

Space radiation threats to astronauts addressed in federal research study

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A better understanding of solar storms and how best to protect astronauts from space radiation is needed as NASA pushes toward manned missions to the moon and Mars in the coming decades, according to a new National Research Council report.

Researchers have been stepping up studies on radiation biology and space shielding in recent years, said the University of Colorado at Boulder's Daniel Baker, chair of the committee that issued an NRC report this week titled, "Space Radiation Hazards and the Vision for Space Exploration." The report probes the physical risks and technology obstacles of extended space journeys and is tied to a 2004 presidential mandate to return to the moon by 2020 and then send human travelers on to Mars, said Baker, director of CU-Boulder's Laboratory for Atmospheric and Space Physics.

Baker, an internationally known space weather expert, said the report brought together space physicists and radiation biologists, amplifying common interests between the groups. "This was an important step," he said. "One of the benefits of this report is that we are beginning to lower the error bar on the health impacts of space radiation to astronauts, and are looking hard at other challenges like more accurate solar forecasting and improved space engineering techniques."

Astronauts are regularly exposed to high doses of radiation, including galactic cosmic rays -- thought to come from distant supernova explosions -- as well as energetic particles from the sun and charged

particles trapped in Earth's magnetic field, he said.

Potential health effects include leukemia and other cancers, and degenerative tissue effects like cataracts, heart disease, digestive diseases and respiratory diseases, according to the report.

Radiation also can cause damage to the central nervous system and cause acute risks like vomiting and nausea, said Baker.

"One concern is that astronauts could become ill from space radiation effects and vomit in their space suits, which could be extremely serious," he said.

The report noted that a violent solar storm that occurred in August 1972 between the Apollo 16 and Apollo 17 missions could have been extremely hazardous to astronauts had they been on the moon. The radiation exposure levels would have varied depending on whether the astronauts were exploring the lunar surface or were inside the landing vehicle, which would have offered more protection, said the report.

"We know that this storm was large enough that it could have had potentially fatal consequences to astronauts had they been on the moon at that time," said Baker.

The report also addresses the issue of "storm shelters" to protect astronauts from harmful radiation, which can be built both inside spacecraft or on the surface of the moon and Mars, Baker said. Such shelters could include cylindrical "cocoons" of thick shielding material for astronauts to crawl in or shelters lined with thick tanks filled with water, since water is not only essential for space travel but also contains large amounts of hydrogen, a proven buffer for mitigating harmful radiation, he said.

Plastic polymers containing large amounts of hydrogen also might be a potentially useful building material for shielding, according to the report. "There is always the possibility that a spacecraft can be blasted by significant doses of radiation, and we need to take that into account when designing spacecraft," he said.

Soils on the moon and Mars also could be used to build efficient shelters from solar storms, especially if astronauts were on extended expeditions putting them hours away from base camps or space vehicles, Baker said. The report recommends creating a "color-coded alert system" for intense solar events that could be transmitted quickly to astronauts roaming alien soils, he said.

Source: University of Colorado at Boulder

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