

## **The Excitement of Ingenuity**

By Joanie Craddock

What could be more exciting than the first flight in a new world? In 1903, the Wright Brothers made history with a 12 second flight. Today, we are able to fly all over the world for much longer than 12 seconds. On April 19th at 3:34 a.m. ET, Ingenuity successfully completed the first powered, controlled flight on Mars. After six years of planning, this tiny solar powered helicopter flew 10 feet above the surface of Mars for almost 40 seconds. It arrived on Mars attached to the belly of Perseverance Mars Rover on February 18, 2021. Just taking the journey from Earth to Mars was a seven month ordeal. Next, Ingenuity needed to safely deploy from the rover. This process alone took over six days. It had to unlock and unfold itself and touch down on the surface of Mars. After that, Ingenuity had to establish radio contact with both the rover a few hundred feet away and its flight operators over 180 million miles away on Earth. The helicopter had to keep itself warm enough to survive the Martian night of minus 90 degrees Celsius. Although it hitched a ride on Perseverance, Ingenuity is a completely separate mission. It was not designed to help with the search for ancient life or collect rock samples. It is a demonstration of the wonders of technology on its own.

This four pound roto-craft with four foot blades and a fuselage the size of a tissue box was made to see if flight is possible on another planet. It was built to be lightweight and strong enough to survive the trip to Mars and fly in the harsh Martian environment. The atmosphere on Mars is very thin. It is about 1% the density of Earth's atmosphere. This was a significant challenge for engineers to test the forces of lift, weight, thrust, and drag that make flight on Earth possible. They needed to test the helicopter in a vacuum chamber at JPL in order to recreate the environment. The helicopter is powered by solar panels that are able to charge Lithium-ion

batteries with enough power for up to 90 seconds of flight. The blades needed to spin ten times faster than a helicopter on Earth would need to spin. The mass of Ingenuity was 1.8 kilograms. Although it weighed about four pounds on Earth, on Mars it only weighed about one and a half pounds. Ingenuity is able to fly 15 feet into the air and travel a distance of 980 feet.

The team of scientists and engineers who worked together on this endeavor cheered as Ingenuity successfully landed back on Mars. The project was built and tested at the Jet Propulsion Laboratory (JPL) in Pasadena, California but other branches of NASA assisted on the project. Both Ames Research Center in California's Silicon Valley and Langley Research Center in Hampton, Virginia, provided flight performance analysis and technical assistance during Ingenuity's development. It is interesting to read the biographies of some of the key people responsible for the success of Ingenuity. Jennifer Shatts, the Systems Engineer, actually failed out of college her sophomore year. She says that her failures have taught her what she is truly capable of and now she has helped to put a helicopter on Mars. Håvard Fjær Grip is the Chief Pilot for Ingenuity. He controls its flight from Earth but he also plays the piano, likes riding his bike, and goes on walks with his dog. MiMi Aung, project manager for Ingenuity Mars Helicopter, has loved math her whole life. Watching her rip up her contingency speech after the success of its first flight brought tears to my eyes. Reading about these regular people who have accomplished extraordinary things is almost as inspiring as watching the successful flight of Ingenuity on Mars.

Although Ingenuity has only been on Mars a short time, it has already contributed to scientific discoveries. The pictures and other data from the first flight is being analyzed by scientists as I write this. The hope for future discoveries is to be able to take pictures on Mars of places that are too steep or slippery for the rover to climb or too small to reach by land. Getting

an aerial view should give scientists a lot of information that could lead to even more exciting discoveries.

Personally, I would call this mission a complete success! It is scheduled to complete its second flight soon. Hopefully there will be more flights performed during this visit and the scientists and engineers will be able to use the data for bigger and better missions in the future! Maybe this is the first step for creating bigger helicopters that astronauts will someday use on Mars. I am sure Orville and Wilbur Wright never imagined that the site at Jezero Crater of the first flight on another planet would be named "Wright Brothers Field" in honor of them. The tiny piece of muslin from the wing on their first plane made it to Mars inside the fuselage of Ingenuity. Although it is no bigger than a postage stamp, it was an incredible honor. I can't wait to see what other successes happen for this mission.

Every scientific discovery sparks curiosity. Here are some more questions I was unable to answer with my research.

1. What is the next planet NASA plans to send another helicopter to for flight testing?
2. How many people collaborated on this mission?
3. How much did the mission cost?
4. Will it be possible to send a helicopter large enough to carry humans in the future?
5. How much bigger would that helicopter have to be?
6. How big would the Lithium-ion batteries need to be to charge that size of a helicopter?

7. The mission will last 30 Martian days. How many Earth days will that take?

**Resources**

<https://www.jpl.nasa.gov/missions/ingenuity>

<https://www.nasa.gov/press-release/nasa-ingenuity-mars-helicopter-prepares-for-first-flight>

<https://cms.megaphone.fm/channel/makingspace?selected=CBS7786064279>

<https://nationalpost.com/news/world/with-ingenuity-test-wright-brothers-plane-flies-again-on-mars>