



ISS EVA 23 Suit Water Intrusion Lessons Learned

Senior Management ViTS Meeting

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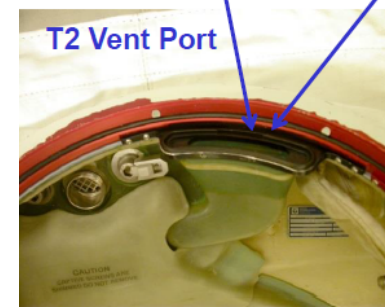
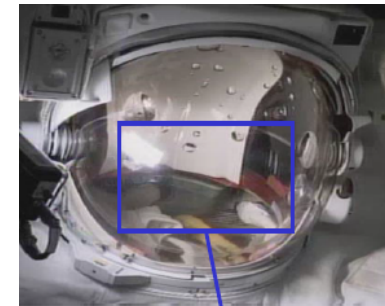


Mishap Summary

- **DATE:** July 16, 2013
- **TIME:** 1241 GMT (0741 CDT)
- **LOCATION:** Outside ISS, on orbit during US EVA 23
- **BRIEF DESCRIPTION:**
 - Roughly 44 minutes (Phase Elapsed Time) into EVA 23, astronaut Luca Parmitano reported water inside his helmet on the back of his head. The EVA ground team and Luca were unable to identify the water's source. As Luca continued to work, the amount of water in the helmet increased and eventually migrated from the back of his head onto his face. EVA 23 was terminated early and the crew safely ingressed the airlock. The water quantity introduced into the helmet was estimated at 1 to 1.5 liters.
 - A related concern occurred during a post-EVA 23 suit dry-out procedure. A vacuum cleaner was used and unexpectedly suctioned O₂ from the suit's secondary high pressure oxygen tank, causing a potentially hazardous mix of electricity and pure O₂.

Summary of Mishap Investigation Board Findings

- The causes for this mishap evolved from:
 - Inorganic materials causing blockage of the drum holes in the space suit water separator, resulting in water spilling into the vent loop
 - Root cause of the blockage is still under investigation
 - Recent findings point to an ionic filter used to scrub the space suit's water transport loop becoming contaminated and shedding silicates into the system
 - The NASA team's lack of knowledge regarding this particular failure mode
 - No one applied knowledge of the physics of water behavior in zero-g to water coming from the vent loop
 - Possible misdiagnosis of water in suit post-EVA 22
 - ISS community perception was that drink bags leak
 - The occurrence of minor amounts of water in the helmet was normalized



Lessons Learned

- Think outside the box
 - Past experience cannot be relied upon to predict future problems.
- Don't assume
 - Any potential problems should be investigated carefully. The “obvious” answer may not be correct.
- Stay hungry
 - Complacency due to our past successes increases risk.
- Close calls are a gift
 - Use them wisely. Each close call is an opportunity to examine our processes with fresh eyes and a renewed sense of urgency.