

MR050L Microbial Analysis of ISS Surfaces Using the Surface Sampler Kit (SSK)

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, <u>ISS Medical Operations Requirements Document</u> (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"> • Preflight test report of samples that may be collected prior to launch of a module or visiting vehicle • 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:	All Flights
Number and Type of Crew Members Required:	One to two crewmembers are trained.
Other Flight Characteristics:	N/A

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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. One to two crewmembers will be trained.		
	Schedule:	Duration: EHS Microbiology Operations - 90/75 min Inexperienced crewmember 90 min training: 5 min - Micro. Intro & Overview 15 min - Introduction to hardware 50 min - Perform sample collection 10 min - Review examples of growth on media 10 min -Review & summarize all micro/answer questions -OR- Experienced crewmember - 75 min training: 5 min - Micro. Intro & Overview 50 min - Perform sample processing 10 min - Review examples of growth on media 10 min - Review & summarize all micro/answer questions	Schedule: Trip 2A7	Personnel Required: Crewmembers/Instructor
Ground Support Requirements Hardware/Software	Preflight Hardware:	Preflight Software:		Test Location:
	Surface Sampler Kit (SSK)	N/A		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			

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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 before final element closeout (15 to 20 days before is preferred) in the element processing facility, as specified in Test Sheets negotiated with individual vendors. 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 appropriate locations 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. JSC Microbiology Laboratory may only be responsible for the first flight of a vehicle, after which vendors may be required to assure the testing is completed.		
	Schedule:	Duration:	Schedule:	Personnel Required:
		ISS Module Surface Sampling ≤ 2 hrs.	Preferred is 15-20 days before module close-out	JSC Microbiology Personnel or vendor-selected delegate as approved by NASA
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 8-10 sites per flight element. • The flight element shall be, to the greatest extent possible, in its fully outfitted configuration, but prior to cargo loading, 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 : Will be dependent on vendor processing schedule			
Data Delivery	A report will be delivered to the Crew Surgeon and all appropriate personnel via email within 10 days of JSC sample processing or forwarded upon receipt of data from vendor.			

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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 every three months in each specified module for continuous monitoring of the environment. One - two sites are sampled in each module (one media plate for bacterial analysis and one media plate for fungal analysis at each sampling location).</p> <p>Incubation is required for all surface samples collected for in-flight processing and analyses. Samples will be stowed in a convenient location and incubated at ambient ISS temperature.</p> <p>All samples for bacterial and fungal analyses are incubated for a total of 5 days, with colony counts performed 5 (T.0+5 days) days after collection. Colony counts are determined by either a direct count or by comparison to a Colony Density Chart provided in the sample analysis procedure. Results are then recorded in the sample analysis procedure.</p> <p>All surface samples will be appropriately contained as specified in the on-board procedures, and a subset of pre-designated samples will be returned to ground for further analysis by the JSC Microbiology Laboratory.</p> <p>Samples that are not designated for return will be placed into appropriately labeled storage bags and discarded as specified in the on-board procedures.</p>		
	Schedule:	Duration:	Schedule:	Personnel Required:
		Unstow surface sampling hardware: 15 min Sample collection using 2 media slides: 10 min/site Stow surface sampling hardware: 10 min	Once every 3 months in each module (Lab, Nodes 1,2, and 3, Columbus, JEM PM, PMM, Airlock).	1 crewmember
Procedures:	Procedures can be found in the System Operations Data File (SODF) Procedures Database Med Ops Book: <ul style="list-style-type: none"> • Microbiology Surface Sampling -Sample Collection 			
Constraints / Special Requirements:	<ul style="list-style-type: none"> • All microbiology kits should be stowed at temperatures between +4° C and +35° C. . • If possible, surface sampling should be done on the same day as microbial air sampling. • Incubation is required for all air samples collected for in-flight processing and analyses. Samples will be stowed in a convenient location and incubated at ambient ISS temperature. • Total time will depend upon number of modules to be sampled.(average total time is 2 hours 35 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			

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

Landing Wave-Off Requirements:	<ul style="list-style-type: none"> ▪ On-Board Computer-Based Training (CBT) is available for crewmembers if desired. ▪ Extra sampling packets are available for contingency.
Data Delivery	<p><u>Real-time surface samples data</u> - See Table 3.5.1b In-flight Activity - Visual Analysis</p> <p><u>Data from the final in-flight samples returned for analysis:</u></p> <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.

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). Colony counts will be performed 5 days after collection of bacterial and fungal samples. The results will be recorded in the procedure.			
	Schedule:	Duration	Schedule	Flexibility	Personnel Required
		Unstow 5 min	At T.0+5 days post-sampling	T.0+5 days can be read between 5 & 6 days.	1 crewmember
		Analysis 2 min/slide (number of samples depends upon number of modules sampled)			
Stow 10 min	Contingency only	N/A	1 crewmember		
Procedures:	<p>Procedures can be found in the Systems Operations Data File (SODF) Procedures Database Med Ops Book:</p> <ul style="list-style-type: none"> • Microbiology Surface Sampling and Air Sampling - 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 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. • The contaminated surface shall be cleaned with the U.S. Disinfectant Wipes. 				
Mission Extension Requirements:	N/A				
Data Delivery	<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.</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>				

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In-Flight Activities, (cont'd)

TABLE 3.5.2: IN-FLIGHT HARDWARE

Hardware/Software Name
Surface Sampler Kit (SSK)
Packet Assembly, Surface Sampler
Incubation Bag

3.6 Postflight Activities

TABLE 3.6: POSTFLIGHT ACTIVITIES

Postflight Activity	Sample destow and return to JSC.		
Constraints/Special Requirements:	Samples: <ul style="list-style-type: none"> • Early Destow - R+3 hours • Early Return - surface samples need to be returned to JSC for analysis as soon as possible 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 if requested. The report will include the results of crew data, air, surface and water sampling.	Electronic reports available through computer inquiry linked through the laboratory information system.

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3.7 Summary Schedule

TABLE 3.7: SUMMARY SCHEDULE

ACTIVITY	DURATION	SCHEDULE	PERSONNEL	CONSTRAINTS
Preflight Training				
EHS Microbiology Operations		Trip 2A7	Crewmembers/ Instructor	None
Inexperienced crewmember -OR-	90 min			
Experienced crewmember	75 min			
Preflight				
ISS Module Surface Sampling	≤ 2 hours	15-20 days before element close-out is preferred	KSC/JSC Microbiology Personnel	Surface sampling will consist of 8-10 sites per flight element.
In-Flight				
Surface Sampling	Unstow: 15 min Sample collection: 10 min/site Stow: 10 min	Once every 3 months in each module (Lab, Nodes 1,2, and 3, Columbus, JEM PM, PMM, Airlock)	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.
Postflight – N/A				
Postflight Debrief				
Debrief	No extra time	~R+30 days	Crewmembers/ Microbiology Team	Included as part of the Med Ops overall debrief.