

DEMOCRITOS: Demonstrator Projects for MW class Nuclear Spacecraft.

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Abstract

DEMOCRITOS (Demonstrators for Conversion, Reactor, Radiator And Thrusters for Electric Propulsion Systems) was an international project founded by the European Commission to enable a realization of a mega-watt class electric propulsion spacecraft. Which concluded in early 2017. The project was a follow-on activity of the successful European-Russian cooperation in the frame of the MEGAHIT (Megawatt Highly Efficient Technologies for Space Power and Propulsion Systems for Long-duration Exploration Missions) project.

The DEMOCRITOS project aims at preparing demonstrators for a mega-watt class nuclear-electric spacecraft. The project involves the following partners: the Nuclear National Laboratory – NLL (U.K.), the German Aerospace Center – DLR (Germany), the Keldysh Research Center – KeRK (Russia), Thales Alenia Space Italia – TAS (Italy), Airbus-Safran Launchers – ASL (France), the European Science Foundation – ESF, (France) and the Centre National d'Etudes Spatiales – CNES (France).

The Instituto de Estudos Avançados – IEA (Brazil) has joined the project as an observer.

In this presentation we will review key aspects of the three demonstrator concepts underpinning DEMOCRITOS:

1) the development logic for a ground demonstrator, whose target is to test end-to-end nuclear-electric propulsion, with the nuclear core replaced by a conventional heater. Our target was to conceptualize ground tests for a 200 kWe conversion loop (closed Brayton cycle), linked to lower power heat-pipe radiator and electric thrusters.

2) Review of previous space reactor concepts and lessons learned applicable to the Democritos project

3) the assembly strategy for a MW class nuclear electric spacecraft. We will conclude with a discussion on future steps towards the realisation of a MW class nuclear electric spacecraft, within the context of international cooperation. Introduction