HUMAN SPACE ENDEAVOURS SYMPOSIUM (B3)
How Can We Best Apply Our Experience to Future Human Missions? (2)

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# JEM ECLSS OPERATION LESSONS LEARNED AND SUGGESTION FOR FUTURE DESIGN

**Abstract**

JEM (Japanese Experiment Module, KIBO) has been operated as a part of International Space Station (ISS) and assembled by three Space shuttles: STS-123<Flight 1J/A> for JLP(JEM Logistics Module Pressurized Section), STS-124<Flight 1J> for JPM (JEM Pressurized Module), and STS-127<Flight 2J/A> for JEF (JEM Exposed Facility). This document describes the overview of JEM ECLSS (Environmental Control and Life Support System), current topic and lessons learned as a perspective of Flight Controller based on our experience for more than two years since 2008.

Following the overview of JEM ECLSS operations, this document focuses on a current issue in JEM ECLSS operations and introduces lessons learned from Flight 1J to now. Just after the initial activation on Flight 1J, THC (Temperature and Humidity Control) B CHX (Cabin Heat Exchanger) outlet liquid sensor detected water scattering from CHX, and THCU (Temperature and Humidity Control Unit) stopped THC operations automatically as a result of auto-stop function called FDIR (Fault Detection, Isolation, and Recovery). Since then that sensor sometimes detected water scattering from CHX or WS (Water Separator) during an weekly-basis THC dryout operation. WS outlet liquid sensor detection led to auto-stop by THCU FDIR and the dryout operation was interrupted. JAXA investigated the root cause and estimated that the more condensate water not being collected and remained around CHX or WS than expected because the airflow to CHX by usually full-bypassed TCV (Temperature Control Valve) was not so effectively contributed to collecting condensate water. To prevent a recurrence of this water detection or auto-stop, JAXA took the permanent actions that they maintain THC operation, with always inhibiting the auto-stop function triggered by the CHX liquid sensor, and with temporarily (during Dryout operation only) inhibiting the same function by the WS liquid sensor. Also we have changed the operational concept that each of two THC alternatively operates with single WS every two weeks and uses calibrated cabin temperature set point for TCV to function well (not to fix full-bypassed position). Since then we can see the decrease in the occurrence and the duration of this water detection.

From these experiences above, this document finally suggests more comfortable software logic to prevent unexpected shutdown of THC function regarding the future design for manned spacecraft operations.