least twice per week for training and familiarization beginning at L-6 months and follow their initial exercise prescriptions for flight. During these sessions the Astronaut Strength, Conditioning and Rehabilitation (ASCR) team will familiarize the crew with use of the exercise equipment, associated software and their individual exercise prescriptions. The prescriptions for aerobic and strength exercises will be reviewed by the Crew Surgeon and ExPC Lead. Prescriptions will be updated according to the individual crewmembers condition.			
	Schedule:	Duration: 2 hrs	Schedule: L-6 months: 2 times per week and thereafter	Flexibility: N/A	Personnel Required: Crewmember/ASCR
Ground Support Requirements Hardware/Software	Preflight Hardware:	Preflight Software:		Test Location:	
	Flight Training CEVIS Flight Training TVIS and T2 Flight Training RED Medical Equipment Computer (MEC)	CEVIS Logging Software TVIS and T2 Logging Software RED Logging Software		U.S.	
Testing Facilities	Minimum Room Dimensions:	Number of Electrical Outlets:	Temperature Requirements:	Special Lighting:	
	Approximately 15 ft. x 15ft	Three 110 V AC (USA)	20 -25° C	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:	Takes place during normally scheduled gym time				
Data Delivery	Data/Report to Designated Recipients (Nominal/Contingency):				
	The ASCR team will provide progress reports to the crew surgeon on a periodic basis preflight.				

3.5 In-Flight Activities

TABLE 3.5.1: IN-FLIGHT ACTIVITIES

In-Flight Activity	Description:	Daily Aerobic and Strength Exercise Two sessions of daily physical exercise totaling 2.5 hours based on the preflight prescriptions will be scheduled for each U.S. crewmember in-flight. The session will include time for set-up and takedown of hardware and post-exercise session hygiene. Aerobic exercise will consist of active or passive TVIS or T2 and/or CEVIS, while strength conditioning will occur on a resistance exercise device (RED). In-flight results will be transferred into the individual exercise data management program on the MEC or ISS File Server. Exercise prescriptions for CEVIS and TVIS are stored on PCMCIA cards and changes to individual exercise prescriptions can be uploaded to the cards on orbit. The exercise prescriptions for T2 are stored on the T2 Display (control panel) and are transferred to an ISS File Server before being downlinked to the ground. Executed RED activities are stored on the RED Display and downlinked to the ground directly from there.					
	Schedule:	Activity:	Duration:	Schedule:	Flexibility:	Blood Volume:	Personnel Required:
	Aerobic and Strength Exercise MEC/SSC Exercise Data Download	2.5 hrs 40 min	Recurrent as prescribed Weekly	N/A N/A	N/A N/A	Crewmember Crewmember	
Procedures:	As prescribed						
Constraints / Special Requirements:	<ol style="list-style-type: none"> To begin no earlier than 75 minutes after meal. To begin no earlier than 60 minutes post-sleep. Complete no later than 2 hours before the start of sleep. Deviations from the above are possible on a case-by-case basis. Schedule arriving-crew member with a nominal 2.5 hrs/day exercise plan no earlier than the fifth day docked to the ISS. All crews must have received CMS Hardware familiarization on TVIS/T2, ARED and CEVIS prior to their first exercise session. 						
Photo / TV Requirements:	Downlinked video is required of the crew exercising on the following CMS hardware: Treadmill: Obtain video of an exercise session of one each crewmember using TVIS or T2. This is requested twice per Increment. RED: obtain video of an exercise session of all crewmembers using the RED. This is requested twice per Increment. CEVIS: Obtain video of an exercise session of one each crewmember using CEVIS one time per Increment. Video of the PFE (MR080L) may substitute for the CEVIS exercise session. 10 min setup, 10 min stow per session.						
Cold Stowage Requirements:	N/A						
Mission Extension Requirements:	As Prescribed by Flight Surgeon						
Landing Wave-Off Requirements:	N/A						

<p>Data Delivery</p>	<p>Data/Report to Designated Recipients (Nominal/Contingency):</p>
	<p>Individual exercise logs will be downloaded to MCC once a week and placed into a share folder designated to the ASCR/ExPC team.. The ASCR/ExPC team will review data sets and downlinked video for determination of exercise frequency, duration, intensity, development of expedition exercise activity profiles, and assessment of exercise adherence. Prescriptions will be modified as necessary based on the crewmembers performance. Biweekly interim reports regarding the exercise activities and prescribed exercise activities conducted during flight shall be compiled and completed by ASCR/ExPC personnel. These reports will be delivered to /and reviewed with the Flight Surgeon from the Exercise Lead and the ASCR within 14 working days of receipt of data. A final summary report of all exercise conducted during the ISS Increment shall be delivered and reviewed within 45 days of mission end. A copy of the exercise logs, interim, and final reports will be archived on an FTP server in building 8</p>

3.6 Postflight Activities: No Postflight Activities

3.7 Summary Schedule

TABLE 3.7: SUMMARY SCHEDULE

ACTIVITY	DURATION	SCHEDULE	FLEXIBILITY	BLOOD VOLUME	PERSONNEL REQUIRED	CONSTRAINTS
Preflight Training						
CMS Ops 1	2 hrs	L- 1 year	+/- 5 Days	N/A	Trainers/Crew	None
CMS Ops 2	2 hrs	L-1 year	+/- 5 Days	N/A	Trainers/Crew	None
Preflight Activities						
Exercise Prescription on Flight Devices	2 hrs	Part of Normal Exercise Time	N/A	N/A	ASCR/Crewmember	None
In-Flight						
Daily Aerobic and Strength Exercise	2.5 hrs	Recurrent as prescribed	N/A	N/A	Crewmember	<ol style="list-style-type: none"> 1. To begin no earlier than 75 minutes after meal. 2. To begin no earlier than 60 minutes post-sleep. 3. Complete no later than 2 hours before the start of sleep. 4. Deviations from the above are possible on a case-by-case basis. 5. . Schedule arriving-crew member with a nominal 2.5 hrs/day exercise plan no earlier than the fifth day docked to the ISS. All crews must have received CMS Hardware familiarization on TVIS/T2, ARED and CEVIS prior to their first exercise session.
Postflight-NA						
Postflight Debrief						
Debrief	No extra time	~R+30 days	As scheduled	N/A	ASCR/EXPC/CMS Ops/ Rep/ Crewmember	Included as part of the Med Ops overall debrief.