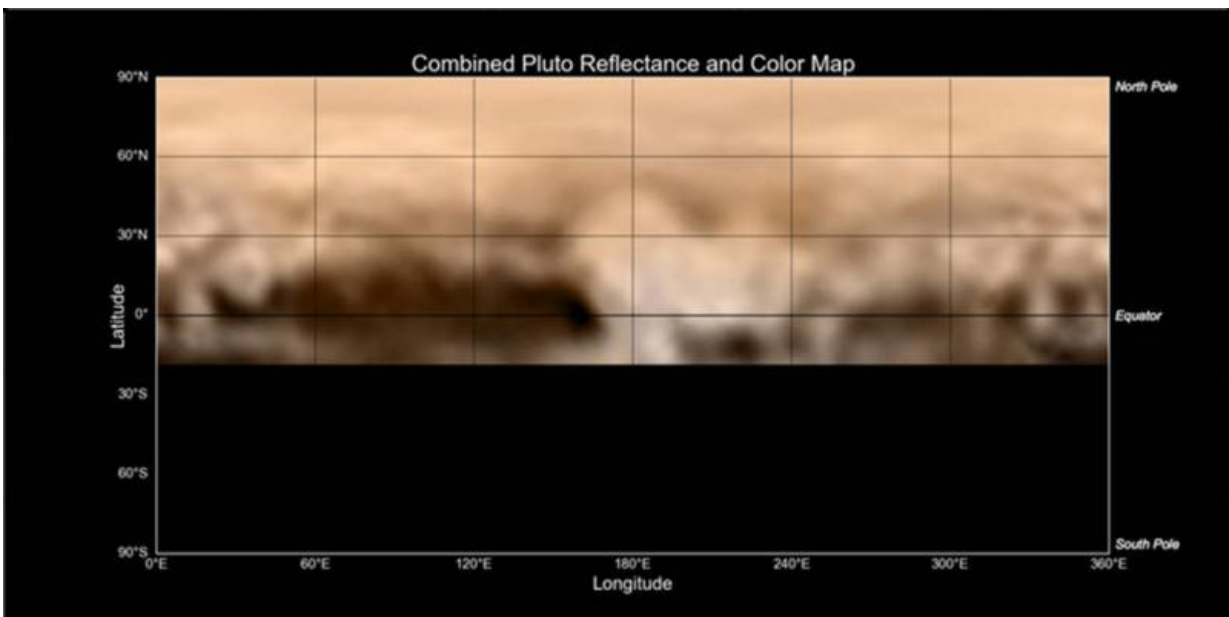


New Horizons' close encounter with Pluto will reveal its icy secrets

July 10 2015, by Jonti Horner And Jonathan P. Marshall



Map of Pluto, released on July 7, 2015, based on data from LORRI and Ralph.

At around 10 pm AEST on Tuesday July 14, the [New Horizons spacecraft](#) will sweep past the dwarf planet Pluto at a distance of less than 12,500 kilometres. In doing so, it will bring one of humankind's most remarkable achievements to a thrilling climax.

Despite years of preparation, and the nine and a half years the spacecraft has been in flight, this will be the most fleeting of encounters. New

Horizons will zip past Pluto faster than a speeding bullet, spending less than 40 hours within a million kilometres of its icy target.

Flung towards Pluto by a fortuitous slingshot

New Horizons is a remarkable spacecraft. It is [the fastest spacecraft ever launched](#), and took advantage of a fortunate alignment of the planets to reach its destination in a timely manner.

New Horizons' trip to the outer solar system began in 2006, and was boosted by a [gravitational slingshot by Jupiter](#), which was ideally placed to give New Horizons a helping hand.

This flyby cut several years from the probe's trip to the outer reaches of the solar system. Had it been launched just a few days later, the opportunity would have been lost, and New Horizons would have had to take a much slower route to its destination.

As a result of this game of celestial pinball, New Horizons is now placed to tear past Pluto at a relative speed of some 14 kilometres per second. To make the best of this brief encounter with the solar system's most famous dwarf planet, it carries a veritable [Swiss army knife of scientific instruments](#).

Seven instruments

To get the best possible views of Pluto, and return the most valuable data, New Horizons has been kitted out with [seven separate instruments](#).

The most well known of these is the Long Range Reconnaissance Imager ([LORRI](#)), a telescopic camera that has been returning black and white images of ever-increasing detail over the past months. Complementary to

LORRI is [Ralph](#), a visible and infrared camera, adding colour to reveal Pluto's Mars-esque reddish hue.

Moving from Pluto's surface to its atmosphere, we come to [Alice](#). This ultraviolet spectrograph will sample the composition of Pluto's tenuous atmosphere, and also yield details of the surfaces of Pluto and its satellites, working hand-in-hand with Ralph.

While Alice studies the atmosphere at ultraviolet wavelengths, it will be complemented by the Radio Science Experiment ([REX](#)), which will carry out a variety of different experiments through the course of the encounter.

Most excitingly, it will use radio signals from Earth to measure both the temperature and composition of Pluto's atmosphere at radio wavelengths. By using signals from Earth, REX will be able to sample the most tenuous outer layers of the atmosphere, invisible to Alice and Ralph.

The next pair of complementary instruments carried by New Horizons are Solar Wind At Pluto ([SWAP](#)) and Pluto Energetic Particle Spectrometer Science Investigation ([PEPSSI](#)). These will work together to capture and study particles bleeding to space from the outer edges of Pluto's atmosphere.

By sniffing [Pluto's escaping gas](#), they will determine its composition with exquisite precision. They will also help us to understand how Pluto's atmosphere interacts with the [Solar wind](#), which is continually streaming outwards from our beloved Sun.

Last, but by no means least, is the Student Dust Counter ([SDC](#)). This instrument, wholly designed and run by students, keeps track of interplanetary debris striking New Horizons as it flies ever outward.

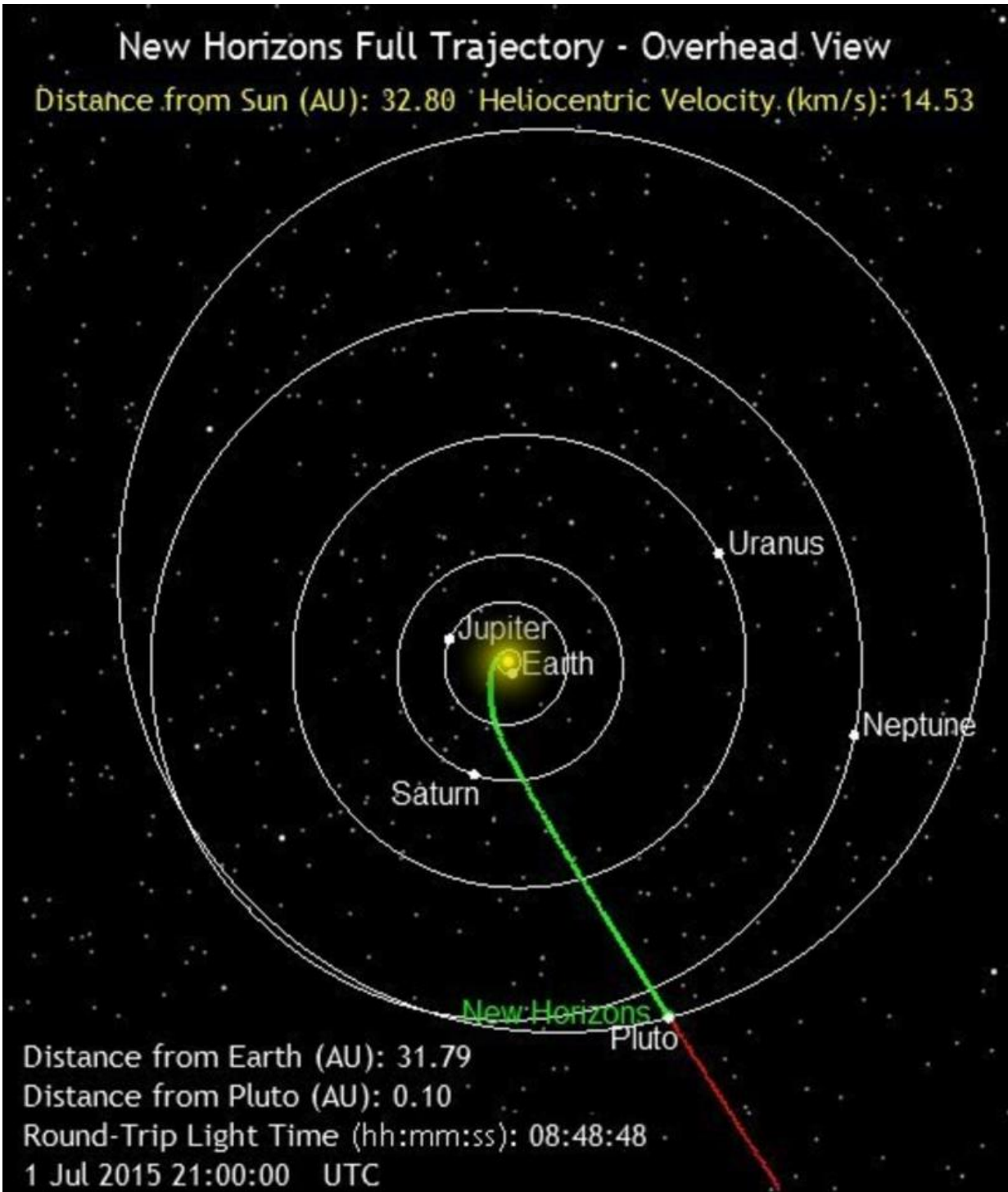
Unlike the other experiments aboard New Horizons, the SDC has remained awake for the entire duration of the mission. In the process, it has continually monitored dust levels during the voyage. This has provided a unique picture of the dust spread throughout the solar system.

A brief encounter, slowly retold

During the flyby, the spacecraft will gather vast amounts of data. This will range from exquisite images to spectra revealing the makeup of Pluto's atmosphere and surface. But New Horizons is now so distant that we won't get to see the data in real time.

Data transmitted by New Horizons faces a lengthy journey back home. Travelling at the speed of light, communication takes almost five hours, one way! And it gets worse.

The great distance begets another problem: low bandwidth. Data returned by New Horizons will trickle back at just one kilobit per second. That's slower than the speed of the internet during the era of the dial-up modem.



The path followed by New Horizons to reach Pluto.

As a result, data obtained during closest approach will take around nine months to be wholly transmitted to Earth.

Not all plain sailing

An excellent illustration of the difficulties involved with missions such as this came earlier this week, on July 4. All of a sudden, as though suffering stage fright with the eyes of the world upon it, [New Horizons fell asleep](#).

This was no planned power nap. Communications with ground control ceased unexpectedly, as the spacecraft went into sleep mode, then switched to its backup computer. There was about an hour and 20 minutes of uncertainty and stress before communications were finally restored.

The cause? The central computer overloaded while simultaneously trying to prepare for new observations and to compress data it had already collected for transmission back home.



A colour image of Pluto taken by LORRI and Ralph on July 3rd, eleven days before closest approach. Credit: NASA

The main computer responded by entering safe mode, and switching to the backup, just as it was programmed to do. So while the glitch was unexpected, it wasn't a catastrophe, although doubtless the staff at

mission control had an anxious 80 minutes.

Fortunately, everything is now back online and functioning perfectly, and with any luck, there won't be any more unplanned naps from our plucky little adventurer.

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