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EMDRIVE THRUST/LOAD CHARACTERISTICS. THEORY, EXPERIMENTAL RESULTS AND A MOON MISSION.

Abstract

EmDrive is the name given to a new propellant-less propulsion technology which has its origins in cold war missile research. The subsequent development work has been shrouded in secrecy and public controversy, and has therefore been largely overlooked by the wider propulsion community. With the technology now maturing, it is time for EmDrive to come out of the shadows. This paper examines one aspect of EmDrive which has caused many experimental problems. The search for thrust from a variety of EmDrive type thrusters, operating at safe, low microwave power levels, has led to very sensitive thrust measurements being attempted. These experiments mainly use torsional balances. In practice this has inevitably led to no thrust being measured. The problem is that, unlike a rocket, but more like an electrical machine, EmDrive requires to work against a load before thrust can be measured. The theory behind this statement is given and a simple idealised experiment is described. The results for overload, optimum load and no load conditions are predicted. An experiment was set up using the original SPR Flight Thruster, recovered after years of testing with two other research groups. The thruster was mounted on a counterbalanced beam with thrust and load measured on a precision electronic balance. A set of experimental results, originally revealed in a lecture given at The UK Defence Academy Shrivenham, are presented. The experiment confirmed the predictions. This is not surprising, as the original radiation pressure theory behind the EmDrive concept is firmly based on classic physics, and complies with the laws of conservation of momentum and energy. The implication of this result is that EmDrive will not necessarily accelerate a spacecraft, when in a true free-space orbital environment, unless steps are taken to introduce a load vector. It further illustrates that in-orbit tests, using a single EmDrive thruster, will give anomalous results. However when EmDrive is applied to a direct flight to the Moon, where a gravity load vector is present, preliminary mission analysis gives very encouraging predictions. The results of a subsequent study of a manned Moon mission are presented.