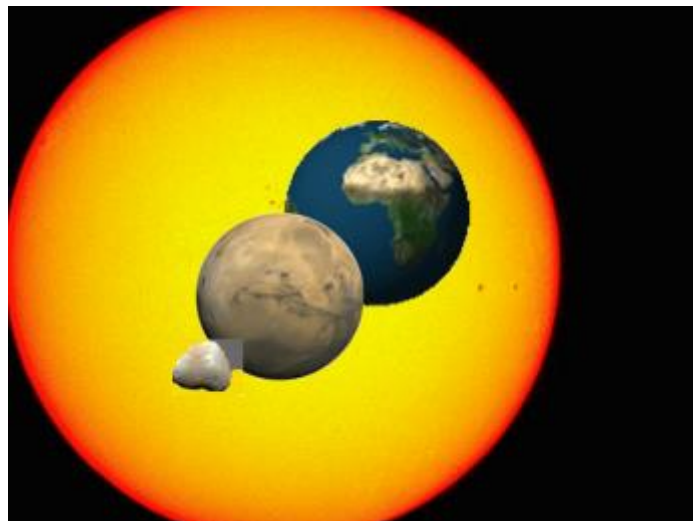


Phobos First

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The story uses the Evolvable Mars Campaign as a foundation to explore preparations for sending a crewed mission to Phobos and to speculate how a craft would approach and land on an essentially gravity-free moon.



"Houston, this is Perez," the crew commander announced into his microphone. "We have completed check out of the Phobos Taxi. The vehicle passes. There are no constraints to rendezvous and docking with Phobos. We are beginning initial burn to catch up to Phobos." The commander began to move forward on his check list without waiting for an acknowledgement. His message would take nearly four minutes to reach Earth, and Mission Control's response would take the same time to return. The Phobos-bound crew was operating essentially independently from Mission Control because of the communication delay. The decision to continue was his alone.

The crew pilot, Christine Morgan, was announcing items on the check list that they were both following. The engine burn to match Phobos' orbit would occur in five minutes. The vehicle check which the entire crew had participated in was a readiness check for the main mission objective, landing on Phobos, Mars' larger moon. When their Orion craft had arrived in orbit around Mars, the Phobos Taxi was waiting in orbit for them; they would, essentially, dock with Phobos with the taxi vehicle, leaving in a higher Mars orbit the Orion and docked habitat which had brought them from earth. Orion was not built as a lander. The Phobos Taxi had been launched two years previously, to reach Mars at its closest approach to Earth. The crew was launched in time for Mars' next close approach. In the intervening time, Mission Control had followed the taxi and made certain that it was in working condition before the crew left Earth. The Orion crew had done their own systems check upon arrival and found the vehicle, if not in perfect order after two years in Mars orbit, then in sufficiently working order to complete the mission objectives.

Perez listened to the list and made certain that switches on his side of the control panel were as indicated by the steady drone of Morgan's voice. Mission Specialist Peter Orlan sat strapped in just behind the pilot and commander and between their chairs. He had a copy of the list, and a swizzle stick as well. His extendable aluminum stick could reach switches on the middle section of the control panel, in case he needed to act on behalf of the commander or pilot in a contingency situation. The fourth member of the crew, Dmitri Gromyko of the Russian Federation Space Agency, was happily clicking away with his favorite mission camera; not just taking random photos. As a trained astronomer and an amateur photographer, his shots were carefully selected to fulfill the mission objectives.

It was amazing. Not just the first crewed mission to Phobos. Of course, that was; however, the entire mission and each piece of hardware were as well. The Orion craft was built by contractors across the United States. The Phobos taxi had been designed and built by the multi-national European Space Agency. The cargo vehicle awaiting them in Mars orbit had been built by the Russian Federation Space Agency. Each vehicle had to integrate with the launch vehicle which transported it to Mars, an international effort led by NASA. The Mars transit vehicle used solar electric propulsion rather than chemically powered rocket engines, such as had been used in low earth orbit and on the Apollo lunar missions. The solar power rocket provided a lower amount of thrust, but it could maintain thrust for a much longer amount of time, as much as 10,000 hours versus eight minutes to earth orbit using chemical fuels. The SEP engines heated a propellant and expanded it through a nozzle, similar to traditional engines. However, since it only needed to carry one propellant, rather than two, there was a significant weight saving. Though for orbital changes, storable chemical propellants were used since they could make changes more quickly with the higher thrust they provided. The mission was impressive, but equally impressive was the amassing of talent and resources from all around the Earth to bring the best minds and technology together for a mission that had inspired the globe. The excitement of sending a crew to Mars' larger moon had attracted great interest, and building a team and the equipment was smoother work for it.

This was a stepping stone to a Mars landing. Phobos, having very low gravity, would be a less complicated landing; lifting off at mission end would also take advantage of the near zero gravity,

requiring less chemical propellant to be carried the long distance from Earth to Mars. Additionally, Phobos always presented the same side to Mars. If the crew set the taxi down on the side facing Mars, this would provide radiation protection to the astronauts, who would receive approximately 35% less radiation than if they stood on the surface of Mars. It was important for all participants and the public, as well, to understand these advantages of a Phobos-first landing, lest they wonder at the wisdom of travelling the extensive distance and falling short of a Mars landing. It would be a dress rehearsal, just as there had been a dress rehearsal for the first landing on Earth's moon.

"T-one minute to ignition," Morgan announced to the crew.

Perez' hand lingered over the switch that would send the command for ignition of the engine. Morgan gave 15 second updates, counting down the last seconds.

"Ten, nine, eight, seven, six, five, four, three, two, one, ignition," she pronounced calmly.

Just as calmly, Perez pressed a finger against the switch. The crew members were pulled back in their seats as the engine fired. The pilot began counting forward by fifteen second intervals, well aware that Perez knew the time. However, it was a backup, a redundancy to be certain that the engine gave the right thrust.

"Shut down," the commander announced and the crew again floated against their seat restraints. He turned in his seat and finally grinned. "We're on the way. Phobos, here we come." Then instantly serious, Perez glanced at his chronometer. "Time for an update. We have a few minutes before we need to make another burn. We can talk about what's coming up at Phobos while we have a quick snack."

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"There she is," Orlan stuck a hand between pilot and commander, pointing to the small dark object visible against the rim of the red planet.

"Just where it's supposed to be," the pilot responded, reaching for the final approach checklist.

Perez nodded. "We've lowered our orbit. We'll come in between Mars and Phobos."

The back seat crew members moved their seats as far forward as possible to be able to watch the moon and the approach. Orlan had his checklist and swizzle stick in hand, ready to act if needed.

"We're closing fast," Morgan muttered. "Seems faster than the simulator."

"It does," the commander agreed. "But Phobos moves pretty quickly itself." He added in a whisper as a reminder to himself, "Orbits Mars twice in a Martian day." He held the throttle and steering apparatus firmly, watching the displays. "Slow a bit," he said aloud as he gave a brief thruster burst.

Morgan watched the affect to their trajectory as the computer displayed it. "We are on path," she said, aware that the commander was watching the same display. Over the years they had practiced this, the pair learned to watch each other, as redundancy, and neither took the other's comments as anything but helpful.

"It's still so small," Dmitri muttered. "Even as we get closer."

"Well," Orlan grinned. "Phobos is small."

“Yes, an asteroid, really.”

Perez slowed the taxi more as it came in close by Phobos. Gromyko was pressed to the window now, taking careful photos of the small moon. “Incredible. Look at it. Just like the photos,” he said without irony.

Perez and Morgan kept their eyes on the displays, tracking the taxi’s responses to the commands as the commander nudged his controls, making fine adjustments. It seemed familiar to Perez, having practiced this maneuver many dozens of times in the simulator, and yet it was foreign to him. He reminded himself that it was like docking with the International Space Station. Due to the near lack of gravity of the diminutive satellite, there was essentially no gravity to pull the taxi down, or to propel against. The taxi would not land, as much as it would join Phobos, like a space craft meeting up with the ISS. Rather than firing engines to pull against Phobos’ gravity, the engines would gently push the vehicle against the surface so that the serrated edges of the landing feet would dig into the surface, sticking the taxi onto the surface. Phobos’ minute gravity would not hold the lander against the surface.

The crew would not be held to the surface either. Each member would be outfitted with a Crew Maneuvering Unit, a backpack-like propelled unit similar to the Manned Maneuvering Unit used during Space Shuttle missions. The crew members would make all movements outside the taxi with the CMU, due to insufficient gravity.

The pilot called out distances to Perez so he could give full attention to his display, a graphic of the taxi and the surface of Phobos, and look out the side view window. True enough, the computer display was sufficient for approach, but he wanted to be certain that the chosen landing area didn’t hold any surprises.

In anticipation of this mission, a satellite had been sent during the planning stages to extensively photograph the surface of the moon for exploration and scientific reasons, but mainly to choose an appropriate location to place the Phobos Taxi. There had been great debate about which feature should be explored first, of course. However, ease of landing was also an important consideration for the initial mission. After all, the scientists were reminded, this was just the first mission, the first of many more to come. Eventually all the suggested features could be explored. A relatively flat area with no large craters was chosen just north of Reldresal Crater. The crater was named for a character in the book “Gulliver’s Travels” and was located at 41° north latitude, 39° west longitude. That would locate the taxi approximately near the center of the Mars-facing side of Phobos.

Perez gave very brief thruster firings. He wondered if it was more difficult to resist gravity and make a soft landing on a planet, or to propel oneself, however gently, toward a planet to make contact. The taxi slowed and moved parallel to the surface when the commander spotted a significant crack in the surface that he didn’t want to land on. Morgan gave a nod, even though Perez wasn’t looking. She approved of his choice, though it wasn’t hers to make.

The only sound was the pilot’s voice, continuing to give distance from surface readings as the taxi maneuvered. Perez couldn’t deny his tension, but didn’t concentrate on it, but on his task. The remaining two crew members watched with a mix of emotions and kept quiet so as not to interfere.

The vehicle settled on the surface of Phobos and the crew felt the intentionally hard landing, as the legs dug into the surface. Then Perez shut down the engines. There was silence for a long moment as each person waited to see if the landing was sufficient to hold them to Phobos. The vehicle was stationary.

“Houston, Phobos Taxi,” Perez said into his microphone, relaying the message through the Orion craft.
“We have made the first crewed landing on Phobos.”