

SOLAR FOODS

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Taking protein to the stars: Solar Foods one of the Phase II winners of NASA Deep Space Food Challenge

A panel of Judges has selected Solar Foods' Solein®-producing technology as one of the winners of the Phase II of Deep Space Food Challenge. The challenge, launched in January 2021 by NASA and their Canadian counterpart organization CSA, seeks innovations to feed astronauts on long space missions.

The Deep Space Food Challenge sets strict requirements for all competitors: each concept must create foods that are safe, nutritious, and tasty, be produced with minimal resources, and result in minimal waste. The Finnish foodtech company Solar Foods entered the challenge with their innovative technology to grow Solein, a novel protein grown using electricity and CO₂. Solar Foods was awarded in the Phase I of the Deep Space Food Challenge in 2021 and proceeded to the second round of the challenge.

The winners of Phase II were announced on May 19th in New York, ahead of the NASA Deep Space Food Challenge Innovation Showcase held at the NYCxDESIGN Festival at the Brooklyn Navy Yard. Solar Foods was chosen as one of the winners from eleven North American and three international Phase II finalists.

"We are exhilarated by this great honor bestowed upon us", exclaims **Arttu Luukanen**, the Senior Vice President of Space & Defense at Solar Foods who has led the team participating in the challenge. "Not only have we learned a great deal about how to integrate our technology in the astronauts' life support system, but coming from outside of the current space cluster the visibility of this achievement also gives our space activities a significant boost. Furthermore, this success confirms our work in developing a space food application is on the right path. Now our journey continues to phase 3 where we will be again advancing our technology."

Mars is within reach – once the food question is solved

Solar Foods' space concept produces Solein according to the same microbial gas fermentation technique the company uses to grow the novel protein on Earth. When integrated with the on-board environmental control and life support systems of a spacecraft, the food production system will be able to utilize both the CO₂ exhaled by the crew as well as waste hydrogen from the on-board oxygen generation system that is currently vented overboard.

Solar Foods has already cooperated with companies that aim to make space habitable, as well as the European Space Agency ESA. The interest for working with Solar Foods has been high and for good reason: Solein is an economical solution to solve nutritional needs on a space mission. To gain permanent footholds on Moon and Mars, humanity must crack the question of space food.

"Introducing our Solein production on-board vessels at Low-Earth Orbit makes sound economic sense. According to our calculations, this technology can save tens of millions of dollars a year as there would be less need to launch as much food and water into space anymore", Luukanen explains.

"And once we embark on missions to the Moon and especially Mars, on-board food production is a mission-critical technology. Launching the required mass of food and water from Earth is impossible for such a long mission, not to mention the insurmountable problem of limited shelf life of even dried foods.

In short, if humanity wants to reach Mars, we need to solve the challenge of food security for a space mission that takes 2 to 3 years”, he summarizes.

”We also firmly believe that innovations necessary towards realizing our space food production technology will directly benefit our Earth-bound operations, as these innovations on bioprocess automation, process stability, system reliability as well as food safety assurance are universally applicable”, Luukanen adds.

Powering the new space race with a fridge-sized protein generator

Following the latest success of Phase II, the company continues the development of its Solein-generator concept for space travel.

The Deep Space Food Challenge set clear specifications for the dimensions and power of any potential food-producing units. Any design concept should be under 2m³ in volume, and a maximum power draw of 3,000 watts and an average draw of ca. 1,500 watts. Solar Foods’ proposed Solein production unit for space would be housed in a cabinet measuring 72x162x56cm and have an meager average draw of ~700 watts. It is designed for a crew of six, and its modular design allows for expanding capacity with increasing occupancy.

With the ultimate goal of providing the main-stay protein for our future Mars-faring astronauts firmly in the Company’s sights, the company seeks to deepen its cooperation with space agencies and private sector companies active in developing the next generation of orbiting space stations as well as the ARTEMIS program, aiming at landing the first woman astronaut near the Lunar south pole by the end of the decade.

What is Solein?

- Solein is a protein that contains all the essential amino acids. Solein is 65-70 % protein, 5-8 % fat, 10-15 % dietary fibers and 3-5 % mineral nutrients. The macronutrient composition of Solein cells is very similar to that of dried soy or algae. Solein provides a source of iron, fiber, B vitamins, and vitamin A in the form of beta-carotene, which also gives Solein its distinct color. It vanishes into foods and doesn’t change the taste of familiar, everyday food products.
- Solein is produced using a bioprocess where microbes are fed with gases (carbon dioxide, hydrogen, and oxygen) and small amounts of nutrients. The bioprocess resembles winemaking, with carbon dioxide and hydrogen replacing sugar as the source of carbon and energy, respectively.
- Solein complements the nutritional profile of food products without the consumer noticing a difference in the final dish. It can be used as a structure-forming ingredient for example in alternative dairy and meat, different snacks and beverages, noodles and pasta, or breads and spreads in replacing meat, dairy, and egg.
- The production of Solein is not reliant on agriculture, weather, or climate: it can be produced in harsh conditions such as deserts, Arctic areas, even space. The process does not require agriculture, photosynthetic plants, or animals, making Solein the world’s most sustainable protein.
- Solein will become available for commercial use for the first time. It is aimed at food brands looking for nutritious, functional, and sustainable protein ingredients of consistent quality that can be reliably delivered for their products. Singapore is the first market to grant Solein a regulatory approval, but Solar Foods is also seeking authorisations in other markets across the world.
- Factory 01 is Solar Foods’ first commercial production facility, which will begin to produce Solein in 2024. Construction of the facility started in Vantaa, Finland during Q4 2021. Factory 01 will

scale Solein production to a level where it can be brought to market for the first time. Solar Foods has plans to expand its network of production facilities in the coming years.

Learn more about Solein at www.solein.com

Find photos in our media bank: <https://solarfoods.com/media/space>

Read NASA's press release: <https://www.nasa.gov/press-release/nasa-selects-winners-announces-final-phase-of-space-food-challenge>

For more information and requests for interviews:

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Solar Foods produces protein using carbon dioxide and electricity. Solein® production, independent of weather and climate conditions, liberates global protein production from the constraints of traditional agriculture. Solar Foods was founded in Espoo, Finland, in 2017 by Dr Pasi Vainikka, Dr Juha-Pekka Pitkänen, Sami Holmström, Jari Tuovinen, Professor Jero Ahola, and Janne Mäkelä as a spinoff from VTT Technical Research Centre of Finland and LUT University. www.solarfoods.com



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