Engineering Design Challenge: Mission to Mars

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 and weight to successfully accomplish the mission.

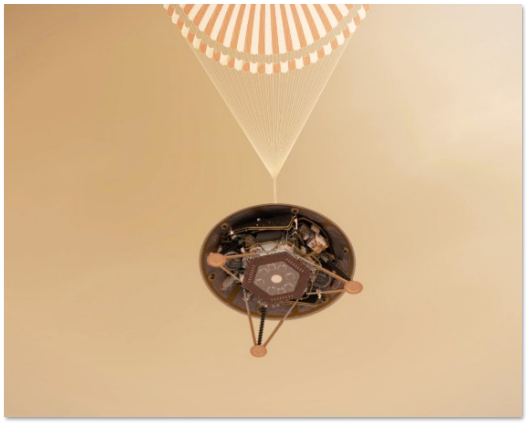

Figure 3. Illustration of NASA's InSight lander descending toward the surface of Mars with its parachute. The lander arrived on Mars in November 2018. (NASA/JPL-Caltech)

The Challenge

Students will work in teams to design and construct a drag device that will slow down the cargo bay when it is dropped from a consistent height. The template for the cargo bay is in the back of this guide. Students should test the cargo bay without the drag device first, as a control test, and then test with the device attached to show that deceleration has been achieved.

Criteria and Constraints

1. Each team **must** design and make a drag device to connect to the cargo bay. The device **must** make the cargo bay slow down when it is tested, or dropped.
2. The entire device **must** be deployed from 2 meters and **must** remain intact throughout the drop.
3. The cargo bay **must** hold 10 grams of cargo secured inside.
4. The overall mass **must not** exceed 50 grams.

Multimedia Resource

To heighten student connections and understanding of the perils of landing on another planet, view "7 Minutes of Terror," a video made by NASA Jet Propulsion Laboratory engineers about the descent and landing system for NASA's Mars rover Curiosity.
https://www.jpl.nasa.gov/video/details.php?id=1090