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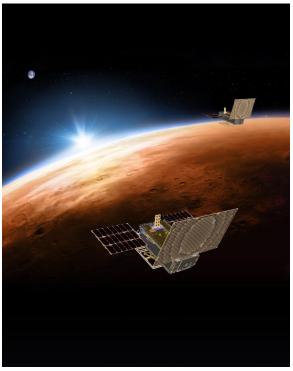15–20 September 2019 | Geneva, Switzerland

# MarCO: The First Interplanetary CubeSats

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## Abstract

The Mars Cube One (MarCO) mission flew the first deep-space CubeSats to Mars in 2018. They were designed to support the InSight spacecraft as a communication relay during the entry, descent, and landing on Mars. The MarCO spacecraft also performed technology demonstration activities during the cruise to Mars, with several key enabling technologies onboard. Prior to acting as a bent-pipe relay for InSight's landing, the mission also demonstrated the capability for a CubeSat sized, DSN-compatible deep space transponder to independently navigate from the Earth to Mars. In doing so, the mission provided flight testing for numerous commercial products. To serve as a communications relay for InSight, the MarCO spacecraft flew by Mars, collecting transmitted data from the lander, and relaying it back to the Deep Space Network (DSN) on Earth. Each of these processes required that the spacecraft attitude and trajectory be maintained, necessitating a coupling between the attitude control and propulsion subsystems. Both of these systems are commercial-off-the-shelf and underwent extensive ground testing prior to flight.

This presentation covers several key features and capabilities of the MarCO spacecraft that enabled the mission to be successful. The presentation includes a summary of the mission architecture, the technologies demonstrated, a summary of the first data returned from the spacecraft, and a summary of the operations near Mars in support of InSight. Additionally, a set of lessons learned is presented to help foster future deep space CubeSats and further the architecture of CubeSats for communication relay support.



## Acknowledgements