

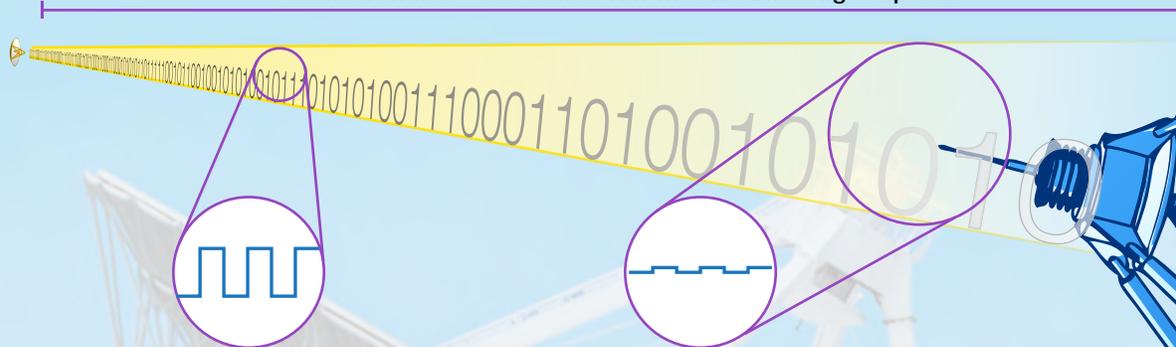


New Horizons is Far Out! Long-Distance Communication

New Horizons launched from Earth at over 10 miles per second (over 36,000 mph) in 2006 and got a speed boost from Jupiter in 2007. It has been speeding out of the solar system ever since and is now over 4 billion miles away, yet NASA can still easily communicate with it!

How We Communicate

~4 billion miles / 6.5 billion km ... 6 hours at light speed!



We talk to New Horizons with radio signals sent to and from the spacecraft at the speed of light, about 670 million miles per hour. Whereas a radio signal to the Moon, 250,000 miles away, takes just over 1.5 seconds to reach it, in 2019 it takes a radio signal over six hours to get to New Horizons.

Communication between Earth and New Horizons is done with sequences of binary data – zeros and ones (called “bits”) – like all computers.

The farther New Horizons travels from Earth, the weaker the signals received here by NASA’s Deep Space tracking network (DSN). NASA’s DSN antennas are huge, over 200 feet in diameter, so that they can collect the faint signals from New Horizons.

Want to Know More?

Signals leave New Horizons with a certain power, and that power is averaged over how many bits are sent. As they travel to Earth, the power decreases with the distance squared (so signal strength is 25% when the distance is 2x). When they get to Earth, each bit must have a minimum amount of power, otherwise we cannot detect it: As the craft moves farther from Earth, we decrease the number of bits per second, so each bit has enough power to detect it.

Communication Rate

- Mariner 4, 1.2m antenna @0.15 billion km = 8.3 bps
- Voyager, 3.7m antenna @19 billion km = 160 bps
- New Horizons, 2.1m antenna @5 billion km = 800 bps

800 bps
56,000 bps
56k modem —the internet in the mid-1990s on Earth

56,000 bps
Mars Reconnaissance Orbiter, 3.0m antenna @0.15 billion km = 500,000 - 4,000,000 bps

Communicating on Earth is fast with modern tech. For example, our Internet communications are often measured in the hundreds of millions of bits per second. In space, vast distances make it is much harder to communicate. In 1964, Mariner 4, the first NASA probe to reach

Mars communicated with Earth at just 8.3 bits per second. New Horizons is almost 1000 times as far as Mariner 4, but thanks to new technology it can communicate with Earth at over 1000 bits per second from the distant Kuiper Belt. It’s a lot faster, but it will still take New Horizons about 20 months to send all data to Earth from its January 1, 2019 flyby of the Kuiper Belt Object, “Ultima Thule.”

Transmitting Our Data

