

3.2 Medical Requirements Overview

TABLE 3.2: MEDICAL REQUIREMENTS OVERVIEW

MRID# and Title:	MR050L Microbial Analysis of ISS Surfaces Using the Surface Sampler Kit (SSK)
Sponsor:	Medical Operations
Discipline:	Environmental Health
Category:	Medical Requirements (MR)
References:	SSP 50260, ISS Medical Operations Requirements Document (ISS MORD)
Purpose/Objectives:	To ensure a microbiologically safe environment for crew members and to ensure compliance with existing acceptability limits established for microbial surface sampling.
Measurement Parameters:	Microbiological assessment of ISS surfaces from preflight sampling and in-flight sampling to detect and enumerate microorganisms.
Deliverables:	<ul style="list-style-type: none"> • Ground-based evaluation of microbiological content of surfaces by quantification and identification of bacteria and fungi. • In-flight evaluation of surfaces from real-time sampling and analysis. • Postflight analyses report of samples collected in flight.
Flight Duration:	≥ 30 days
Number of Flights:	4A & subs
Number and Type of Crew Members Required:	Two crewmembers are trained, of which one crewmember is operator.
Other Flight Characteristics:	N/A

3.3 Preflight Training

TABLE 3.3: PREFLIGHT TRAINING

Preflight Training Activity	Description:	Training will describe the in-flight sampling of ISS surfaces. Collection, processing, analysis, data entry, and proper stowage will be demonstrated and then performed by crewmembers. In-flight collection schedules will be reviewed. Two crewmembers will be trained, one of which will be operator. Due to condensed training schedules, only one crewmember may be trained (per CB office request).		
	Schedule:	Duration:	Schedule:	Personnel Required:
		EHS Microbiology Operations & Interpretation - 120/60 min Inexperienced crewmember 120 min training: 10 min - Micro. Intro & Overview 15 min - Introduction to hardware 55 min – Perform sample collection 30 min – Review examples of growth on media 10 min -Review & summarize all micro/answer questions -OR- Experienced crewmember – 60 min training: 5 min – Micro. Intro & Overview 40 min – Perform sample processing 10 min – Review examples of growth on media 5 min – Review & summarize all micro/answer questions	L-12 months	Crewmembers/Instructor
Ground Support Requirements Hardware/Software	Preflight Hardware:	Preflight Software:	Test Location:	
	Surface Sampler Kit (SSK) Medical Equipment Computer (MEC)	Microbiology Data Entry Software	U.S.	
Training Facilities	Minimum Room Dimensions:	Number of Electrical Outlets:	Temperature Requirements:	Special Lighting:
	8' x 10'	One (1)	Ambient	N/A
	Hot or Cold Running Water:	Privacy Requirements:	Other:	
	N/A	N/A	1 Table & 6 chairs	
Constraints/Special Requirements:	None			
Launch Delay Requirements:	Training will be repeated if requested by the crewmember.			
Notes:	None			

3.4 Preflight Activities

TABLE 3.4: PREFLIGHT ACTIVITIES

Preflight Activity	Description:	Pre-flight microbiological sampling of interior surfaces of specified habitable flight elements (as specified in ISS MORD) shall be performed 15 to 20 days before closeout, as specified in NSTS 21426 and ACOMC #A-MICRO-CKS-001. This allows time for completion of analyses (quantification and identification of bacteria and fungi), reporting results, and performance of any remediation activities that may be required. JSC Microbiology personnel will travel to KSC for collection of samples, as specified in JSC 18633. Samples are hand-carried back to JSC for processing, as specified in JSC 32015. Standard laboratory procedures are used to quantify and identify bacteria and fungi.		
	Schedule:	Duration:	Schedule:	Personnel Required:
		ISS Module Surface Sampling ≤ 2 hrs.	15-20 days before module close-out	KSC/JSC Microbiology Personnel
Ground Support Requirements Hardware/Software	Preflight Hardware:	Preflight Software:	Test Location:	
	Microbial Collection Kit	N/A	U.S.	
Testing Facilities	Minimum Room Dimensions:	Number of Electrical Outlets:	Temperature Requirements:	Special Lighting:
	8' x 10' with workbench area	One (1)	Ambient	N/A
	Hot or Cold Running Water:	Privacy Requirements:	Vibration/Acoustic Isolation:	Other:
	Yes	N/A	N/A	Refrigeration
Constraints/Special Requirements:	<ul style="list-style-type: none"> • Surface Sampling will consist of 6-8 sites per flight element. • The flight element shall be, to the greatest extent possible, in its fully outfitted configuration when preflight surface sampling activities occur. • Any payloads or associated hardware for ISS habitable flight elements, which have been assessed by the NASA/International Partner’s Payloads Safety Review Panels and identified as a potential microbiological hazard, may be evaluated as specified by the Panels (e.g. surface sampling on a payload may be performed prior to vehicle loading). <ul style="list-style-type: none"> ▪ Remediation recommendation will be based on test results. 			
Launch Delay Requirements:	None			
Notes:	Late Access : L-2 weeks			
Data Delivery	Data/Report to Designated Recipients (Nominal/Contingency):			
	A report will be delivered to the Crew Surgeon and all appropriate personnel within 10 days of sample processing.			

3.5 In-Flight Activities

TABLE 3.5.1a: IN-FLIGHT ACTIVITIES – Surface Sampling

In-Flight Activity	Description:	<p>Interior surfaces will be monitored in designated habitable modules (as specified in ISS MORD) using the Surface Sampler Kit. Sampling will occur once per month for the first three months after each new, specified module is added to the ISS assembly in order to establish baseline evaluation of the microbial environment. Two sites are sampled in each module (one media plate for bacterial analysis and one media plate for fungal analysis at each sampling location). Thereafter, sampling will occur once every three months in each specified module for continuous monitoring of the environment.</p> <p>Incubation is required for all surface samples collected for in-flight processing and analyses. Prior to the arrival of the incubator all samples will be stowed inside their respective kit and incubated at ambient temperature. When an incubator becomes available, the incubation temperature range shall be: Bacterial samples: +25° C to +37° C Fungal samples: +25° C to +30° C</p> <p>All samples for bacterial analyses are incubated for a total of 5 days, with colony counts performed at 5 (T.0+5 days) days after collection. All samples for fungal analyses are incubated for a total of 5 days, with colony counts performed at that time. Colony counts are determined by either a direct count or by comparison to a Colony Density Chart provided in each kit. Results are then recorded on data sheets and then entered into the MEC.</p> <p>Before biological waste disposal and refrigeration capabilities become available, all surface samples will be appropriately contained within the SSK as specified in the on-board procedures, and returned to ground for further analysis by the JSC Microbiology Laboratory.</p> <p>Upon availability of biological waste disposal and refrigeration capabilities, samples that are not designated for return will be placed into appropriately labeled bags (biohazard) and discarded as specified in the on-board procedures. Refrigeration will enable all surface samples to be stowed at +2°C to +8°C until return to ground.</p>		
	Schedule:	Duration:	Schedule:	Personnel Required:
	Unstow 15 min Sampling 10 min per slide Stow 10 min	-Once during first 6 weeks of each module’s on-orbit time. -Once every 3 months thereafter, in each module (Lab, Node 1, SM) sampling.	1 crewmember	

TABLE 3.5.1a: IN-FLIGHT ACTIVITIES – Surface Sampling (cont’d)

Procedures:	Procedures can be found in the System Operations Data File (SODF) Procedures Database Med Ops Book: <ul style="list-style-type: none"> • Surface Sampler Kit (SSK)-Sample Collection/Incubation
Constraints / Special Requirements:	<ul style="list-style-type: none"> • Until refrigeration is available, all microbiology kits should be stowed at temperatures between +4° C and +35° C. After refrigeration is available, all consumables and archived samples will be stowed at temperatures between +2° C to +8° C. • If possible, surface sampling should be done on the same day as air and water sampling.
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:	See Constraints/Special Requirements
Mission Extension Requirements:	N/A
Landing Wave-Off Requirements:	<ul style="list-style-type: none"> ▪ On-Board Computer-Based Training (CBT) is available for crewmembers if desired. ▪ Extra media plates are available in the kit for contingency.
Data Delivery	Data/Report to Designated Recipients (Nominal/Contingency):
	<u>Real-time surface samples data</u> - See Table 3.5.1b In-flight Activity - Visual Analysis
	<u>Data from the final in-flight samples returned for analysis:</u> <ul style="list-style-type: none"> • Results will be available within 7-10 days following sample receipt in the laboratory. • If a clinically significant organism is observed upon completion of analysis, an interim report will be delivered to the Crew Surgeon as soon as possible.

3.5 In-Flight Activities

TABLE 3.5.1b: IN-FLIGHT ACTIVITIES – Visual Analysis (colony count of surface samples)

In-Flight Activity	Description:	Visual Analysis (colony count of surface samples)									
	Schedule:	<table border="1"> <thead> <tr> <th>Duration</th> <th>Schedule</th> <th>Flexibility</th> <th>Personnel Required</th> </tr> </thead> <tbody> <tr> <td>Unstow 5 min Analysis 2 min/slide (number of samples depends upon number of modules sampled) Stow 10 min</td> <td>At T.0+5 days post-sampling</td> <td>T.0+5 days can be read between 5 & 6 days.</td> <td>1 crewmember</td> </tr> </tbody> </table>	Duration	Schedule	Flexibility	Personnel Required	Unstow 5 min Analysis 2 min/slide (number of samples depends upon number of modules sampled) Stow 10 min	At T.0+5 days post-sampling	T.0+5 days can be read between 5 & 6 days.	1 crewmember	
Duration	Schedule	Flexibility	Personnel Required								
Unstow 5 min Analysis 2 min/slide (number of samples depends upon number of modules sampled) Stow 10 min	At T.0+5 days post-sampling	T.0+5 days can be read between 5 & 6 days.	1 crewmember								
Procedures:	Procedures can be found in the Systems Operations Data File (SODF) Procedures Database Med Ops Book: <ul style="list-style-type: none"> Surface Sampler Kit (SSK)/Water Microbiology Kit (WMK) - Visual Analysis & Data Recording 										
Constraints / Special Requirements:	N/A										
Photo/TV Requirements:	<ul style="list-style-type: none"> In the event that an acceptability limit is exceeded, a request for contingency digital photography downlink of the sample shall be requested. NASA/JSC and RSA/IBMP microbiologists shall evaluate, by visual inspection, the microbial risk. The NASA/JSC and RSA/IBMP microbiologists will notify the Increment Flight Surgeon of their evaluation. The contaminated surface shall be cleaned with the housekeeping detergent or biocide as appropriate. 										
Mission Extension Requirements:	N/A										
Data Delivery	Data/Report to Designated Recipients (Nominal/Contingency):										
	<p>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. Data sheets are stowed in the appropriate kit.</p> <p>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.</p> <p>Comprehensive final report – See Table 3.6 Postflight Activity Data Delivery</p>										

In-Flight Activities, (cont'd)

TABLE 3.5.2: IN-FLIGHT HARDWARE

Hardware/Software Name	P/N
Surface Sampler Kit (SSK) (Specific quantities per flight will be found in the current manifest)	SEM 46109455-XXX

3.6 Postflight Activities

TABLE 3.6: POSTFLIGHT ACTIVITIES

Postflight Activity	There are no postflight activities		
Constraints/Special Requirements:	Samples: <ul style="list-style-type: none"> • Early Destow - R+3 hours if samples are not refrigerated • Early Return - Surface Sampler Kits need to be returned to JSC for analysis within 24-48 hours after destow. Stowage temperatures during transport should be 2° - 8°C. 		
Data Delivery	Data/Report to Designated Recipient (Nominal/Contingency):	Mission Summary Report:	Data Archives:
	A report from the final in-flight samples returned for further analysis will be available within 7-10 days following sample receipt in the laboratory. If a clinically significant organism is observed upon completion of the analysis, an interim report will be delivered to the Crew Surgeon as soon as possible.	A comprehensive final report of the ISS microbial environment will be submitted to the Crew Surgeon, IPs, MMOP and all appropriate personnel no later than R+3 months following completion of the expedition. The report will include the results of crew data, air, surface and water sampling.	Electronic report available through computer inquiry linked through the laboratory information system.

3.7 Summary Schedule**TABLE 3.7: SUMMARY SCHEDULE**

ACTIVITY	DURATION	SCHEDULE	PERSONNEL	CONSTRAINTS
Preflight Training				
EHS Microbiology Operations and Interpretation		L-12 months	Crewmembers/ Instructor	None
Inexperienced crewmember -OR- Experienced crewmember	120 min 60 min			
Preflight				
ISS Module Surface Sampling	≤ 2 hours	15-20 days before module close-out	KSC/JSC Microbiology Personnel	Surface sampling will consist of 6-8 sites per flight element.
In-Flight				
Surface Sampling	15 min. unstow 10 min./slide 10 min. stow	Once during first 6 weeks of each module's on-orbit time. Once every 3 months thereafter, in each module (Lab, Node 1, SM) sampling.	1 Crewmember	-Surface slides 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, surface sampling should be performed on the same day as air and water sampling.
Visual Analysis (colony count of surface samples)	5 min. unstow Analysis 2 min/slide 10 min. stow	At T.0+5 days post- sampling	1 Crewmember	Total time will depend upon number of samples to be analyzed.
Photo/TV Requirements	10 min.	**Contingency only** (Digital Photography)	1 Operator	Required when specified acceptability limits are exceeded during Visual Analysis.
Wheels-Stop – N/A				
Postflight – N/A				
Postflight Debrief				
Debrief	No extra time	~R+30 days	Crewmembers/ Microbiology Team	Included as part of the Med Ops overall debrief.