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AN INTERPLANETARY COMMUNICATIONS RELAY POWERED BY AMERICIUM-241 FUELLED RADIOISOTOPE POWER SYSTEMS

Abstract

A mission concept for a distributed interplanetary communications relay infrastructure is being developed by a team of experts in mission design and radioisotope power systems (RPS) based at the Johns Hopkins Applied Physics Laboratory and the University of Leicester, UK.

The concept involves placing one or more communications spacecraft in orbit at multiple specified locations to serve as relays for distant spacecraft across the Solar System. By utilizing communications relays, future missions could significantly reduce the power requirements for telecommunications systems, resulting in mass, complexity, and cost savings. The University of Leicester has been developing Americium-241 (^{241}Am)-fuelled RPS for over a decade. Their radioisotope thermoelectric generator (RTG) design, currently at technology readiness level (TRL) 5, is being considered as a power source for this infrastructure. The long half-life of ^{241}Am (432 years) makes it ideal for decades-long missions, ensuring a relatively constant power output over these timescales. The mission concept study is being conducted using the Johns Hopkins concurrent engineering facility, and leverages APL's extensive experience in space missions

and supporting the NASA RPS program. APL have designed, built, and operated numerous spacecraft, including the New Horizons probe and the upcoming Dragonfly mission, both powered by radioisotope thermoelectric generators.

The communications relay infrastructure, facilitated by RPS, would significantly reduce the mass and power requirements of communications systems for planetary science missions, enabling greater science capabilities and supporting multiple missions over decades. As an analog, we consider the Electra telecommunications protocol in place at Mars. The Electra telecommunication package provides navigation assistance to spacecraft when they are arriving at Mars. Electra also relays signals and data from landers and rovers when they do not have direct radio contact with Earth. With the proposed concept, we look to offer telecommunications services across the Solar System.