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## MINI FLUORESCENCE MICROSCOPE: PROTOTYPE RESULTS AND FURTHER DEVELOPMENT

**Abstract**

The Mini Fluorescence Microscope (MFM) is a project by Aboa Space Research Oy (ASRO), in collaboration with University of Turku. The objectives of the project were to assess the feasibility of developing and manufacturing the smallest possible fluorescence microscope to perform live cell imaging in space, and to build a breadboard model of the microscope to test and verify the concept. The purpose was to reach the limits of feasibility while providing the best possible performance for scientific application, such as exploration programs dedicated to radiation, partial and microgravity related research. The instrument is primarily developed for KUBIK, which is an incubator on-board the International Space Station (ISS) that includes a centrifuge.

Two prototype versions of the microscope were manufactured and tested during the project, and the results of the first version were presented at the IAC 2021. Following the first prototype testing, a second version was manufactured with improvements in the design. The resulting prototype has dimensions of

approximately 82 mm x 42 mm x 33 mm, and it consists of four custom subsystem modules: the optics, cell culture chamber, motorized XY-stage, and electronics. In addition, an electrical ground support equipment and Micro-Manager user interface were developed during the activity. The instrument has two excitation wavelengths and achieves a lateral resolution of 530 nm. The prototype development project resulted in multiple valuable lessons learned and was concluded in 2022.

Currently under planning is the follow-up project with objectives of further developing a space-qualified MFM and demonstrating it in the KUBIK platform on-board the ISS. The goal is to achieve a versatile instrument especially for life sciences in human and robotic exploration missions and commercial space applications, but also for ground-based applications. This paper presents the final results of the prototype project and outlines the plan for further development of the Mini Fluorescence Microscope. The prototype development work was made possible through the European Space Agency's Technology Research Programme contract 4000126303/18/NL/KML.