



Memorial Spaceflights and Extraterrestrial Burial

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Contents

25.1	Space Burial in Popular Culture	341
25.1.1	Memorial Spaceflights	342
25.2	Lunar Burials and Solar Orbits	343
25.3	International Law for the Commercial Use of Space	343
25.4	A Brief History and Future Plans	344
	References	344

25.1 Space Burial in Popular Culture

He would have his body shot into space enclosed in a rocket to become a satellite of the earth as long as the earth continued to exist. He reasoned logically. Any material substance, whether of organic or inorganic origin, cast into the depths of space would exist indefinitely. He had visualized his dead body enclosed in a rocket flying off into the illimitable maw of space.

Neil R. Jones, “The Jameson Satellite”, *Amazing Stories*, July 1931 [1]

Mankind’s fascination with space, borne of the innately human desire to explore the universe around us, has inspired authors and screenwriters to consider how people will live and die as we reach out into the final frontier. Like the sailing vessels of the Age of Exploration, the spaceship is an island in a void both inhospitable and often violent as over a century of science fiction would attest. Jules Verne understood the dangers of the vacuum in his novel *From the Earth to the*

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Moon first published in 1865, “[...] for in spite of your diver’s dress, swollen by the expansion of air within you, you would have burst like a shell” [2]. Images of starship funerals evoke the naval traditions of burial at sea in popular science fiction films and television. This was notably exemplified in 1982’s *Star Trek II: The Wrath of Khan*. In the film Mr. Spock sacrifices himself to save his crewmates from deadly radiation after the film’s climatic space battle. To honor his commitment to, “the needs of the many,” he is interred in a torpedo casing and launched from the United Starship *Enterprise* towardere of a new planet as Chief Engineer Scott plays *Amazing Grace* on the bagpipes [3]. For many people, a deep symbolism is present in their dedication of some part of themselves to the vast unknown, be it the sea or outer space. Wende Doohan, wife of James Doohan who played Engineer Scott in several *Star Trek* television shows and films, said at his memorial service,

It’s a unique experience because memorials are for the living and you’re mourning the loss of someone, someone that you cared about a great deal. And yet, when the rocket goes up, as much as you miss them, as much as you loved them, you are so excited, and so happy, and so joyful that you get to experience what they really wanted. And you just know that they are somewhere yelling, ‘Yahoo!’ because they finally made it [...] It’s an unbelievable experience [4].

Jon McBride, an American astronaut, said at a service dedicated to families present at a memorial flight launch, “I am [...] flooded by emotions of what I see and hear, to be with you, and think of the wonderful thing you chose to do for your loved ones. They truly ‘slipped the surly bonds of earth, and touch the face of God [5].”

25.1.1 Memorial Spaceflights

The modern practice of “space burial” is limited by presently available technology, cost, and international treaties governing the peaceful use of space [6–8]. At the time of this writing only two privately owned companies in the United States have the clearance and resources necessary to perform memorial spaceflights [9, 10]. Counter to the vision of Mr. Jones, whose quote opening this chapter represents one of the first printed examples of interment in space, no organization or business can send a whole body to space. Instead, most extraterrestrial memorials are performed with a “symbolic portion of cremated remains,” about 1 g in mass [11]. There are two flight types currently offered: sub-orbital and orbital. A sub-orbital flight path allows for an intact return to Earth by recovery of the capsules from the reusable rocket stage after reaching a maximum altitude of about 70 km [12]. An orbital flight path attaches the capsules to rocket stages or satellites intended to remain in orbit. In accordance with regulations, these spacecrafts are expected to re-enter Earth’s atmosphere and disintegrate, “like a shooting star,” as their orbits decay [13]. Future flights are planned for deep space missions into solar orbit and beyond [14].

25.2 Lunar Burials and Solar Orbits

A portion of the remains of Eugene Shoemaker, who co-discovered the comet Shoemaker-Levy 9 that dramatically impacted Jupiter in July 1994, were included in the payload of the National Aeronautics and Space Administration (NASA) *Lunar Prospector* mission. Carolyn C. Porco, planetary scientist at the University of Arizona, wrote in her article *Destination Moon*, “[...] I read in the morning newspaper that Gene’s body would be cremated. The love he engendered in all who knew him, his inspirational life, and how badly he had wanted to get to the moon all flashed through my mind with the speed of a cosmic impact. Let’s send Gene to the moon, I thought. This is his last chance.” [15] His remains are the only to have been placed on a celestial body outside of Earth, though additional lunar missions are scheduled to include payloads of human remains. To date no remains have been permitted to leave Earth orbit on a commercial spaceflight. A mission for solar orbit is scheduled for 2022, though this was delayed due to the COVID-19 pandemic [10, 16].

25.3 International Law for the Commercial Use of Space

The use of outer space is regulated by five international treaties and other principles established by joint resolutions of the United Nations Organization. The initial treaty, The Outer Space Treaty was first proposed in 1966 and ratified in October 1967. The treaty serves primarily to limit military use of space, including the ban on placement of weapons of mass destruction on or in orbit of any celestial body. However, there are three key principles present in this treaty relevant to the commercial use of space by member States of the United Nations:

- States shall be responsible for national space activities whether carried out by governmental or non-governmental entities.
- States shall be liable for damage caused by their space objects.
- States shall avoid harmful contamination of space and celestial bodies [6].

In accordance with these provisions, all memorial spaceflights originating in the United States must be approved by the Office of Commercial Space Transportation of the Federal Aviation Administration. To comply with regulations more easily, all flights from the two commercial entities providing these services do not release any material from a spacecraft. Functionally, all memorial spaceflights are conducted as additional cargo on missions designed for other purposes. Most missions designate cremains as a “secondary payload” to distinguish the material from a “primary payload” which may be intended for placement in orbit [7]

25.4 A Brief History and Future Plans

The first memorial spaceflight was conducted in 1992 in secret by a member of the crew of the Space Shuttle *Columbia*. Majel Barret Roddenberry loaned a portion of her husband Gene's ashes so that he was, "[...] able, just once, to go into that great galaxy he dreamed about, where so few men have gone before [...]" Mr. Roddenberry would also be part of the first commercial memorial spaceflight, Founders Flight, from Celestis, Inc., launched as a secondary payload to Spain's MINISAT 01 mission on April 21, 1997. It was launched by a Pegasus rocket from an Orbital Sciences Corporation Stargazer aircraft. The satellite orbited the Earth every 96 min until it reentered the atmosphere on May 20, 2002. Other notable individuals on board Founders Flight included physicist Gerard O'Neill, rocket scientists Beauford Franklin and Krafft Ehrlicke, and psychologist Timothy Leary. The remains of 20 other people were included in the first flight [17].

From 1997 to 2019, Celestis, Inc. has conducted 16 memorial flights, including serving as the private sponsor for including Mr. Shoemaker's remains on *Lunar Prospector*. Three of these missions carried the remains of *Star Trek* actor James Doohan and NASA astronaut Gordon Cooper. The most recent of these flights, New Frontier, also carried portions of the remains of 306 other people [18].

Another corporation, Elysium Space, intends to offer a service where the remains are contained within a separate "CubeSat" intended to be jettisoned from the launch vehicle and allowed to orbit freely before eventually re-entering the atmosphere and burning up. Elysium also plans to create "lunar mausoleums" using lunar lander technology from Astrobotic [16].

As of 2021, flights with Celestis, Inc. may be reserved across four unique services. The sub-orbital "Earth Rise" package is priced starting at \$2,495 USD and includes the return of the decedent's cremains or DNA sample. The Earth orbit service starts at \$4,995. Planned Lunar orbital or surface missions as well as Deep Space launches are priced at \$12,500. All services include invitations to launch events, memorial services, a commemorative certificate, and a mission completion guarantee that promises a complementary second mission if the first attempt is not successful. Celestis also offers multiple capsule sizes that permit one, two, or three participants in a single launch for an additional fee [11].

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