

**3.2 Medical Requirements Overview****TABLE 3.2: MEDICAL REQUIREMENT OVERVIEW**

<b>MRID# and Title</b>	MR010L Clinical Laboratory Testing for Long Duration Flights
<b>Sponsor</b>	Medical Operations
<b>IPT</b>	N/A
<b>Category</b>	Medical Requirements (MR)
<b>References</b>	<u>ISS Medical Operations Requirements Document (MORD), SSP 50260</u> Paragraph 3.1 Flight Crewmember Medical Evaluations and Certifications Paragraph 3.5 Preflight Medical Evaluations Paragraph 3.7 Postflight Medical Evaluations Paragraph 4.0 Medical Intervention & Care Paragraph 4.2 Preflight Paragraph 4.4.1.1 Postflight Care <u>Astronaut Medical Evaluation Requirements Document (AMERD), JSC 24834</u> Pre- & Postflight testing
<b>Purpose/Objectives</b>	To evaluate crewmember medical fitness for flight and for post-flight recovery by analysis of clinical specimens.
<b>Measurement Parameters</b>	Clinical laboratory examination includes blood for hematology, clinical biochemistry; and urine for routine urinalysis
<b>Deliverables</b>	Preflight and postflight Medical Assessment Testing (MAT) reports to the crew surgeon.
<b>Flight Duration</b>	≥30 days
<b>Number of Flights</b>	All flights
<b>Number and Type of Crewmembers Required</b>	All prime and back-up crewmembers for preflight, and prime crewmembers for postflight.
<b>Other Characteristics</b>	Long-Duration Crew Microbiology is referenced in MR021L

3.3 Preflight Training - None

3.4 Preflight Activities

**TABLE 3.4: PREFLIGHT ACTIVITIES**

<b>Preflight Activity</b>	<b>Description</b>	<p>Clinical Laboratory Testing will be performed on L-45/30 days and L-10 days. The examination will include collection of blood and urine from crewmembers for analyses to enhance the physician’s medical evaluation of crew health prior to flight.</p> <p>Preflight Clinical Laboratory Testing will include the following:</p> <p><b>L-45/30 days:</b>  <i>Blood (10-hr fast required):</i> <u>Hematology</u> – CBC w/differential, reticulocytes; <u>Chemistry profile</u> – glucose, BUN, creatinine, AST, ALT, GGTP, alkaline phosphatase, total bilirubin, total protein, electrolytes, calcium, magnesium, phosphorus, creatine kinase, LD, uric acid, albumin; <u>Ionized calcium</u>; <u>Thyroid function</u> – free T4, TSH; <u>Iron profile</u> – iron, iron binding capacity, transferrin, transferrin saturation, ferritin; <u>Special chemistry</u> – C-reactive protein; <u>Bone Markers</u> – bone specific alkaline phosphatase, osteocalcin; <u>Archive tube</u>.</p> <p><i>Urine:</i> Urinalysis  <i>Urine (second void of the morning requested):</i> N-telopeptide (a bone marker).</p> <p><b>L-10 days:</b>  <i>Blood:</i> Serum HCG on females</p>				
	<b>Schedule</b>	Duration	Schedule	Flexibility	Blood Volume	Personnel Required
	Blood Collection - 10 min	L-45/30 days	N/A	30 mL	Crewmembers/ Lab Personnel	
	Random Urine Collection - 5 min	L-10 days	N/A	5 mL	Self-collected	
	Blood Collection - 10 min. (females only)	L-10 days	N/A	5 mL	Female Crewmembers/ Lab Personnel	

**TABLE 3.4: PREFLIGHT ACTIVITIES (cont'd)**

Ground Support Requirements Hardware/Software	Preflight Hardware:		Preflight Software:	Test Location:
	Blood Collection supplies & consumables Urine Collection supplies & consumables Hematology instrumentation & consumables Biochemistry instrumentation & consumables Immunology instrumentation & consumables		N/A	U.S. /Russia U.S. /Russia U.S. /Russia U.S. U.S.
Testing Facilities	Minimum room dimensions:	Number of electrical outlets:	Temperature requirements:	Special lighting:
	Two rooms, each with dimensions of 10' x 10'	Minimum 12 (in U.S. 120V, in Russia 220V & power converter)	Ambient	Sufficient lighting for blood collection & laboratory bench work.
	Hot or cold running water:	Privacy requirements:	Vibration/Acoustic Isolation:	Other:
	Sink with hot and cold water for hand-washing.	Private rooms free from distractions.  Access to restroom for urine collection.	N/A	<u>Room 1 (Laboratory):</u> Countertops or tables, cabinets, 4 chairs (minimum), refrigerator/freezer, and centrifuge, in a room designated "Laboratory". <u>Room 2 (Blood Collection Area):</u> Gurney (1), table (1), and chairs (2) in a room designated as "Sample Collection Area". <u>Restroom</u>
Constraints/Special Requirements	<ul style="list-style-type: none"> <li>For L-45/30 blood draw crewmember is required to be fasting 10 hrs. before blood collection.</li> <li>Urine collections – Second void of the morning required</li> <li>If the L-10 day clinical laboratory testing occurs during the 3-month annual exam window (2 months prior to the birth month or during the birth month), the flight surgeon may request that laboratory testing on L-10 be augmented to meet the requirements for both the flight and annual physical exam.</li> </ul>			
Launch Delay Requirements	Clinical Laboratory analyses will be repeated at the crew surgeon's discretion if launch is delayed.			
Notes	<ul style="list-style-type: none"> <li>Upon completion of analyses, any remaining aliquots of all blood samples are archived frozen at the JSC Clinical Laboratory.</li> <li>Consumables and Hematology instrumentation will be hand-carried to Russia.</li> </ul> <u>Preflight and Postflight sample collection outside of U.S.:</u> Sample collection and processing occurring in Russia will require analyses of samples for tests that are time critical. <ul style="list-style-type: none"> <li>Some analyses will be performed in Russia by JSC Clinical Laboratory personnel using equipment hand-carried from the U.S.</li> <li>Aliquots of blood and urine samples collected by JSC Clinical Laboratory personnel in Russia will be packed in dry ice and hand-carried to the U.S. to be analyzed at JSC.</li> <li>The JSC Clinical Laboratory will analyze samples within 24-72 hrs of laboratory receipt of samples from Russia.</li> </ul>			

**TABLE 3.4: PREFLIGHT ACTIVITIES (cont'd)**

<b>Data Delivery</b>	<b>Data/Report to Designated Recipients (Nominal/Contingency):</b> <ul style="list-style-type: none"><li>• All hematology, urinalysis and clinical chemistry data will be entered into the Laboratory Information System within 24-72 hrs after laboratory receives samples; data will reside in the crewmembers Electronic Medical Record. Copies of the data will be provided to the Crew Surgeon upon request.</li><li>• Reports from test samples sent to a reference laboratory entered into the Laboratory Information System as the results are received in the Clinical Laboratory and will reside in the crewmembers Electronic Medical Record. Copies of the data will be provided to the Crew Surgeon upon request.</li></ul>
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**3.5 In-Flight Activities – None**

## 3.6 Postflight Activities

TABLE 3.6: POSTFLIGHT ACTIVITIES

Postflight Activity	Description																														
	<p>Clinical Laboratory Testing will be performed on R+0 (landing day), R+3/7 days, and R+30 days. The examination will include collection of blood and urine for analyses to enhance the physician's medical evaluation of postflight crew health.</p> <p>Postflight Clinical Laboratory Testing will include the following:</p> <p><b>R+0 days:</b>  <i>Blood:</i> <u>Hematology</u> - CBC w/differential, reticulocytes; <u>Chemistry profile</u> – glucose, BUN, creatinine, AST, ALT, GGTP, alkaline phosphatase, total bilirubin, total protein, electrolytes, calcium, magnesium, phosphorus, creatine kinase, LD, uric acid, albumin; <u>Ionized calcium</u>; <u>Thyroid function</u> – free T4, TSH; <u>Iron profile</u> – iron, iron binding capacity, transferrin, transferrin saturation, ferritin; <u>Special chemistry</u> – C-reactive protein; <u>Bone markers</u> – bone specific alkaline phosphatase, osteocalcin;  <u>Archive tube</u>  <i>i-Stat:</i> Na, K, glucose, ionized calcium, pH</p> <p><i>Urine:</i> Urinalysis  <i>Urine (second void of the next morning required):</i> N-telopeptide (a bone marker)</p> <p><b>R+3/7 days:</b>  <i>Blood (10-hr fast required):</i> <u>Hematology</u> - CBC w/differential, reticulocytes; <u>Chemistry profile</u> – glucose, BUN, creatinine, AST, ALT, GGTP, alkaline phosphatase, total bilirubin, total protein, electrolytes, calcium, magnesium, phosphorus, creatine kinase, LD, uric acid, albumin; <u>Special chemistry</u> – C-reactive protein</p> <p><b>R+30 days:</b>  <i>Blood (10-hr fast required):</i> <u>Hematology</u> - CBC w/differential, reticulocytes; <u>Chemistry profile</u> – glucose, BUN, creatinine, AST, ALT, GGTP, alkaline phosphatase, total bilirubin, total protein, electrolytes, calcium, magnesium, phosphorus, creatine kinase, LD, uric acid, albumin; <u>Iron profile</u> - iron, iron binding capacity, transferrin, transferrin saturation, ferritin; <u>Special chemistry</u> – C-reactive protein; <u>Bone markers</u> – bone specific alkaline phosphatase, osteocalcin</p> <p><i>Urine (second void of the morning required):</i> N-telopeptide (a bone marker)</p>																														
Schedule	<table border="1"> <thead> <tr> <th>Duration</th> <th>Schedule</th> <th>Flexibility</th> <th>Blood Volume</th> <th>Personnel Required</th> </tr> </thead> <tbody> <tr> <td>Blood Collection – 10 min</td> <td>R+0</td> <td>N/A</td> <td>30 mL</td> <td>Crewmembers/ Lab Personnel</td> </tr> <tr> <td>Random Urine Collection – 5 min</td> <td></td> <td>N/A</td> <td>N/A</td> <td>Self-collected</td> </tr> <tr> <td>Blood Collection – 10 min</td> <td>R+3/7 days</td> <td>N/A</td> <td>15 mL</td> <td>Crewmembers/ Lab Personnel</td> </tr> <tr> <td>Blood Collection – 10 min</td> <td>R+30 days</td> <td>N/A</td> <td>20 mL</td> <td>Crewmembers/ Lab Personnel</td> </tr> <tr> <td>Random Urine Collection – 5 min</td> <td></td> <td>N/A</td> <td>N/A</td> <td>Self-collected</td> </tr> </tbody> </table>	Duration	Schedule	Flexibility	Blood Volume	Personnel Required	Blood Collection – 10 min	R+0	N/A	30 mL	Crewmembers/ Lab Personnel	Random Urine Collection – 5 min		N/A	N/A	Self-collected	Blood Collection – 10 min	R+3/7 days	N/A	15 mL	Crewmembers/ Lab Personnel	Blood Collection – 10 min	R+30 days	N/A	20 mL	Crewmembers/ Lab Personnel	Random Urine Collection – 5 min		N/A	N/A	Self-collected
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	Blood Collection – 10 min	R+30 days	N/A	20 mL	Crewmembers/ Lab Personnel																										
Random Urine Collection – 5 min		N/A	N/A	Self-collected																											

Table 3.6 Postflight Activities (cont'd)

MR010L Clinical Laboratory Testing for Long Duration Flights

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Ground Support Requirements Hardware/Software	Postflight Hardware:		Postflight Software:	Test Location:	
	Blood Collection supplies & consumables Urine Collection supplies & consumables Hematology instrumentation & consumables Biochemistry instrumentation & consumables Immunology instrumentation & consumables		N/A	U.S. /Russia U.S. /Russia U.S. /Russia U.S. U.S.	
Postflight Activity Facilities	Minimum room dimensions:	Number of electrical outlets:	Temperature requirements:	Special lighting:	
	Two rooms, each with dimensions of 10' x 10'	Minimum 12 (in U.S. 120V, in Russia 220V & power converter)	Ambient	Sufficient lighting for blood collection & laboratory bench work.	
	Hot or cold running water:	Privacy requirements:	Other:		
	Sink with hot and cold water for hand-washing.	Private rooms free from distractions. Access to restroom for urine collection.	<u>Room 1 (Laboratory):</u> Countertops or tables, cabinets, 4 chairs (minimum), refrigerator/freezer, and centrifuge in a room designated "Laboratory". <u>Room 2 (Blood Collection Area):</u> Gurney (1), table (1), and chairs (2) in a room designated "Sample Collection Area". <u>Restroom</u>		

**Postflight Activities (cont'd)**

<p><b>Constraints/Special Requirements</b></p>	<ul style="list-style-type: none"> <li>• Urine collections – Second void of the morning required</li> <li>• At R+3/7 days &amp; R+30 days crewmember is required to be fasting 10 hrs. before blood collection.</li> <li>• Re-evaluate at 1 year to determine if there is a difference between postflight laboratory results at R+3 days versus R+7 days.</li> </ul>		
<p><b>Notes</b></p>	<ul style="list-style-type: none"> <li>• Upon completion of analyses, any remaining aliquots of all blood samples are archived frozen in the JSC Clinical Laboratory.</li> <li>• Consumables and Hematology instrumentation will be hand-carried to Russia.</li> </ul> <p><b><u>Preflight and Postflight sample collection outside of U.S.:</u></b> Sample collection and processing occurring in Russia will require analyses of samples for test that are time critical.</p> <ul style="list-style-type: none"> <li>• Some analyses will be performed in Russia by JSC Clinical Laboratory personnel on hand-carried equipment from the U.S.</li> <li>• Aliquots of blood and urine samples collected by JSC Clinical Laboratory personnel in Russia will be packed in dry ice and hand-carried to the U.S. to be analyzed at JSC.</li> <li>• The JSC Clinical Laboratory will analyze samples within 24-72 hrs of laboratory receipt of samples from Russia.</li> </ul>		
<p><b>Data Delivery</b></p>	<p><b>Data/Report to Designated Recipient (Nominal/Contingency):</b></p>	<p><b>Mission Summary Report:</b></p>	<p><b>Data Archives:</b></p>
<ul style="list-style-type: none"> <li>• All hematology, urinalysis and clinical chemistry data will be entered into the Laboratory Information System within 24-72 hrs after laboratory receives samples; data will reside in the crewmembers Electronic Medical Record. Copies of the data will be provided to the Crew Surgeon upon request.</li> <li>• Reports from test samples sent to a reference laboratory entered into the Laboratory Information System as the results are received in the Clinical Laboratory and will reside in the crewmembers Electronic Medical Record. Copies of the data will be provided to the Crew Surgeon upon request.</li> </ul>		<p>N/A</p>	<p>All pre- &amp; postflight data electronically available</p>

## 3.7 Summary Schedule

TABLE 3.7: SUMMARY SCHEDULE

ACTIVITY	DURATION OF ACTIVITY	SCHEDULE	FLEXIBILITY	BLOOD VOLUME	PERSONNEL REQUIRED	CONSTRAINTS
<b>Preflight Training – N/A</b>						
<b>Preflight Activity</b>						
Blood Collection	10 min	L-45/30 days	N/A	30 mL	Crewmembers/ Lab Personnel	Fasting 10 hrs required
Random Urine Collection	5 min		N/A	N/A	Crewmembers (self-collected)	Second void of the morning required
Blood Collection	10 min (females only)	L-10 days	N/A	5 mL	Female crewmembers/ Lab Personnel	If the L-10 day clinical laboratory testing occurs during the 3-month annual exam window (2 months prior to the birth month or during the birth month), the flight surgeon may request that laboratory testing on L-10 be augmented to meet the requirements for both the flight and annual physical exam.
<b>In-flight – N/A</b>						
<b>Wheels-Stop - N/A</b>						

**TABLE 3.7: SUMMARY SCHEDULE (con't)**

<b>Postflight Activity</b>						
Blood Collection	10 min	R+0	N/A	30 mL	Crewmembers/ Lab Personnel	None
Random Urine Collection	5 min		N/A	N/A	Crewmembers (self-collected)	Second void of the next morning required
Blood Collection	10 min	R+3/7 days	N/A	15 mL	Crewmembers/ Lab Personnel	Fasting 10 hrs required  Re-evaluate at 1 year to determine if there is a difference between postflight laboratory results at R+3 days versus R+7 days.
Blood Collection	10 min		N/A	20 mL	Crewmembers/ Lab Personnel	Fasting 10 hrs required
Random Urine Collection	5 min	R+30 days	N/A	N/A	Crewmembers (self-collected)	Second void of the morning required
<b>Postflight Debrief</b>						
N/A						