

A Brief Eternity

It seems ages since we launched the Voyagers. But in the grand scheme, it's but a moment ago.

INSPIRED BY THE VOYAGER mission's 40th anniversary last summer, I recently watched a 1999 BBC series, *The Planets*. In particular I savored Episode Three, which focused on the giant planets and the Voyager spacecraft. The episode recalled those heady days in the mid-1960s when NASA's deep thinkers envisioned dispatching probes on a "Grand Tour" of all the outer planets.

I was quickly reminded how space exploration then remained in its infancy. In those days, unmanned craft had ventured no farther than to Venus and Mars. For the Grand Tour to be successful, scientists would have to overcome many mission "impossibles."

But I was even more struck by how the series had captured *brevity*. Henry Thoreau's maxim, "Time is but the stream I go a-fishing in," came to mind. Despite being our longest-lived spacecraft, Voyagers 1 and 2 constitute but a ripple in the endless current of Time.

In the decade-plus that saw the canceling of the Grand Tour program and the launching of its replacement, the Voyagers, in 1977, scientists shared their fears: Constrained by limited

electronics and navigational knowledge, could they build machines that could last in space for at least 10 years? Would planet-aided gravity assists really reduce travel time? Could the spacecraft survive crossing the asteroid belt and Jupiter's intense radiation field? Could we receive the data transmitted by these spacecraft across billions of kilometers of space?

Where in that flow of Time and Space will humankind's continuum lie?

To their everlasting credit, the scientists and engineers figured it out. In the early 1970s they dispatched two less-elaborate probes, Pioneers 10 and 11, as scouts to reconnoiter the way. Learning vital lessons from them, NASA personnel hurriedly redesigned both Voyagers and fortified the Deep Space Network to enable the all-important transfer of data.

The Voyagers pushed the very limits of our science and engineering. But we prevailed, and in a comparative tick of

cosmic time. In the coming decades, that tick generated wide-spreading reverberations across the solar system: roving on Mars, orbiting Jupiter and Saturn, landing on Titan, flying by Pluto, and landing on a comet, to share but a few.

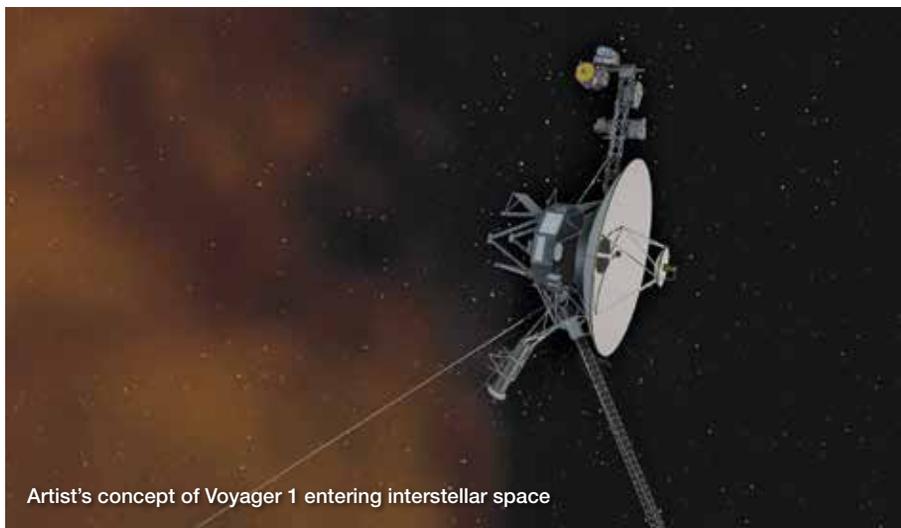
Now, as Voyager 2 punches the heliosheath to join Voyager 1 in interstellar space, these hoary spacecraft are nearing the end of their scientific lifetimes. And so, alas, are their creators, who were at the height of their careers when the Voyagers launched.

Aerospace engineer Gary Flandro, who calculated the rare planetary alignment underlying the entire adventure, is now reaching his mature years. Voyager chief scientist Ed Stone and imaging-team head Brad Smith — the same. James Van Allen, Carl Sagan, and former Jet Propulsion Laboratory director Bruce Murray are sadly no longer with us, their energies extinguished even as their contributions continue to influence the scientific continuum.

We humans wish we could anchor ourselves for a longer stay, but each of us is merely a drop in Thoreau's ceaseless stream, as ephemeral as a drop of dew on a sunny morning. What will the next drop or ripple produce? Who will contribute and for how long? What will we learn about the cosmos? Where in that flow of Time and Space will humankind's continuum lie?

Watching *The Planets*, I realized more poignantly than ever before how everything we have ever known, or ever will know, is but a single breath in the life of the grandest continuum of all: the universe itself.

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Artist's concept of Voyager 1 entering interstellar space