24119 Nasa's Mars helicopter Ingenuity has ended its mission – its success paves the way for more flying vehicles on other planets and moons

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It is difficult to emphasise the significance of the milestone surpassed by Nasa's Mars helicopter, Ingenuity. The little (1.8kg) helicopter touched down with the Perseverance rover in 2021. On 25 January, Nasa announced that the flying vehicle had to perform an emergency landing which damaged one of its rotors and ended its mission.

This reminds us that space exploration is still difficult to do. But Ingenuity's three years on Mars proved that powered, controlled flight on Mars was possible.

The little helicopter lasted for far longer than had been planned and flew higher and further than many had envisaged. Beyond this Martian experiment, the rotorcraft's success paves the way for other missions using flying vehicles to explore planets and moons.

Ingenuity was audacious, original and completely new. The photos it took of Perseverance from a bird's eye view were breathtaking. Meanwhile, Perseverance also took videos of Ingenuity flying in the air. Nothing like it had ever been seen before.

Ingenuity wasn't intended to last for very long. It was designed to prove helicopter flight in the thin Mars atmosphere. But it went way beyond expectations, surviving three years on the Martian surface, even through a dusty season, and making 72 flights. Much of its success was aided by the communication network that now exists on Mars.

Ingenuity receives instructions and transmits data to Perseverance, which communicates with a fleet of satellites. These, in turn, communicate with two deep space networks on Earth, systems of radio antennas around the world that command and track spacecraft.

It took 50 years of planetary exploration to get here, but already we can see the impact on future exploration that Ingenuity's mission is having. The next interplanetary rotorcraft will be the Dragonfly mission to Saturn's moon Titan.

It will be very different from Ingenuity. It will weigh about a ton and fly with eight rotors. It is a huge vehicle designed to fly in Titan's thick atmosphere.

One of the next Red Planet missions will be Mars Sample Return, aiming to collect sample containers of Martian soil. This has been planned to be carried out with use of a rover, but the success of Ingenuity has led to the idea – and now the development – of a helicopter to do that.

The future that Ingenuity has opened up for us is exciting. We'll see helicopters on Mars and Venus, more balloons on Venus, swimming vehicles under the icy moons of Jupiter and Saturn, and maybe even an aeroplane or two.

414 words