

Implications for space travel

Missions beyond low Earth orbit leave the protection of the geomagnetic field, and transit the Van Allen belts. Thus they may need to be shielded against exposure to cosmic rays, Van Allen radiation, or solar flares. The region between two to four Earth radii lies between the two radiation belts and is sometimes referred to as the "safe zone".

Solar cells, integrated circuits, and sensors can be damaged by radiation. Geomagnetic storms occasionally damage electronic components on spacecraft. Miniaturization and digitization of electronics and logic circuits have made satellites more vulnerable to radiation, as the total electric charge in these circuits is now small enough so as to be comparable with the charge of incoming ions. Electronics on satellites must be hardened against radiation to operate reliably. The Hubble Space Telescope, among other satellites, often has its sensors turned off when passing through regions of intense radiation. A satellite shielded by 3 mm of aluminium in an elliptic orbit (200 by 20,000 miles (320 by 32,190 km)) passing the radiation belts will receive about 2,500 rem (25 Sv) per year. Almost all radiation will be received while passing the inner belt.

The Apollo missions marked the first event where humans traveled through the Van Allen belts, which was one of several radiation hazards known by mission planners. The astronauts had low exposure in the Van Allen belts due to the short period of time spent flying through them. The command module's inner structure was an aluminum "sandwich" consisting of a welded aluminium inner skin, a thermally bonded honeycomb core, and a thin aluminium "face sheet". The steel honeycomb core and outer face sheets were thermally bonded to the inner skin.

In fact, the astronauts' overall exposure was dominated by solar particles once outside Earth's magnetic field. The total radiation received by the astronauts varied from mission to mission but was measured to be between 0.16 and 1.14 rads (1.6 and 11.4 mGy), much less than the standard of 5 rem (50 mSv) per year set by the United States Atomic Energy Commission for people who work with radioactivity.