Space Flight Analogues as Test Bed for Food Production and Life Support Systems

Experiences from SIRIUS-17

DEFENCE AND SPACE
Viktor Fetter

7/2/2018

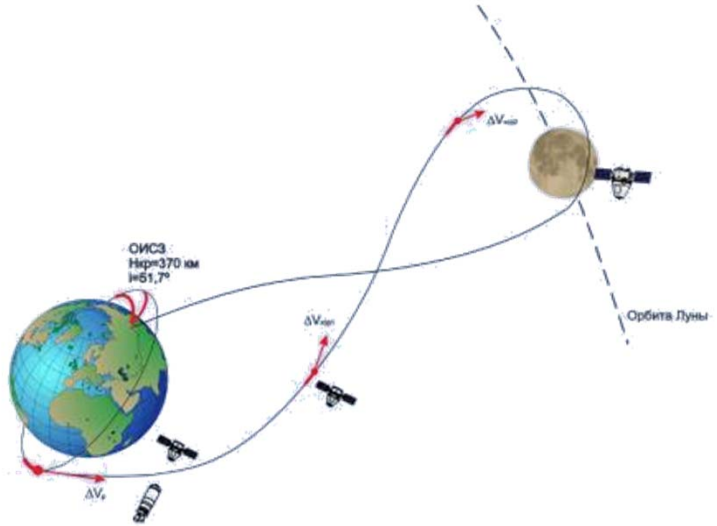
AIRBUS

Overview of the SIRIUS-17 Mission

Simulated Moon Mission (17 days)

IBMB in cooperation with NASA

Focus on potential use of cis-lunar DSG

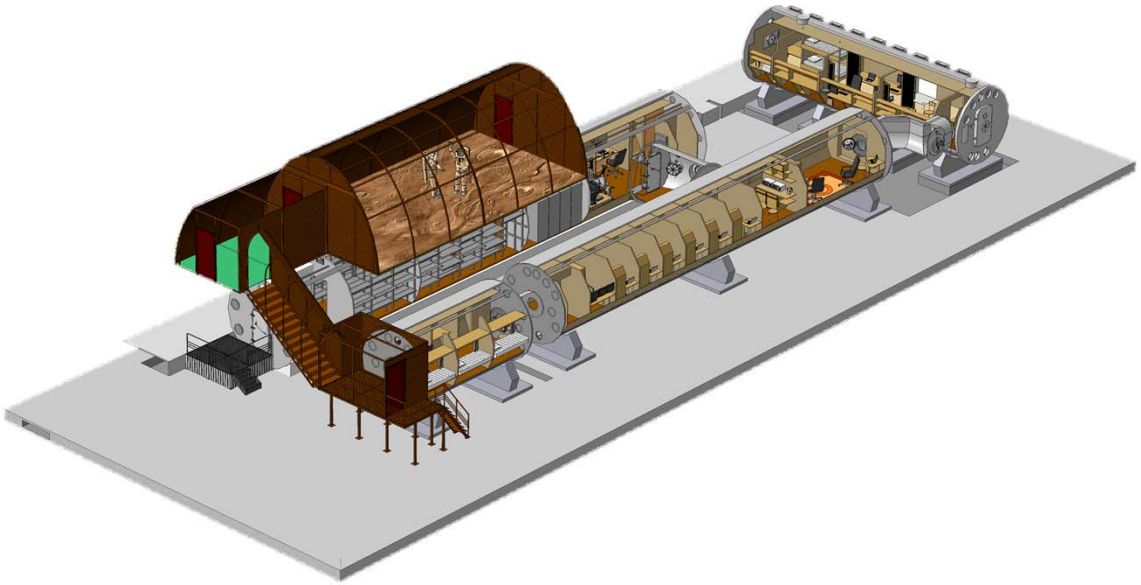


All pictures ©IBMP

AIRBUS

Overview of the SIRIUS-17 Mission – Facility

Space Flight Analogue Facility @IBMP, Moscow



©IBMP

©IBMP

AIRBUS

Overview of the SIRIUS-17 Mission – Research Studies

Psychophysiological

Operational Simulations

Immunity and Health

All pictures ©IBMP

AIRBUS

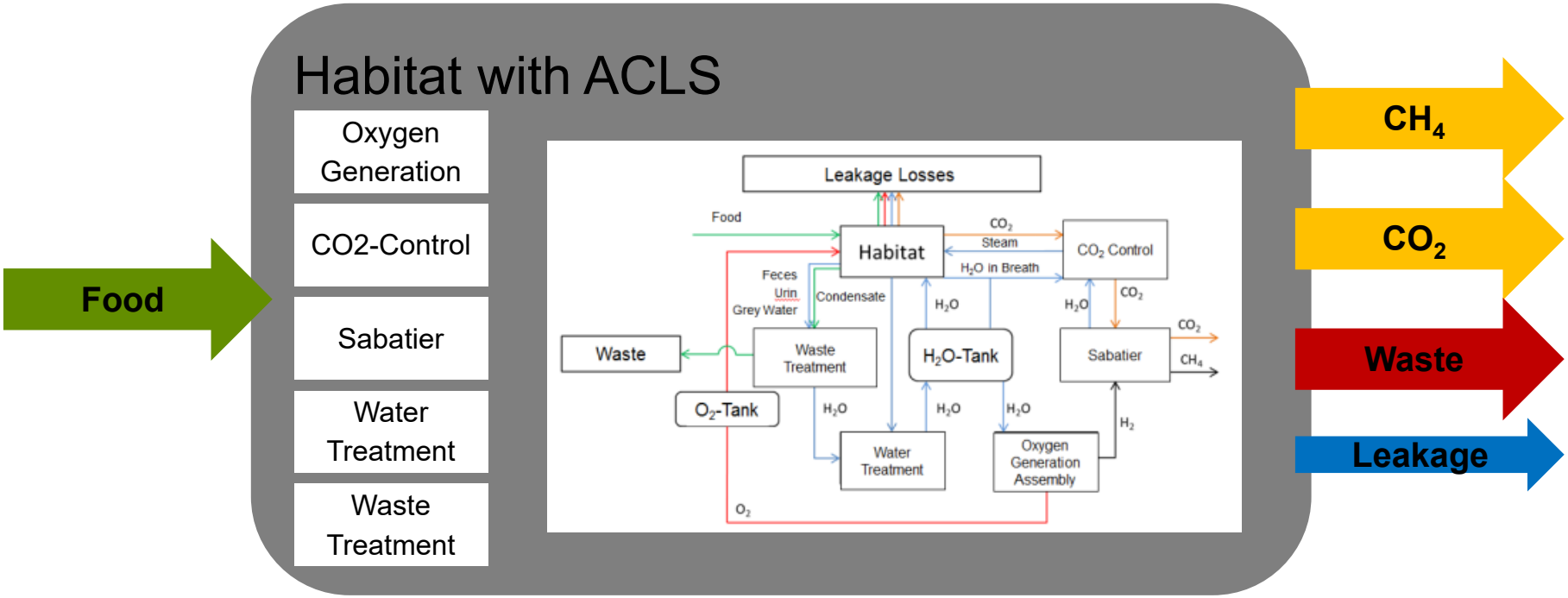
Plants in SIRIUS-17

- **Sustainable provision of fresh food**
- **Positive impact of plants on human emotions, behaviour and health**

All pictures ©IBMP

AIRBUS

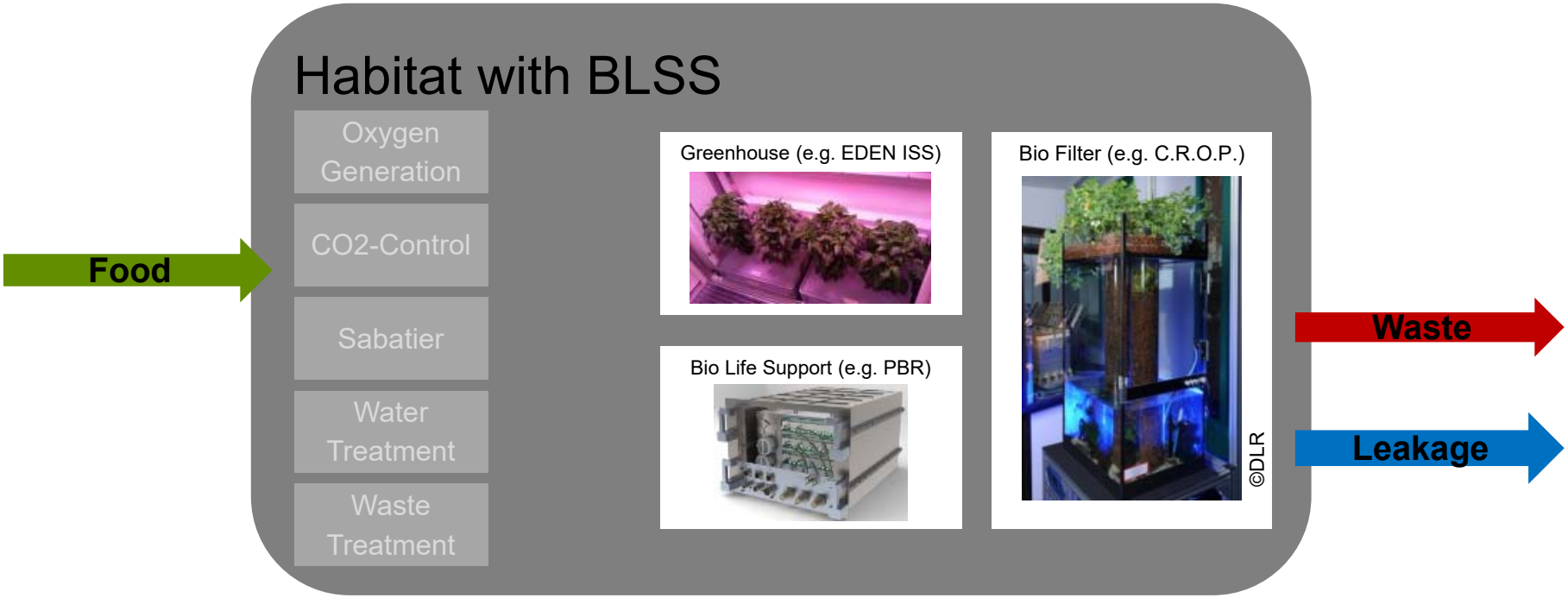
Life Support Systems – Current State Advanced Closed Loop System (ACLS)



Airbus diploma thesis by T. SCHMIEL (2018): "Analysis and evaluation of the entire material cycle of a manned moon base"

AIRBUS

Life Support Systems – Biological Life Support System (BLSS)

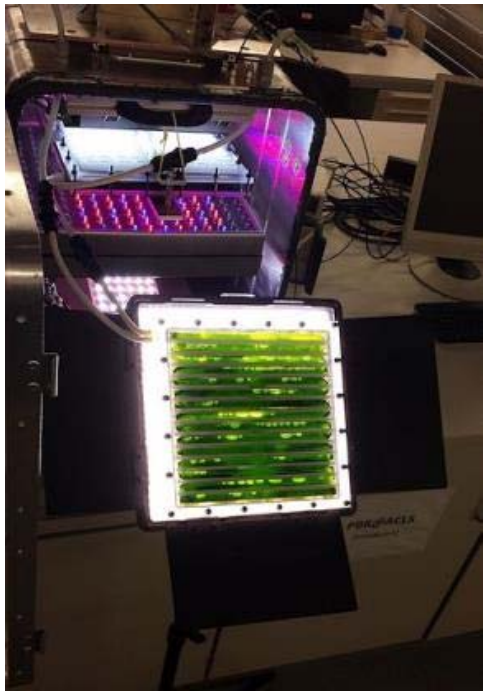


AIRBUS

Photo Bio Reactor

Photo Bio Reactor:

- **Conversion of CO_2 into biomass and O_2**
- **Photosynthesis of an algae system**
- **Launch to ISS scheduled for 2018**
- **DLR Project in cooperation with University of Stuttgart and Airbus**



©DLR

AIRBUS

EDEN ISS

EDEN ISS:

- **Cultivation of food in closed-looped systems**
- **Advanced nutrition delivery system, lighting system, bio-detection and decontamination system**
- **Test facility in Antarctica**
- **DLR Project in cooperation with a consortium including Airbus**

©DLR

AIRBUS

Combined Regenerative Organic Food Production

C.R.O.P.:

- **DLR research project**
- **Bio-filter system to generate fertilizer out of processed urine and organic waste**
- **Technology based on microbiological filter made of porous lava stone**

All pictures ©DLR

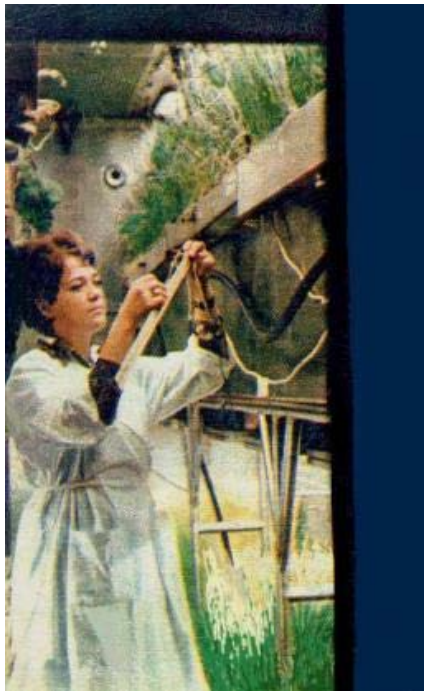
AIRBUS

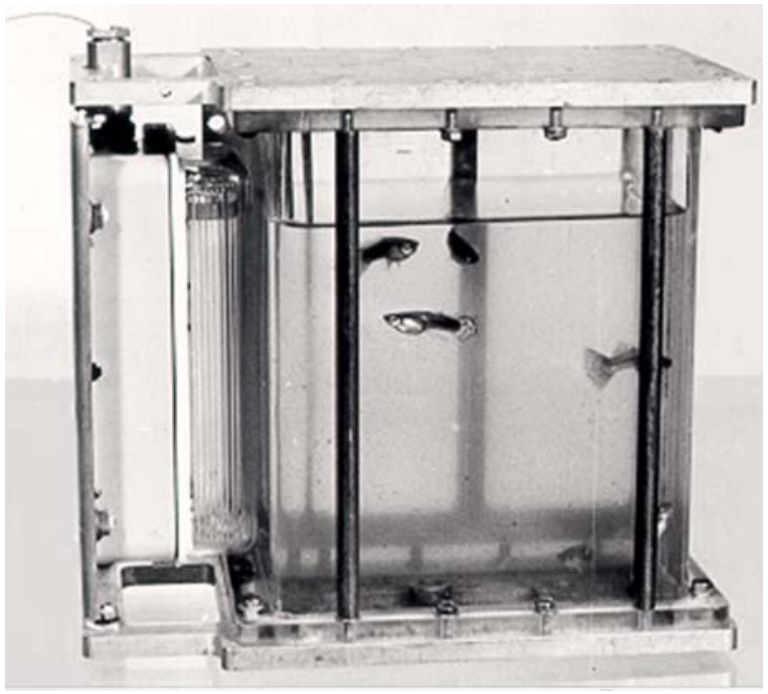
Past Studies Performed on Ground

Experiments with BLSS in Soviet Union (1965-1985):

- **Interaction “human-unicellular algae-mineralisation”**
- **15 m^3 habitat**
- **59 l water (incl. algae)**
- **1.5 to 2 months**

Further experiments with multicellular organisms





All pictures ©IBMP

Past Studies Performed in Space

- > net 5 years growing experience in space
- 1990-2011: 23 different experiments
- > 10 different plants tested in space
- e.g. SVET @ MIR
- e.g. LADA @ RS ISS (mizuna, reddish, genetically marked dwarf peas, barley, super-dwarf wheat, etc.)

All pictures ©IBMP

AIRBUS

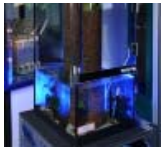
Roadmap to Integrated Biological Life Support Systems

Synthesis of Pre-Cursor Experiments

EDEN ISS

PBR

C.R.O.P.

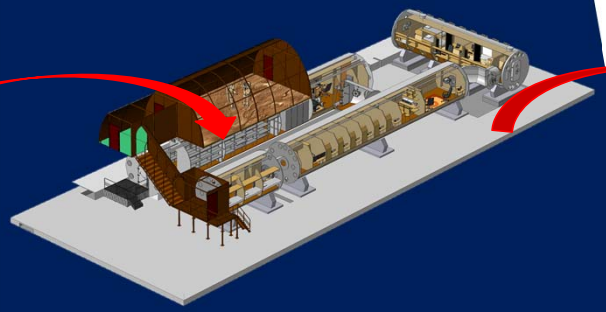


©DLR

Space Flight Experience

©IBMP

Tests in Space Flight Analogues (e.g. NEK)



Potential Products

- Oxygen
- Fresh Water
- Food
- Propellant

©IBMP

Future Application in Space (e.g. Moon)

Potential Products

- Oxygen
- Fresh Water
- Food
- Propellant

©ESA

AIRBUS

Thank you

Viktor Fetter
Airbus Defence and Space GmbH
Microgravity Payloads
viktor.fetter@airbus.com

Copyright Airbus

AIRBUS