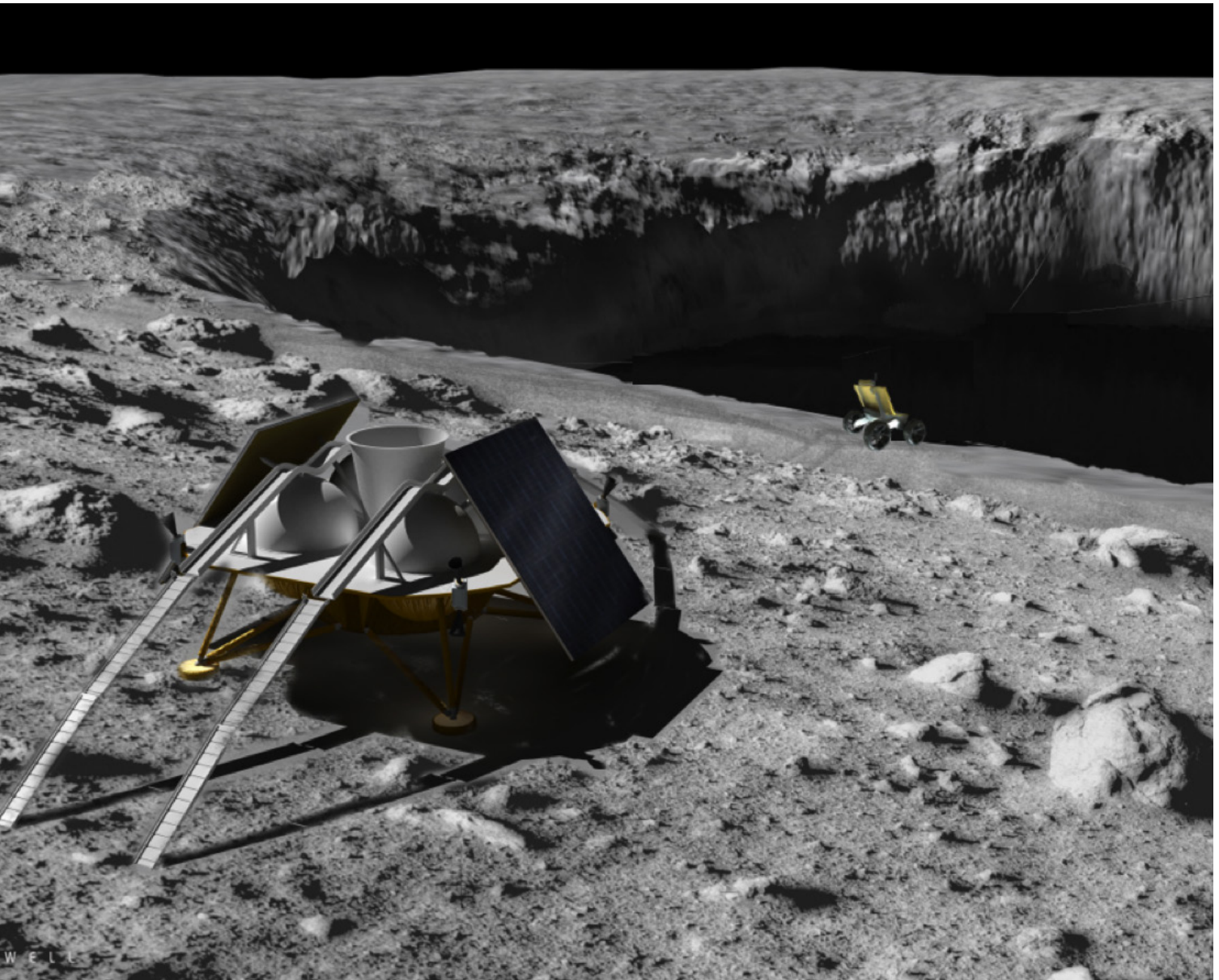# ASTROBOTIC TECHNOLOGY, INC.
DESIGNING ROBOTIC SYSTEMS
FOR SPACE EXPLORATION WITH SOLIDWORKS

Astrobotic, along with partner Carnegie Mellon University, uses SOLIDWORKS Professional design software to develop robotic landers and rovers for planetary exploration. Astrobotic's Griffin lander will launch on a SpaceX Falcon 9 to pursue the Google Lunar XPRIZE and usher in a commercial planetary transport business.

ASTROBOTIC

Challenge:
Design robotic systems efficiently to capitalize on emerging opportunities using an affordable, full-featured system that can integrate with Astrobotic's existing technology ecosystem.

Solution:
Use SOLIDWORKS Professional software for design and development of space robotics, both across the company and with partner Carnegie Mellon University.

Results:
- Selected by NASA as one of three industry partners for development of robotic lunar landing capability under the Lunar CATALYST program
- Established itself as the leading Google Lunar XPRIZE team and was selected for three out of three Milestone prizes, largely on strength of its technology development progress
- Developed variety of robots for space-related uses
- Attracted 18 NASA contracts to date for space robotics development

William L. "Red" Whittaker has devoted his life to creating robots that operate in extreme environments. With the announcement of the Google Lunar XPRIZE—a $30 million incentive prize meant to spur "a new era of lunar exploration that will be more sustainable and more accessible to all"—the Carnegie Mellon University (CMU) professor founded Astrobotic Technology, Inc., and assembled a team to take robots into space.

As the Fredkin Research Professor at CMU's Robotics Institute, director of CMU's Field Robotics Center, and chief scientist of CMU's Robotics Engineering Consortium, Whittaker has directed several innovations in robotics development, including the first robots to enter Three Mile Island after the nuclear accident, the NASA Nomad unmanned rover, and the computer-driven car that navigated city streets to win the 2007 DARPA (Defense Advanced Research Projects Agency) Urban Challenge. As chairman and CSO of Astrobotic, Whittaker has turned his focus to space.

Under executives John Thornton, Steven Huber, and Kevin Peterson, Astrobotic is building on Whittaker's legacy to create a sustainable space robotics business. "In the past, Red would assemble a pickup CMU team in response to research challenges to show what is technically possible," explains Steven Huber, COO. "With Astrobotic, we are building a company that will develop space-based robotic systems and technologies, as a revenue-generating business, in concert with our pursuit of the Google Lunar XPRIZE."

Competing successfully against the 18 teams still in the running for the Lunar XPRIZE required an efficient design platform with robust visualization, communication, and manufacturing capabilities. Astrobotic chose SOLIDWORKS® Professional design software because it met these requirements, integrates directly with MasterCAM® machining software, and is the primary CAD package used at Carnegie Mellon, where the company's staff works/has traditionally worked.

"CMU is a SOLIDWORKS university, so we all have experience using the software," Huber explains. "We view SOLIDWORKS as the CAD leader, and the ease of the SOLIDWORKS user interface is important to us. When tools are accessible, members of our staff can express their innate creativity more freely. From conceptual design to rendering to machining, we use SOLIDWORKS for everything we do."

DESIGNING ROBOTIC LANDERS, ROVERS, AND MINERS

Using SOLIDWORKS, Astrobotic has developed a lunar landing spacecraft and two solar-powered rovers for exploring the equatorial and polar regions of the Moon. In addition to solidifying its leading position for the Lunar XPRIZE, Astrobotic is delivering affordable space robotics technology to meet the payload, exploration, and mining needs of other lunar and planetary missions, including several funded by NASA contracts.

"The SOLIDWORKS platform enables us to deliver on time at an affordable price," Huber stresses. "Every team member relies on SOLIDWORKS to design and communicate. For example, whenever we come up with a new design, we create renderings to drive annotated slide shows to facilitate design reviews. We make extensive use of the RealView feature for this purpose."

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— Steven Huber, COO

RIDING FALCON 9 ROCKET

Astrobotic will catch a ride off-Earth with Space Exploration Technologies (SpaceX), which made history as the world's first privately held company to send a cargo payload to the International Space Station, when its Dragon spacecraft docked with the orbiting outpost in May 2012. A Falcon 9 will carry Astrobotic's lander to orbit, then perform trans lunar injection to propel it toward the Moon. Astrobotic's lander then separates from the rocket, corrects course en route to the Moon, enters lunar orbit, and safely touches down on the Moon's surface.

"We are passionate about reaching the Moon, establishing a sustained lunar presence, and ushering in the space-based robotics industry," Huber says. "With SOLIDWORKS, we are developing a new generation of space hardware and robotic systems that utilize our highly accurate navigation and trajectory-control technologies to enable us to land robots within 100 meters of any point on the Moon."

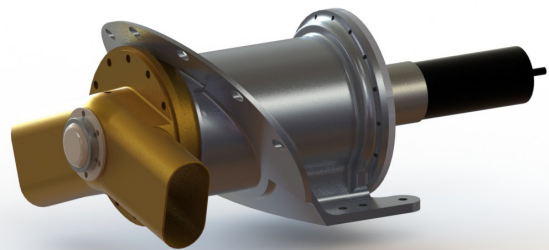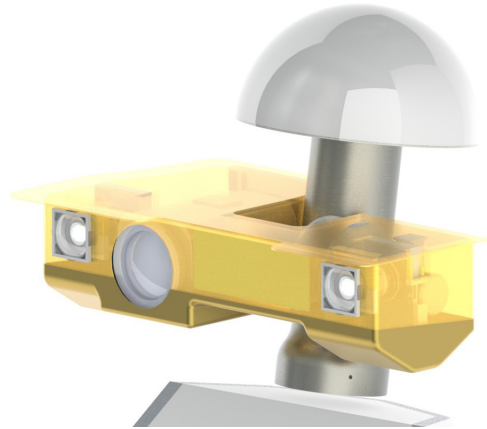## TAKING ADVANTAGE OF EMERGING OPPORTUNITIES

Astrobotic has won NASA contracts to develop robots to mine the Moon for water and methane, explore lunar and Martian caves, and land on asteroids, as well as build a low-gravity facility and study how robots can prepare a permanent NASA lunar base. The company has also cultivated a growing payload delivery business for carrying scientific and commercial payloads to the Moon.

"At Astrobotic, we're growing a company that's involved in every aspect of using robots in space," Huber explains. "Using SOLIDWORKS jump-starts our quest to create robots that help mankind travel back to the Moon and beyond."

Astrobotic Technology has leveraged SOLIDWORKS Professional software to develop its lunar lander and execute NASA contracts to develop robots to mine the Moon for water and methane, explore lunar and Martian caves, land on asteroids, build a low-gravity facility, and study how robots can prepare a permanent NASA lunar base.

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