Halley 2061 Missions - New Technologies

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Introduction

Comet Halley is mankind's historical comet from Babylonian tablets to Edmund Halley's calculations predicting its return. The Halley missions of 1986 produced tantalizing views of its nucleus. Halley's return in 2061 will generate great public interest. We foresee many missions to Halley for the 2061 opportunity. This led us to ask the question "is a rendezvous mission possible?" The" yes" answer may demand propulsion capability that is not currently available to our knowledge. Because of Halley's retrograde orbit even simple flyby missions have high flyby speeds and danger from comet material.

Science goals and objectives

Despite our previous comet missions, our knowledge is still very limited. While, ideally we would like to return a cryogenic comet sample for detailed analysis on earth, In-situ chemical analysis would be a primary goal of the mission. The secondary goal would be the internal structure of the comet. Other measurement include, size, shape, mass and rate of outgassing during the periapsis passage.

Target destination

Comet Halley in 2061 will be visited by many spacecraft in flyby orbits, similar to the 1986 missions. This rendezvous mission will supplement such missions by providing surface observations and possibly communication relay.

Mission architecture Platforms

Rendezvous – mother spacecraft, one or two landers and secondary orbiter of internal comet measurements.

Flybys -International fleet of observational spacecraft
-Deep Impact –like - impactor and mother s/c.

Expected measurements

Size, shape, mass, composition, out gassing during periapsis passage, etc.
It is highly likely that a repeat of the Deep Impact mission and Rosetta mission objectives will be met.

Target solicitation –

NASA - New Frontiers and/or Flagship opportunity
ESA - ???

Technology challenges

Rendezvous to the high speed retrograde inclined orbit can be achieved by the use of an advanced propulsion system or by the use of a Jupiter gravity assist solution.

Jerry Horsewood has derived potential trajectories for both. The former requires a launch in 2059 and the later in 2049.

Ralph McNutt's thoughts on the Halley nuclear propulsion trajectory. "The issue is with not **the what** but with **the how**, because I doubt that in 20 years we can be even near the technology requirements without some really significant engineering dollars – which was well illustrated by the massive Project Prometheus study of 2003 – 2005. There are two problems: the first is physics and the second is politics; the first may be easier to solve. "

The challenge to NASA is to solve the "Halley Rendezvous" problem with nuclear reactors and more of the Solar System will be opened up for exploration.

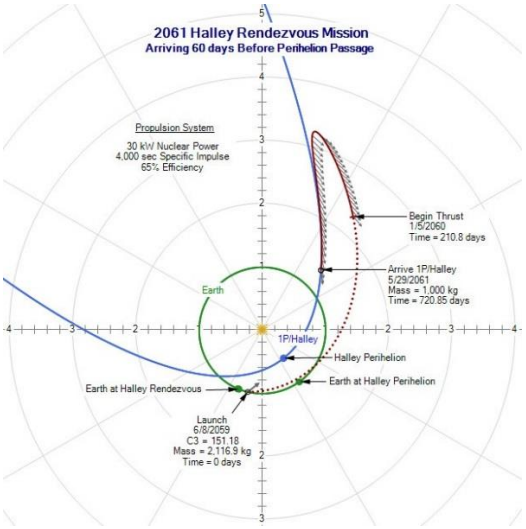

Figure 1 Nuclear Propulsion Option (Jerry Horsewood)

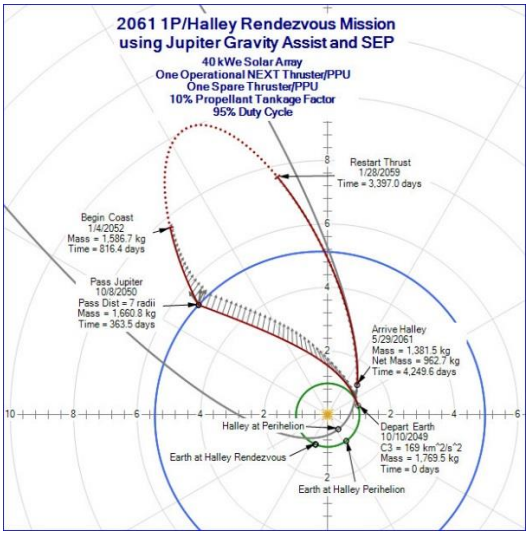

Figure 2 Jupiter Gravitational Assist Option (Jerry Horsewood)

Big telescope observations

Re-discovery of Halley depends on telescopic measurements as the orbit of Halley will have changed since 1986 because of non –gravitational forces. Optimizing the JGA solution means that orbital knowledge is available well before launch in 2049 so critical course corrections can be planned for the hibernating spacecraft. Which telescopes are best for early discovery? The James Webb or ground based?

Conclusions

Our favorite is the nuclear power solution because we get there in 2 years.

Space hardware drifting around our solar system for 12 years can die in that time. The Rosetta Mission team were really sweating waiting for the s/c to come out of hibernation. Should we be inventing new propulsion systems to get to small bodies more efficiently?

For a 2049 launch, hardware build would have to start 5 to 7 years earlier. We would be using whatever technology that is available in 2040.

Launch in 2059 would give until 2050 to develop the new systems.

Of course we could brute force it by putting a SpaceX starship on top of an Artemis launcher or whatever proven hardware is available in 2050.