

### ELECTROAERODYNAMIC PROPULSION

## A charged flight

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The propulsion systems of modern aircraft typically rely on the process of combustion, and the use of turbines and propellers, to generate thrust for flying. An alternative approach is to use ionic wind, where charged air molecules accelerated by an electric field generate thrust. The idea is attractive for aircraft because the process is silent and does not require fossil fuels. However, its implementation has so far proved challenging. Steven Barrett and colleagues at Massachusetts Institute of Technology have now built an electrically powered plane with no moving parts that can sustain flight by ionic wind propulsion.

The researchers developed a high-voltage power converter propulsion system that can deliver 40 kV between two asymmetric electrodes. The output voltage of the converter is regulated to produce the

flow of ionized air molecules needed to keep the plane flying. Design parameters, such as the wing span and the electrical power requirements, were determined by algorithmic optimization techniques. To illustrate the capabilities of the approach, and using a launch system to accelerate the plane, Barrett and colleagues performed ten flights covering a distance of about 40 to 45 metres in an indoor track. The thrust-to-power ratio was found to be  $5 \text{ N kW}^{-1}$ , comparable to conventional jet engine propulsion, and the overall efficiency of the thruster was estimated to be around 2.56%.

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