3.2 Medical Requirements Overview

TABLE 3.2: MEDICAL REQUIREMENTS OVERVIEW

MRID# and Title:	MR052L Microbial Analysis of ISS Air Using the Microbial Air Sampler (MAS)
Sponsor:	Medical Operations
Discipline:	Environmental Health System (EHS)
Category:	Medical Requirements (MR)
References:	SSP 50260 ISS Medical Operations Requirements Document (MORD)
Purpose/Objectives:	To evaluate the air quality within the U.S. On-orbit Segment (USOS) habitable environment of ISS for the presence of microbial contaminants based on results from preflight analysis, in-flight analysis, and postflight analysis of archive samples.
Measurement Parameters:	The detection of microorganisms in the ISS air
Deliverables:	• Preflight assessment of the microorganisms recovered from spaceflight vehicle and module. • In-flight assessment of microorganisms recovered from the air within the USOS of ISS. • Postflight report assessing the microorganisms recovered from the air samples within the USOS of ISS based on analysis of archive samples.
Flight Duration:	≥ 30 days
Number of Flights:	Every ISS Increment
Number and Type of Crew Members Required:	One to two crewmembers (CM) are trained in all EHS activities (US Specialist). One EHS CM will perform the in-flight activities.
Other Flight Characteristics:	N/A

3.3 Preflight Training

TABLE 3.3: PREFLIGHT TRAINING

Preflight Training Activity Description:	Each USOS CM will be trained in all EHS activities (US Specialist).			
	Duration:	**Schedule:**	**Flexibility:**	**Personnel Required:**
Schedule:	EHS Microbiology Operations: Inexperienced crewmember: 60 minutes Experienced crewmember: Crew retention of skills tested in EHS Assessment.	 Pre-Assignment Training Flow L-24/20	 N/A	Crewmembers/ Instructor
Ground Support Requirements Hardware/Software:	**Preflight Hardware:**	**Preflight Software:**	**Test Location:**	
	Microbial Air Sampler (MAS) Kit	N/A	U.S.	
Training Facilities:	**Minimum Room Dimensions:**	**Number of Electrical Outlets:**	**Temperature Requirements:**	**Special Lighting:**
	8' x 10'	2 (110 volts AC)	Ambient	N/A
	Hot or Cold Running Water:	**Privacy Requirements:**	**Other:**	
	No	N/A	Table & 4 chairs	
Constraints/Special Requirements:	None			
Launch Delay Requirements:	Refresher training will be conducted at crewmember's request.			
Notes:	Crewmembers also have a chance to refresh skills during Routine Ops (Day-In-The-Life) simulations during the assigned flow. Experienced CM – CMs who have had previous training on EHS activities. Inexperienced CM – CMs who have not had previous training on EHS activities.			

3.4 Preflight Activities

TABLE 3.4: PREFLIGHT ACTIVITIES

<table>
<tr><td rowspan="3">Preflight Activity Description:

Schedule:</td><td colspan="6">Pre-flight samples will be collected from all vehicles and modules launching to the ISS. These samples will be analyzed to verify the quality of air sampled from the vehicle and module meet ISS applicable requirements and is safe for the ISS environment and crew.</td></tr>
<tr><td>Activity:</td><td>Duration:</td><td>Schedule:</td><td>Flexibility:</td><td colspan="2">Personnel Required:</td></tr>
<tr><td>Preflight Module Sampling</td><td>ISS Module Air Sampling ≤ 2 hours.</td><td>Preferred is 15-20 days before module close-out</td><td>N/A</td><td colspan="2">JSC Microbiology Laboratory Personnel or vendor-selected delegate as approved by NASA</td></tr>
<tr><td rowspan="2">Ground Support Requirements Hardware/Software:</td><td colspan="2">Preflight Hardware:</td><td colspan="2">Preflight Software:</td><td colspan="2">Test Location:</td></tr>
<tr><td colspan="2">Microbial Air Sampler III</td><td colspan="2">N/A</td><td colspan="2">U.S.</td></tr>
<tr><td rowspan="4">Testing Facilities:</td><td colspan="2">Minimum Room Dimensions:</td><td>Number of Electrical Outlets:</td><td>Temperature Requirements:</td><td>Special Lighting:</td></tr>
<tr><td colspan="2">N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td colspan="2">Hot or Cold Running Water:</td><td>Privacy Requirements:</td><td>Vibration/Acoustic Isolation:</td><td>Other:</td></tr>
<tr><td colspan="2">Water for hand-washing</td><td>Private room free from any distractions</td><td>N/A</td><td>Refrigeration</td></tr>
<tr><td>Constraints/Special Requirements:</td><td colspan="6">• Detailed logistics (quantity) will be determined by personnel from the JSC Microbiology Laboratory in coordination with visiting vehicle representatives, hardware providers, and the Multilateral Medical Operations Panel (MMOP) Microbiology Subgroup.
• The module shall be as close to final configuration as is possible when preflight air sampling activities occur. Airflow is desired but not required.</td></tr>
<tr><td>Launch Delay Requirements:</td><td colspan="6">Remediation will need to be performed if the sample locations exceed the requirements. Repeat sampling is necessary after remediation to verify the source of the contamination has been resolved.</td></tr>
<tr><td>Notes:</td><td colspan="6">N/A</td></tr>
<tr><td>Data Delivery:</td><td colspan="6">Reports from preflight microbial analysis of air samples will be provided to the JSC Microbiology Laboratory personnel and the MMOP Microbiology Subgroup prior to vehicle launch.</td></tr>
</table>

3.5 In-Flight Activities

TABLE 3.5.1a: IN-FLIGHT ACTIVITIES-MICROBIAL AIR SAMPLE COLLECTION

In-Flight Activity Description:	Microbial Air Sample Collection – ISS air will be sampled for in-flight and ground analysis.				
Schedule:	**Activity:**	**Duration:**	**Schedule:**	**Flexibility:**	**Personnel Required:**
	Microbial Air Sampling	Unstow/stow: 15 minutes Sample Collection: 15 minutes/site	Within 30 days of a returning Soyuz in designated modules.	N/A	1 Crewmember
Procedures:	Procedures are located in the System Operations Data File (SODF) Med Ops Book.				
Constraints / Special Requirements:	• Whenever possible, microbiology sample collections should be coordinated with microbial surface sampling. • Samples will be stowed in a convenient location and incubated at ambient ISS temperature. • Total time will depend upon the number of modules to be sampled (nominal sampling session is generally 105 minutes)				
Photo / TV Requirements:	In the event that an acceptability limit is exceeded, a request for contingency digital photography downlink of the sample shall be requested by ground-control. See In-flight Activity – Visual Analysis.				
Cold Stowage Requirements:	N/A				
Mission Extension Requirements:	N/A				
Landing Wave-Off Requirements:	N/A				
Notes:	• Extra sampling packets are available for contingency • Data and sample source should be recorded on surface sample slide • Late access for hardware: L-2 weeks				
Data Delivery:	N/A				

TABLE 3.5.1b: IN-FLIGHT ACTIVITIES- VISUAL ANALYSIS

<table>
<tr><td>In-Flight Activity
Description:</td><td colspan="5">Visual Analysis of Colony Counts of the media plates. Colony counts will be performed 5 days after collection of bacterial and fungal samples. The results will be recorded in the procedure.</td></tr>
<tr><td>Schedule:</td><td>Activity:</td><td>Duration:</td><td>Schedule:</td><td>Flexibility:</td><td>Personnel Required:</td></tr>
<tr><td></td><td>Microbial Air Sampling
Visual Analysis</td><td>Unstow: 5 minutes

Analysis: 2 minutes/Petri dish
(number of samples depends upon number of sites sampled)

Stow: 10 minutes</td><td>At T.0+5 days post-sampling</td><td>Can be read between T.0+5 & T.0+6 days</td><td>1 Crewmember</td></tr>
<tr><td>Procedures:</td><td colspan="5">Procedures are located in the Systems Operations Data File (SODF) Procedures Database Med Ops Book</td></tr>
<tr><td>Constraints / Special Requirements:</td><td colspan="5">• In the event that an acceptability limit is exceeded, a request for contingency digital photography downlink of the sample shall be requested. NASA/JSC microbiologists shall evaluate, by visual inspection, the microbial risk.
• The NASA/JSC microbiologists will notify the MMOP Microbiology Subgroup and Increment Flight Surgeon of their evaluation.
• An attempt to identify the source of the contamination shall be performed. Resampling of the affected module may be performed, including the air inlet source(s) of the module.
• Coordination of all appropriate personnel (Microbiology Specialists, Med Ops, ECLSS) shall occur to determine appropriate remediation operations.
• A nominal Sampling Session is 95 minutes (12 petri dishes and 26 slides)</td></tr>
<tr><td>Photo / TV Requirements:</td><td colspan="5">If microbial counts exceed the specifications in as specified in the ISS MORD, then:
A request for contingency video/digital photography downlink of the sample shall be requested.</td></tr>
<tr><td>Mission Extension Requirements:</td><td colspan="5">N/A</td></tr>
<tr><td>Notes:</td><td colspan="5">N/A</td></tr>
<tr><td>Data Delivery:</td><td colspan="5">If sample results exceed specified acceptability limits as indicated in the ISS MORD and SODF procedures, the results shall be called down to the ground at the first available communication opportunity.

Results from real-time surface samples are downlinked to the ground at the first available opportunity and are delivered to the Microbiology Laboratory as soon as possible. A preliminary report is delivered to the Crew Surgeon and all appropriate personnel within 1 business day from the receipt of data.
Comprehensive final report – See Table 3.6 Postflight Activity Data Delivery</td></tr>
</table>

TABLE 3.5.2: IN-FLIGHT HARDWARE

Hardware/Software Name
Microbial Air Sampler (MAS) Kit
Petri Dish Packet
Incubation Bag

3.6 Postflight Activities

TABLE 3.6: POSTFLIGHT ACTIVITIES

Postflight Activity Description:	Sample destow and return to JSC.
Constraints/Special Requirements:	Microbial Air Sampler Kit needs to be returned to JSC Microbiology Lab within 24 hours after destow. Stowage temperatures during transport must be between +4ºC to +54ºC.
Early Destow / Early Return:	N/A.
Notes:	None
Data Delivery:	Data/Report to Designated Recipient (Nominal/Contingency): An interim report from the final in-flight samples returned for further analysis will be submitted via Mission Integration Coordinator to Crew Surgeon within 7-10 days following sample receipt in the laboratory. Mission Summary Report: If a clinically significant organism is observed upon completion of the analysis, an interim report will be delivered to the Crew Surgeon within 48 hours following sample receipt in the laboratory. A comprehensive final report of the ISS microbial environment will be submitted via Mission Integration Coordinator to the Crew Surgeon and all appropriate personnel no later than R+3 months following completion of the expedition if requested. The report will include the results of crew data, air, surface, and water sampling. Data Archives: Electronic report available through computer inquiry linked to the laboratory information system.

3.7 Summary Schedule

TABLE 3.7: SUMMARY SCHEDULE

ACTIVITY:	DURATION:	SCHEDULE:	PERSONNEL REQUIRED:	CONSTRAINTS:
Preflight Training:				
EHS Microbiology Operations:	Inexperienced crewmember: 60 minutes Experienced crewmember: Crew retention of skills tested in EHS Assessment.	Pre-Assignment Training Flow L-24/20	Crewmember/ Instructor	None
Preflight Activity: – No crew time				
Preflight Module Sampling	≤2 hours	15-20 days before element close-out is preferred	JSC Microbiology Laboratory Personnel	The module shall be as close to final configuration as possible. Airflow is desired but not required.
In-flight Activity:				
Microbial Air Sampling	Unstow/stow : 15 minutes Sample Collection : 15 minutes/sample	Once every 3 months in designated modules (Lab, Nodes 1,2, and 3, Columbus, JEM PM)	1 Crewmember	• Samples will be incubated for a total of 5 days after sample collection. • Total time will depend upon number of modules to be sampled. • If possible, sampling should be performed on the same day as surface sampling.
Micro Visual Analysis (colony count)	Unstow: 5 minutes Analysis: 2 minutes/ Petri Dish Stow: 10 minutes	At T.0+5 days post-sampling	1 Crewmember	Total time will depend upon number of samples to be analyzed. If sample results exceed acceptability limits, the results shall be voiced to the ground at the earliest opportunity.
Postflight: – No crew time				
Debrief	No extra time	~R+30 days	Crewmembers/ Microbiology Team	Included as part of the Med Ops overall debrief.