

IAF SPACE EXPLORATION SYMPOSIUM (A3)  
Small Bodies Missions and Technologies (Part 2) (4B)

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## JANUS: LAUNCHING A NASA SMALLSAT MISSION TO EXPLORE BINARY ASTEROIDS

**Abstract**

Janus is a two-spacecraft SmallSat mission to fly by two different pairs of binary Near Earth Asteroids, 175706 (1996 FG3) and 35107 (1991 VH). Identical Janus spacecraft are scheduled to launch in August 2022 as secondary payloads with the NASA Psyche mission, on a SpaceX Falcon Heavy launch vehicle. Janus is part of NASA's Small Innovative Missions for Planetary Exploration (SIMPLEx) program. Like the larger Discovery and New Frontiers planetary science mission classes, SIMPLEx missions are competed, cost-capped, and led by a principal investigator (PI). However, in SIMPLEx-2 the cost cap for missions was approximately 1/10th the cost of Discovery missions, and spacecraft must be designed to piggyback with a primary mission rather than choosing their own launch trajectory. Janus is led by Dr. Dan Scheeres at the University of Colorado Boulder and managed, built, and operated by Lockheed Martin. Janus will be the first mission to launch of three selected in the SIMPLEx-2 selection round. Planetary SmallSats can

use components developed for the growing LEO SmallSat market, but share many challenges in common with larger deep space missions. For instance, Janus must execute deep space maneuvers to achieve hundreds of meters per second  $\Delta V$  to reach its destinations, close a telecommunication link at ranges up to 2.4 AU, autonomously manage a months-long telecommunications blackout during solar conjunction, operate at a maximum Sun range of 1.62 AU, and survive for almost four years in interplanetary space before encountering the target asteroids. Janus will acquire and track the target asteroids during the flyby using a vision feedback system developed for the Lucy mission, and return high-resolution visible and infra-red images of the asteroids. Although the Janus science camera suite is not as high performance as science instruments on more expensive missions, Janus benefits from the agility of small spacecraft to fly closer to its targets and slew to track them, allowing it to return higher resolution images from more view angles than past asteroid and comet flyby missions. The implementation team successfully managed an aggressive development schedule despite COVID-19 related supply chain impacts and work environments, while remaining on target for the SIMPLEX-2 cost cap. Janus is a pathfinder for achievable and affordable SmallSat science missions in the future and demonstrates the valuable partnership between the SmallSat commercial component industry, an experienced deep space mission engineering team, a focused science team, and a forward-looking NASA model for Class-D science missions.