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USE OF A MAGNETIC SHIELD FOR ACTIVE PROTECTION AGAINST SOLAR PARTICLE RADIATION

Abstract

Leaving Earth's protective magnetic field for manned missions to other planets exposes the crew to dangerous radiation. Especially solar particle events, driven by solar flares, inject large amounts of protons and other energetic nuclei into space and pose a great threat to the crew's health.
This thesis deals with the use of a magnetic radiation shield. A wide homogeneous magnetic field can be established using multiple Helmholtz coils. This artificial magnetic field is able to deflect crossing ionised particles emitted from the sun. Assembled in sufficient range outside the spacecraft, perpendicular to the suns radiation, it is possible to deflect the ionised particles, emitted straight from the sun, past the spacecraft and hence protect the ship and its crew. The work analyses different coil configurations and the effect of different distances between magnetic shield and spacecraft, in order to obtain an optimum between mass and necessary power to maintain the magnetic field. Furthermore, the assembly of spacecraft and radiation shield has been analysed. Due to the advantageous possibility of greater distance between the magnetic shield and the spacecraft, a new concept, separating the shield from the spacecraft, has been studied. This tandem flight allows increasing the distance between spacecraft and radiation shield significantly. There is no longer the need for a shield mount arm and its structural limitations. Additionally a less powerful magnetic field is necessary to deflect the ionised particles past the spacecraft. Moreover this shield is independent, reusable and even capable to protect more than one spaceship at the same time. On the other hand the independent shield needs its own propulsion and navigation system. For this purpose the study includes an analysis on mass and power budget and resulting efficiency.