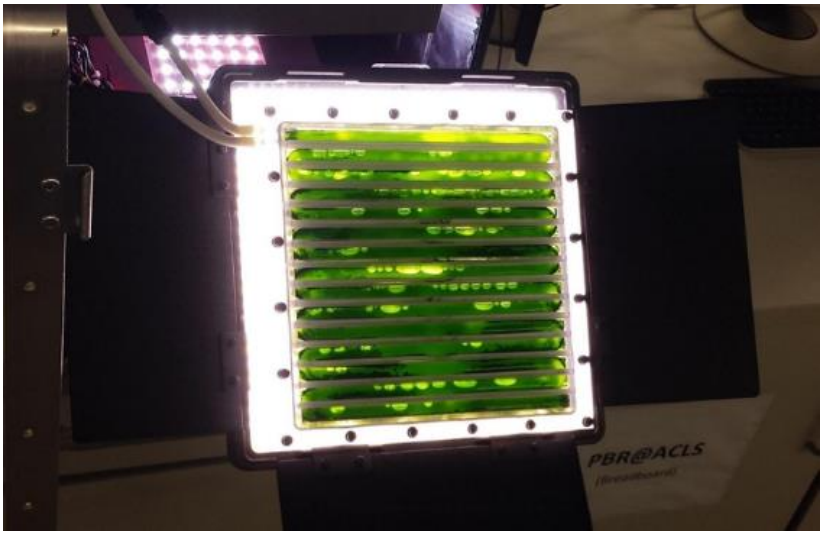
**Category:** Life sciences, Pharmacy & Medicine

**Reference:** TD-DE-1042

**Photobioreactor**

Whether it involves an outpost on the Moon or a long flight through space, humans are unable to survive in space without technological systems that provide everything necessary for life. For long-term missions, it is necessary to close the resource cycle to the greatest extent possible in order to survive without relying on deliveries of fresh supplies. The innovative Photobioreactor experiment promises to make a large leap towards a closed cycle. In the experiment, algae convert the carbon dioxide exhaled by astronauts on the ISS into oxygen and edible biomass by means of photosynthesis.




In order for astronauts to survive in space, all the resources necessary for life must be available. Conventional life-support systems use physico-chemical processes for this purpose and depend on regular replenishment deliveries. However, because astronauts cannot carry unlimited supplies on large exploration missions, the resource cycle must be closed.

In summer 2018, the "Life Support Rack" (Advanced Closed-Loop System - ACLS) - a physical-chemical air recycling system - was brought to the ISS. However, ACLS could not convert all of the carbon dioxide (CO2) filtered from cabin air into oxygen (O2). In combination with ACLS, the photobioreactor experiment makes some of the excess CO2 available to microalgae for photosynthesis, which also produce oxygen. This increases the efficiency of the entire system while producing edible biomass.

**Innovative Aspects:**
PBR is the first hybrid life-support system - an important milestone in closing resource cycles. This approach is a step towards reducing the need for replenishment in space and should make future long-term exploration missions possible. On Earth, contributions are being made to air treatment in separated spaces (e.g. submarines), to the reduction of CO2 by microalgae or to food production in poor, sunny regions.

**Application Areas:**
On Earth, there are contributions to air processing in compartmentalized spaces (e.g. submarines), for the reduction of CO2 by microalgae or to food production in poor, sun-rich regions.

**Cooperation:**
There is interest in joint development projects and cooperation for possible applications on Earth.