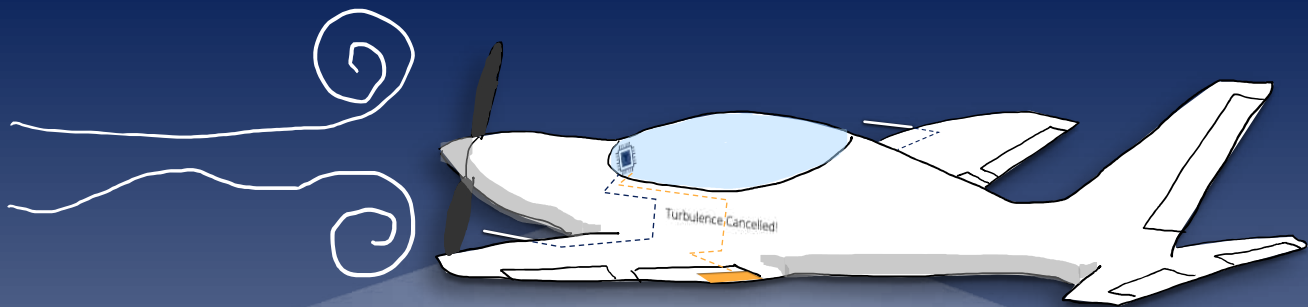


TURBULENCE CANCELLING FOR AIRCRAFT & AAM



Patented System to eliminate >80% of turbulence effects



Comfort

Smooth, relaxed flight, joy,
USP factor



Safety

Smooth flight = subjective
increased safety, less pilot
fatigue.



Economy

Fly efficient light aircraft,
with the same comfort as in
heavier aircraft.



Planning security

Feasibility even in
turbulence, higher
utilization of acft.



Maintenance

Avoidance of high g-load
events, less AOG



Performance

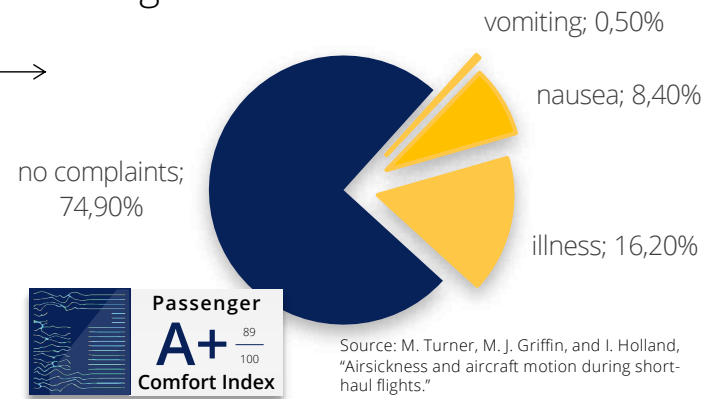
Highest performance
with light aircraft

Contact

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- "My partner/friends do not fly with me because of turbulence"
- Every 4th passenger has problems with turbulence →
- "I only fly in the morning or later evening when the air is calmer"
- "I don't fly with these light aircraft. They are like feathers in the wind. I prefer proper wing loading for smooth flights"
- "Light aircraft could be a very interesting, cost efficient and time saving alternative to scheduled flights"

Passenger Comfort



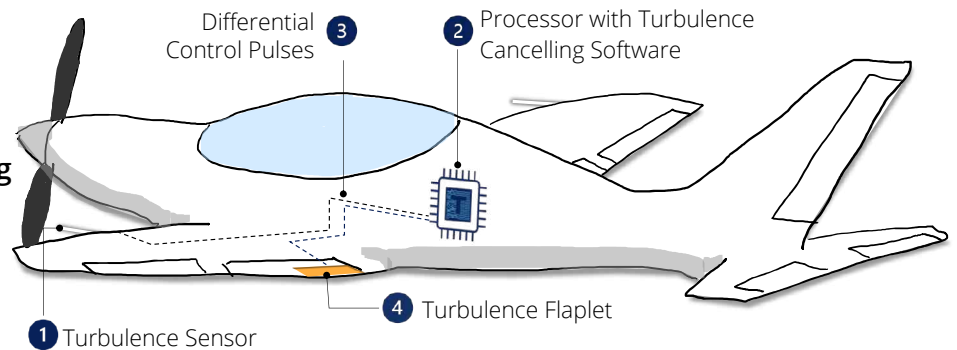
Turbulence Solutions is providing a patented technology that is able to reduce the negative effects of turbulence by more than 80%. The system can be used in advanced air mobility (AAM), light aircraft (part 23, UL, LSA) and airliners (part 25).

Turbulence Solutions emerged from a research project at the Vienna University of Technology and is headquartered in Vienna, Austria, Europe.



Components of Turbulence Cancelling

1. Turbulence Sensor
2. Processor
3. Control Pulses
4. Turbulence Flaplet



Comfort
Smooth, relaxed flight, joy, USP factor



Safety
Smooth flight = subjective increased safety, less pilot fatigue



Economy
Fly efficient light aircraft, with the same comfort as in heavier aircraft



Planning security
Feasibility even in turbulence, higher utilization of acft.



Maintenance
Avoidance of high g-load events, less AOG



Performance
Highest performance with light aircraft



Thermic Turbulence



Orographic Turbulence



Clear Air Turbulences (CAT)




"Urban Canyon" Turbulence

Get in touch with us!
www.turbulence-solutions.aero
hello@turbulence-solutions.aero

TURBULENCE CANCELLING IN 4 STEPS

1




Turbulence Assessment

We determine the achievable effects of Turbulence Cancelling on the specific type of aircraft, in example by how much the negative effects of turbulence can theoretically be reduced.

For the analysis of the Turbulence Cancelling potential and the requirement alignment, we need about 1-2 month from the transmission of the required flight model data, or the initial ID-flights.

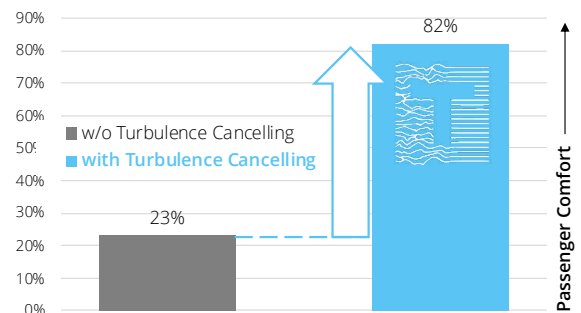
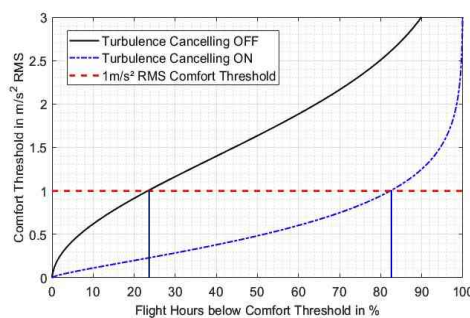
2




Conceptual Design

In the second step we determine the specific configuration for the specific aircraft type based on cost and benefit considerations. The perimeters are Flight Variables, Flight Dynamics, Direct Lift, and Turbulence Anticipation. For the preparation of the design decision, we need about 3-5 months from the order.

Flight time in "Comfort-Zone" with less than 0.3 g peak-turbulence impact increased from 23% to 82% with Turbulence Cancelling for AAM.



3



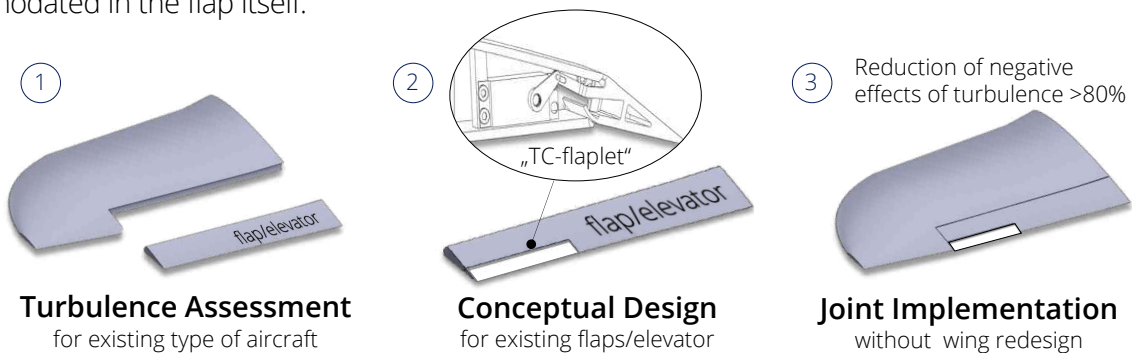
Joint Implementation

Based on the selected configuration, we work together with the OEM or MRO to develop the exact configuration and implementation for series production.

Essentially, we program the Turbulence Cancelling System (TCS) for the specific type of aircraft and support the OEM/MRO in the implementation of the components.

For this we need about 5-8 months until we have a flying prototype.

It is important to know that the aircraft or the wing does not have to be redesigned. The sensors are attached to the existing wing and the mechanics for the Turbulence Cancelling control can be accommodated in the flap itself.



4



Licensing

Then series production can start. Together we determine the pricing for the Turbulence Cancelling technology for the specific aircraft type, define the costs incurred for the installation of the components and share the additional profit.

A fair business model with very low initial investment needed.

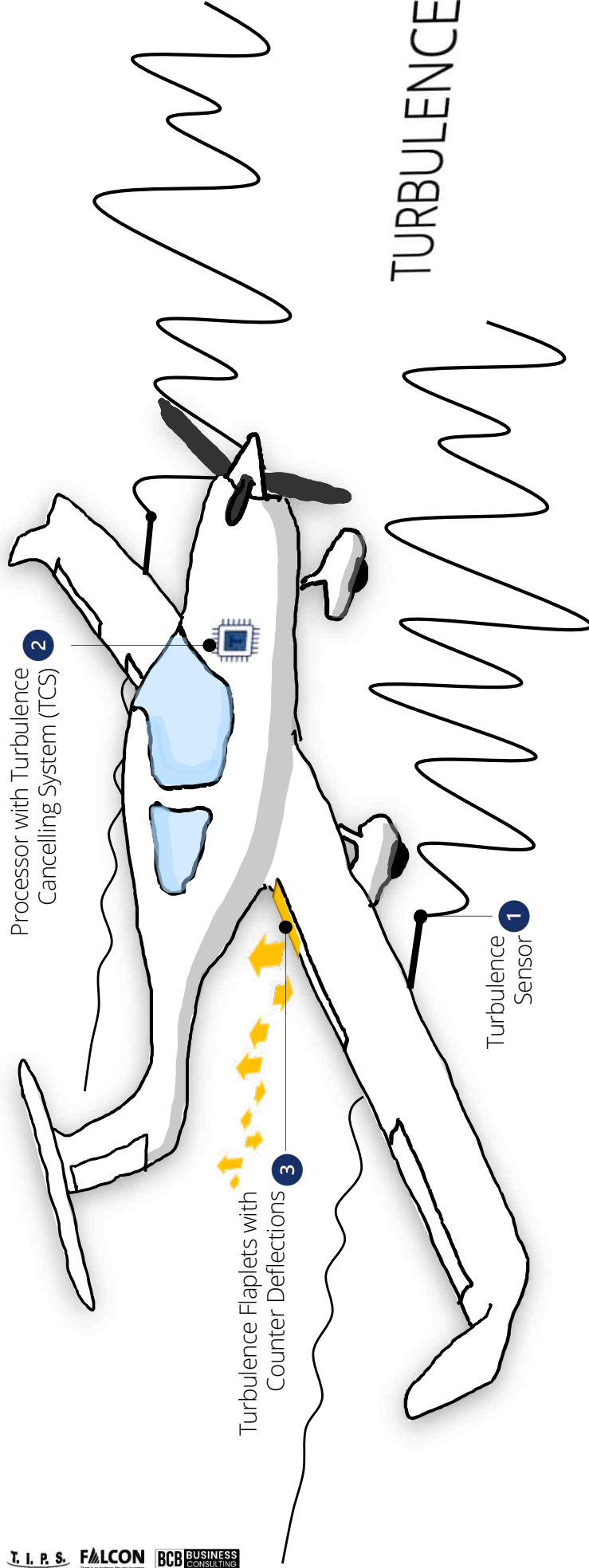
Turbulence Cancelling creates a completely new quality of flight experience, especially in light aircraft, including Turboprops, Business Jets and eVTOLs (Advanced Air Mobility).

Performance, safety, economy, planning security and comfort are just a few arguments in favor of Turbulence Cancelling. Make flights turbulence-free!

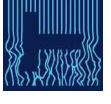


Turbulence Cancelling System (TCS)

Light Aircraft



- 1 Turbulence Sensor measures air movements ahead of wing.
- 2 TCS calculates the resulting movement of the aircraft and determines the necessary counter-deflections.
- 3 Automatic deflections are made to Turbulence Flaplets to nearly eliminate (>80%) the effects of turbulence.



TURBULENCE SOLUTIONS GROUP

Turbulence Solutions was founded in 2018 by DI Andras Galffy as part of his research work at the Vienna University of Technology, Austria, for the initial purpose of patent registration and further development of the technology through research collaborations. Since 2021, the focus has been on product- and, most recently, on market-development.

MANAGEMENT & SHAREHOLDER

A dedicated management team with decades of experience leads the successful development of Turbulence Solutions Group. Funding is based on subsidy programs (Republic of Austria) and through equity capital. The company is 100% owned by management.



DI Andras Galffy: CEO, Head of Research and Technology; 87% shares

Andras, the inventor, researcher and founder of Turbulence Solutions. As part of his studies at the Vienna University of Technology, he carried out basic research work on turbulence suppression and expanded the approach in his PhD studies. Lecturer at university (Joanneum, Graz). He holds several flight licenses (CPL/IR)



Dr. Robert Mühlbacher: Head of Product Management, Certification and QM; 8% shares

Experienced enterprise system architect and developer; In his 35 years of professional experience, he has worked on a large number of projects, primarily in IT-roles. Lecturer at university (WU, Vienna). Focus on aviation since 2018. Currently in training for Private Pilot License.



Oliver Breiteneder, MBA: Head of Business Development and Markets; 5% shares

Oliver brings in decades of experience in top management, over 30 years of experience in commercial banking, President of flylinz - Flugschule Linz (ATO), Senior Partner of a management consultant company. He studied economics and aviation management and lectured at universities. Pilot (PPL/IR) since 2003.

COMPANY STATUS

After successful manned test flights on a fixed-wing aircraft (proof of concept, FFG project SmartWings) in 2021 and the successful granting of US and EU patents, Turbulence Solutions aesent the technology to the international aviation market. To ensure rapid implementation, a particular focus has been placed on the light aircraft sector, and particularly on the European Ultralight Aircraft market (fast approval process, high benefit for high performance but light aircraft). Since 2024, the Turbulence Cancelling System can be selected as an option in series production of an European high-performance Ultralight Aircraft.

At the same time, great interest in the area of Advanced Air Mobility (AAM) has been discovered, as quality of flight, and in particular turbulence suppression, is increasingly seen as an enabling factor for the successful implementation of AAM operating models.

In 2023 a US subsidiary (TS Avionics, Inc.) was founded to respond to the great interest in the US-market. Currently some 13 employees are working in the group, mainly university-trained aviation engineers.

We are all united by the joy of aviation and the desire to make flights turbulence-free!



STATEMENT OF OPPORTUNITY

Turbulence Solutions is looking for partners and customers who want to implement this technology in their products and in their markets.

UNIQUE DIFFERENTIATOR

Urban/Regional Air Mobility (AAM): Turbulence cancellation is a critical enabling technology that enhances passenger confidence and trust, directly supporting air taxi operational models. A smoother flight experience fosters a stronger perception of safety among passengers, which is essential for encouraging regular use of this innovative air transport solution. Consequently, Turbulence Cancelling plays a pivotal role in ensuring the long-term success and viability of the air taxi business model.

Private / Business Aviation (high-end Light Aircraft, Part 23, Microlight, LSA): Turbulence Cancelling has particularly good effects on aircraft with low wing loading and/or with wide speed ranges. Smaller, more economical and less expensive aircraft fly as stable and smooth as much larger ones. The system can be implemented as an optional extra for new orders (forward-fit) and as a retro-fit kit for subsequent upgrades of aircraft (STC).

Airliner (Part 25): Reduced turbulence increase passenger experience, enables cost- and time-savings through shorter routes (less detours) and positive impacts on maintenance and repairs. Increased passenger comfort and reduced CO₂ emissions can also be an important decision-making criterion for choosing an airline and thus offer additional sales arguments for passengers.

TRACTION & MILESTONES

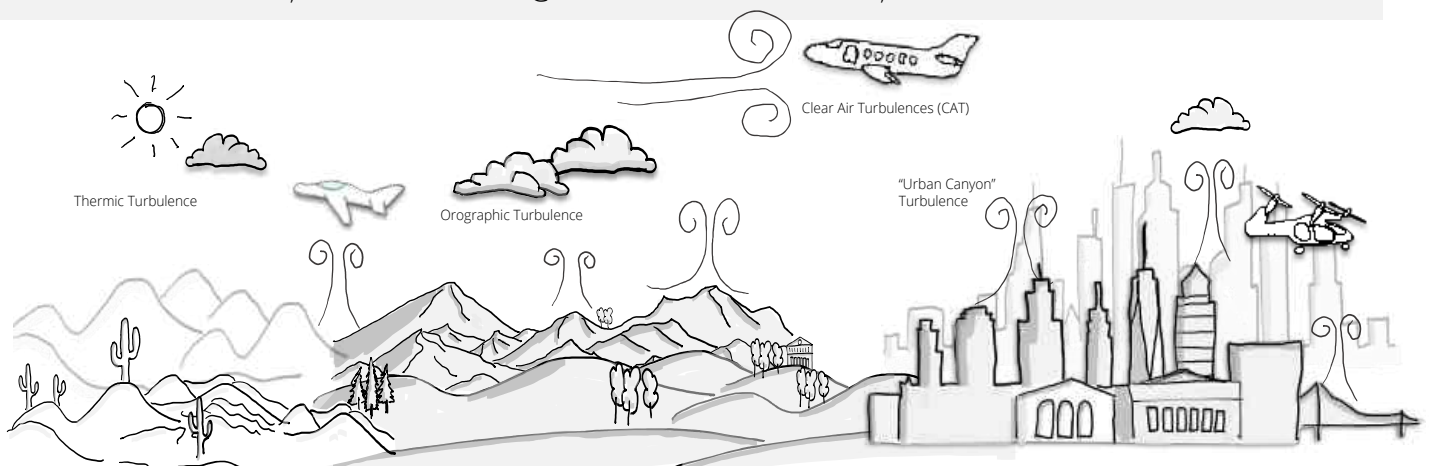
Achieved

- ✓ Manned Demonstration Flights, Q4/21
- ✓ US Patent Grant, Q2/22
- ✓ aws Seedfinancing, EUR 700k, Q3/22
- ✓ Pilot Customer (OEM), Q4/22
- ✓ FFG SmartWings 2, EUR 1.000k, Q1/23
- ✓ Founding EU/US subsidiaries, Q2/23
- ✓ EU Patent Grant, Q3/23
- ✓ Demonstrator Aircraft, Q4/23
- ✓ TCS in Series Production Q2/25



CONTACT

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- Oliver Breiteneder, oliver.breiteneder@turbulence-solutions.aero, Mobile +43 660 580 94 15



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.

The new "Turbulence-Cancelling" technology has been developed based on research at the Vienna University of Technology, Austria, and is now ready for implementation.

The patented technology works in a similar way to the already established "Noise Cancelling". Based on targeted counter deflections of control surfaces, the disruptive effects of turbulence, such as vertical acceleration, can be reduced by more than 80%. Tests with a manned prototype in 2021, a light and therefore very turbulence-prone, single-engine propeller aircraft (Colomban MC30), confirmed these effects in practice. Since 2024, the Turbulence Cancelling System has been available as an option for the series-produced Shark 600 light aircraft.

Inventor and CEO of Turbulence Solutions Group, András Gálffy, explains that "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."

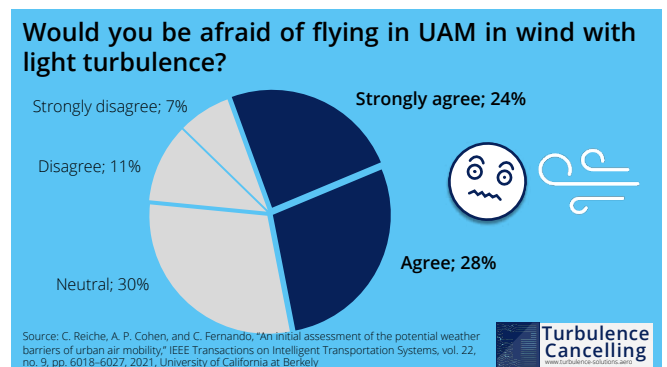
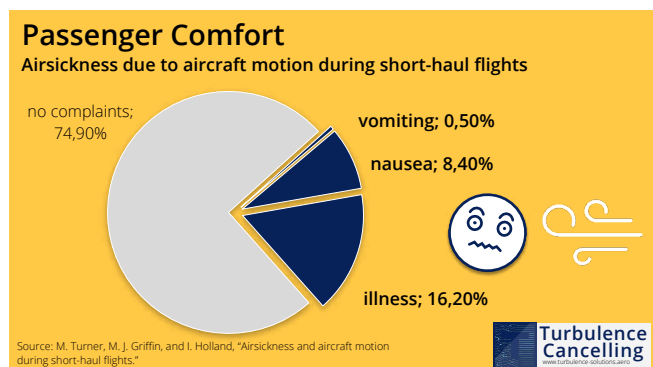
So-called e-VTOL aircraft (Electric Vertical Take-off and Landing) with wings in the Advanced-Air-Mobility market are also extremely affected. "Extreme turbulence occurs in urban areas in particular. However, the sustainable use of the new

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."

The degree of utilization 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 with an embedded flight training organization, has deep insight into the usage behavior 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 Turbulence Cancelling will have an increased utilization and will attract new pilots/passengers.

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

Turbulence Cancelling technology also offers considerable advantages in scheduled air traffic. In addition to fuel savings and increased comfort, Turbulence Cancelling 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 airplane happens as a result of turbulence."



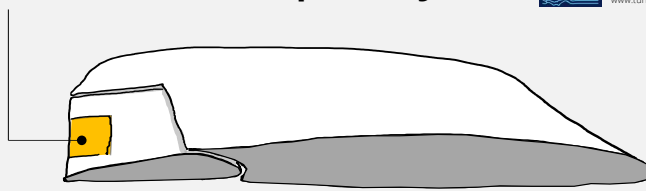
How does the Turbulence Cancelling System (TCS) work?

Like the already established 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. Contrary to the "Gust-Load-Alleviation" technology, the Turbulence Cancelling system focuses on passenger comfort and not just weight reduction or the protection of the wing/airframe structures. Turbulence Cancelling is to be offered as an option

for new aircraft, and it is also possible to retrofit existing aircraft models with this system. Especially if the Turbulence Cancelling system is already offered for the same aircraft type.

TCS can be implemented into the existing flap without the need to redesign the wing or the fuselage and it can also be integrated into an existing fly-by-wire system, provided the flaps meet the corresponding actuation requirements.

Turbulence Flaplet by



No need to redesign wing or fuselage. "Turbulence Flaplet" is implemented into the existing flap. It is mounted in a way that limits the roll moment to a level that can be easily compensated for with the primary flight controls (ailerons). Even in the very unlikely event of an asymmetrical deflection.

- **"Limited by design"**

- Flaplet can only deflect +/- 15°
- Flaplet size limits impact

- **Assistance System**

- Fail-Safe, not Fail-Operational (yet)
- Can be turned off at any moment during operation

- **Pilot in control**

- Pilot can turn off system
- Pilot can overpower system

- **Monitoring of System States**

When will Turbulence Cancelling 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 (<https://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 Turbulence Cancelling technology live in flight by

flipping a switch" says András Gálffy.

The technology acts as an assistance system that can be deactivated at any time.

Currently negotiations are taking place with manufacturers of certified aircraft (part 23, part 25).

Due to the more complex approval regulations for certified aircraft, we expect approval in approx. 3-5 years.

First aircraft in series production with Turbulence Cancelling System

Shark 600

(<https://www.shark.aero/>)

V_H 300 km/h (IAS)/162 KCAS
 Engine Rotax 912 ULS (100 HP)
 Range >1.100 km
 MTOM 600 kg



LINKS

Homepage

<https://turbulence-solutions.aero>



OSAKA, KANSAI, JAPAN
EXPO 2025



AUSTRIA
EXPO 2025
composing the future
未来を作曲

OFFICIAL PARTICIPANT

Research and Development

Technical University Vienna: <https://www.acin.tuwien.ac.at/en/project/aktive-turbulenzunterdrueckung-fuer-flugzeuge-smartwings/>

Press & Media

The Times: <https://www.thetimes.co.uk/article/the-plane-tech-that-could-make-turbulence-a-thing-of-the-past-zb62nr3kc>

ORF: <https://noe.orf.at/stories/3010796/> (German)

Salzburger Nachrichten: <https://www.sn.at/panorama/wissen/wenn-es-im-flieger-nicht-mehr-turbulent-zugeht-72858490> (German)

Die Presse: <https://www.diepresse.com/5651774/ohne-turbulenzen-mittendurch-neue-stabilisatoren> (German)

Die Krone: <https://www.krone.at/1942342> (German)

eVTOL Insights: <https://evtolinsights.com/2024/01/podcast-andras-galffy-of-turbulence-solutions-on-what-his-company-is-doing-to-tackle-in-flight-turbulence-in-aviation/>

Flying: <https://www.flyingmag.com/startup-looking-to-eliminate-turbulence-for-ga-pilots-goes-viral/>

Interesting Engineering: <https://interestingengineering.com/innovation/turbulence-solutions-aviation-industry-free>

TV

Servus TV: <https://www.pm-wissen.com/videos/aa-24murtjzd1w11/> (German)

Pro 7: <https://www.prosieben.at/serien/galileo/videos/galileo-fuer-mehr-sicherheit-und-komfort-fliegen-ohne-turbulenzen-v-2r7r032bvwk2> (German)

Fox TV: <https://www.foxweather.com/watch/play-6b8f8594b0014c5>

CNN <https://www.linkedin.com/feed/update/urn:li:activity:7259128379805683712>



Social Media

LinkedIn: <https://www.linkedin.com/company/turbulence-solutions/>

Explanations of the technology

<https://www.linkedin.com/feed/update/urn:li:activity:7029783111915712513>

<https://www.linkedin.com/feed/update/urn:li:activity:7021774118853222400>

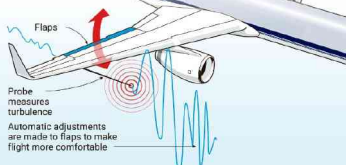
<https://www.linkedin.com/feed/update/urn:li:activity:7020787669769072640>

https://youtu.be/_4sofwudP0w (German)



Smooth flying

THE TIMES



#T50 #CodexTalks

WORLD'S TOP 50 INNOVATORS 2024

FUTURE OF MOBILITY

MAY 8 - 10 LONDON

BLANCPAIN CHICAGO BOOTH LONDON



Andras Galfy
CEO,
Turbulence Solutions



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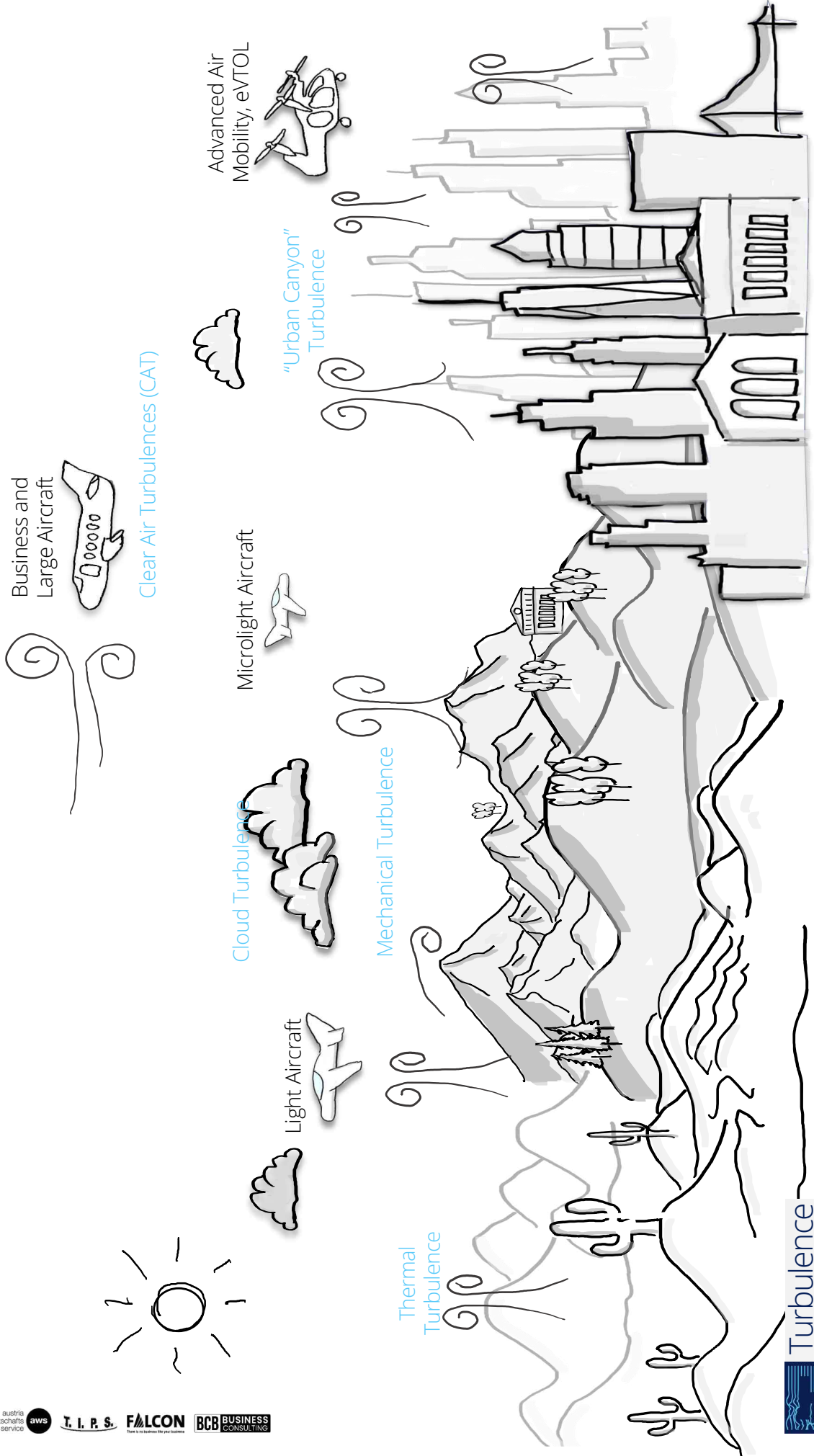
Forward-looking statements

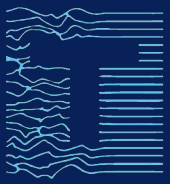
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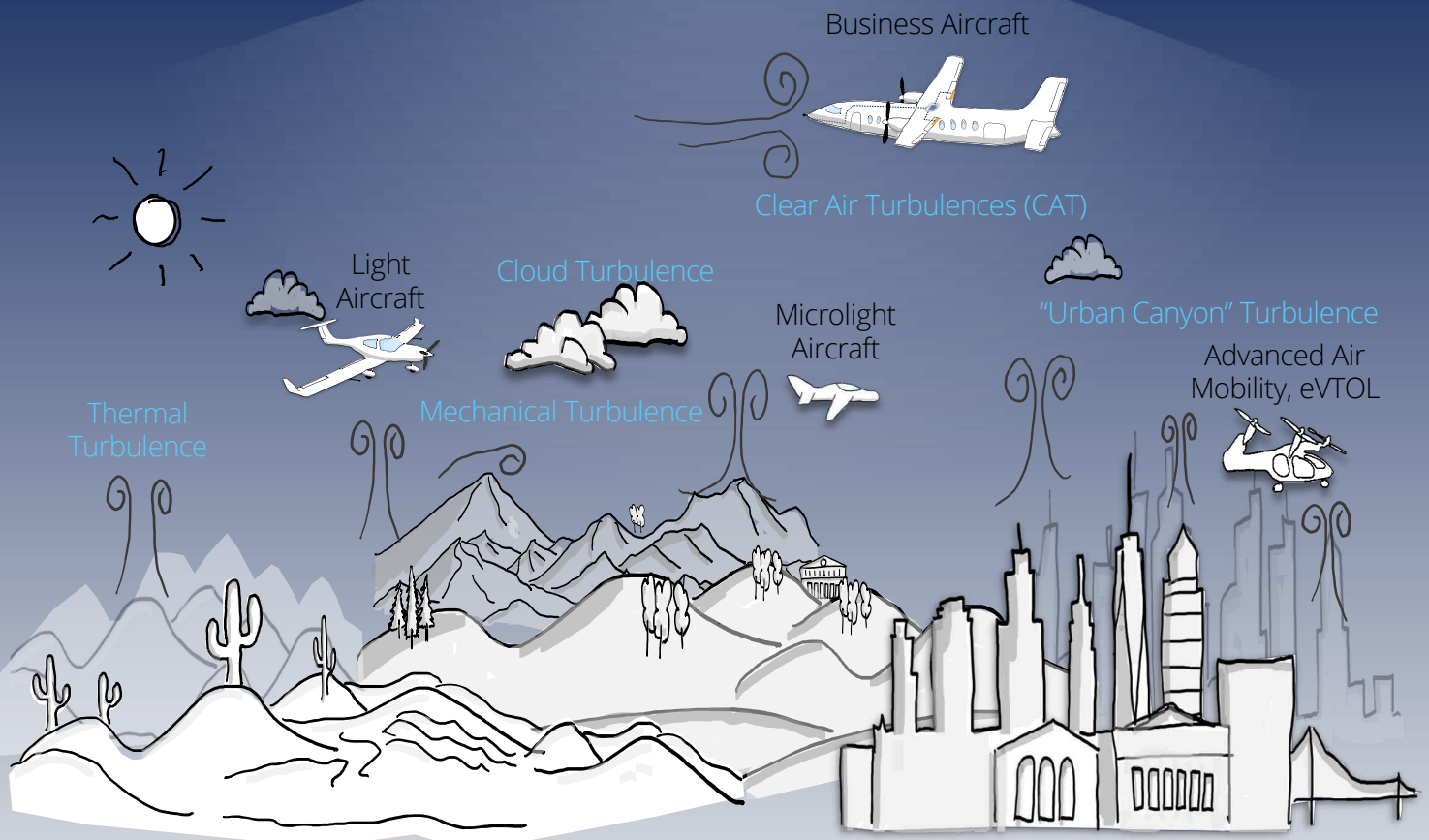
Turbulence Cancelling System (TCS)

eliminating >80% of turbulence for:





TURBULENCE CANCELLING FOR AIRCRAFT & AAM



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