

# NASA counting on humanoid robots in deep space exploration

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As humanity moves forward with space exploration, we should prepare for risky and extremely hazardous endeavors such as manned missions to Mars and asteroids. Having fully operational robotic help ready to assist in every dangerous task would be of the utmost importance during long-lasting journeys beyond Earth. NASA is seriously considering this subject matter, ushering new humanoid robots, expected to be space pioneers that could offer astronauts a helping hand in future expeditions.

"NASA is counting on robots to setup and care for [deep space exploration](#) facilities and equipment pre-deployed ahead of astronauts. Robots are also excellent precursors for conducting science missions ahead of human exploration," Sasha Congiu Ellis of NASA's Langley Research Center, told Astrowatch.net.

That's why the agency is developing a six-foot tall humanoid robot called R5, previously known as Valkyrie. The machine weighs about 290 lbs., and what's interesting, it was initially designed to complete disaster-relief maneuvers. In November 2015, NASA awarded two R5 robots to university groups competing in the Defense Advanced Research Projects Agency (DARPA) Robotics Challenge (DRC).

One robot is tested by the Massachusetts Institute of Technology (MIT) in Cambridge, Massachusetts under its Robust Autonomy for Extreme Space Environments program. The second one is available for the Northeastern University in Boston, Massachusetts for its Accessible Testing on Humanoid-Robot-R5 and Evaluation of NASA Administered (ATHENA) Space Robotics Challenge.



NASA's R5 robot. Credit: NASA

According to NASA, the teams have two years to perform research and software development in order to improve the robot's autonomy. They will be also receiving \$250,000 a year for two years and have access to onsite and virtual technical support from the agency. Moreover, the robots will compete in a Space Robotics Challenge through NASA's Centennial Challenge Program.

"This will be our first hands-on experience with this hardware. We will leverage our lessons learned from the DARPA Robotics Challenge to perform tasks relevant to future space missions with Valkyrie autonomously," Taskin Padir, the principal investigator of ATHENA at the Northeastern University, told SpaceFlight Insider.

Padir's team will make contributions in three main areas, constrained motion planning and control, grasping of unknown objects, and human-robot interaction. Their testing strategy will rely on completing these task by progressing from teleoperation to full autonomy.

ATHENA program will include collecting or recovering desired samples or items, such as Mars soil and rocks as well as exiting a habitat airlock hatch and using a ladder to reach the terrestrial surface. Next test will check if the robot is capable of removing a communications or power cable from a soft-goods storage location and attach it to a connector located at least 33 feet away, while traversing an irregular rocky terrain, like the surface of Mars. The task list concludes with repairing or replacing damaged components on complex equipment, such as a broken valve or a damaged tire on a planetary rover.



NASA's R5 robot in the team's garage. R5 was built by engineers at NASA's Johnson Space Center in Houston. Credit: NASA

Ellis admitted that all these tests are Mars-oriented as the Red Planet is perceived as the next giant leap for humanity in space exploration.

"The universities selected as hosts for NASA robots will be asked to validate tasks like those needed on a Mars mission, pre deploying and setting up equipment ahead of human members of the crew," she said.

Creating more dexterous autonomous robots, designed to operate in extreme space environments could be crucial for expeditions to Mars

and beyond. Humanoid machines could easily undertake activities dangerous for future astronauts.

"Extreme [space](#) environments are dangerous for humans. And, robots are ideal for dangerous tasks. NASA already has rovers on Mars. This is an effort to advance autonomy of [humanoid robots](#). We will have a better understanding of when and how humanoid robots will help with future deep [space exploration](#) missions as we continue our research and development in this field," Padir said.

In developing R5, NASA can rely on experience coming from its Robonaut project. The latest version of this humanoid robot, Robonaut 2, flew to the International Space Station (ISS) in 2011. It was built as a prototype to work on Earth but was sent to ISS and is completing regular and repetitive tasks inside the orbital laboratory, like pressing buttons, flipping, switches and turning knobs. It also worked with two tools: the air flow meter and an RFID inventory scanner. In 2014, the robot received a pair of climbing legs to help it move around the station. It is successfully paving way for future more complex humanoid robots like R5.

"NASA has the first of this new class of care taking [robot](#) onboard the ISS today. Called Robonaut 2, this system is being used to develop and test new approaches for robots to perform maintenance and repair tasks," Ellis noted.

Source: [Astrowatch.net](http://Astrowatch.net)

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