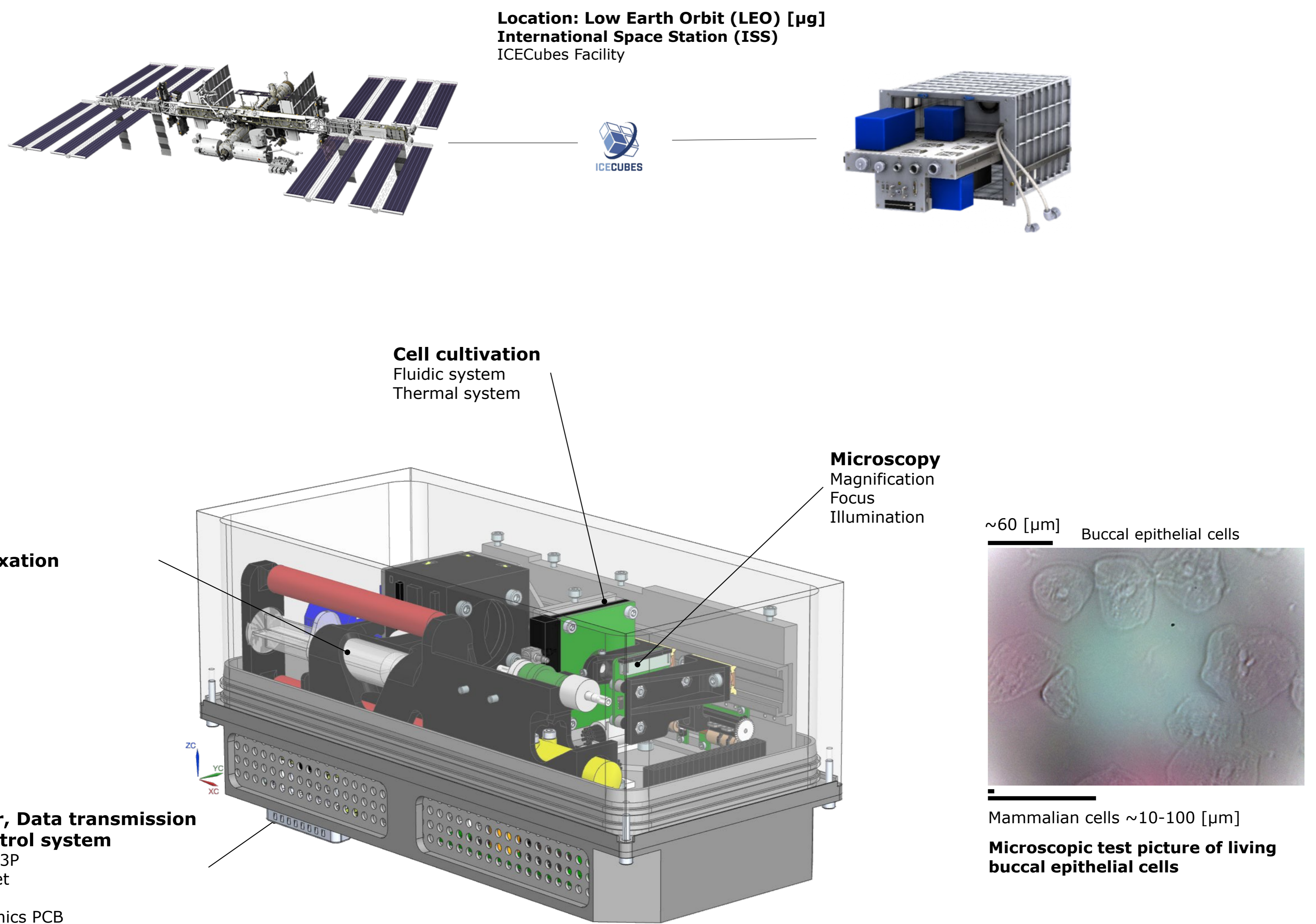


Master-Thesis in Engineering, Specialisation Business Engineering and Production

# System Engineering of an Explorative Mammalian Cell Cube (EMC2) for Space Applications



## Multipurpose Mammalian Cell Cultivation System for Space applications (2U size)

### Introduction

Microgravity conditions allow to observe cell culture in a unique environment. In contrast to standard 2D cell culture on Earth, cells often acquire scaffold-free, three dimensional structures in microgravity. Thanks to the ongoing commercialisation of space flight a service provider (ICEcubes service) now provides a standardized experiment platform on the International Space Station (ISS) (see Fig.1). Thus, industry and universities can book a place on this "ICEcubes" framework including support service to carry out their own experiments in microgravity over a prolonged time.

In this master thesis the prototype of an "ICEcube" which stands for international commercial experimental cube, was developed. This experiment hardware, called Explorative Mammalian Cell Cube (EMC<sup>2</sup>) should cultivate mammalian cells with the additional functionality of microscopic imaging and cell fixation (see Fig. 2). The goal of the master thesis was to test the functionalities of the EMC<sup>2</sup> system within the given space constraint of 2U (225x100x100mm) outer dimensions.

### Results

The semi-autonomous functionality of microscopic imaging of low and high contrast probes within a range of 10-100 microns was verified (see Fig. 3). In addition, the fluidic system functionalities including the cell fixation and nutrient delivery for the cells were verified by testing. In conclusion the proposed hardware design fits within the required dimension of 225x100x100mm (see Fig. 2). Pending is the definition of electronics to handle the system in fully autonomous state with the possibility of telecommand interaction and the therefore needed software.

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