askSTart

Winds of change

Flight using an aircraft without propellers and jet engines that silently glides through the air? This sounds like the stuff of science fiction and brings to mind speedy Star Wars and Star Trek spacecraft that emit blue glowing jet trails. Recently, a team of Massachusetts Institute of Technology (MIT) researchers achieved an aviation breakthrough by building the world's first ion drive prototype plane with no moving parts that generated enough ionic wind for sustained flights. **The Straits Times** takes a look at what might be the next 'great way' to fly in the future.

ACHIEVING THE IMPROBABLE

The results of the aircraft's successful first-ever solid-state steady level flight are significant because the ionic wind propulsion method was once thought impractical and no one before this had flown anything heavier than a few grams with it.

Flight test results

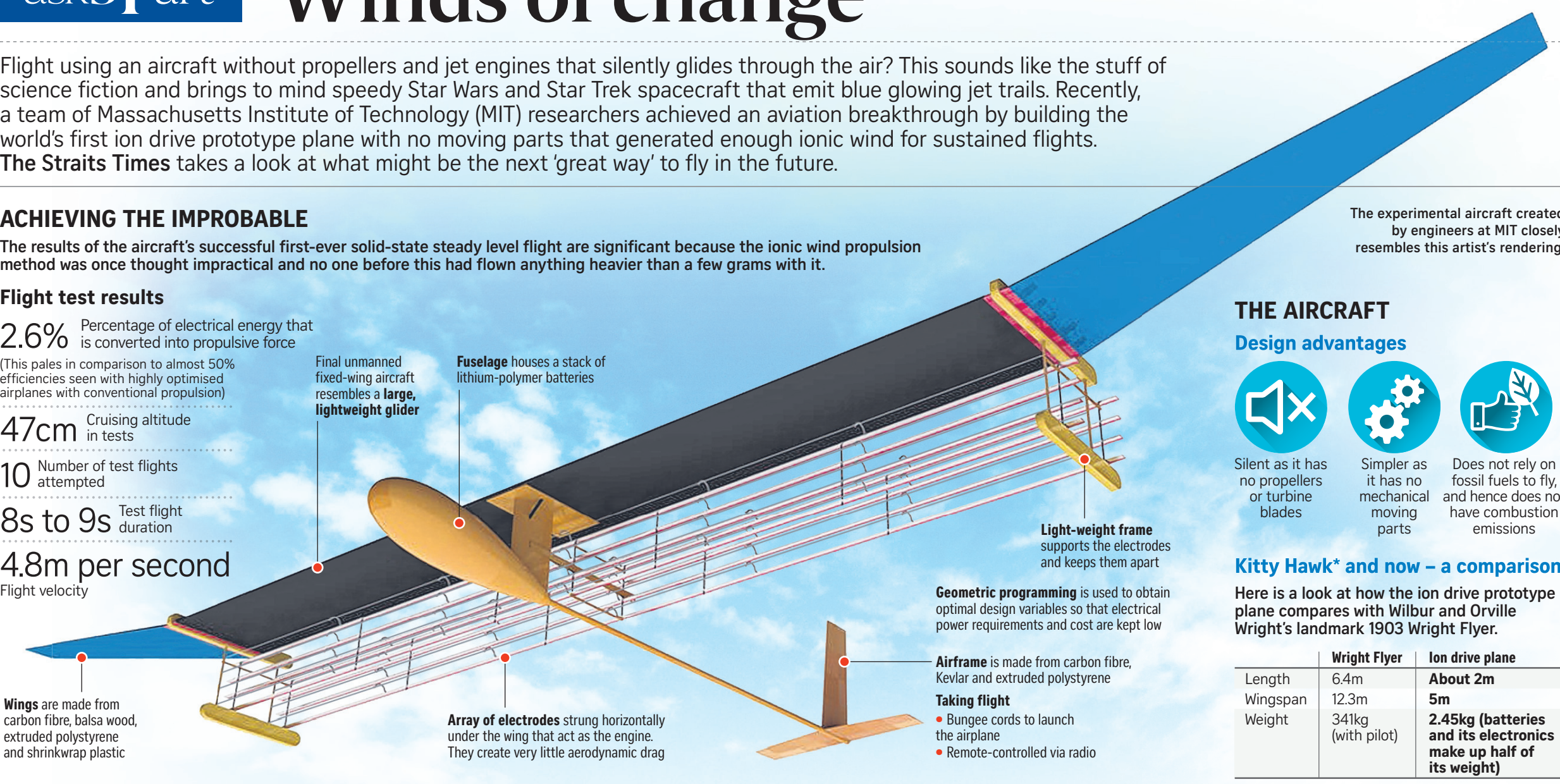
2.6% Percentage of electrical energy that is converted into propulsive force
(This pales in comparison to almost 50% efficiencies seen with highly optimised airplanes with conventional propulsion)

47cm Cruising altitude in tests

10 Number of test flights attempted

8s to 9s Test flight duration

4.8m per second Flight velocity



The experimental aircraft created by engineers at MIT closely resembles this artist's rendering.

THE AIRCRAFT

Design advantages

- Silent as it has no propellers or turbine blades
- Simpler as it has no mechanical moving parts
- Does not rely on fossil fuels to fly, and hence does not have combustion emissions

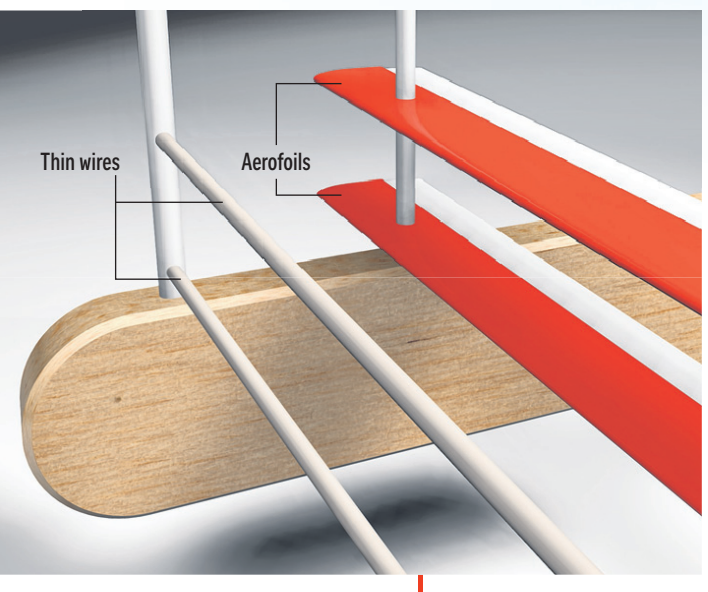
Kitty Hawk* and now – a comparison

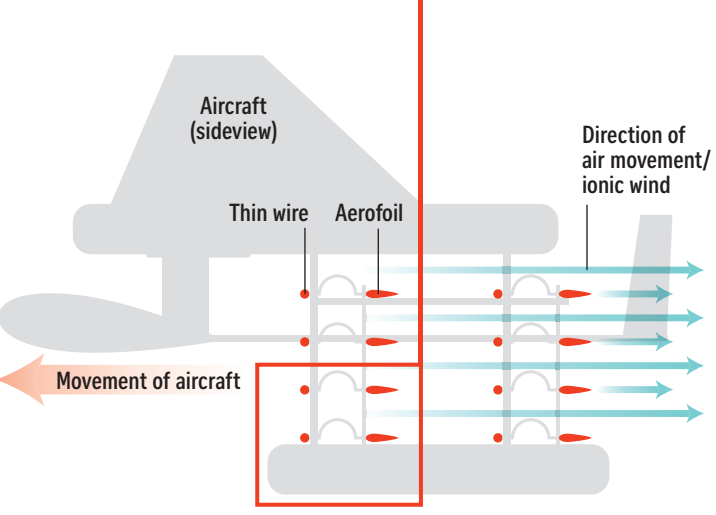
Here is a look at how the ion drive prototype plane compares with Wilbur and Orville Wright's landmark 1903 Wright Flyer.

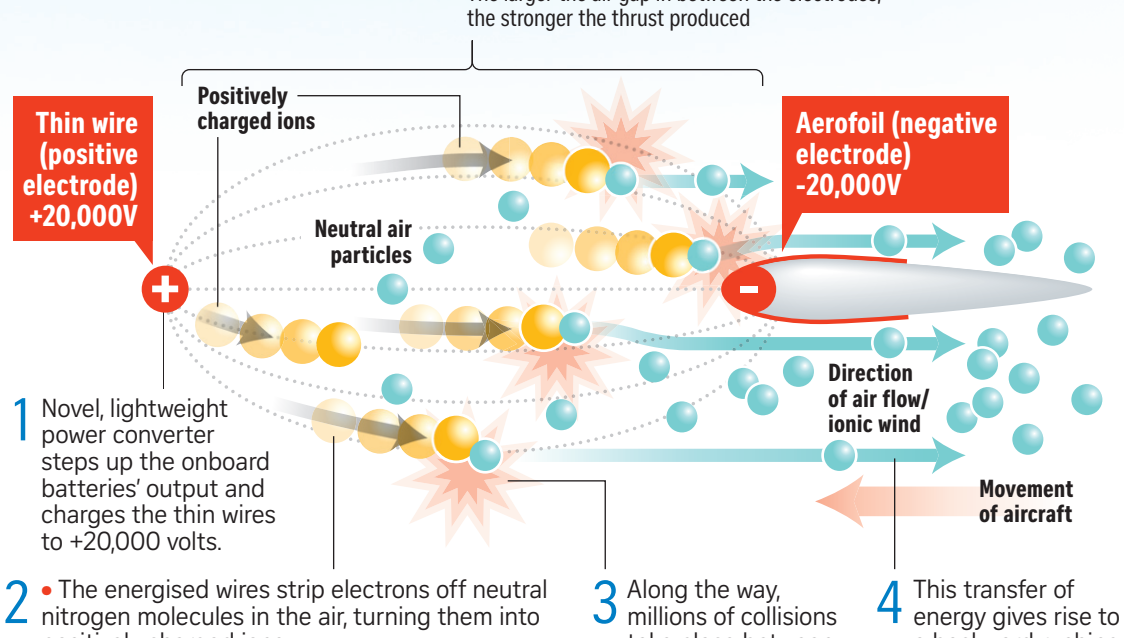
	Wright Flyer	Ion drive plane
Length	6.4m	**About 2m**
Wingspan	12.3m	**5m**
Weight	341kg (with pilot)	**2.45kg (batteries and its electronics make up half of its weight)**

NOTE: *Kitty Hawk in North Carolina was the venue where the Wright brothers tested their first powered aircraft.

PROPELLING THE AIRCRAFT – HOW IT WORKS







1 Novel, lightweight power converter steps up the onboard batteries' output and charges the thin wires to +20,000 volts.

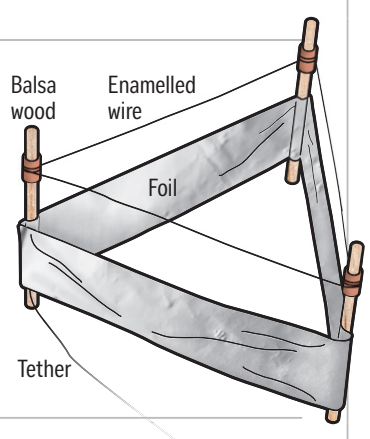
2 • The energised wires strip electrons off neutral nitrogen molecules in the air, turning them into positively charged ions.
• This cloud of nitrogen ions is then attracted – carried along the electric field – to the negatively charged (-20,000V) aerofoils at the back.

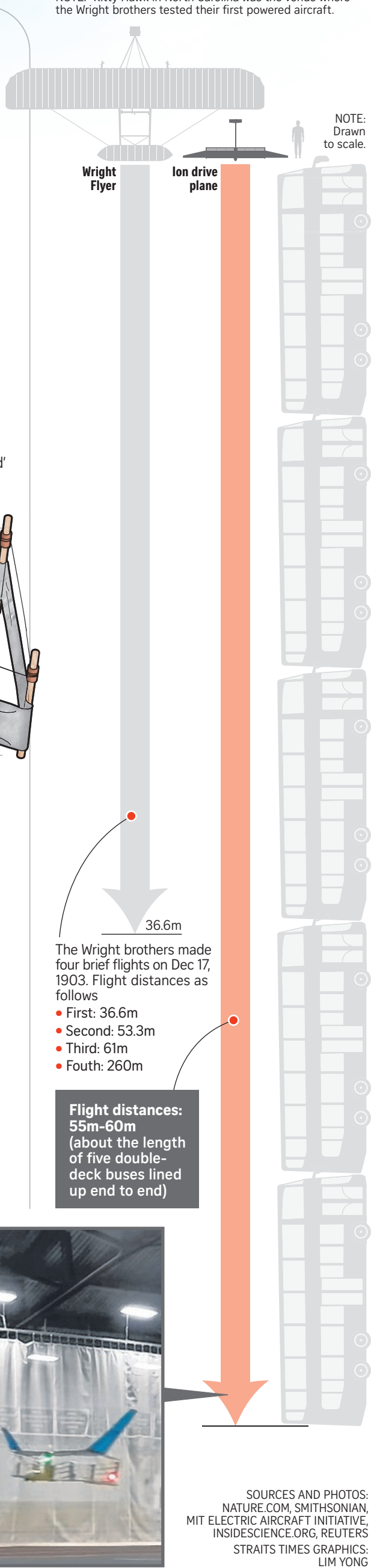
3 Along the way, millions of collisions take place between these ions and neutral air molecules.

4 This transfer of energy gives rise to a backward rushing wind – or 'ionic wind' – which pushes the plane forward.

DEMYSTIFYING IONIC WIND

- Its scientific term is "electroaerodynamic (EAD) propulsion". This process occurs only in gases and not in liquids.
- In 1921, while experimenting with electrodes, an American inventor, Thomas Townsend Brown, thought he had discovered a connection between electric or "antigravity" effect. Unbeknown to him, it was actually EAD at work.
- Ion thrusters are not exactly a new technology – they have helped propel deep-space probes in the near vacuum of space.
- Typical designs by hobbyists are small, tethered "ioncraft" that can hover only briefly in the air (right).





POTENTIAL AREAS OF APPLICATIONS

Although we are not likely to see a viable airplane that is aerodynamically propelled any time soon, its prospects are, nonetheless, promising.

Near term

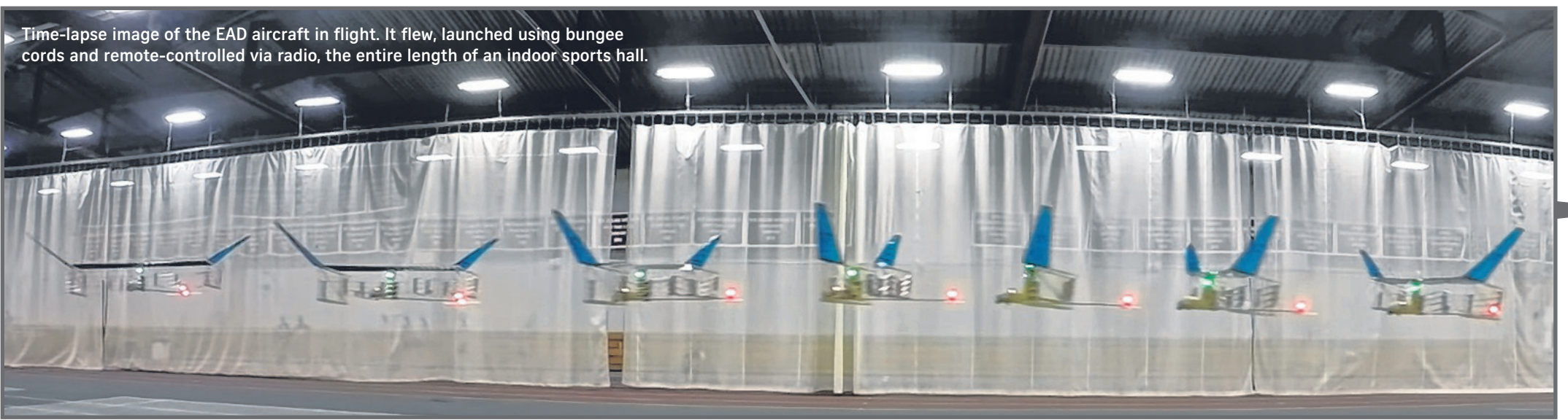
- Silent or near-silent drones (right) used for filming, deliveries or environmental monitoring.

Longer term

- **Military drones**
Absence of infrared signal renders them near impossible to detect.
- **Hybrid passenger planes**
Pairing ion drives with conventional jet engines so as to achieve fuel efficiency.
- **Embedding the technology into the skin of an aircraft**
A neater design without external electrodes.
- **Doing away with aircraft moving parts such as rudders and aerofoils**
This is attainable by manipulating the electric fields and it would vastly reduce maintenance costs.

The simulations failed all the time. We had to make hundreds of changes... I thought it had maybe a 50–50 chance. My colleague at MIT thought it was more like a 1 per cent chance it would work.

STEVEN BARRETT, ASSOCIATE PROFESSOR OF AERONAUTICS AND ASTRONAUTICS AT MIT, IN HIS INTERVIEW WITH SCIENTIFIC AMERICAN ON HOW EVERYTHING PERTAINING TO THE DESIGN OF THE PROTOTYPE WAS OPTIMISED TO GET IT AIRBORNE - WHICH IT DID AGAINST ALL ODDS



Time-lapse image of the EAD aircraft in flight. It flew, launched using bungee cords and remote-controlled via radio, the entire length of an indoor sports hall.

SOURCES AND PHOTOS: NATURE.COM, SMITHSONIAN, MIT ELECTRIC AIRCRAFT INITIATIVE, INSIDESCIENCE.ORG, REUTERS

STRAITS TIMES GRAPHICS: LIM YONG