

**3.2 Medical Requirements Overview**

**TABLE 3.2: MEDICAL REQUIREMENTS OVERVIEW**

<b>MEDB# and Title:</b>	MEDB 1.10 Eye Examinations
<b>Sponsor:</b>	Medical Operations
<b>IPT:</b>	Therapeutics and Clinical Care
<b>Category:</b>	Medical Requirements
<b>References:</b>	SSP 50260 ISS Medical Operations Requirements Document (MORD) SSP 50667 Medical Evaluations Documentation (MED) Volume B
<b>Purpose/Objectives:</b>	To assess the status of ocular health and function pre- in- and postflight.
<b>Measurement Parameters:</b>	Questionnaire, visual acuity, refraction, automated visual fields, Amsler grid, pupil reflexes, extraocular muscle evaluation, biomicroscopy (slit lamp), dilated fundoscopic examination including video fundoscopy, retinal photography, tonometry, optical coherence tomography (OCT), A-scan ultrasound, 2-D imaging ultrasound, high-resolution MRI
<b>Deliverables:</b>	A pre- in- and postflight ocular report will be included in the CMIS
<b>Flight Duration:</b>	≥ 30 days
<b>Number of Flights:</b>	All long duration flights
<b>Number and Type of Crew Members Required:</b>	All ISS primary crewmembers, and backup crewmembers for preflight
<b>Other Flight Characteristics:</b>	N/A

3.3 Preflight Training

TABLE 3.3: PREFLIGHT TRAINING

<b>Preflight Training Activity</b>	<b>Description:</b>	Classes will be conducted to train the crew to conduct in-flight eye examinations.			
	<b>Schedule:</b>	<b>Duration:</b>	<b>Schedule:</b>	<b>Flexibility:</b>	<b>Personnel Required:</b>
		Video funduscopy (hardware) 30 min. Video funduscopy 30 min.* Tonometry 30 min.** 2-D Ultrasound 60 min.	L-120 with MEDB preflight exam* L-120	+/- 60 days NA* +/- 60 days	SD Trainers and CM SD Trainers, Optometrist, and CM* SD Trainers and CM SD trainers, Ultrasound Specialist, ISSMP personnel, and CM
<b>Ground Support Requirements Hardware/Software</b>	<b>Preflight Hardware:</b>	<b>Preflight Software:</b>		<b>Test Location:</b>	
	Video fundoscope, tonometry device, flight-like ultrasound	none		U.S.	
<b>Training Facilities</b>	<b>Minimum Room Dimensions:</b>	<b>Number of Electrical Outlets:</b>	<b>Temperature Requirements:</b>	<b>Special Lighting:</b>	
	Standard room, 8 ft. x 10 ft., Payload Development Lab (PDL) for ultrasound training	4 (U.S. 110V, Russia 220V)	Normal, 20° – 25° C.	Normal lighting	
	<b>Hot or Cold Running Water:</b>	<b>Privacy Requirements:</b>	<b>Other:</b>		
	Hot and cold water for hand washing.	Private room required	Enough chairs and tables to accommodate the crew and trainers.		
<b>Constraints/Special Requirements:</b>	N/A				
<b>Launch Delay Requirements:</b>	Refresher training to be scheduled at Crew Surgeon request				
<b>Notes:</b>	*Second portion of video funduscopy training must be coordinated with MEDB JSC onsite exam **Tonometry training will take less time when combined with CMO training Training procedures can be found in Space Medicine crew training lesson plans and the SODF: ISS Med (Medical Checklist)				

**3.4 Preflight Activities**

**TABLE 3.4: PREFLIGHT ACTIVITIES**

<b>Preflight Activity</b>	<b>Description:</b>	Eye examinations will be conducted preflight by specialists. The examinations will include: L-90/45 days* <ul style="list-style-type: none"> <li>• Questionnaire</li> <li>• Contact Lens / Spectacle Storage Plan</li> <li>• Best corrected visual acuity</li> <li>• Refraction (manifest)</li> <li>• Refraction (cycloplegic)</li> <li>• Automated visual fields</li> <li>• Amsler grid testing</li> <li>• Pupil reflexes</li> <li>• Extraocular muscle assessment</li> <li>• Biomicroscopy (slit lamp)</li> <li>• Dilated funduscopy including video funduscopy (PanOptic or similar)</li> <li>• Retinal photography</li> <li>• Tonometry</li> <li>• Optical coherence tomography - OCT (high resolution)</li> <li>• A-Scan ultrasound</li> <li>• 2-D Imaging ultrasound</li> <li>• MRI (high-resolution, 3T or better using specialized sequences and coils)*</li> </ul>			
	<b>Schedule:</b>	<b>Duration:</b>	<b>Schedule:</b>	<b>Flexibility:</b>	<b>Personnel Required:</b>
		Eye examination and testing: 3 hours (travel and examination time for MRI not included: travel time estimated approximately 2 hrs or less round trip, exam time approximately 2 hrs) Note: Some tests (e.g. MRI and ultrasound) will need to be scheduled separately from other tests	L-90/45 days & as clinically indicated	N/A	Specialists and crewmember
<b>Ground Support Requirements Hardware/Software</b>	<b>Preflight Hardware:</b>	<b>Preflight Software:</b>	<b>Test Location:</b>		
	Ocular examination equipment, OCT, A-scan ultrasound, general purpose 2-D ultrasound. MRI is stationary equipment	N/A	U.S.		

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<b>Testing Facilities (NASA/JSC Flight Medicine eye clinic, Coastal Eye Associates, UT-Houston, or other qualified providers)</b>	<b>Minimum Room Dimensions:</b>	<b>Number of Electrical Outlets:</b>	<b>Temperature Requirements:</b>	<b>Special Lighting:</b>
	8' x 10'	2 (110V)	Ambient	Adjustable
	<b>Hot or Cold Running Water:</b>	<b>Privacy Requirements:</b>	<b>Vibration/Acoustic Isolation:</b>	<b>Other:</b>
	N/A	Private room free of distraction	N/A	N/A
<b>Constraints/Special Requirements:</b>	<p>Results from the eye examination conducted during an annual physical may be used if within the required timeframe. Drugs used to dilate the pupils will cause increased sensitivity to bright light and blurred vision. The optometry exam should be scheduled after neurovestibular activities or other tests that require the use of the eyes. Constraints <u>following</u> the exam include:</p> <ul style="list-style-type: none"> <li>• No piloting of aircraft for 24 hours after dilation</li> <li>• Driving may be done but with extra caution</li> <li>• Avoid operation of any heavy equipment</li> <li>• Avoid operation of anything that may require acute vision, such as Remote Arm operation training</li> <li>• Avoid bright light situations</li> <li>• Small print will be difficult to read: avoid scheduling dilation prior to reading or computer tasks</li> </ul>			
<b>Launch Delay Requirements:</b>	N/A			
<b>Notes:</b>	Corneal topography performed if indicated.			
<b>Data Delivery</b>	<b>Data/Report to Designated Recipients (Nominal/Contingency):</b>			
	Preflight eye examination reports will be kept in the crewmember's medical file and electronic medical record. It will be distributed at the discretion of the Flight Surgeon.			

**3.5 In-Flight Activities**

**TABLE 3.5.1: IN-FLIGHT ACTIVITIES**

<b>In-Flight Activity</b>	<b>Description:</b>	Eye examinations				
	<b>Schedule:</b>	<b>Activity:</b>	<b>Duration:</b>	<b>Schedule:</b>	<b>Flexibility:</b>	<b>Personnel Required:</b>
		Questionnaire Visual Acuity (near and far) Amsler Grid Dilated video funduscopy (PanOptic or similar) Tonometry 2-D imaging ultrasound	130 min. (this does not include ultrasound setup and stow time)	All testing performed at L+30 and R-30; L+100 if requested, and as otherwise clinically indicated.	<b>+/- 7 days</b>	Crewmember plus crewmember assistant for tonometry, video funduscopy and ultrasound (assistant time 100 min). TSC ground support personnel (ultrasound and remote guidance)
<b>Procedures:</b>	In-flight procedures can be found within the SODF: ISS Med (Medical Checklist)					
<b>Constraints / Special Requirements:</b>	2-D imaging ultrasound requires privatized 2-way audio communication and video downlink for remote guidance. In exceptional cases, exams may be attempted by store-and-forward (no remote guidance) at the discretion of the remote guider and Flight Surgeon. Video funduscopy remote guidance and observation may be requested by the flight surgeon in some cases. Ultrasound and video funduscopy data will be downlinked following the exams. Drugs used to dilate the pupils will cause increased sensitivity to bright light and blurred vision. The optometry exam should be scheduled after activities or other tests that require the use of the eyes. Constraints <u>following</u> the exam include: <ul style="list-style-type: none"> <li>• No piloting for 24 hours after dilation</li> <li>• Avoid operation of anything that may require acute vision, such as Remote Arm operation</li> <li>• Avoid bright light situations.</li> <li>• Small print will be difficult to read: avoid scheduling dilation prior to reading or computer tasks</li> <li>• Dilation and funduscopy should be scheduled at the end of the crew day to minimize impacts</li> </ul>					
<b>Photo / TV Requirements:</b>	Live, privatized ultrasound scanhead video downlink must be available. Privatized cabin video downlink may be requested by remote guidance team or Flight Surgeon.					
<b>Mission Extension Requirements:</b>	N/A					
<b>Landing Wave-Off Requirements:</b>	N/A					
<b>Data Delivery</b>	<b>Data/Report to Designated Recipients (Nominal/Contingency):</b>					

	In-flight eye examination reports will be kept in the crewmember’s medical file and electronic medical record. It will be distributed at the discretion of the Flight Surgeon.
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**3.6 Postflight Activities**

**TABLE 3.6 POSTFLIGHT ACTIVITIES**

<b>Postflight Activity</b>	<b>Description:</b>	<p>R+0/1 Examination, which includes ophthalmoscopic exam, conducted by flight surgeon</p> <p>R+1 – R+3 days (or as soon as possible)</p> <p>Eye examinations will be conducted postflight by specialists. The examinations will include:</p> <ul style="list-style-type: none"> <li>• Questionnaire</li> <li>• Best corrected visual acuity</li> <li>• Refraction (manifest)</li> <li>• Refraction (cycloplegic)</li> <li>• Automated visual fields</li> <li>• Amsler grid testing</li> <li>• Pupil reflexes</li> <li>• Extraocular muscle assessment</li> <li>• Biomicroscopy (slit lamp)</li> <li>• Dilated funduscopy</li> <li>• Retinal photography</li> <li>• Tonometry</li> <li>• Optical coherence tomography - OCT (high resolution)</li> <li>• A-Scan ultrasound</li> <li>• 2-D Imaging ultrasound</li> <li>• MRI (high-resolution, 3T or better using specialized sequences and coils)</li> </ul>			
		<b>Duration:</b>	<b>Schedule:</b>	<b>Flexibility:</b>	<b>Personnel Required:</b>

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<p><b>Schedule:</b></p>	<p>Eye Examination: 5 min                      Eye examinations and testing: 3 hours (travel and examination time for MRI not included: travel time estimated approximately 2 hrs or less round trip, exam time approximately 2 hrs)                      Note: Some tests (e.g. MRI and ultrasound) will need to be scheduled separately from other tests</p>	<p>R+0/1                      R+1 – R+3 days (or as soon as possible)</p>	<p>N/A                      See notes</p>	<p>Flight Surgeon &amp; CM                      Specialists &amp; CM</p>
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<b>Ground Support Requirements Hardware/Software</b>	<b>Postflight Hardware:</b>		<b>Postflight Software:</b>		<b>Test Location:</b>	
	Ocular examination equipment, OCT, A-scan ultrasound, general purpose 2-D ultrasound. MRI is stationary equipment.		N/A		U.S.	
<b>Testing Facilities (NASA/JSC Flight Medicine Eye clinic, Coastal Eye Associates, UT-Houston, or other qualified providers)</b>	<b>Minimum Room Dimensions:</b>		<b>Number of Electrical Outlets:</b>		<b>Temperature Requirements:</b>	
	8' x 10'		2 (110V)		Ambient	
	<b>Hot or Cold Running Water:</b>		<b>Privacy Requirements:</b>		<b>Vibration/Acoustic Isolation:</b>	
	N/A		Private room free of distraction		N/A	
<b>Constraints/Special Requirements:</b>	<p>Drugs used to dilate the pupils will cause increased sensitivity to bright light and blurred vision. The optometry exam should be scheduled after neurovestibular activities or other tests that require the use of the eyes. Constraints <u>following</u> the exam include:</p> <ul style="list-style-type: none"> <li>• No piloting of aircraft for 24 hours after dilation</li> <li>• Driving may be done but with extra caution</li> <li>• Avoid operation of any heavy equipment</li> <li>• Avoid operation of anything that may require acute vision, such as Remote Arm operation training</li> <li>• Avoid bright light situations</li> <li>• Small print will be difficult to read: avoid scheduling dilation prior to reading or computer tasks</li> </ul>					
<b>Notes</b>	Postflight battery of tests should be conducted as soon as possible. If eye exam results are off- nominal, a follow up exam may be scheduled at any time at the discretion of the vision specialist/flight surgeon. Corneal topography performed if indicated.					
<b>Data Delivery</b>	<b>Data/Report to Designated Recipients (Nominal/Contingency):</b>					
	Postflight eye examination reports will be kept in the crewmember's medical file and electronic medical record. It will be distributed at the discretion of the Flight Surgeon.					

**3.7 Summary Schedule**

**TABLE 3.7: SUMMARY SCHEDULE**

ACTIVITY	DURATION	SCHEDULE	FLEXIBILITY	PERSONNEL REQUIRED	CONSTRAINTS
<b>Preflight Training:</b>					
Video fundoscopy (hardware)	30 min.	L-120	+/- 60 days	SD Trainers and CM	<b>NA</b> with MEDB exam
Video fundoscopy	30 min.	with MEDB preflight exam	NA	SD Trainers, optometrist, and CM	
Tonometry	30 min.	L-120	+/- 60 days	SD trainers and CM	
2-D Ultrasound	60 min.	L-120	+/- 60 days	SD trainers, ultrasound specialist, and CM	
<b>Preflight Activity:</b>					
Eye Examinations: <ul style="list-style-type: none"> <li>• Questionnaire</li> <li>• Contact Lens / Spectacle Storage Plan</li> <li>• Best corrected visual acuity</li> <li>• Refraction (manifest)</li> <li>• Refraction (cycloplegic)</li> <li>• Automated visual fields</li> <li>• Amsler grid testing</li> <li>• Pupil reflexes</li> <li>• Extraocular muscle assessment</li> <li>• Biomicroscopy (slit lamp)</li> <li>• Dilated fundoscopy</li> <li>• Retinal photography</li> <li>• Tonometry</li> <li>• Optical coherence tomography- OCT (high resolution)</li> <li>• A-Scan ultrasound</li> <li>• 2-D imaging ultrasound</li> <li>• MRI (high-resolution, 3T or better using specialized sequences and coils)*</li> </ul>	3 hours  40-120 min additional time for MRI round trip travel plus 120 minutes for procedure	L-90/45 days*  *MRI is acceptable up to L-365 days	N/A	Specialists & CM	Drugs used to dilate the pupils will cause increased sensitivity to bright light and blurred vision. The optometry exam should be scheduled after neurovestibular activities or other tests that require the use of the eyes. Constraints following the exam include: <ul style="list-style-type: none"> <li>• No piloting of aircraft for 24 hours after dilation</li> <li>• Driving may be done but with extra caution</li> <li>• Avoid operation of any heavy equipment</li> <li>• Avoid operation of anything that may require acute vision, such as Remote Arm operation training</li> <li>• Avoid bright light situations.</li> <li>• Small print will be difficult to read: avoid scheduling dilation prior to reading or computer tasks</li> </ul>

<b>In-flight</b>					
Questionnaire Visual Acuity (near and far) Amsler Grid Dilated video fundoscopy (PanOptic or similar) Tonometry 2-D imaging ultrasound	130 min	All testing performed at L+30 and R-30; L+100 if requested, and as otherwise clinically indicated.	N/A	Crewmember and crewmember assistant, ground support	2-D imaging ultrasound requires privatized 2-way audio communication and video downlink for remote guidance. Ultrasound and video fundoscopy data will be downlinked following the exams.  Drugs used to dilate the pupils will cause increased sensitivity to bright light and blurred vision. The optometry exam should be scheduled after activities or other tests that require the use of the eyes. Constraints <u>following</u> the exam include: <ul style="list-style-type: none"> <li>• No piloting for 24 hours after dilation</li> <li>• Avoid operation of anything that may require acute vision, such as Remote Arm operation</li> <li>• Avoid bright light situations.</li> </ul>

					<ul style="list-style-type: none"><li>• Small print will be difficult to read: avoid scheduling dilation prior to reading or computer tasks</li><li>• Dilation and funduscopy should be scheduled at the end of the crew day to minimize impacts</li></ul>
<b>Wheels-Stop: N/A</b>					

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ACTIVITY	DURATION	SCHEDULE	FLEXIBILITY	PERSONNEL REQUIRED	CONSTRAINTS
<b>Postflight Activity</b>					
Initial optometry examination:	5 min	R+0/1	N/A	Flight Surgeon & CM	
Eye Examinations: <ul style="list-style-type: none"> <li>• Questionnaire</li> <li>• Best corrected visual acuity</li> <li>• Refraction (manifest)</li> <li>• Refraction (cycloplegic)</li> <li>• Automated visual fields</li> <li>• Amsler grid testing</li> <li>• Pupil reflexes</li> <li>• Extraocular muscle assessment</li> <li>• Biomicroscopy (slit lamp)</li> <li>• Dilated funduscopy including video funduscopy (PanOptic or similar)</li> <li>• Retinal photography</li> <li>• Tonometry</li> <li>• Optical coherence tomography - OCT (high resolution)</li> <li>• A-Scan ultrasound</li> <li>• 2-D Imaging ultrasound</li> <li>• MRI (high-resolution, 3T or better using specialized sequences and coils)</li> </ul>	3 hours  40-120 min additional time for MRI round trip travel plus 120 minutes for procedure	R+1 – R+3 days (or as soon as possible)	If eye exam results are off-nominal, a follow up exam may be scheduled at any time at the discretion of the specialist/flight surgeon.	Specialists & CM	Drugs used to dilate the pupils will cause increased sensitivity to bright light and blurred vision. The ophthalmic exam should be scheduled after <i>neurovestibular activities</i> or other tests that require the use of the eyes. Constraints <u>following</u> the exam include: <ul style="list-style-type: none"> <li>• No piloting of aircraft for 24 hours after dilation</li> <li>• Driving may be done but with extra caution</li> <li>• Avoid operation of any heavy equipment</li> <li>• Avoid operation of anything that may require acute vision, such as Remote Arm operation training</li> <li>• Avoid bright light situations.</li> <li>• Small print will be difficult to read: avoid scheduling dilation prior to reading or computer tasks</li> </ul>
<b>Postflight Debrief: N/A</b>					