

IAF MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)  
Life and Physical Sciences under reduced Gravity (7)

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ADVANCEMENTS IN THE MINI FLUORESCENCE MICROSCOPE DEVELOPMENT: PROGRESS  
AND PROSPECTS**Abstract**

The Mini Fluorescence Microscope (MFM), developed by Aboa Space Research Oy (ASRO) in collaboration with the University of Turku (UTU), is a un ultra-compact instrument aimed at enhancing space-based live cell imaging capabilities. The instrument is designed to address key challenges in space research, such as cellular responses to microgravity and radiation, as well as the exploration of long-term human habitation in space and the potential for extraterrestrial life. The prototype development phase, the results of which were presented at the IAC 2023, led to a design measuring approximately 83 mm x 42 mm x 33 mm, with two excitation channels and a lateral resolution of 530 nm, facilitating detailed cellular analysis. Building upon the successful prototype development phase, this paper provides an update on the ongoing efforts to further enhance the MFM for space-based life sciences research. Currently, a follow-up project is underway to further improve the instrument, targeting the ICE Cubes platform on-board the International Space Station. The test results of the first prototype helped in identifying areas of improvement in the MFM. It was found that autofocus is a required functionality. Further, a fluidic system providing medium exchange capability would be beneficial for supporting cell growth and function. Along with the implementation of these features, increasing the overall autonomy of the system is also a target of the follow-up project. The objective is to develop and test an engineering qualification model (EQM) of the MFM. These development efforts aim for a versatile instrument for life sciences

research in both human and robotic exploration missions, as well as commercial space applications, and even ground-based research in challenging environments.