

# Failure Modes and Effects Analysis/Critical Items List

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 Title: Risk Assessment Executive Summary Report (RAESR) for the USA SAFER

Item Name: Thruster      Qty: 24      FMEA Number: US-SFR-140  
 Item Part Number: B84138-1      ORU Name: SAFER  
 Subsystem Name: Propulsion      ORU Part Number: SED33105900-311  
 Function: Provides propulsive impulse for translation and rotation.

Item Type Designator: C      PG/IP Identifier: N/A  
 Reference Designator/Find No.: N/A      Drawing Number: SED33105904  
 Logistics Control Number: N/A

End Item Name: SAFER  
 End Item Capability: Six degrees of freedom through 24 thrusters, each rated at 0.8 ± 0.08 lbs. force in vacuum.  
 End Item Function: Provides emergency EVA self-rescue for separated crewmember.  
 ISS Zone: EVA      Shuttle Zone: EVA

**Criticality**

Critical Item: Yes: \_\_\_\_\_ No:  X       Criticality Category:      ISS: 1R      Shuttle: 1R/3  
 Success Paths:      Success Paths Remaining:

### Failure (Mode, Cause, Detection, Corrective Action)

**Failure Mode:** Thruster fails open.  
**Failure Mode Code:**  
**Failure Cause:** Avionics EEE part failure, return spring failure, contamination, piece-part failure.  
**Failure Detection:**  
**Flight:** IVA – IVA checkout.  
 EVA – Uncommanded motion; “Thruster On” light illuminated.  
**Ground:** Functional Test.  
**Time To Detect Quantity:** 30      **Time To Detect Units:** Seconds  
**Correcting Action:** IVA – If a failure is detected during the IVA checkout, the back-up SAFER (if available) will be used.  
 EVA – Continue self-rescue.  
**Remarks:** SAFER is not certified to handle control system “force fights” (firing additional thrusters to maintain control).  
 However if this failure occurs it may be possible for the crewmember to make manual inputs to overcome the unwanted thrust and continue with the self rescue. All GN2 would leak through a single failed open thruster in approximately 4 minutes.  
**Failure Effect Phase:** EVA Operations      **Affected Stage(S):** EVA Operations

### Failure Effect

**On ORU/Assembly:**  
First/Second Failure: Inadvertent EVA crewmember separation.  
Third (this) Failure: Uncommanded motion; “Thruster On” light illuminated.  
**On Subsystem/Next Assembly:** Uncontrolled loss of GN<sub>2</sub>.  
**On End Item/Segment:** Uncommanded motion. Possible loss of mission objectives if SAFER required for EVA.  
**On Crew/ISS:** Possible loss of EVA crewmember.  
**Time To Effect Quantity:** 1      **Time To Effect Units:** Minutes

### Redundancy Screen

<b>ISS</b>	<b>(Shuttle)</b>				
<b>Checkout Pre-Launch</b>	<b>(A):</b>	Pass			
<b>Checkout On-Orbit</b>	<b>(B):</b>	N/A			
<b>Detection Flight Crew:</b>		Pass	<b>Or</b>	<b>Detection Ground Crew:</b>	Fail
<b>Loss Of Redundancy From A Single Cause</b>	<b>(C):</b>	N/A			