Engineering Design Challenge: Parachuting Onto Mars

As NASA plans new robotic missions and human expeditions to Mars, it becomes more important for spacecraft that carry payloads to be able to accommodate heavier and larger payloads to support an extended stay on the Martian surface. NASA seeks to use atmospheric drag as a solution for planetary atmospheric decelerations, deploying next-generation drag devices at high supersonic speed to safely land crew, cargo, and vehicles. NASA is currently conducting full-scale, stratospheric testing of breakthrough technologies high above Earth to test their value for future missions to Mars.

Figure 6. The Low-Density Supersonic Decelerator (LDSD) test vehicle is one of several drag devices NASA has engineered for landing large payloads on Mars. (NASA/JPL–Caltech)

The Challenge

Because spacecraft that land on the surface of Mars travel at extremely high speeds, they need some sort of drag device to slow them down to prevent them from crashing into the planet and becoming damaged. As missions increase in complexity, landers and rovers become heavier and require even more effective drag devices. Engineers must work within the limits (or constraints) of mass, weight, and space on a rocket to successfully accomplish the mission. Students will work in teams to design and construct a drag device that will slow down the team-built cargo bay when it is dropped from a consistent height.

Criteria and Constraints

1. The drag device must connect to a team-built cargo bay that is assembled using the template provided in this guide.
2. The entire device must be deployed from 2 m and remain intact throughout the drop.
3. The cargo bay must hold 10 g.
4. The overall mass cannot exceed 50 g.