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SPACE SYSTEMS SYMPOSIUM (D1)
Innovative and Visionary Space Systems Concepts (1)

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AN L1 POSITIONED DUST CLOUD AS AN EFFECTIVE METHOD OF SPACE-BASED GEO-ENGINEERING

Abstract

Even with a general consent that climate change is occurring, there has been little progress politically towards an agreement on the reduction of greenhouse gases (GHG). This makes the probability of controlling anthropogenic GHG emissions in time to "prevent" global warming unlikely. In this scenario the engineering of Earths climate, geo-engineering, is foreseen as an emergency solution for mitigating the effects of increasing greenhouse gases. It has been shown that with a 1.7% reduction in solar insolation a reduction in global mean temperature of two degrees can be achieved. This paper will focus on the feasibility of using space based solar radiation management schemes to reduce the solar insolation to enable effective geo-engineering. Several possible schemes have been already proposed, e.g., L1 reflector/refractor disks, a dust cloud at the Earth-Moon equilateral Lagrange points and a dust ring around the Earth.

The work presented here will discuss the possibility of capturing small near Earth asteroids and generating an artificial could of dust around the L1 point in the Sun-Earth system. The dynamics of the dispersion of the cloud are investigated to determine the optimum set of initial conditions that will maximise the effective lifetime of the cloud. Several methods of generating a dust cloud from a captured asteroid will be discussed and the evolution of the resulting dust clouds will be compared against the optimum conditions. The engineering challenges of this and previously suggested schemes will be discussed by analysing the required mass to be delivered into orbit. Other factors will be compared such as the efficiency of the different options, an estimate of their technology readiness levels and the effective lifetime of each method. Finally, an estimate will be made of the total asteroid mass required to manufacture solar reflectors through the sublimation of asteroid surface material. This will then be compared against the mass required for the generation of the L1 dust cloud to determine whether a significant mass saving can be made.