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Sandbraking: A technique for landing large payloads on Mars through the use of the sands of Phobos or Deimos

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The basis of a novel technique for spacecraft deceleration and landing large payloads on Mars is outlined. The technique, designated as Sandbraking is based on the use of particles of sand transported from a permanent outpost on the Martian moons of Phobos or Deimos. The sand is loaded on the spacecraft orbiting in a Phobos or Deimos transfer orbit. During the last stages of the Mars atmospheric descent, the sand is released at once. Although both spacecraft and particles of sand have initially the same velocity at the moment the sand is released. However, immediately after the sand is released, owing to the huge atmospheric drag differences acting on the vehicle and the particles of sand, the particles of sand will have a relative velocity with respect to the spacecraft's framework equal to the difference of their terminal velocities. As a result, particles of sand will impact on a "pusher-plate" located at the front of the vehicle (see fig.1) where momentum exchange will be generated. This dynamic ram pressure from the particles colliding against the pusher will translate into a prompt deceleration force. Utilizing a simplified geometrical model, the collision efficiency of this proposed technique is based on the particle inertial impaction as well as the expected decelerations and the requirements of mass of sand as function of the deceleration desired and the extra fuel needed for transporting this amount of sand from the permanent outpost on the Martian moons. Conclusion from this preliminary assessment is that the proposed Sandbraking technique could be a very interesting solution to the problem for landing large payloads on Mars, and the Martian Moons can play an important role in future manned missions to Mars not envisaged so far.

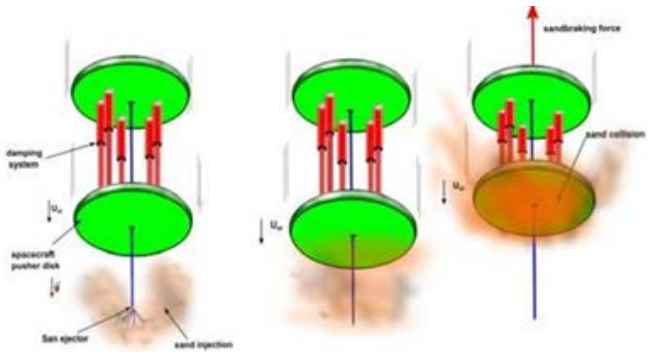

Fig.1 illustration of Mars Sandsbraking technique

Biography

Francisco J Arias is a Reader in Fluid Mechanics and Nuclear Energy at Polytechnic University of Catalonia. He completed his BA in Physics at University of Barcelona and BA in Material Engineering at Polytechnic University of Catalonia where he completed his PhD in Nuclear Engineering. He researches into the application of advanced energy concepts in solar, nuclear and marine energy. He also works with alternative concepts for space applications, rocket and planetary science.

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