

Destination Moon

by Carolyn C. Porco



Renowned geologist Gene Shoemaker aspired to visit the moon. He never made it, but his ashes did.

I don't remember when I first met Gene Shoemaker, but chances are I heard him before I saw him. He was a warm, jovial, and boisterous man, with a hearty, body-quaking laugh that bounded its happy way across a room, a laugh that seemingly could defy physical law and pierce vacuum. And because he was always laughing, one's encounter with the man usually began acoustically. Mine probably did too. Neither one of us, of course, could possibly have foreseen that the crossing of our lifelines on that day would lead, some 25 years later, to Gene's history-making interment on the moon. The cause and effect of human affairs is often invisible to its players.

In 1976 I was a graduate student in the Division of Geological and Planetary Sciences at the California Institute of Technology in Pasadena. I had come to the study of geology reluctantly. I was, after all, from the Bronx. I hadn't seen a cow until I was 16, and I certainly knew nothing about rocks. So, it must have been the thrill of adventure that inspired me to sign up for a geology field trip by caravan across the deserts between Pasadena and northern Arizona, and then by raft down the Colorado River through the lower part of the Grand Canyon. Gene Shoemaker was the professor of geology who would lead the expedition.

I didn't know then that Gene was a legend, that he had been involved in the space program from its earliest days, that he was responsible for persuading the infant NASA to conduct scientific investigations of the lunar surface during the Apollo missions, that he wanted to be the first scientist-astronaut to go to the moon and study its geology firsthand, that he helped train the astronauts to recognize and retrieve rocks of geologic interest, that he was responsible for establishing the science of photo-geology (the study of a planetary surface from images), that he was directly responsible for our understanding of the chronology of early solar system history. I would not find these things out for a few more years. I just knew I wanted to run the rapids of the Grand Canyon.

Gene, I came to learn, was part cowboy raconteur, part Buddhist monk — a charismatic, denim-clad

storyteller so completely one with his world, his work, and his life that a typical stop-look-see field expedition in the rudiments of southwestern U.S. geology became a magic carpet ride.

By the time it reaches northern Arizona from its source in the western Rockies, the mighty Colorado River has sliced its way through 600 million years of history and through the colorful rock layers that form the walls of the Grand Canyon. This was Shoemaker country, a region the man knew intimately: its slopes and elevations, the dip of its beds, the sequence of slow changes that raised the land and laid the river, ultimately in the channel it cuts today. In Gene's

recounting, the plateau became a mythical land, transformed many times over by ancient upheavals and the ebb and flow of the ocean. And his passionate storytelling ensured that his rapt audience could see it all take place right before our eyes.

Never mind that Gene was a disorganized tour guide who routinely flirted with danger. We sometimes ended up pitching camp in the canyon after dark on impossible slopes. Our rafting excursion nearly ended in disaster when Gene, cursing as heartily as he laughed, couldn't start the outboard motor that was supposed to push all our tied-together rafts across Lake Mead. None of this really mattered. To walk on the roof of the Colorado plateau, to float through its many layers with Gene, was to comprehend, to respect, and to experience, with the mind and senses aflame, the deep antiquity of the place.

The man was in the habit of thinking deeply and reaching far. In 1960, he demonstrated something that jolted the complacency out of everyone who was paying attention: Earth had been struck by a celestial projectile, measuring 150 feet (45 meters) across and traveling faster than a speeding bullet. And Meteor Crater, a 550-foot-deep, 4,000-foot-wide bowl-shaped depression near Winslow, Arizona, was the scar to prove it. In a

Gene Shoemaker, standing in Meteor Crater, became the first person whose remains ended up on another world: the moon.



single mental leap, Gene had made a connection between the heavens and Earth that no one before him had seen. Terrible destruction could rain down on our planet from above. And he was convinced that the craters on the moon, widely believed at the time to be the result of explosive volcanic eruptions, were the result of the same cosmic hailstorm.

By the time I enrolled for my second field trip with Gene to visit and examine Meteor Crater, I was aware of "The Story." Gene had desperately wanted to go to the moon himself as an Apollo astronaut to test out his ideas on the cosmic origin of craters, but Addison's disease had grounded him. The Apollo program, however, had proven him correct: The inner solar system was at one time an incredibly violent place.

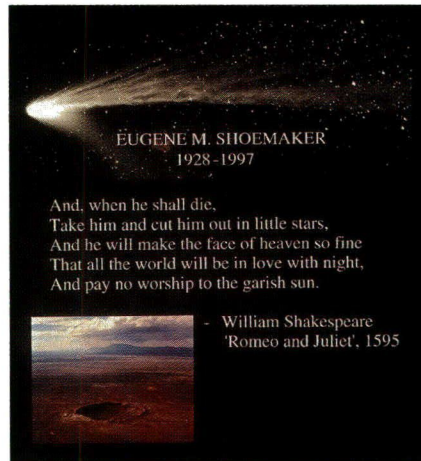
In the 1980s, Gene and I met up again as members of the Voyager Imaging Team. The Voyager discoveries of a similar epoch of violence in the outer solar system, as recorded on the icy satellites of the giant planets, gave Gene much to think about. Employing his technique of determining the relative ages of the surfaces on a body by looking at the spatial density of craters, Gene broadsided everyone again by informing them that not only had these bodies suffered severe impacts, but that some of them had been broken to bits and reassembled, and in some cases, many times. Collisions were everywhere and could destroy worlds or even

create them. Our own moon was created in a colossal impact of a Mars-sized object with Earth. How gratifying it was to him that he lived to see a collision: that of a comet he co-discovered, Comet Shoemaker-Levy 9, with Jupiter in 1994.

In the years following the last Voyager encounter with Neptune, I didn't see much of Gene. But whenever I knew he was anywhere nearby I made a point of finding him. Time with Gene was mind-expanding. He understood so much, so thoroughly, and he shared his knowledge freely, punctuated always with that laugh. I came away from these meetings inspired and renewed in my feeling that to be a planetary explorer was the most meaningful calling a person could follow.

To my close friends, I

Accompanying Gene Shoemaker's ashes to the moon was a small plaque that contained two photos and a passage from *Romeo and Juliet*.



would call an encounter with Gene "My Shoemaker Fix." I had become a Gene junkie.

His wife Carolyn later told me that the man was always thinking, punching his calculator, pursuing new ideas, rejecting bad ones. He was brilliant; he was renowned. He should have been richly rewarded and well-supported in his research. Yet, even he wasn't free of the trials and burdens of a modern-day scientist. To do any scientific investigations, he too had to write proposals and gain financial support of some kind. And he wasn't always successful. He was as frustrated as the rest of us.

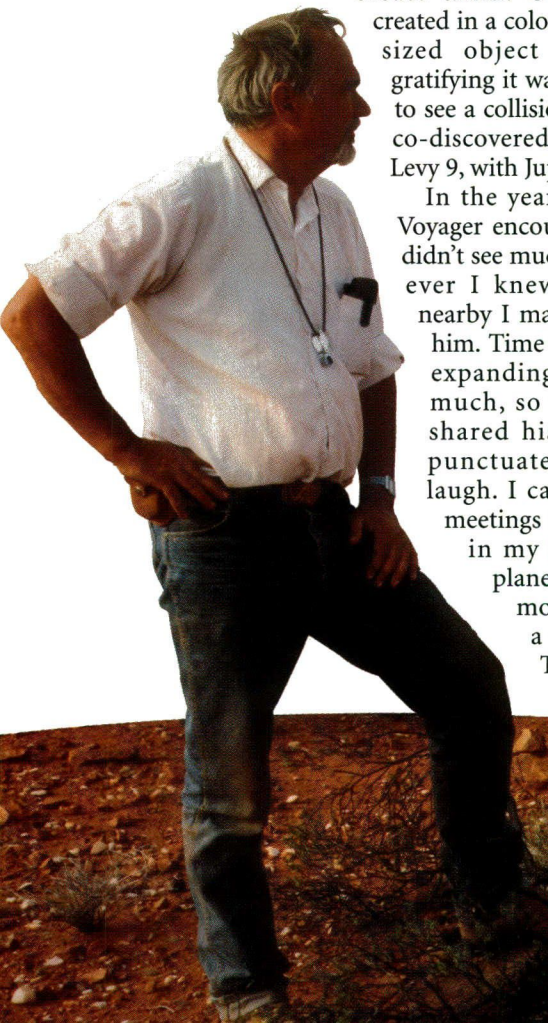
The last time I saw Gene was at the Applied Physics Laboratory in Laurel, Maryland, during the NEAR spacecraft's June 1997 encounter with the asteroid Mathilde. Gene and his wife were, like myself, special guests of the NEAR science team. We could sit back and enjoy the views. Mathilde would be only the third asteroid visited by a spacecraft, and it was a different class from the other two. The images showed an asteroid that was mostly crater: huge chunks taken out of it by the ubiquitous process of impacts. Tracking the spacecraft as it passed Mathilde allowed a determination of the asteroid's mass. The density was low, possibly as low as water ice. But the asteroid certainly wasn't made of water. What was it? Gene punched some numbers into his calculator, looked at the answer with a deep, furrowed brow, and announced to all in the room: "It's a sand pile!"

There it was. He had done it again, and this time it happened right in front of me. I was awestruck. He had made another mental leap that shifted paradigms, diverted people's thinking, and focused it elsewhere. Mathilde was not a solid, rocky body but instead had to be something no more substantial than a pile of rubble. By extension, other asteroids could be rubble piles too, held together presumably by self-gravity sufficient to counter the potentially shattering effects of impacts. Planetary scientists have taken this new outlook on asteroids and are running all over the place with it.

Less than a month later, Gene was dead, killed in a tragic automobile accident in central Australia. Like everyone who learned of that awful development on that awful day, I was stunned. What new insights went with him, we'll never know. It was a loss difficult to measure.

The following day, 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.

It was a Saturday. I went into work, logged onto my computer, and started pummeling with e-mails anyone who could help in furthering this idea. What is





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the next lunar mission? When will it be launched? Would it be technically feasible to include a small, lightweight capsule with perhaps an epigraph? How do I get in touch with Carolyn Shoemaker (who was injured herself in the accident and recuperating somewhere in a hospital in the middle of Australia) to find out if she would approve the idea?

Within 30 hours I had my answers: It's amazing how many people in the space business can be found working on the weekend. Lunar Prospector was the next mission going to the moon. But it was in final systems testing, to be shipped to Cape Canaveral from Moffett Field in California within two months. Even though it was late in the game, mission manager Scott Hubbard was warm to the idea (so long as the mass could be kept to a minimum), and Carolyn Shoemaker had sent back the message that the Shoemaker family would be forever grateful if I could actually pull it off.

And within nine days, I had the go-ahead from the NASA official who could make it happen. Associate Administrator for Space Science Wesley Huntress had responded, "I like that idea, Carolyn. I like the poetry of it."

It was a bit of a scramble as there wasn't much time. I wanted to include something to commemorate Gene's scientific legacy. It seemed appropriate to choose his favorite photo of Meteor Crater and a photo of the last comet that he and his wife saw together, Comet Hale-Bopp. And somehow, I extracted from the dusty realm of dim memory a passage I had read from *Romeo and Juliet* long ago that seemed perfect for the occasion.

In one crazy weekend in late August 1997, the idea turned into reality. On Friday I drove from Tucson to Phoenix, where I had arranged to have my design laser-engraved onto a small piece of brass foil. The following day I drove north to Flagstaff. That afternoon, in an intimate ceremony in the back of Gene's house, in view of his beloved San Francisco Peaks, members of the Shoemaker family and I collected Gene's ashes into a small capsule. The next day, I drove to Phoenix for a flight to Ames Research Center in California,

One of Gene Shoemaker's favorite places: the Grand Canyon in Arizona.

where the following day, a Monday, I delivered the whole package to Scott Hubbard. It was then out of my hands.

On January 6, 1998, Lunar Prospector was finally sent on its way to the moon. Eighteen months later, on July 31, 1999, it crashed on command into the lunar south polar region, carrying Gene's ashes down to the surface. The fulfillment of one man's dreams, and the final episode of his inspirational life, met on impact.

In the last two years, my Shoemaker Tribute website (condor.lpl.arizona.edu/~carolyn/tribute.html) has received thousands of hits from people all over the globe. People I don't even know have expressed gratitude for honoring this man's wish to get to the moon and describe being moved to the point of tears after hearing the story of Gene Shoemaker.

It is a story that reverberates many places in the heart. It is one man's story for sure: of his dream, his disappointment, his life lived to the fullest, his legacy, and his final journey home. But it is our story, too. Thirty years ago, we humans arrived at the moon in life, and now one of us has arrived there in death. We have put our mark on the heavens and they have become our own. And now they beckon like never before.

What is it that makes one person see things that others don't, think thoughts that others wouldn't dare, and go places that others will only imagine? It's hard to say. But Gene was one of those people. And if there was ever a person who deserved to be given this special place in history, of being the first human to be sent to rest on another celestial body, it was he. To those of us who knew and loved him, that silver orb in the night sky will never be the same. May his laughing spirit walk its barren, windless reaches in peace, forever. **A**

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