



The *Farthest* depicts the cosmic journey of the Voyager probes.

## SPACE SCIENCE

# Voyager at 40

Alexandra Witze applauds a documentary on the twin NASA probes as they sail out of the Solar System.

In a nondescript office building in Altadena, California, not far from the main campus of NASA's Jet Propulsion Laboratory (JPL), a few engineers keep tabs on humanity's most distant emissaries. Their job is to communicate with the twin Voyager probes, launched by NASA in 1977 and currently sailing out of the Solar System.

Irish filmmaker Emer Reynolds has commemorated the mission's 40th anniversary in a brilliant documentary, *The Farthest*. The film traces the probes' history from their fraught beginnings, when then-US president Richard Nixon authorized fly-bys of only Jupiter and Saturn, through later planetary encounters including Uranus and Neptune, and on towards interstellar space.

It can be hard to grasp the distances involved. Voyager 1, the farthest out, is more than 20 billion kilometres from Earth, whizzing along in the empty cosmic reaches. It takes over a day and a half for a signal from Earth, travelling at the speed of light, to reach the spacecraft and for a return signal to ping back. At less than one-trillionth of a watt, the signal is so weak that, to hear it, JPL's engineers must integrate data from the Deep Space Network, three arrays of giant radio antennas around the world.

Yet there was a time when the Voyagers

## The Farthest

DIRECTOR: EMER REYNOLDS  
*Crossing the Line*  
 Productions/HHMI  
 Tangled Bank Studios:  
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[go.nature.com/2vqx055](http://go.nature.com/2vqx055)

planets Jupiter and Saturn, gathering photographs and scientific data, they went their separate ways, Voyager 2 sailing on to Uranus and Neptune — a first for any spacecraft — and Voyager 1 heading out of the Solar System. As historian Stephen Pyne wrote in *Voyager* (Viking, 2010), they were true explorers in the spirit of Earth's first circumnavigator, Ferdinand Magellan, who charted the unknown using a fleet of ships.

*The Farthest* showcases the scientists and engineers who made it happen. We hear about how the JPL-based team quietly worked to keep the options for Uranus and Neptune open, and invented clever interplanetary trajectories to save time and money and enable the encounters. We see them solve what could have been mission-aborting glitches, such as when an instrument platform on Voyager 2

roared. At their launches, on 20 August and 5 September 1977, the school-bus-sized probes soared separately into space. After they zipped past the giant

temporarily stopped moving at the end of its Saturn encounter. We meet characters such as Ed Stone, Voyager's legendary project scientist, who grows greyer at each press conference, but never loses his clear articulation of the wonders the spacecraft have seen.

And they're wonders indeed. Scientific discoveries come fast and furious each time one of the probes flies past a planet. Every image taken as the spacecraft approaches its target becomes the best ever made of it. Jupiter's Great Red Spot pops into focus, glaring balefully in a swirl of tempestuous clouds. Volcanoes on its moon Io hove unexpectedly into view. Saturn's extraordinary ring system appears, along with its haze-encrusted moon Titan. Even poor Uranus, that boring aquamarine blob, turns out to have an unusual magnetic field, torqued as the planet orbits on its side. And lurking in the cold, gassy clouds of Neptune was a vast dark spot.

Reynolds wisely avoids fetishizing the oft-lionized JPL team, opting instead for moody mission-control shots and thoughtful interviews. She interweaves the chronological account of Voyager's explorations with the philosophical implications of the famous golden records that the craft carry, as a message to the stars. In a programme spearheaded by planetary scientist Carl Sagan, these discs were packaged with their own stylus and diagrams showing how to play them. They carry sounds including spoken greetings in 55 languages, music ranging from Beethoven's Fifth Symphony to the strains of pan pipes from the Solomon Islands, and images including Earth's location in the Milky Way, derived from the relative locations of pulsars.

Many of the Voyager team members are still around, and *The Farthest* interviews a number about their hopes for the records. In retrospect, the discs seem amazingly audacious. How do you explain Earth and Earthlings to an alien, especially given that the team had six weeks to put the discs together? As Frank Drake, a pioneer in the search for extraterrestrial intelligence, puts it in the film: "It's going to be out there to represent us for the next 5 billion years." No pressure at all.

By the time Reynolds gets to Voyager 1's iconic 1990 photograph of the 'pale blue dot' — Earth, drifting like a mote of dust in a sunbeam seen from a distance beyond Neptune — she has transformed the documentary into a meditation on the nature of space and time. In August 2012, Voyager 1 crossed into interstellar space, the first human-made object to leave the Solar System. Voyager 2 will soon follow. As their plutonium power sources wane, the craft leave us pondering much more about ourselves than about the cosmos. The farther they go, the better the shot we have at eternity. ■

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