Antarctica analogue test campaign preliminary result of R.U.C.O.L.A., the EDEN ISS rack-like plant production unit for microgravity applications

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Main Objectives

EDEN ISS project (H2020 framework)
- Advance the TRL of higher plants cultivation technologies for food production in space, aiming at future exploration missions
- Involve non space SMEs in the space sector for mutual benefit

R.U.C.O.L.A. Unit
- Advance the TRL of a rack-like food complement unit for microgravity applications (e.g. ISS, Cis Lunar habitat, commercial space stations, transit vehicles, etc.)

Antarctica Test Campaign

Use Antarctica as a space-analog test site for the following key aspects:
- Logistics (manage nominal and off-nominal activities in 9 months without refurbishment and very limited crew, validation of remote operations)
- Microbiological environment (the contamination you bring is that you have to manage)
- Psychology (not many colored, moist, warm, green-smelling habitats around)

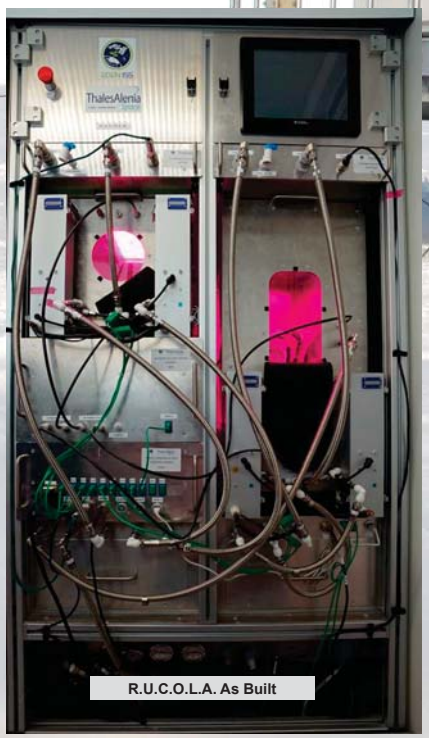
Antarctica Test Facility Description

Neumayer Station III

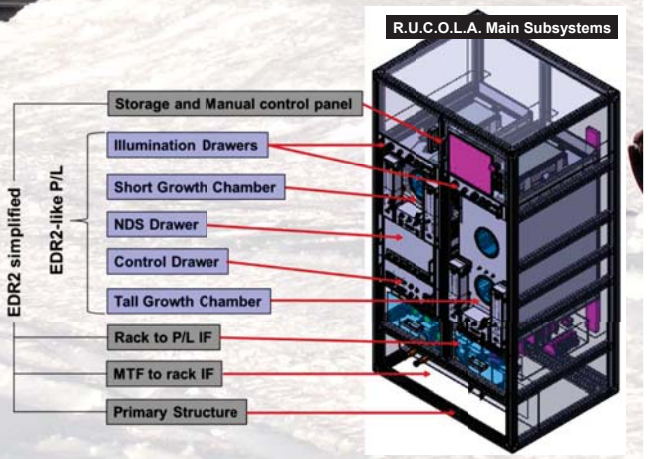
The experiment is located nearby the Neumayer Station III, owned by the German Polar Institute (Alfred Wagner Institute - AWI), located on the approximately 200 metres thick Ekstrom Ice Shelf

Mobile Test Facility (MTF)

The R.U.C.O.L.A. unit developed by Thales Alenia Space is contained into a Mobile Test Facility (MTF), a controlled environment developed by the EDEN ISS consortium under the lead of the German Space Center (DLR-Bremen), placed 400m from the Neumayer Station III



R.U.C.O.L.A. As Built



Laboratory Test Campaign Main Results

Light Distribution
- White light uniformity ratio: 0.87
- Red/Blue/far red light uniformity ratio: 0.79

Temperature and Humidity Control
- Controlled temperature: 16-25°C ± 1.4°C
- Controlled relative humidity: 60-80% ± 4.8% (only de-humidification)

Nutrient Delivery System Performance
- Reservoirs replacement every 33 days
- Controlled pH: 5.0-7.0 ± 0.2
- Controlled EC: 0.0-2.5mS/cm ± 0.1 mS/cm

Seeds viability
- In commercial germination unit: 91%
- In R.U.C.O.L.A (laboratory): 74%

Antarctica Integration and Test Campaign Main Highlights

Temperature and Humidity Control (THC)
- Controlled temperature: 19-25°C ± 2.1°C

Higher than expected thermal loads during Antarctica day impacted THC performance

Nutrient Delivery System Performance
- Reservoirs replacement every 10 days

Very low air moisture and increased leak rate after transportation impacted sensibly condensate recovery capability

Seeds viability
- In R.U.C.O.L.A (Antarctica first batch): 34%

Seeds were glued with agar on special tape. The extremely variable transport conditions may have impacted seeds viability.

HORIZON 2020
THE FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION

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EDEN ISS

ThalesAlenia Space
a Thales / Leonardo company