Title: Propellant-Optimal Integrated Entry and Powered Descent Guidance for Human-Scale Mars Missions

Institution: San Diego State University
City/State: San Diego, CA
PI: Ping Lu

Summary:
This project will develop the method and algorithms for integrated optimal entry, descent, and landing (EDL) guidance for human Mars missions with pin-point precision. A successive convex-optimization-based framework will be developed to rapidly and reliably optimize the end-to-end three-dimensional entry and powered descent trajectory. This capability will provide a powerful tool to design human-scale EDL missions at Mars. Based on the understanding of the integrated optimal trajectory obtained, this project will further develop onboard algorithms to autonomously guide the vehicle to achieve the near-optimal entry-to-touchdown trajectory. This project will provide advanced tools and capability for human-scale Mars EDL missions. Furthermore, this project will enhance the knowledge and skills of the faculty, graduate students, and undergraduate students in this NASA-unique research area. The education component of the project includes promotion of STEM and engagement of students by developing EDL course content in relevant senior technical elective and graduate courses, infusing active guidance and control design in the student-run Rocket Project, and offering summer internships for high-school students. Concerted efforts will be made to develop and strengthen collaboration with NASA centers for the enrichment of the research program with real-world experience and opportunities for students to benefit from first-hand interactions with NASA engineers and summer internships.