Mission To Mars: Designing a Spacecraft Impact Protection and Detection System with Radiation Shielding

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Future spacecraft missions to Mars will require new technology and ideas for the challenges that deep space missions will face. New spacecraft designs will need to incorporate advanced radiation and micrometeoroid impact protection for long term space travel. Crews also face the challenge of quickly locating hull breeches in the spacecraft, which create life threatening conditions. This project seeks to develop a passive impact protection and detection system, along with a system to shield against solar radiation threats. Two different types of sealants were tested for use in this interior passive protection system. A rubber based and a water based sealant were applied to the inside of 9 aluminum test plates, in different configurations, which were then assembled to a 2 gallon air tank pressurized to 14.7 psi, to simulate a pressurized spacecraft hull. Pneumatic nail guns were used to shoot 3 different size nails into the pressurized plates to simulate high speed micrometeoroid impacts. Additionally, Boron-Nitride Nanotubes and lead sheeting were tested as X-Ray shielding at a dental office. The results of my experiment strongly supported my hypothesis. Test results showed the rubber based sealant to be 100% effective in sealing all 168 high speed penetrations. The water based sealant was considered ineffective at sealing at the 14.7 psi. The lead sheet was only 50% effective in shielding against X-ray radiation at 6.4 mAs. In conclusion, passive impact protection systems can be effective in overcoming some of the significant challenges that deep space travel and planet colonization will face.

Awards Won:

American Institute of Aeronautics &amp Astronautics: Second Award of $1500.00