Editorial for the CEAS Aeronautical Journal special issue on Active Flow Control research within the AFLoNext project

Jochen Wild¹

Published online: 17 October 2020
© The Author(s) 2020

This special issue of the CEAS Aeronautical Journal summarises articles describing results of the work packages investigating “Active Flow Control” (AFC) as part of the EU funded project AFLoNext [1]. The abbreviation AFLoNext stands for “Active Flow, Loads and Noise Control on Next Generation Wing” and was an Innovation Action in the scope of the European 7th Framework Programme. The project was conducted from 2013 to 2018 involving 40 partners out of 15 European Countries. The project scope included investigations on maturation of Hybrid Laminar Flow Control (HLFC) including a flight test with a simplified suction system at the tail of an Airbus A320 aircraft and a Ground Based Demonstrator for the complete wing leading edge integration including suction system, high-lift device and anti-icing systems concluded with an anti-icing test at the icing wind tunnel of CIRA (Italian Aerospace Research Centre). Noise-reducing technologies at the high-lift system and the landing gear have been developed and demonstrated in flight. Vibration reduction technology has been applied on landing gear doors. Beside this, Active Flow Control for separation and buffet control has been a major topic of the project.

For separation suppression, two critical areas of the wing significantly impacting the aircraft’s low-speed performance at take-off and landing have been treated, which are assumed to get more significant at modern aircraft. As engines get larger in diameter to increase the bypass ratio for fuel efficiency, the interaction with the wing shows an area just downstream of the engine significantly more prone to separation onset [2]. Within the AFLoNext AFC activity, active flow separation suppression has been investigated and demonstrated up to a full-scale wind tunnel test. The

contributions of Schlösser and Bauer [3] and of Weigel et al. [4] describe the development of AFC actuators on aircraft scale, which have been implemented in the demonstration test.

Second, the design of wing tips with non-straight plan-forms prevent the inclusion of high-lift systems in this area and bear the risk of early flow separation. As this can take place at flight condition, suppressing flow separation benefits not only the generation of lift but also the reduction of drag during take-off and initial climb. The contribution of Rosenblum et al. [5] summarises design and simulation activities to identify the best suited way to suppress early wing tip separation by means of AFC.

In the high-speed regime, flow separation control for buffet onset suppression offers benefits on the overall aircraft level either in speed flexibility or in wing weight reduction. The contribution of Sartor et al. [6] provides an insight into a benchmark activity for validation and calibration of numerical simulation tools for buffet onset suppression influenced by AFC. This contribution has been awarded the EREA Best Paper Award 2019 as it reflects a collaborative action involving most European research institutions in aerodynamics. By having calibrated simulation tools, the following collaborative design activities provided good insight into the benefit of buffet suppression up to an assessment on full aircraft level.

Concluding the project activities in the domain of Active Flow Control, the project results have been disseminated within the scope of the 6th CEAS Conference in 2017 at Bucharest. Three Special Sessions with a total of 13 presentations were provided summarizing the conducted research. From these contributions, the most valuable have been progressed towards full paper contributions to the CEAS Aeronautical Journal, which are now published by this special issue.

✉ Jochen Wild
jochen.wild@dlr.de

¹ German Aerospace Center (DLR), Institute of Aerodynamics and Flow Technology, Lilienthalplatz 7, 38108 Brunswick, Germany

Acknowledgements The AFLoNext project was supported by the European Community's Seventh Framework Programme FP7/2007-2013, under Grant agreement no. 604013.

Funding Open Access funding enabled and organized by Projekt DEAL.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

References

1. AFLoNext project, public web-site. <https://aflonext.eu> (2020). Accessed 7 Oct 2020
2. Fricke, S., Ciobaca, V., Kröhnert, A. et al.: Active Flow Control Applied at the Engine-Wing Junction, 5th CEAS Air & Space Conference (2015). https://aerospace-europe.eu/media/books/CEAS2015_249.pdf
3. Schlösser, P., Bauer, M.: Design of a pulsed jet actuator for separation control. CEAS Aeronaut. J. (2018). <https://doi.org/10.1007/s13272-018-0328-x>
4. Weigel, P., Schüller, M., Lipowski, M., et al.: Design of a synthetic jet actuator for flow separation control. CEAS Aeronaut. J. (2020)
5. Rosenblum, J.P., Vrchota, P., Prachar, A., et al.: Active flow separation control at the outer wing. CEAS Aeronaut. J. (2019). <https://doi.org/10.1007/s13272-019-00402-4>
6. Sartor, F., Minervino, M., Wild, J., et al.: A CFD benchmark of active flow control for buffet prevention. CEAS Aeronaut. J. (2019). <https://doi.org/10.1007/s13272-019-00415-z>

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.