In greening air travel, small parts can make a big difference

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Making particular aircraft components lighter can help cut aviation's CO_2 emissions. Credit: CC0 via Unsplash

Aircraft flaps and emergency power units are part of efforts to reduce the aviation industry's contribution to global warming.

Each time a plane takes off or lands, flaps on the wings extend or retract to maintain stability and serve as a visual reminder that an aircraft is composed of thousands of complicated parts.

Redesigning some of these components might also reduce the greenhouse gases—including carbon dioxide—that aircraft emit. Aviation accounts for around 2.5% of global discharges of CO_2.

All aboard

"We need to take the lead on the reduction of greenhouse gases," said Yan Duranteau of French aerospace company Safran. "Aircraft need to become cleaner."

In the debate on greening aviation, much attention is paid to issues like alternative fuels. In April this year, the EU agreed to set binding targets for the availability of sustainable aviation fuels in Europe.

Known as ReFuelEU, the new legislation stipulates that, as of 2025, suppliers must ensure that 2% of fuel made available at EU airports is sustainable, rising to 6% in 2030, 20% in 2035 and 70% in 2050.

Nonetheless, other actions also help. Making aircraft lighter, for example, can reduce fuel consumption and, in turn, emissions—a strategy pursued in the SWING project that ended in September 2022 after three years.

"We need all solutions to combat climate change," said Christophe Cornu, who coordinated SWING and is a researcher at the French Technical Center for Mechanical Industries, or Cetim. "This includes decreasing weight."

Front flaps

SWING focused on the Krueger flaps located at the front of the aircraft's wing.

During landing and take-off, these flaps get extended to make the wing larger and change its aerodynamic shape. This gives the aircraft more stability during those critical moments when it flies at lower speed.

SWING made a new design for these flaps using thermoplastic polymers, a material that can be recycled and is lighter than the usual metals.

"We decreased the weight of the component by close to 20%," said Cornu. He hopes that the materials developed during the project will be used for more parts than just the Krueger flap.

"There's still a lot of research and development and testing to be done," Cornu said. "But if we can redesign an entire aircraft with these new materials, we could reduce its emissions by up to 20%."

Hydrogen hopes

Another aircraft component being rethought is the emergency power unit. In case of loss of power, this device allows the continued operation of critical systems such as the flight controls.

At present, a small wind turbine is often used for emergency power in civilian aircraft. The rotations of this piece of equipment, called a ram air turbine and extended from the body of the aircraft during flight, powers an electrical generator or a hydraulic pump.

The FLHYSAFE project, which ended last month after five and a half years, sought to replace that system with a hydrogen-powered alternative.

The main goal of the new system is to make aircraft safer even as environmental benefits are also promised.

"A turbine cannot be checked for each flight—it would be too complicated to actually generate the air speeds on the ground to make the turbine turn," said Safran's Duranteau, who coordinated FLHYSAFE. "A fuel cell system can, however, be constantly monitored and avoid hidden failures, which makes it safer."

The project researchers hope that their system, which is now being tested, will work better under emergency conditions than the turbines used today. The team has an additional motivation—to prove that hydrogen can work in aviation and serve as its zero-emissions fuel.

"Thinking about specific parts like this allows us to better understand hydrogen for aviation," said Duranteau. "An emergency power unit is a complex system, with a lot of constraints. By managing to run this system on hydrogen, we're taking a major step forward."

In the ReFuelEU legislation, hydrogen is included as part of a sustainable fuel mix and expected progressively to support the decarbonization of air transport.

Long haul

The emergency power unit that was developed by FLHYSAFE and the new flaps that emerged from SWING could be used in existing aircraft.

But, as a result of the long development time and certification required

in aviation, their actual introduction would be no sooner than 2030. The new parts will also have to integrate seamlessly with the other sections of an aircraft.

"We still have a long way to go," said Duranteau. "Parts for hydrogen in aviation, like the storage tanks, aren't mature enough yet. We have to improve them before we can integrate this kind of system in an aircraft."

The SWING flaps are being validated with Sonaca, a Belgian aerospace company that supplies parts to plane manufacturer Airbus.

"A Krueger flap needs to integrate into the entire wing," said Cornu of Cetim. "Just designing the flap isn't enough. You need to change the entire wing to make this work."

In the research community, this work is deemed to be a small but important contribution to fighting climate change.

"Today we're just redesigning a small part of the wing," said Cornu. "But the lessons learned can be used for a lot of components of the aircraft. What we're doing here has the potential to radically change how aircraft work."

More information: SWING
FLHYSAFE EU-funded research and innovation in air transport

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