

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

<b>MRID# and Title:</b>	MR030L Radiation Monitoring Using Charged Particle Directional Spectrometer (CPDS)
<b>Sponsor:</b>	Medical Operations
<b>Discipline:</b>	Radiation
<b>Category:</b>	Medical Requirements
<b>References:</b>	SSP 50260 ISS Medical Operations Requirement Document
<b>Purpose/Objectives:</b>	To monitor crew exposure to radiation and perform risk assessment by monitoring proton and other particle fluxes as a function of time, energy and direction. Internal and external ISS radiation environments will be monitored.
<b>Measurement Parameters:</b>	<ul style="list-style-type: none"> <li>• <b><u>Intravehicular Charged Particle Directional Spectrometer (IV-CPDS)</u></b> – will characterize primary trapped and galactic cosmic radiation penetrating into Station and secondary radiation resulting from interaction with Station materials.</li> <li>• <b><u>Extravehicular Charged Particle Directional Spectrometer (EV-CPDS)</u></b> – will measure fluxes of trapped and galactic cosmic rays as a function of time, charge, energy, and direction outside Station in the space environment throughout the solar cycle.</li> </ul>
<b>Deliverables:</b>	A report characterizing the radiation environment for updating exposure records for occupational health risk assessments.
<b>Flight Duration:</b>	≥ 30 days
<b>Number of Flights:</b>	IV-CPDS: 5A.1 & subs EV-CPDS: 8A & subs
<b>Number and Type of Crew Members Required:</b>	One crewmember to initially activate/checkout and to periodically relocate the IV-CPDS
<b>Other Flight Characteristics:</b>	None

3.3 Preflight Training

TABLE 3.3: PREFLIGHT TRAINING

<b>Preflight Training Activity</b>	<b>Description:</b> Training will be covered in the following Environmental Health System (EHS) documents and lessons: EHS Radiation Operations Crew training of EV-CPDS deployment will be done by the EVA group as part of assembly operations training.			
	<b>Schedule:</b>	<b>Duration:</b>	<b>Schedule:</b>	<b>Flexibility:</b>
	EHS Radiation Operations	90 min	L-12 months	N/A
<b>Ground Support Requirements Hardware/Software</b>	<b>Preflight Hardware:</b>		<b>Preflight Software:</b>	<b>Test Location:</b>
	IV-CPDS Instrument Assembly IV-CPDS Power Data Cable Assembly Rack Boom Assembly Personal Computer System (PCS) or the equivalent for displays		N/A	U.S.
<b>Training Facilities</b>	<b>Minimum Room Dimensions:</b>	<b>Number of Electrical Outlets:</b>	<b>Temperature Requirements:</b>	<b>Special Lighting:</b>
	8' x 10'	2 (110 Volts AC)	Ambient	N/A
	<b>Hot or Cold Running Water:</b>	<b>Privacy Requirements:</b>	<b>Other:</b>	
	N/A	N/A	1 Table and 6 chairs	
<b>Constraints/Special Requirements:</b>	None			
<b>Launch Delay Requirements:</b>	Refresher training will be repeated if requested by crewmember.			
<b>Notes:</b>	None			

3.4 Preflight Activities – No Preflight Activities

3.5 In-Flight Activities

TABLE 3.5.1a: IN-FLIGHT ACTIVITIES – IV-CPDS

<b>In-Flight Activity</b>	<b>Description:</b>	The IV-CPDS will monitor the time-resolved charged particle measurements within each habitable module, excluding the Russian modules. Each module will be surveyed by relocating the IV-CPDS periodically as needed. The Space Radiation Analysis Group (SRAG) will determine relocation sites.			
	<b>Schedule:</b>	<b>Activity:</b>	<b>Duration:</b>	<b>Schedule:</b>	<b>Personnel Required:</b>
		IV-CPDS Initial Activation & Checkout	30 min	Once on ISS, within 1 week of arrival	1 Operator
		IV-CPDS Relocation	10 min	No more frequently than once per month Weekly	1 Operator
	IV-CPDS data downlink to ground	0 crew time		None	
<b>Procedures:</b>	Procedures will be developed and contained within the System Operations Data File (SODF) Med Ops Book: <ul style="list-style-type: none"> <li>• IV-CPDS – Initial Activation &amp; Checkout</li> <li>• IV-CPDS – Relocate</li> <li>• IV-CPDS Malfunction</li> <li>• IV-CPDS Fuse Changeout</li> </ul>				
<b>Constraints / Special Requirements:</b>	<ul style="list-style-type: none"> <li>• Ground controllers will perform IV-CPDS download, operations, calibration, and self-tests.</li> <li>• New location must not impede rapid egress or block access to any rack.</li> </ul>				
<b>Photo / TV Requirements:</b>	Photo of IV-CPDS will only be required on a contingency basis.				
<b>Cold Stowage Requirements:</b>	N/A				
<b>Mission Extension Requirements:</b>	N/A				
<b>Landing Wave-Off Requirements:</b>	N/A				
<b>Data Delivery</b>	<b>Data/Report to Designated Recipients (Nominal/Contingency):</b>				
	IV-CPDS: In-flight dose rate will be provided continuously for telemetry. Detailed time resolved particle spectra shall be downlinked weekly for analysis. See Table 3.6 Postflight Activities				

**TABLE 3.5.1b: IN-FLIGHT ACTIVITIES – EV-CPDS**

<b>In-Flight Activity</b>	<b>Description:</b>	The EV-CPDS will monitor the time-resolved charged particle spectra immediately exterior to the vehicle. It will be mounted on a boom attached to the Integrated Truss Structure S0 outside the ISS.			
		<b>Activity:</b>	<b>Duration:</b>	<b>Schedule:</b>	<b>Personnel Required:</b>
	<b>Schedule:</b>	EV-CPDS Deploy	20 min	Once - initial deploy (8A)	EVA Crew Member
		EV-CPDS data downlink to ground	0 crew time	Weekly	None
<b>Procedures:</b>	<ul style="list-style-type: none"> <li>EV-CPDS procedures will be found in the SODF (Systems Operation Data File)</li> </ul>				
<b>Constraints / Special Requirements:</b>	<ul style="list-style-type: none"> <li>EV-CPDS deployed during EVA.</li> <li>Ground controllers will perform EV-CPDS download, operations, calibration, and self-tests.</li> </ul>				
<b>Photo / TV Requirements:</b>	As needed				
<b>Cold Stowage Requirements:</b>	N/A				
<b>Mission Extension Requirements:</b>	N/A				
<b>Landing Wave-Off Requirements:</b>	N/A				
<b>Data Delivery</b>	<b>Data/Report to Designated Recipients (Nominal/Contingency):</b>				
	EV-CPDS: Detailed time resolved particle spectra shall be downlinked weekly for analysis. See Table 3.6 Postflight Activities				

**In-Flight Activities, (cont.)**

**TABLE 3.5.2: IN-FLIGHT HARDWARE**

Hardware/Software Name	P/N
IV-CPDS Instrument Assembly contains: CPDS Assembly Mount Assembly	SEG16103466-XXX
IV-CPDS Power/Data Cable Assembly	SEG16103090-XXX
Rack Boom Assembly	SEG16103469-XXX
EV-CPDS	SEG16102821-XXX

**3.6 Postflight Activities**

**TABLE 3.6: POSTFLIGHT ACTIVITIES**

Postflight Activity	Description:			
	Charged particle spectral data, crew dosimeter measurements and data from other applicable instruments shall be used in conjunction with computer models to calculate organ specific dose equivalents.			
Data Delivery		Data/Report to Designated Recipients (Nominal/Contingency):	Mission Summary Report:	Data Archives:
		Pertinent data from the IV-CPDS & EV-CPDS will be included in the final crew radiation report prepared by the Space Health Radiation Officer (SHRO). This will be integrated with other radiation data when available.	Approximately R+90 days	A report containing crew radiation exposures will be distributed to the crewmembers' medical records and the mission-specific medical records.

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

ACTIVITY	DURATION	SCHEDULE	PERSONNEL REQUIRED	CONSTRAINTS
<b>Preflight Training</b>				
EHS Radiation Operations	90 min	L-12 months	Crewmembers/Instructors	None
<b>Preflight: None</b>				
<b>In-Flight:</b>				
IV-CPDS Relocation	10 min	No more frequently than once per month	1 Operator	New location must not impede rapid egress or block access to any rack.
IV-CPDS data downlink to ground	0 crew time	Weekly	None	N/A
EV-CPDS data downlink to ground	0 crew time	Weekly	None	N/A
<b>Wheels-Stop: N/A</b>				
<b>Postflight: N/A</b>				
<b>Postflight Debrief:</b>				
Debrief	No extra time	~R+30 days	Crewmembers/Radiation team	Included as part of the Med Ops overall debrief.