


# Smooth Move



Atmospheric turbulence is an unsolved problem for aviation, affecting economy, safety and comfort. To date, there has been no practicable solution to this other than long-distance detours or hold on and fly through. **Kreisha Ballantyne** takes a closer look.



**T**urbulence Solutions emerged from a research project at the Vienna University of Technology and is headquartered in Vienna, Austria. The company aims to provide a patented technology that is able to reduce the negative effects of turbulence by more than 80%. The system can be used in advanced air mobility (AAM), light aircraft and airliners.

The Vienna-based startup aims to tackle turbulence by combining sensors, lidar, and smart flight control software to measure, predict and smooth out the bumps before they hit.

Turbulence Solutions is taking on a problem that's only getting worse. A recent study from the University of Reading found that severe turbulence over the North Atlantic has jumped 55% in the past 40 years, driven by climate change. And it's not just a blip—NASA warned in March that by 2050, clear-air turbulence

could double in frequency, with average intensity climbing by 10 to 40 percent.

Flights are frequently rerouted mid-air to dodge turbulence—which means more fuel burn and, in turn, higher carbon emissions. As turbulence increases with climate change, so too does the industry's environmental impact.

That's where the Turbulence Cancelling System could make a real difference, delivering up to 10 percent in fuel savings. Scaled across the industry, that adds up to a meaningful cut in emissions.

### How does the Turbulence Cancelling System (TCS) work?

The patented technology works in a similar way to the already established noise cancelling systems. Based on targeted

counter deflections of control surfaces, the disruptive effects of turbulence, such as vertical acceleration, can be reduced by more than 80%.

The system essentially creates counter turbulence to steady an aircraft's motion as it flies. To do this, Turbulence Solutions installs sensors and small flaps to the aircraft's wings. The flaps quickly generate vertical lift to counteract turbulence when needed. By quickly adjusting, they deflect turbulent airflow for a smoother ride.

Like noise-cancelling systems, counter-turbulences are generated by precise deflections of control surfaces, which are superimposed with the movement caused by turbulence and thus cancel them out.

The system's Turbulence Load Prediction function acts as a kind of "feedforward," spotting rough air ahead of the aircraft before you fly into it. Using a mix of pressure sensors and wind lidar, it measures differential pressure

in front of the wing and predicts vertical acceleration—accurate to within about  $1 \text{ m/s}^2$ , according to the company.

That information feeds into a Direct Lift Control system that tweaks the wing's shape in real time—think bird-like response—adjusting within fractions of a second to reduce flap inertia and keep the angle of attack steady. It considers not just wing root loads but vertical acceleration, pitch, roll and wing bending. It's designed to work with conventional flaps or enable more advanced wing morphing.

Contrary to the "Gust-Load-Alleviation" technology, the TCS focusses on passenger comfort and not just weight reduction or the protection of the wing/airframe structures.

### TCS in action

Tests with a manned prototype in 2021, a light and therefore very turbulence-prone, single-engine propeller aircraft (Colomban

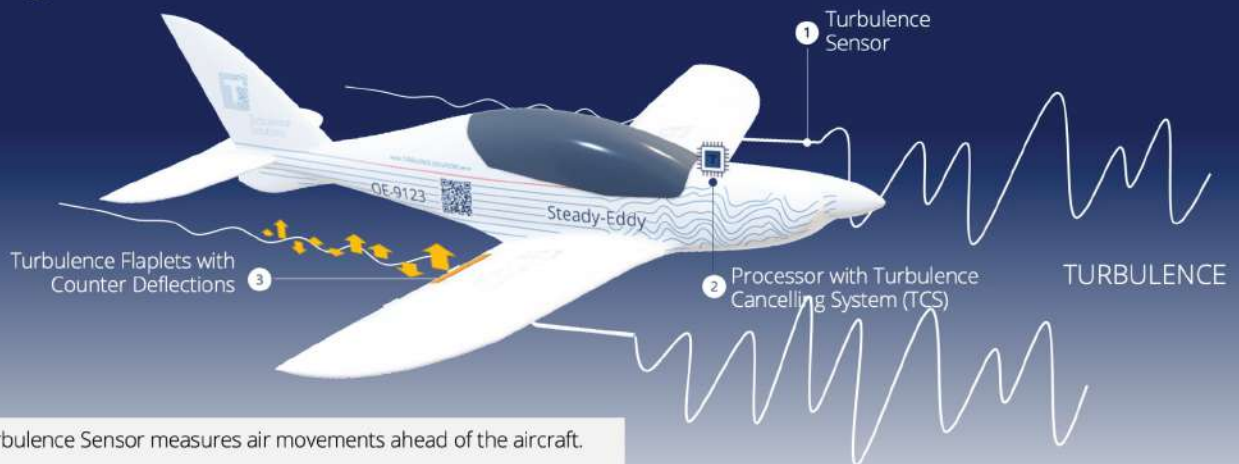


The real life, full sized Steady Eddy.

IMAGE: TURBULENCE SOLUTIONS



# Turbulence Cancelling System (TCS) for Light Aircraft (Shark 600 TCS)



- 1 Turbulence Sensor measures air movements ahead of the aircraft.
- 2 TCS calculates the resulting movement of the aircraft and determines the necessary counter-deflections.
- 3 Automatic Counter-Deflections on the Turbulence Flaplets virtually eliminate the negative effects of turbulence (> 70%).



## “Turbulence is the number one cause of injuries in commercial aviation”

MC30), confirmed these effects in practice. Since 2024, the TCS has been available as an option for the series-produced Shark 600 light aircraft.

Inventor and CEO of Turbulence Solutions Group, András Gálffy, explains: “Aircraft flying at low altitudes and thus exposed to thermal and orographic turbulence such as light aircraft, turboprops and very light business jets, can benefit from turbulence cancelling. In the future, it will be possible to fly directly and reliably through turbulence while further increasing comfort, punctuality and reducing fuel consumption.”

e-VTOL aircraft (Electric Vertical Take-off and Landing) with wings in the advanced-air-mobility market are also extremely

affected. “Extreme turbulence occurs in urban areas in particular. However, the sustainable use of the new flight services will largely depend on the acceptance of future passengers. And this is mainly supported by the feeling of safety, to which a turbulence-free flight contributes significantly,” he says.

The degree of utilisation of conventional aircraft also depends on weather conditions. “I often see that our aircraft remain on the ground when the weather conditions indicate turbulence,” explains Oliver Breiteneder, who, as president of charter company flylinz, has deep insight into the usage behaviour of sports and business pilots. “In the rarest of cases, the decisive factor is the pilots themselves, but the passengers.”

Oliver Breiteneder expects that



aircraft equipped with a TCS will have an increased utilisation and will attract new pilots/passengers.

International studies show that even light turbulence causes discomfort for most potential passengers, and for some, even fear. This is particularly important for the new market for urban air taxis.

TCS technology also offers considerable advantages in scheduled air traffic. In addition to fuel savings and increased comfort, TCS also reduces injuries. "Did you know that turbulence is the number one cause of injuries in commercial aviation?" explains András Gálffy. "More than every third accident on an aircraft happens as a result of turbulence."

## When will TCS be available?

The system is fully developed, has been tested successfully in manned test flights and is already installed optionally by a European aircraft manufacturer (shark.aero).

"This aircraft model was presented for the first time at AERO Friedrichshafen 2024. We will also start a tour with a demonstrator aircraft from this manufacturer in which you can experience the TCS technology

live in flight by flipping a switch," says András Gálffy.

The TCS was also on display at Avalon this year at the Shark Aero Stand, where I caught up with Oliver Breiteneder for a real-life demonstration. A model of the cutting-edge TCS technology was a 'mini-me' of the prototype 'Steady Eddy'. By blowing on the model's boom sensors, Oliver was able demonstrate how the technology works to

reduce turbulence in flight. Recently, the life-size Steady Eddy was delivered to its base in BadVöslau, Austria.

The technology acts as an assistance system that can be deactivated at any time. Currently negotiations are taking place with manufacturers of certified aircraft. [↑](#)

For more information, visit [turbulence-solutions.aero/](http://turbulence-solutions.aero/)



CLOCKWISE FROM BOTTOM LEFT:  
The Turbulence  
Flaplets Control Unit.

The TCS works in a similar way to the already established noise cancelling systems.

Recently, the life-size Steady Eddy was delivered to its base in BadVöslau, Austria.



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