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New Horizons hardware out of this world

Mission's prized instrument built by Ball Aerospace

By Todd Neff, Camera Staff Writer
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CAPE CANAVERAL, Fla. — The superlatives regaling NASA's New Horizons mission to Pluto and the Kuiper Belt tend to focus on the speed of the rocket — it will be the fastest in history, leaving Earth at about 36,000 mph. Or the spacecraft's destination of the solar system's most distant reaches more than 3 billion miles away.

But the seven scientific instruments on board also will break new ground. They comprise the most sophisticated suite of hardware ever to do initial reconnaissance of a planet. They also are extremely lightweight, weighing 100 pounds combined, and together consume less than 28 watts — about half a reading lamp's worth. The only moving parts are doors and canopies that will open just once.

"We are light years ahead of what Voyager would have delivered," said Alan Stern, New Horizons' principal investigator, referring to the spacecraft that visited Saturn 25 years ago.

The instruments' job is to understand the surface and atmosphere of Pluto, its moon Charon and one or two Kuiper Belt objects to be named later.

It won't be hard to exceed current knowledge. Pluto, with a diameter estimated at 1,470 miles — less than one-fifth of Earth's — is so small and distant that seeing it from Earth is akin to observing a quarter at a distance of 25 miles. Hubble images of Pluto offer little clues as to its actual appearance.

One challenge of the mission will be getting data back to Earth. The fastest transmission speed from Pluto, more than four light hours from Earth, will be 125 bytes per second. A compressed, one-megabyte image from the spacecraft's long-range camera will take more than 2 hours to beam back. Mission planners say it will take 9 months to radio all the post-encounter data.

Pluto appears pink — probably because of some sort of complex organic material mixed in with its nitrogen-rich surface ices — but nobody knows exactly why, said Robert Cruikshank, of NASA Ames Research Center and a member of the New Horizons science team. He detected methane in its ices in 1976, making him the first to unearth any clue as to Pluto's composition.

Stern called the Boulder-built Ralph instrument "the central piece of the entire payload" on Sunday.

The instrument, built by Ball Aerospace & Technologies Corp., combines seven visible-light digital imagers for mapping Pluto with resolution as good as 250 meters per pixel. Ralph also has an infrared spectrometer capable of mapping nitrogen, methane, carbon monoxide, water ice and other materials on Pluto, Charon and the recently discovered P1 and P2 Pluto moons. NASA's Goddard Space Flight Center built the spectrometer, which also will map surface temperatures.

Stern said the Alice instrument, an ultraviolet spectrometer, is the other half of New Horizons' scientific heart. It will analyze the composition of Pluto's atmosphere, which wasn't discovered until 1988. Scientists say Charon probably doesn't have an atmosphere at all.

New Horizons also will capture radio waves blasted from NASA's deep space network to assess the temperature and pressure of Pluto's atmosphere. The shot must be timed perfectly just as the spacecraft passes behind Pluto on a July day in 2015. An instrument called REX is connected to the craft's high-gain antenna. It will measure to an accuracy of a few billionths of a second how the atmosphere slows Earth-sent radio waves at different altitudes, said Len Tyler, of Stanford University, who leads the REX team.

University of Colorado scientist Fran Bagenal will use two instruments, called SWAP and PEPSSI, to study the escape of Pluto's atmosphere into space and its interaction with the solar wind, the hot atmosphere escaping the sun.

"You can think of Pluto as a colossal comet," Bagenal said.

By measuring fresh ions in the solar wind, scientists can measure the total amount that's escaping, she said. Bagenal said Pluto is probably losing 3 million tons of ices a year, amounting to a thickness of a foot per million years.

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