

NASA's Mars helicopter Ingenuity successfully completed its historic first flight

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Key Objectives

- Prove powered flight in the thin atmosphere of Mars. The Red Planet has lower gravity (about one-third that of Earth) but its atmosphere is just 1% as thick, making it much harder to generate lift.
- Operate autonomously. Ingenuity will use solar power to charge its batteries and rely on internal heaters to maintain operational temperatures during the cold Martian nights.

Basic Dimensions and Specs (*)

- Height: about 19 inches (0.49 meters)
- Rotor system span: about 4 feet (1.2 meters)
- Counter-rotating blades spin about 2,400 rpm

The spin-up of the rotor blades will take about 12 seconds to go from 0 to 2,537 rpm, the optimal speed for the first flight.

Based on the information provided above, calculate

- a) The angular velocity of the blades once they reach their final rpm;
- b) The angular acceleration of the blades during the spin-up period;
- c) The tangential velocity of the blade tips once they have reached their final rpm;
- d) Compare the tangential velocity to the speed of sound on Mars.

<https://www.cnn.com/2021/04/19/world/mars-helicopter-ingenuity-first-flight-scen-trnd/index.html>

* Source: https://mars.nasa.gov/files/mars2020/MarsHelicopterIngenuity_FactSheet.pdf