Space mice and robots among latest science heading into space from Wallops Island

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Space mice, radiation vests, robotic avatars and recycling polymers for 3-D printers are among the science experiments bound for the International Space Station on the next commercial resupply mission

from Virginia.

Northrop Grumman's 12th robotic mission—and its first under a new NASA contract—is set to launch no earlier than 9:59 a.m. Saturday, Nov. 2, from the state-owned Mid-Atlantic Regional Spaceport on Wallops Island.

Antares rocket launches are visible from Hampton Roads and throughout the mid-Atlantic, weather permitting.

This latest cargo run of an uncrewed Cygnus spacecraft has NASA scientists turning nostalgic.

"We're a little over a year away from a big milestone for us: 20 years of continuous human presence aboard the International Space Station," Bryan Dansberry, assistant program scientist for the ISS, said to reporters in a phone call Thursday.

"Over 19 years ago, the station started out as an orbiting outpost that has really evolved into a robust and surprisingly versatile laboratory."

To date, Dansberry said, more than 2,900 investigations have been conducted by nearly 4,000 investigators representing 108 countries. Last month, astronauts set a record: one week of 127 hours of astronaut time devoted to research, besting the record set in May.

And this year, said Michael Roberts, interim chief scientist for the ISS U.S. National Laboratory, "is the most prolific year of research on the space station by a wide margin."

When the next Cygnus spacecraft arrives, station crew will unload groceries, hardware and about 4,600 pounds of science payload. They'll find the latest in a Budweiser investigation into how germinated barley

seeds can be processed in a microgravity environment, and an alliance of Italian auto-maker Lamborghini and Houston Methodist Research Institute to test the strength of 3-D-printed carbon fibers in space.

Other experiments include:

Rodent Research-14 marks the first time a life sciences mission using rodents will launch on a Cygnus. The goal is to document the effect of microgravity on the biological circadian rhythm, and specifically the 12-hour "circatidal" clock that's believed to control stress levels and protein responses and coordinate metabolism.

"Part of the goal there is to understand how persons in space respond to these stresses in the absence of gravity," said principal investigator Brian York of the Baylor College of Medicine in Houston. "And understanding these mechanisms will hopefully identify pathways that can be pharmacologically targeted in order to manipulate them on station or during travel for long space flight."

Here on Earth, the study could lead to new therapies for metabolic diseases that contribute to insulin resistance, type 2 diabetes and cancer.

But, like the Russian space dog Laika, the 40 mice used in this experiment won't survive their voyage. According to NASA, they'll eventually be "sacrificed" by the station crew, dissected and their blood and tissue frozen for return to Earth.

In a joint effort by NASA and the Israel Space Agency, the AstroRad vest is being developed to shield astronauts from the threat of deep space radiation. On this mission, a prototype will be used to gather ergonomic feedback from astronauts on its fit, form and function.

This particular vest is tailored for a female crew member, said Kathleen

Coderre, principal investigator with Lockheed Martin in Denver, which built the vest of high-density polyethylene, a thermoplastic polymer. Vests for females will be thicker around sensitive organs, she said, which will make it slightly bulkier.

"It may reduce the range of motion a bit more," Coderre said. "Also, females do have a greater sensitivity to the space radiation environment. So it is a goal to make a comfortable vest to protect both male and female, but the female use case, from an ergonomics perspective, actually will give us a little bit better data."

Next year, when an uncrewed Orion space capsule is scheduled to loop around the moon, a medical "phantom," or test dummy, strapped inside will be wearing an AstroRad vest to see if it can properly shield human organs. That phantom—and its twin, which won't be wearing a vest—were built by Norfolk engineers and technicians at CIRS Inc. That experiment was devised by DLR, the German Aerospace Center.

The human/robot interface will get a test run in a European Space Agency initiative to see how well an orbiting astronaut can control a robot on the surface of the moon or another planet.

"Simply spoken, we want to pick up a rock. So the astronaut will have a robotic avatar on the surface of the moon and can command the robot with an advanced user interface," said Thomas Krueger, team lead of ESA's Human-Robot Interaction Lab.

In this case, though, the rock will be on some Earth terrain filling in for the lunar surface. The experiment is considered an analog scenario for future lunar or Martian exploration, NASA said.

The Made In Space Recycler heading for the space station is built to break down used polymer parts and materials into feedstock filament.

Astronauts can then use that filament to print out new items using the Made In Space 3-D printer already operating on the station.

"We're trying to improve the sustainability of manufacturing capabilities on the station, so that way we don't have to continue to launch polymer in the form of filament," said Michael Snyder, principal investigator at Made in Space Inc. in Jacksonville, Fla. "This is significant because of the implication for future exploration missions, as well as the commercialization of low-Earth orbit."

Recycled filament as well as items made from it will be returned to Earth for testing. Snyder said in-space manufacturing is essential for future exploration missions to the moon or Mars, while the technology also has applications for recycling and conserving resources here on Earth.