

MR092L In-flight Radiation Monitoring with Radiation Assessment Detector (Rad Detector) for Long Duration Flights

3.2 Medical Requirements Overview

TABLE 3.2: MEDICAL REQUIREMENTS OVERVIEW

MRID# and Title:	MR092L In-flight Radiation Monitoring with Radiation Assessment Detector (Rad Detector) for Long Duration Flights
Sponsor:	Medical Operations
Discipline:	Radiation
Category:	Medical Requirements
References:	SSP 50260 ISS Medical Operations Requirements Document
Purpose/Objectives:	One of several devices included in the suite of active radiation detecting hardware used to monitor crew exposure to radiation and perform risk assessment by measuring charged particle and neutron fluxes as a function of time, energy, and direction internal to ISS.
Measurement Parameters:	Radiation dose and dose equivalent as a function of time; Particle type, energy, and direction.
Deliverables:	<p>SRAG is responsible for archiving all cyclic telemetry, raw dumped data, and processed data of the Rad Detector. The cyclic telemetry is stored on the SRAG SQL servers for operational usage and monitoring crew exposures. The processed data is archived on the SRAG internal website.</p> <p>Deliverables include characterization of the radiation environment for updating exposure records for occupational health risk assessments, real-time data for use during radiation contingencies, and onboard crew alarm for contingency radiation events. Elements of the processed data are included in a comprehensive report that is delivered to the NASA Radiation Health Officer (RHO) following a crewmember's expedition. The archived data is also used for projecting crew mission exposure levels for future expedition flight readiness reviews.</p>
Flight Duration:	≥ 30 days
Number of Flights:	Every ISS Increment
Number and Type of Crew Members Required:	Designated crewmembers will be assigned as operators.
Other Flight Characteristics:	N/A

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3.3 Preflight Training

TABLE 3.3: PREFLIGHT TRAINING

Preflight Training Activity Description:	Training will be covered in the following lessons and documents: EHS Radiation Operations			
	Training classes will introduce the radiation hardware & procedures and review the radiation environment in space. The location and function of each piece of hardware is detailed. Hands on training will also be provided. Relocation procedures will be covered to provide an understanding of what is involved in the monthly relocate activities on ISS.			
Schedule:	Duration:	Schedule:	Flexibility:	Personnel Required:
	EHS Radiation Operations: 45 minutes	NLT L-19 months	N/A	Crewmember/Instructors
Ground Support Requirements: Hardware/Software	Preflight Hardware:		Preflight Software:	Test Location:
	Rad Detector		None	U.S.
Training Facilities:	Minimum Room Dimensions:	Number of Electrical Outlets:	Temperature Requirements:	Special Lighting:
	8' x 10'	2	Ambient	N/A
	Hot or Cold Running Water:	Privacy Requirements:	Other:	
	N/A	N/A	1 Table, 4-6 Chairs	
Constraints/Special Requirements:	N/A			
Launch Delay Requirements:	Training will be repeated if requested by the crewmember.			
Notes:	N/A			

3.4 Preflight Activities - None

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3.5 In-Flight Activities

TABLE 3.5.1: IN-FLIGHT ACTIVITIES

In-Flight Activity Description:	Rad Detector will operate continuously to provide radiation measurements of charged particle and neutron environments. The Rad Detector will be relocated periodically throughout the habitable modules of the station to analyze the internal radiation environment. Space Radiation Analysis Group (SRAG) will define a relocation plan to determine how long and at which locations the Rad Detector will be deployed. Nominal deployment sites will be within the cable reach of the CHeCS Power/Data ports if 1553 data connection is available. When 1553 data is available, measured spectra in the cyclic telemetry will be available in real-time and the full set of data will be downlinked by BME approximately weekly on demand. If 1553 data is not available and/or if SRAG defines a specific location that precludes access to a CHeCS Power/Data port, then real-time telemetry will not be available but will either be downlinked the next time Rad Detector is plugged into a CHeCS Power/Data port, or transferred to an SSC for downlink by the crew or BME. The Rad Detector SSC application will be available for the crew to send commands and monitor telemetry from an SSC if needed (or BME can do this via SSC remote desktop).			
	Activity:	Duration:	Schedule:	Personnel Required:
	Schedule: Rad Detector Relocate	20 minutes	Once every 3 months	1 Crewmember
Rad Detector Rotate	10 minutes	Once a month	1 Crewmember	
Procedures:	All in-flight procedures are developed in-house and contained within the System Operations Data file (SODF) Med Ops book.			
Constraints / Special Requirements:	Scrub turnaround = N/A Rad Detector will be secured via hook and loop fasteners to the face of an ISPR/ISS bulkhead or via the unit-provided Camera Shoe to the Multiuse Bracket Assembly or Flexible Bracket Assembly that is connected to an ISPR seat track, and/or via Velcro and/or Kapton Tape. The Rad Detector alarm is tied into the ISS Caution and Warning system (class 3 alarm). The Rad Detector does not contain a local alarm. Deployment locations must not impede rapid egress or block access to any rack. Rad Detector Rotate will occur only on months that do not have Rad Detector Relocate scheduled.			
Photo / TV Requirements:	Photos of Rad Detector are required when it is relocated or rotated. Photos are necessary to document the position and orientation of the detector heads, surroundings of Rad Detector, and to ensure the detectors are not shielded more than expected.			
Cold Stowage Requirements:	N/A			
Mission Extension Requirements:	N/A			
Landing Wave-Off Requirements:	N/A			

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<p>Data Delivery:</p>	<p>Elements of the processed data are included in a comprehensive report that is delivered to the NASA Radiation Health Officer (RHO) following a crewmember's expedition.</p> <p>Cyclic Data (minute-by-minute data): This data will be obtained via the ISS S-Band telemetry resource. Data will be collected by SRAG in support of real-time console operations. This data will also be used to help make real-time risk management, operational decisions to meet the As Low As Reasonably Achievable (ALARA) principle for the protection of the crew from ionizing radiation during Space Weather events.</p> <p>Rad Detector Dump Data: When 1553 data connection is available, BME will dump data from the Rad Detector once per week. If 1553 data connection is not available, meaning data dumps cannot be performed, it is advisable that Rad Detector be connected to an SSC so that BME can downlink the data via remote desktop once per week or the crew manually transfers the data to an SSC approximately once per month so that it is available for downlink via OCA.</p> <p>Instrument Health/Status Data: The hardware sustaining organization will review and analyze the engineering data files and provide a periodic summary of the Rad Detector's health & status to SRAG. These status reports will not be forwarded to the Crew Surgeon nominally.</p>
<p>Notes:</p>	<p>None</p>

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In-Flight Activities, (cont.)

TABLE 3.5.2: IN-FLIGHT HARDWARE

Hardware/Software Name
Rad Detector
Rad Detector Power/Data Cable 10ft
Rad Detector USB Cable - 6ft

3.6 Postflight Activities

TABLE 3.6: POSTFLIGHT ACTIVITIES

Postflight Activity	Description:	Submittal of final mission expedition report.
Constraints/Special Requirements:		N/A
Early Destow / Early Return:		N/A
Notes:		Crewmember radiation exposure from each mission and their accumulated radiation exposure will be used for occupational health risk assessment.
Data Delivery:		Elements of the processed data are included in a comprehensive report that is delivered to the NASA Radiation Health Officer (RHO) following a crewmember's expedition.
Mission Summary Report:		Approximately R+90 days
Data Archives:		Approximately R+90 days

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3.7 Summary Schedule

TABLE 3.7: SUMMARY SCHEDULE

ACTIVITY:	DURATION:	SCHEDULE:	PERSONNEL REQUIRED:	CONSTRAINTS:
Preflight Training:				
EHS Radiation Operations	45 minutes	NLT L-6 months	Crewmembers/Instructors	None
Preflight: N/A				
In-Flight Activity:				
Rad Detector Relocate	20 minutes	Once every 3 months	1 Crewmember	New location must not impede rapid egress or block access to any rack.
Rad Detector Rotate	10 minutes	Once a month	1 Crewmember	Only on months that do not have Rad Detector Relocate scheduled.
Postflight:				
Final Mission Expedition Report	None	~R+90 days	Space Radiation Analysis Group (SRAG)	Report provided to Radiation Health Officer (RHO) to provide to crewmembers postflight.
Postflight Debrief:				
Debrief	No extra time	~R+30 days	Crewmembers/Radiation Team	Included as part of the Med Ops overall debrief.