Paper ID: 52620
oral

IAF MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Microgravity Sciences on board ISS and beyond (6)

Author: Dr. Jean Chegançcas
Airbus Defence and Space, France

Mr. Hubertus Stephan
Airbus DS GmbH, Germany

THE THREE MELFI FREEZERS IN ISS OFFERING EXTENDED LIFE AND OUTSTANDING PERFORMANCE FOR LIFE SCIENCE

Abstract

Inside the International Space Station (ISS) the necessary permanent freezing and refrigeration capabilities for life science experiments completely relies on the MELFI units since more than 12 years now and is foreseen to continue further, while the design for extended life was initially targeting 10 years. Launched in 2006, the first unit will complete, by summer 2019, thirteen years of continuous operations without intervention on the internal Nitrogen gas cycle, while all necessary hardware and operations were initially planned for preventive maintenance every two years. This unit has demonstrated outstanding performance on orbit and proved the technical decisions made during the development program. Current utilization of MELFI units in the ISS is taking full benefit of the initial specifications, which allows for wide adaptations to cope with the mission scenario imposed by the life extension in orbit. The two other MELFI units, launched respectively in 2008 and 2009, are permanently supporting the first unit providing additional conditioned volume necessary for the science on board, and also for preparing thermal mass used to protect the samples on their way down to earth. The MELFI pool of the three refrigeration units will reach by mid-2019 a cumulated collective operational running time over 25 years, while the cumulated time inside ISS will reach 34 years. Each MELFI unit may simultaneously provide different temperatures between +2C and over 95C, while the most frequent utilisation for all units is a configuration with 3 dewars at -95C and one dewar at +2C. The MELFI pool is outfitted with all supporting hardware to allow for extended operation on orbit including preventive and corrective maintenance. The internal components were designed to allow for easy on board maintenance. Spare equipment was installed in each MELFI unit on ISS and specific maintenance means were developed which required crew training before the cold gas cycle could be accessed. The MELFI pool continues demonstrating the behaviour expected to possibly accompany the life science during ISS life extension. The paper will present first how the design choices made for the initial missions were already identifying features necessary for extended duration missions, and will then give highlights on the utilization of the MELFI refrigeration pool during the recent years in ISS.