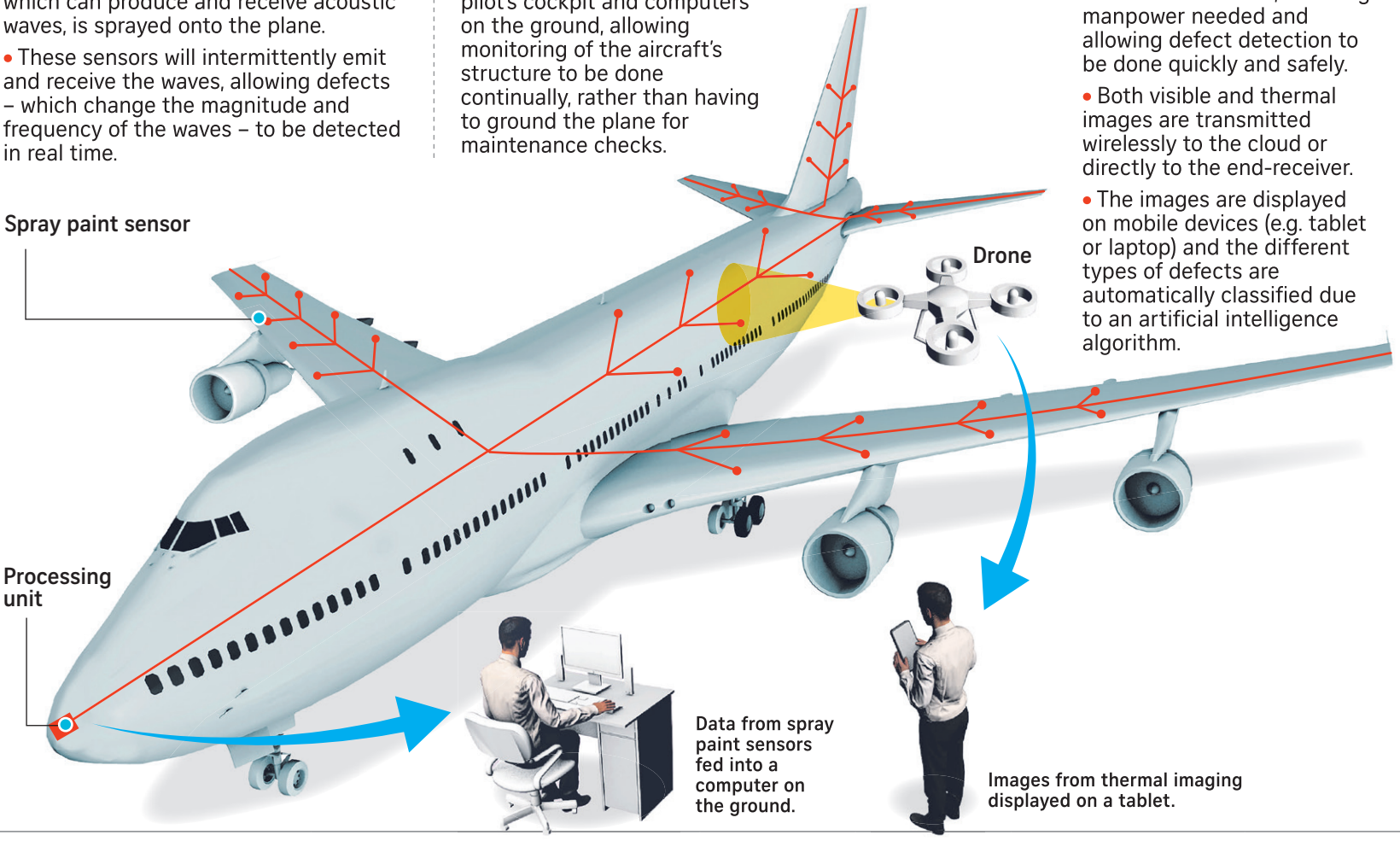
Science takes flight

The aerospace industry is constantly looking for new ways to be more efficient, from improving its repair processes to producing lighter materials for planes and using less fuel. Ahead of the Singapore Airshow, **Timothy Goh** speaks to scientists from the Agency for Science, Technology and Research to see how its Institute of Materials Research and Engineering is paving the way for smarter aviation solutions.

1 SPRAY PAINT SENSORS

- A coating of piezoelectric sensors, which can produce and receive acoustic waves, is sprayed onto the plane.
- These sensors will intermittently emit and receive the waves, allowing defects – which change the magnitude and frequency of the waves – to be detected in real time.
- The data can be fed into the pilot's cockpit and computers on the ground, allowing monitoring of the aircraft's structure to be done continually, rather than having to ground the plane for maintenance checks.



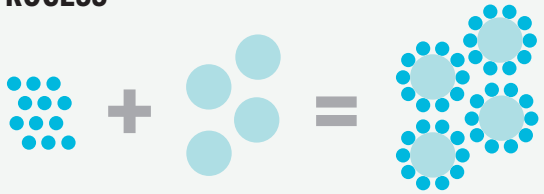
2 THERMAL IMAGING

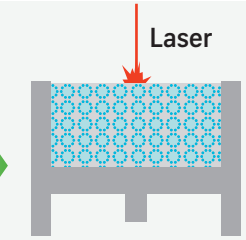
- Light is shone on the plane's surface to heat it up by 1 deg C to 2 deg C.
- The heated area is monitored by a very sensitive thermal camera, which highlights areas with defects as having a different temperature from the rest of the plane.
- The technology can be mounted on drones, reducing manpower needed and allowing defect detection to be done quickly and safely.
- Both visible and thermal images are transmitted wirelessly to the cloud or directly to the end-receiver.
- The images are displayed on mobile devices (e.g. tablet or laptop) and the different types of defects are automatically classified due to an artificial intelligence algorithm.

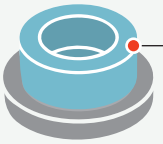
3 SOFT MAGNET

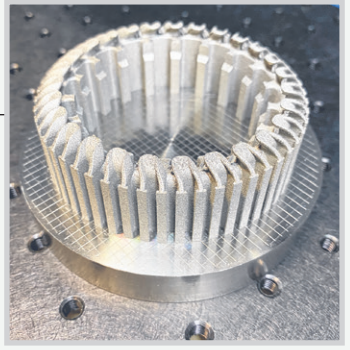
- Plane engines that have their pneumatic components replaced by electrical ones, also known as More Electric Engines, have been a goal in the aerospace industry.
- Magnets are needed in these electrical components, operating under harsh conditions and high temperatures, but creating them has been difficult because mechanical and magnetic strength are often inversely related in magnets.
- Researchers here have used a special process to create magnets that have both types of strengths, paving the way for developing such engines in the future.

PROCESS









1 Composite powder
Nanoparticles are functionalised onto the metal powder surface through physical mixing.

2 Selective laser melting
The nanoparticle-coated metal powders are fused together.

3 Metal matrix composite

Source: AGENCY FOR SCIENCE, TECHNOLOGY AND RESEARCH PHOTO: LIM KAILI STRAITS TIMES GRAPHICS