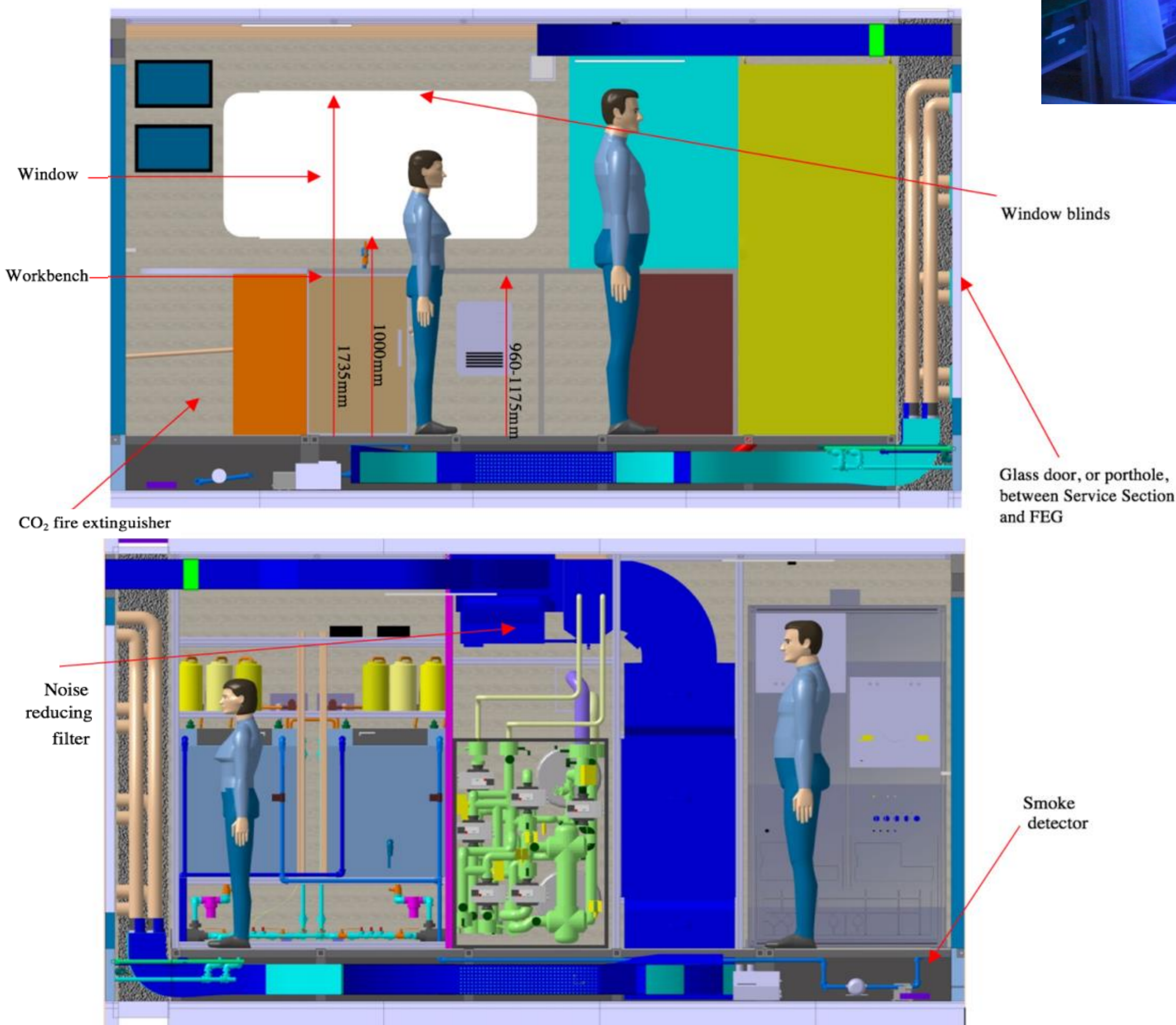


EDEN-ISS: Human factors, performance, and safety aspects for food production in space exploration

The EDEN ISS is a project of a working environment to test food production for space missions. This work aims in particular to present specific aspects of the EDEN-ISS project related to human factors. It will address how the project can manage to increase performance and safety based on the design with a holistic approach.



Figure 1. EDEN-ISS laboratory at the DLR Bremen (c) Schlacht



As the distance from Earth and the duration of space missions increase, human factors will play an ever more important part in the design of space modules. The harsh environment in space and the distance from Earth have a great impact on both the physiological and psychological state of the astronauts. Moreover, as the duration of space missions increases, there will be an essential need for a space module to be self-sustainable. This includes the ability to produce food.

The EDEN ISS project is concerned with testing cultivation technologies for food production to be applied in future space missions and in other extreme contexts, such as in Antarctica, where the project will be tested first next year.

Fig. 2-3 Side view of the service section of EDEN ISS with human factors implementations (c) Vrakking, Bernini 2016

A bio-regenerative life support system needs to be fully incorporated into space stations, transit vehicles, and eventually into habitats on the Moon and on Mars. These concepts aim to decrease the supply mass by generating and re-generating essential resources for humans through biological processes. The production of food will also impact the overall system (e.g., food production, carbon dioxide reduction, oxygen production, water recycling, and waste management).

Furthermore, in long-distance and long-duration space mission, fresh crops are not only beneficial for human physiological health, but also have a positive impact on the crew's psychological well-being. In this context, the focus is on operator interaction and the task shall be tackled from the human factors perspective, applying a holistic approach derived by the application of the Integrated Design Process (IDP) developed by Schlacht. In other words, the operator's needs in relation to psychological, physical, socio-cultural, environmental, and operational factors need to be taken into account. Indeed considering the full isolation in dangerous and extreme environment where you may risk constantly your life, also the support of psychological and socio-cultural aspects is crucial for safety. For this reason the human factors aspects of the EDEN-ISS project developed with a holistic approach, also will not only serve to increase the overall human well-being, but also the mission safety.

Irene Lia Schlacht
Jacopo Bernini
Daniel Schubert
Bernard Foing

(Politecnico di Milano, Italy; Karlsruhe Institute of Technology, Germany; Irene.Schlacht@mail.polimi.it)
(Karlsruhe Institute of Technology, Germany, JacopoBernini@hotmail.it)
(German Aerospace Center, DLR Bremen, Germany, Daniel.Schubert@dlr.de)
(ILEWG, European Space Agency, The Netherlands, Bernard.Foing@esa.int)