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Astrobotic and NASA Partnership Develop Software and Trajectory for *Griffin* Lander

Astrobotic's Pathway to the Moon Verified by NASA "Gold Standard" Simulation Tools

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Pittsburgh, PA - Astrobotic Technology, in partnership with NASA under the [Lunar CATALYST](#) initiative, has developed a preliminary version of its flight software for precision guidance. This software will direct the *Griffin* lander to safe touchdown on the Moon at a pit in the Lacus Mortis region on Astrobotic's first mission. Astrobotic developed the software using NASA's Core Flight Software (CFS), then validated *Griffin's* mission performance and fuel usage using NASA-proven modeling and simulation tools.

The team used the simulation to evaluate *Griffin's* performance in multiple mission phases: from translunar injection (TLI) to lunar orbit capture, targeted powered descent, and precision landing on the surface of the Moon. Testing in simulation validated *Griffin's* ability to autonomously guide itself to a precise touchdown near the Lacus Mortis pit.

In this effort under CATALYST, Astrobotic integrated its guidance software with NASA's CFS flight software architecture, a platform-independent suite that seamlessly accommodates common applications and mission-specific software. Astrobotic then executed simulations that coupled its flight software with NASA's [TRICK](#) simulation environment for developing, integrating, and operating simulations; [JEOD](#) for modeling the forces acting on *Griffin* in space; and [EDGE](#) for advanced 3D simulations.

The simulations run a flight version of the guidance software and incorporate estimates of propulsion performance and vehicle mass. Planned future versions of the simulation will incorporate data from upcoming free flight tests, hot fire tests of *Griffin's* engines, and updated masses of flight hardware and payloads.

"The simulation environment gives us confidence in *Griffin's* ability to touch down safely," says Kevin Peterson, Astrobotic's Chief Technology Officer. "The partnership with NASA under the CATALYST program gives Astrobotic access to tools like Core Flight Software that have been flight-proven. These tools provide the developing



commercial lunar industry with reliability that would otherwise take decades to develop.”

NASA engineers provided integral support for this effort, both remotely and on site at Astrobotic’s headquarters in Pittsburgh. They trained the Astrobotic team on the simulation tools, provided technical support to integrate Griffin’s landing software into the simulation environment, and worked with the Astrobotic team to run thousands of simulation tests evaluating the variability in the lunar trajectory, with the goal of developing robust and reliable flight software. “We congratulate Astrobotic on successfully completing this end-to-end mission simulation,” said Jason Crusan, director of Advanced Exploration Systems at NASA Headquarters in Washington. “This is an important milestone toward developing their lunar lander, and we look forward to continuing our partnership under Lunar CATALYST.”

Earlier this year, Astrobotic was selected by NASA’s [Flight Opportunities Program](#) to test the navigation technology that will guide Astrobotic’s first commercial soft landing on the Moon. The upcoming test, expected for this fall, builds on last June’s visually-guided precision rocket landing to improve *Griffin’s* ability to measure distance to the ground during the final fifty meters of descent.

Astrobotic was one of three companies selected by NASA under the Lunar CATALYST program, which establishes no-funds-exchanged Space Act Agreements to encourage the development of robotic lunar landers that can be integrated with U.S. commercial launch capabilities to deliver payloads to the lunar surface. For more about Lunar CATALYST, see <http://www.nasa.gov/lunarcatalyst>.

Video footage of Astrobotic’s actual trajectory and lunar terrain flyover with Griffin flight software can be viewed on [Astrobotic’s YouTube Page](#).

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About Astrobotic: Astrobotic is a lunar logistics company that delivers payloads to the Moon for companies, governments, universities, non-profits, and individuals. Our spacecraft accommodates multiple customers on a single flight, offering flexibility at an industry-defining low price. Astrobotic is a NASA contractor, and an official partner with NASA on the Lunar CATALYST program. With its partner Carnegie Mellon University, Astrobotic is pursuing the Google Lunar XPRIZE. Astrobotic was founded in 2007 and is headquartered in Pittsburgh, PA.

About Lunar CATALYST

NASA’s Lunar Cargo Transportation and Landing by Soft Touchdown (Lunar CATALYST) initiative is establishing multiple no-funds-exchanged Space Act Agreement (SAA) partnerships with U.S. private sector entities. The purpose of these SAAs is to encourage the development of robotic lunar landers that can be integrated with U.S. commercial launch capabilities to deliver payloads to the lunar surface.