

MARE

Matroshka AstroRad Radiation Experiment

Brief description

The exhibit shows the MARE payload which will fly onboard the first flight of the new NASA ORION spacecraft around the Moon in the frame of the Artemis I mission. It consists of two anthropomorphic female phantoms (Helga and Zohar) equipped with radiation detectors to measure the radiation load outside Low Earth Orbit.

Aims

MARE will measure human organ dose values of the radiation environment that future space crews may be exposed to and demonstrate radiation shielding effectiveness of crew Personal Protection Equipment provided with the AstroRad vest. MARE will provide these relevant dose quantities in the highest precision possible for the first time.

Applications

- Radiation protection in space
- Radiation risk assessment for humans on exploration-missions
- Increase knowledge base for deep space radiation protection

Outlook

- Increase knowledge of radiation risk in preparation for exploration missions to the Moon and to Mars
- Enhance the international cooperation in space radiation research



Parties involved

DLR, NASA, Lockheed Martin, ISA, StemRad

Facts and figures

MARE is the biggest international effort in the research related to radiation risk assessment for humans for exploration missions. The MARE hardware is developed in close international collaboration and will be a pathfinder mission to enable safe and secure deep space human exploration.



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Future long duration exploration missions require renewed efforts to adequately mitigate risks of crew health effects due to radiation exposure. Orion is NASA's next generation human Exploration spacecraft. NASA Orion's first test flight Beyond Earth Orbit (BEO) is the Artemis I mission. Artemis I presents the opportunity to perform a detailed characterization of the radiation exposure of human body analogs located internal to the spacecraft in the free-space environment beyond the Earth's magnetosphere protection. The MARE experiment has been proposed by the German Aerospace Center (DLR) and the Israel Space Agency (ISA) as an Orion science payload, approved by NASA, and was manifested on the Artemis I flight in May 2017.

MARE consists of two tissue-equivalent female radiotherapy phantoms (Helga and Zohar), Zohar fitted with the AstroRad radiation protection vest, an extensive complement of radiation detectors, and ancillary hardware for vehicle installation. The science and payload integration is performed by DLR with support from ISA and NASA participating as co-principal investigators. Lockheed Martin and StemRad support the development of the science objectives associated with AstroRad. The MARE radiation detectors are provided by international research teams on three continents who participate as co-investigators.

MARE serves as an example of international collaboration for space exploration. Measurements performed on Artemis I will constitute valuable risk assessment and mitigation input data for future Exploration missions and enable safe space exploration by humans.