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HUMAN SPACE ENDEAVOURS SYMPOSIUM (B3)
How Can We Best Apply Our Experience to Future Human Missions? (2)

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LANDING GEAR DESIGN FOR A 1/3 SCALE GEMINI-STYLE CAPSULE

Abstract

Historically, all United States (US) National Aeronautics and Space Administration (NASA) capsule based spaceflight missions have culminated in an ocean splash down and retrieval. A non-profit organization, Americans in Orbit – 50 years (AIO-50), intends to provide sustainable, bi-annual, commercial launches in Low Earth Orbit (LEO) utilizing a Gemini-style capsule, service module and Space Science Module (SSM) atop a Falcon 9 rocket. Upon atmospheric re-entry the capsule will descend onto land – thus landing gear integrated into the Improved and Reusable Gemini (Gemini-IR) capsule will be required. The impetus for the AIO-50 commercial launches is to promote an interest in space flight and Science, Technology, Engineering and Math (STEM) careers among primary, secondary, and post-secondary education students. The mission of each launch will emphasize outreach efforts between the two astronauts onboard and the aforementioned students as well as the placement of student designed scientific experiments and payload - maintained in the SSM - into LEO. The department of Mechanical and Aerospace Engineering (MAE) at the University of Alabama in Huntsville (UAH) has collaborated with AIO-50 to form the International Space Science Education Program (ISSEP). Via the ISSEP several MAE senior undergraduate design teams have designed, modeled, simulated, analyzed, fabricated, tested and demonstrated various space flight hardware designs in support of the vision of AIO-50. Initial designs have focused upon the design, fabrication and testing of a 1/3 scale Gemini-style capsule with fixed landing gear. An MAE design team has developed a skidded landing gear for the 1/3 scale capsule. The concept generation process included a detailed review of NASA's original designs for landing gear affixed to a capsule. The team conducted extensive technical analysis that included consideration of the vertical and horizontal descent rates, impact forces and aerodynamic analysis. Additionally, Finite Element Analysis (FEA) provided critical information regarding deflections, stresses and Factors of Safety (FOS). The collaboration between the UAH MAE department and AIO-50 via the ISSEP has provided the MAE design teams with invaluable space flight hardware design experience. The team design efforts provide the students with an excellent foundation as the future workforce of various aerospace industries. The present paper describes the collaboration between the MAE department and AIO-50, the engineering design process implemented by the landing gear team, Computer Aided Design (CAD) models, technical analyses and test results of the fabricated landing gear.