

Voyager mission was a bargain, costing only \$9 per taxpayer

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LA CANADA FLINTRIDGE — Voyager's wildly successful encounter with Neptune this week ends a once-in-a-lifetime grand tour of the four giant outer planets — the most productive space mission ever launched.

The total cost of the Voyager program since 1972, when design began on the twin spacecraft, is just \$865 million — less than NASA spends on three shuttle launches.

For the equivalent of less than \$9 per American taxpayer, the Voyager program rewrote our knowledge of the outer solar system, turning the fuzzy blobs of light seen

from Earth-bound telescopes into fantastic worlds stranger than anyone had imagined.

The Voyager saga became possible in 1961, when a graduate student working at NASA's Jet Propulsion Lab here realized it would be possible to use the gravity of one planet to boost a spacecraft on to the next.

Michael Minovitch also calculated that Jupiter, Saturn, Uranus and Neptune would be in the right position in the late 1970s — and not again for another 176 years — to use gravity boosts for a so-called grand tour of all four.

After much planning, Minovitch's idea became reality in 1977, when Voyager 1 and

Voyager 2 were launched from Kennedy Space Center two weeks apart.

Voyager 1 and 2 both went to Jupiter and Saturn. But Voyager 2 was given a slightly different path that whipped it on to Uranus and finally Neptune.

Today, just 12 years later, the two spacecraft have sent back to Earth a total of 5 trillion bits of scientific data — enough, Voyager scientist Charles Kohlhasse calculates, to fill more than 6,000 complete sets of the "Encyclopaedia Britannica."

Analysis and interpretation of that torrent of data will continue for years.