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Author: Mr. Jochen Keppler
Institute of Space Systems, University of Stuttgart, Germany, keppler@irs.uni-stuttgart.de

Mr. Harald Helisch
University of Stuttgart, Germany, helisch@irs.uni-stuttgart.de

Dr. Gisela Detrell
Institute of Space Systems, University of Stuttgart, Germany, detrell@irs.uni-stuttgart.de

Dr. Stefan Belz
University of Stuttgart, Germany, belz@irs.uni-stuttgart.de

Mr. Johannes Martin
IRS, University of Stuttgart, Germany, martin@irs.uni-stuttgart.de

Prof. Stefanos Fasoulas
University of Stuttgart, Germany, fasoulas@irs.uni-stuttgart.de

Prof. Reinhold Ewald
Institute of Space Systems, University of Stuttgart, Germany, ewald@irs.uni-stuttgart.de

Mr. Norbert Henn
Germany, norbert.henn@space-exploration-henn.com

Dr. Oliver Angerer
DLR (German Aerospace Center), Germany, Oliver.Angerer@dlr.de

Mr. Heinz Hartstein
Airbus DS, Germany, heinz.hartstein@airbus.com

MICROALGAE CULTIVATION IN SPACE FOR FUTURE EXPLORATION MISSIONS: A SUMMARY
OF THE DEVELOPMENT PROGRESS OF THE SPACEFLIGHT EXPERIMENT PBR@LSR ON THE
INTERNATIONAL SPACE STATION ISS**Abstract**

The spaceflight experiment PBR@LSR (*Photobioreactor at the Life Support Rack*) is set to be launched to the International Space Station (ISS) in November 2018. It consists of a photobioreactor (PBR) for microalgae cultivation which is connected to the carbon dioxide (CO₂) concentration assembly of the European Life Support Rack (LSR), formerly known as Advanced Closed Loop System (ACLS). LSR will be accommodated in the US lab "Destiny" in summer 2018 and will adsorb and concentrate CO₂ from the cabin air and further process it to regenerate oxygen (O₂) in a physico-chemical way. After the CO₂ concentration process, a dedicated interface allows for utilizing a surplus of CO₂ for cultivating microalgae in the PBR. The combination of PBR and LSR shall demonstrate the first hybrid life support system in space during a time span of 180 days. The microalgae species *Chlorella vulgaris* has been selected for cultivation in the PBR. By photosynthesis, *C. vulgaris* consumes CO₂ and produces O₂ and edible protein-rich biomass, which can cover up to 30% of human diet. The PBR@LSR experiment and its development was initiated in 2014 by the German Aerospace Center (DLR) and the Institute of Space Systems (IRS) of the University of Stuttgart with Airbus Defence and Space as prime for the flight hardware. The biotechnological development started in early 2015 with a first breadboard setup at IRS which demonstrated the principle functionality of the system. During the breadboard phase numerous test have been performed focusing on either biology or engineering. With the knowledge gained,

the breadboard design was constantly improved and finally converged towards the flight model design. This paper sums up the development progress of the spaceflight experiment PBR@LSR from the early development steps during the breadboard phase until flight readiness and shows selected components in the final design.