

MEDB 1.8 Hearing Assessment

3.2 Medical Requirements Overview

TABLE 3.2: MEDICAL REQUIREMENTS OVERVIEW

MEDB# and Title:	MEDB 1.8 Hearing Assessment (includes MED Volume B sections 1.8 and 1.8.1)
Sponsor:	Medical Operations
Discipline:	Neurological Function/Acoustic
Category:	Medical Requirements (MR)
References:	ISS Medical Operations Requirements Document (MORD) SSP 50260: Medical Evaluation Documents (MED) Volume B Section 1.8 Hearing Assessment Medical Evaluation Documents (MED) Volume B Section 1.8.1 Hearing Protection
Purpose/Objectives:	To assess (and detect any changes in) crewmember hearing status preflight, on orbit, and post-flight
Measurement Parameters:	Hearing thresholds at specified frequencies within the range of 250 Hz – 10,000 Hz and additional audiological tests as determined by an audiologist.
Deliverables:	Audiometry report - reviewed by Audiologist and Crew Surgeon. On-Orbit Hearing Assessments results will be sent down via data downlink within the week of on-orbit test (this is private data).
Flight Duration:	≥ 30 days
Number of Flights:	All
Number and Type of Crew Members Required:	All ISS prime, long-duration crews required. Back-up crews required for training only.
Other Flight Characteristics:	N/A

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3.3 Preflight Training

TABLE 3.3: PREFLIGHT TRAINING

Preflight Training Activity	Description:	Crewmember will be trained on the set up of the On-Orbit Hearing Assessment (OOHA) protocol, using EarQ application on any Station Support Computer (SSC) laptop. As detailed in MR084L, this training lesson also includes the use of hearing protection, as well as training on the use of the acoustic dosimeter and sound level meter.			
	Schedule:	Duration:	Schedule:	Flexibility:	Personnel Required:
		EHS ACOUSTICS 31001 – Inexperienced CM - 60 min. (includes Acoustic Dosimeter , Sound Level Meter, hearing protection devices and EarQ software training – see MR084L) EHS ACOUSTICS 31001 - Experienced CM – 30 min	No earlier than L-18 months	N/A	Crewmembers/instructors
Ground Support Requirements Hardware/Software	Preflight Hardware:	Preflight Software:		Test Location:	
	Acoustic Dosimeter Acoustic Dosimeter Data Receiver Sound Level Meter Space Station Computer (SSC) Laptop RS 232 cableHearing Protection Devices (custom Prophonics and Etymotics, Foam earplugs) Bose QC2 Headphones USB to Serial Adapter QC2 Mobile Communications Kit AAA batteries(for Bose QC2 headsets) C batteries (for SLM)	Certified “Noise Explorer” on SSC (for Sound Level Meter), EarQ software (for OOHA), and QuestSuite Professional II (for Acoustic Dosimeter)		US	
Training Facilities	Minimum Room Dimensions:	Number of Electrical Outlets:	Temperature Requirements:	Special Lighting:	
	Approx. 29 feet X 14 feet	2	Ambient	N/A	
	Hot or Cold Running Water:	Privacy Requirements:	Other:		
	N/A	Private room, free of distraction.	One table, 6-8 chairs.		
Constraints/Special Requirements:	N/A				
Launch Delay Requirements:	Crewmember may request refresher training if desired.				
Notes:	Experienced crewmembers (CM) – those CMs who have had previous EHS Acoustic Training. Inexperienced CMs – those CMs who have never had EHS Acoustic Training.				

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3.4 Preflight Activities

TABLE 3.4.1: PREFLIGHT ACTIVITIES

Preflight Activity	Description:	Ear impressions of crewmember's external ear canals will be made by audiologist. Impressions will then be used in fabrication of custom earwear for Prophonics Molded Earplugs, for use in OOHA (as well as for custom Etymotics earplugs as described in MR084L). Crewmembers will become familiar with ISS hearing protection devices(MEDB 1.8.1).		
	Schedule:	Duration:	Schedule:	Personnel Required:
		30 minutes	No earlier than L-30 months	All Crewmembers/Audiologist
Ground Support Requirements Hardware/Software	Preflight Hardware:	Preflight Software:		Test Location:
	Audiologist's materials for fabricating silicone impressions of external ear canals	N/A		US
Testing Facilities	Minimum Room Dimensions:	Number of Electrical Outlets:	Temperature Requirements:	Special Lighting:
	8' x 10'	None	Ambient	None
	Hot or Cold Running Water:	Privacy Requirements:	Vibration/Acoustic Isolation:	Other:
	N/A	Private room free of distractions	N/A	Table, 2 chairs, Otoscope
Constraints/Special Requirements:	<ul style="list-style-type: none"> Crewmember's ear canals must be free of earwax, which alter the shape of the actual ear canal. Excessive earwax, if seen, must be removed prior to ear impression. 			
Notes:	N/A			
Data Delivery	Data/Report to Designated Recipients (Nominal/Contingency):			
	None			

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TABLE 3.4.2: PREFLIGHT ACTIVITIES

Preflight Activity	Description:	Crewmember will be fit-checked to ensure proper fit of the custom-made earwear (Prophonics Molded Earplugs Set and Etymotics earplugs as described in MR084L), be familiarized with correct method of inserting custom-made earwear, perform an initial ground-based Functional Check and baseline OOHA with the EarQ software, and be tested with conventional audiometry to obtain baseline hearing data prior to flight. The Functional (listening) Check of the Prophonics earwear will be conducted to confirm that the crewmember can hear an audible signal in both earplugs. To serve as a reference for the baseline OOHA (with results that vary from conventional audiometric results, due to use of custom-made Prophonics ear monitors, the EarQ technique, and the acoustic output of the SSC laptop), conventional audiometry will be conducted, using an ANSI-calibrated audiometer and earphones, immediately after the baseline OOHA (MEDB 1.8.1)			
	Schedule:	Duration:	Schedule:	Flexibility:	Personnel Required:
	65 minutes total, consisting of: Fit/Function Check of earwear, OOHA familiarization and test, and Audiometry	L-20/5 months Fit check must occur at least 30 days after ear impressions	N/A	Crewmember, audiologist, hardware engineer	
Ground Support Requirements Hardware/Software	Preflight Hardware:	Preflight Software:	Test Location:		
	SSC laptop Prophonics Molded Earplugs Set Etymotics Earplugs Bose QC2 headphones AAA Batteries Air-Conduction Audiometer Sound-treated Audiometric Booth	EarQ software	U.S.		
Testing Facilities	Minimum Room Dimensions:	Number of Electrical Outlets:	Temperature Requirements:	Special Lighting:	
	8' x 10' (for EarQ)	Two	Ambient	N/A	
	Hot or Cold Running Water:	Privacy Requirements:	Vibration/Acoustic Isolation:	Other:	
	N/A	Private room free of distractions	Low noise levels	One table, 2 chairs, Otoscope	
Constraints/Special Requirements:	Crewmember should not be exposed to loud noises (greater than 85dBA or weapons firing) for at least 16 hours prior to conventional audiometry and baseline OOHA.				
Launch Delay Requirements:					
Notes:					
Data Delivery	Data/Report to Designated Recipients (Nominal/Contingency):				
	A copy of the baseline OOHA and reference audiometry data will also be included in the crewmember's Electronic Medical Record.				

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TABLE 3.4.3: PREFLIGHT ACTIVITIES

Preflight Activity	Description:	Crewmember's hearing will be tested using audiometry during their last rotation L-90/30 (no earlier than L-90±15days).			
	Schedule:	Duration:	Schedule:	Flexibility:	Personnel Required:
		Audiometry: 20 minutes	During last rotation L-90/30 (no earlier than L-90±15days)	Flexibility in schedule so that test is performed at the JSC Flight Medicine Clinic.	Audiologist, crewmember
Ground Support Requirements Hardware/Software	Preflight Hardware:	Preflight Software:		Test Location:	
	Sound-treated Audiometric Booth Audiometry equipment Note: Hardware provided by JSC Clinic	Audiometry software provided by JSC Clinic		U.S./JSC Clinic	
Testing Facilities	Minimum Room Dimensions:	Number of Electrical Outlets:	Temperature Requirements:	Special Lighting:	
	Approximately 4 ft. X 5 ft.	2	Normal range	N/A	
	Hot or Cold Running Water:	Privacy Requirements:	Vibration/Acoustic Isolation:	Other:	
	N/A	A sound-treated audiometric booth is provided by the JSC Clinic	Acoustic isolation is necessary	N/A	
Constraints/Special Requirements:	Test will be conducted in the U.S. at the JSC Flight Medicine Clinic				
Launch Delay Requirements:	N/A				
Notes:					
Data Delivery	Data/Report to Designated Recipients (Nominal/Contingency):				
	Results from audiometry will be included in the crewmember's Electronic Medical Record.				

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3.5 In-Flight Activities

TABLE 3.5.1: IN-FLIGHT ACTIVITIES

In-Flight Activity	Description:	The On-Orbit Hearing Assessment (OOHA) will assess changes in crew hearing on-orbit. The crewmember will be scheduled to perform an OOHA using the EarQ software on any on-orbit SSC laptop once within the first 14 days of flight, and then every 45-60 days thereafter.					
	Schedule:	Activity:	Duration:	Schedule:	Flexibility:	Blood Volume:	Personnel Required:
		On-Orbit Hearing Assessment (OOHA) using EarQ	Setup: 3 min EarQ test: 20 min/crewmember Stow: 2 min	First inflight OOHA on or before FD14; each 45 days thereafter, and as dictated by noise environment or crewmember complaints.	First test may occur on or before FD14.	N/A	All crewmembers
Procedures:	2.6.420 ON-ORBIT HEARING ASSESSMENT WITH EARQ SOFTWARE - NOMINAL OPS						
Constraints / Special Requirements:	All crewmembers can be scheduled simultaneously, if not using the same SSC laptop or same Bose Headphones. Deployed location for this test will be at any SSC laptop on-orbit, in a quiet location. Crewmember can use the same location for uniform conditions among all test results.						
Photo / TV Requirements:	N/A						
Cold Stowage Requirements:	N/A						
Mission Extension Requirements:	N/A						
Landing Wave-Off Requirements:	N/A						
Data Delivery	Data/Report to Designated Recipients (Nominal/Contingency):						
	Results from the OOHA will be saved to an on-board CHecs data folder on the ISS OPS LAN file server, and downloaded to the ground within a week from the test. The Audiologist will deliver a report to the FS within 3 days after receiving data. If a significant threshold shift is detected, the crew will be referred back to the in-flight procedures for corrective action.						

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In-Flight Activities, (cont.)

TABLE 3.5.2: IN-FLIGHT HARDWARE

Hardware/Software Name
SSC
EarQ software
Bose QC2 Noise Cancelling Headphones
Prophonics Earphones

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3.6 Postflight Activities

TABLE 3.6: POSTFLIGHT ACTIVITIES

Postflight Activity	Description:	Crewmember's hearing will be tested using conventional audiometry at R+3 days. When possible, this test will be combined with the postflight physical exam on the same day MEDB 1.1 Long duration Pre/Postflight Physical Exam).			
	Schedule:	Duration:	Schedule:	Flexibility:	Personnel Required:
		Audiometry: 20 minutes	R+3 days (If abnormal, R+10/14, R+60)	Flexibility in schedule so that test is performed at the JSC Flight Medicine Clinic.	Audiologist, crewmember
Ground Support Requirements Hardware/Software	Postflight Hardware:	Postflight Software:		Test Location:	
	sound-treated audiometric booth Audiometry equipment Note: Hardware provided by JSC Clinic	Audiometry software provided by JSC Clinic		U.S./JSC Clinic	
Testing Facilities	Minimum Room Dimensions:	Number of Electrical Outlets:	Temperature Requirements:	Special Lighting:	
	Approximately 4 ft. X 5 ft.	2	Normal range	N/A	
	Hot or Cold Running Water:	Privacy Requirements:	Vibration/Acoustic Isolation:	Other:	
	N/A	A sound-treated audiometric booth is provided by the JSC Clinic	Acoustic isolation is necessary	N/A	
Constraints/Special Requirements:	Upon return to the U.S. test will be conducted at the JSC Flight Medicine Clinic				
Early Destow / Early Return:	N/A				
Notes:	When possible, this test is combined with the post-flight physical (MEDB 1.1 Long Duration Pre/Postflight Physical Exam) on R+3 days.				
Data Delivery	Data/Report to Designated Recipients (Nominal/Contingency):				
	Results from the audiometry will be included in the crewmember's medical report and Electronic Medical Record.				

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TABLE 3.7: SUMMARY SCHEDULE

ACTIVITY	DURATION	SCHEDULE	FLEXIBILITY	BLOOD VOLUME	PERSONNEL REQUIRED	CONSTRAINTS
Preflight Training						
EHS Acoustic Training (includes hearing protection devices, ISS acoustic dosimeter, & EarQ audiometry training)	60 minutes	No earlier than L-18 months	N/A	N/A	Crewmember/instructor	N/A
Preflight Activities						
. Ear impressions of external ear canals will be made by audiologist. Crewmembers will become familiar with ISS hearing protection devices (MEDB 1.8.1).	30 minutes	NET L-30 months	N/A	N/A	All Crewmembers/Audiologist/Hardware Engineer	N/A
Ground-based fit check, functional check and hearing assessment (with EarQ software and conventional audiometry)	65 minutes	L-20/5 months	N/A	N/A	Crewmember, audiologist	N/A
Audiometry	20 minutes	During last rotation (no earlier than L-90/30 days)	Flexibility in schedule so that test is performed at the JSC Flight Medicine Clinic.	N/A	Audiologist, crewmember	Test will be conducted in the U.S. at the JSC Flight Medicine Clinic

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In-Flight						
On-Orbit Hearing Assessment (OOHA) with EarQ	Setup: 3 min EarQ test: 20 min / crewmember Stow: 2 min	One time on FD14 or earlier, then every 45 days	First test may occur on or before FD14.	N/A	Crew	Crewmembers can be scheduled simultaneously. Deployed location for this test will be at any SSC laptop location on-orbit, preferably in a quiet location. Crew can use the same location for uniform test results.
Postflight :						
Audiometry	20 minutes	R+3 days (If abnormal, R+10/14, R+60)	Flexibility in schedule so that test is performed at the JSC Flight Medicine Clinic.	N/A	Audiologist, Crewmember	Upon return to the U.S. test will be conducted at the JSC Flight Medicine Clinic
Postflight Debrief						
Part of the overall Med Ops Debrief.						