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NUCLEAR POWERED SPACECRAFT SAFETY

Abstract

The most vital and limited resource of many spacecraft, particularly those on missions to the outer solar system, is electrical power. Radioisotope Thermal Generators (RTGs) and nuclear reactors are able to provide reliable power over long periods of time even in the absence of solar energy, and can be effective enablers of otherwise impossible missions. Five of the Apollo missions, the Mars Science Laboratory (Curiosity Rover) and several interplanetary probes (Voyager 1, 2 and Pioneer 10, 11) have already proved nuclear power sources to be a reliable component for power and thermal management in both manned and robotic missions.

While these systems are inherently reliable, lack of testing and risk planning has led to several incidents involving spacecraft equipped with nuclear power sources. These events led to changes in the design of nuclear power systems and the regulations governing their use. Nevertheless, the safe use of nuclear power on spacecraft is a debated topic, with national agencies defining their own independent and often contradictory guidelines for their use. New applications and missions requiring nuclear power systems in space are now emerging which justify the cost and safety risks associated with their use. As many of these projects will be carried out by collaborating nations, unanimity in guidelines and legislation between cooperating nations is paramount for the success of these projects.

The Space Safety and Sustainability project group of the Space Generation Advisory Council (SGAC) has recently analysed and reviewed the existing guidelines regarding the safe use of nuclear power for space

applications. This paper provides an overview of current guidelines followed by different stakeholders and outlines a way for harmonising these best practices.