

National Aeronautics and Space Administration



TECHNOLOGY SOLUTION

Aerospace

Deployed Electromagnetic Radiation Deflector Shield

Creating a Zone of Minimum Radiation and Magnetic/Plasma Effects for Spacecraft

Spaceflight outside of the Earth's protective magnetic field is dangerous from a cosmic radiation perspective. Inside Earth's magnetic field, where the manned International Space Station (ISS) orbits, the radiation encountered is minimal and almost all is deflected by our planet's magnetic fields. However, outside that protective shield, the Sun's solar wind (high energy radiation, solar energetic particles or SEPs) consisting of protons, electrons, alpha particles and plasmas continuously bombards the spacecraft for the months or years of spaceflight. On occasion the Sun produces a CME (Coronal Mass Ejection) that vastly increases the energy and volume of this radiation. These particles damage human DNA as well as living tissue and can destroy sensitive electronics. The Deployed Electromagnetic Radiation Deflector Shield (DERDS) provides a magnetic field that will deflect SEPs and CMEs and other harmful solar and cosmic rays away from a manned spacecraft, robotic spacecraft, or manned extra-planetary base stations using an electromagnet that is deployed between the spacecraft/station and the source of radiation and creates a magnetosphere or zone of minimal radiation in which the spacecraft or base station would reside.

BENEFITS

- Deflects harmful solar and cosmic rays
- Creates zone of minimal radiation
- Reduces need for additional shielding
- Reduces weight and cost of launch vehicle



THE TECHNOLOGY

The typical remedy for space radiation hazards has been to harden the space vehicle's electronics and software from these high-speed particles and placing heavy shielding in these manned or sensitive areas. This adds considerable weight and cost to the launch vehicle, reduces payload capacity, and is passive in nature. SEPs and CMEs can be deflected by a magnetic field to pass around the spacecraft and not be absorbed by it. This deflection of solar wind and radiation is due to the Lorentz force. However, a magnetic field that is attached to the spacecraft and enclosing it would cause other shielding issues with equipment and would require much more electrical power to operate due to the need to enclose the entire spacecraft within that attached magnetic field. This would also perturb the data collection and transmissions of the

This would also perturb the data collection and transmissions of the spacecraft. Additionally, the generated magnetic field can capture some of the solar radiation as a plasma within the magnetic torus further impeding scientific data collection due to its close position to the spacecraft.

DERDS is deployed in space away from the protected spacecraft to remain between the radiation source and the spacecraft. It utilizes on board cosmic ray sensors to note the need for the strength of the magnetic field, and on-board sensors to position itself directly in line between the radiation source and the protected spacecraft or station. Onboard computers and thrusters maintain the required position, so that the magnetic field is positioned for the best deflection angle based on incoming radiation. The DERDS magnetic field can be varied in both direction, intensity, and time by use of both AC and DC electrical power inputs and varied as needed to optimize the deflection angle and power requirements. The magnetic field can also be perturbed in irregular or set patterns by onboard computers and sensors as needed to maintain the proper deflection of SEPs, CMEs, and other cosmic rays. DERDS creates a magnetic field that will not need to be so large (with a much larger power requirement) as to encompass the entire protected spacecraft, and the magnetic field will not interfere with the spacecraft.



National Aeronautics and Space Administration Agency Licensing Concierge

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APPLICATIONS

The technology has several potential applications:

- Manned Spacecraft
- Robotic Spacecraft
- Manned Extra-planetary Base Stations

PUBLICATIONS

Patent No: 10,583,939

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