MAE COLLOQUIUM

Modeling Supersonic Parachute Inflations for Landing Spacecraft on Mars

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Refreshments at 3:30 pm | 116 Upson Hall

Abstract:

Supersonic Disk-Gap-Band (DGB) parachutes have been used to successfully land spacecraft on Mars since 1976, starting with the Viking 1 and 2 landers. In the past, extensive test programs generated full-scale Mars relevant flight data to qualify these original parachute designs. This original work has allowed subsequent Mars missions to be able to leverage the original test results and design successful supersonic DGB parachutes without having to pursue additional costly full-scale supersonic test campaigns. However, as Mars missions continue to grow in size, larger and more capable parachutes will be required. Furthermore, results of the Low-Density Supersonic Decelerators (LDSD) program have called into question the feasibility of extrapolating subsonic test results to supersonic parachute deployments. This has motivated a large investment into developing computational capabilities geared towards high-fidelity fluid-structure interaction (FSI) modeling of supersonic parachute inflations, relevant to Mars. This talk will summarize the progress that a JPL/Stanford collaboration has made upgrading the AERO computational suite (https://bitbucket.org/frg/) over the past several years, as well as summarizing recent full-scale supersonic parachute tests performed in the upper atmosphere on Earth (ASPIRE).

Bio:

Jason Rabinovitch is a Mechanical Engineer at the NASA Jet Propulsion Laboratory (JPL), California Institute of Technology, where he works in the Entry, Descent, and Landing & Formulation Group. Prior to JPL, Dr. Rabinovitch received a B.Sc. in Mechanical Engineering from Yale University in 2008, a M.Sc. in Aerospace Engineering from the California Institute of Technology in 2009, a M.Sc. in Fluid Mechanics from École Polytechnique (France) in 2010, and a Ph.D. in Aeronautics from Caltech in 2014. His PhD research focused on CFD for hypersonic flows and ablation modeling, and since then he has been fortunate to work on a variety of different projects at JPL since starting in 2014. These projects have ranged from delivering flight hardware to the upcoming Mars 2020 mission, designing, implementing, and testing a low-density low-speed open jet fan-array wind tunnel for the Mars Helicopter, to developing a hybrid rocket propulsion system for small satellites. His current research interests span a wide range of topics related to experimental and computational fluid mechanics applied to EDL, vehicle design, propulsion, and geophysical applications. In particular, Dr. Rabinovitch's current work focuses on modeling supersonic parachute inflations in the upper atmosphere of Mars, and using DSMC simulations to look at hypervelocity sampling in the upper atmosphere of Venus for the Cupid's Arrow mission concept. Jason is originally from Toronto, is a fan of the Toronto Maple Leafs, and plays goalie for the JPL ice hockey team “The Rovers.”

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