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Title

Progress Summary of H2020-project FALCon

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Abstract

The innovative approach “in-air-capturing” for the efficient return of reusable space transportation vehicles has been refined in the EC-funded H2020-project FALCon. Following the basic idea, winged stages are to be caught in the air and towed by subsonic airplanes back to their launch site without any necessity of an own propulsion system [1]. This patented procedure called in-air-capturing is a special form of mid-air retrieval.

The project FALCon (Formation flight for in-Air Launcher 1st stage Capturing demonstration) funded in Horizon 2020 and running from 2019 until 2022 has achieved significant progress. The project finished after 45 months in November 2022 has addressed three key areas:

- “in-air-capturing”-Development Roadmap and economic benefit assessment
- “in-air-capturing”-Experimental Flight Demonstration
- “in-air-capturing”-Simulation (subscale and full-scale)

A systematic assessment of different RLV-return and recovery options demonstrates that in-air-capturing (IAC) offers the best performance and at the same time allows minimum environmental footprint for all medium to large launch systems. The advantage of IAC compared to VTVL is confirmed for different propellant combinations with an even more dominant edge in case of hydrocarbon fuels because of the lower engine Isp compared to the LOX-LH2-combination. All results from these studies indicate that in-air-capturing is highly attractive from a launch-cost perspective.

The 9th EUCASS-conference in 2022 dedicated a full session to detailed presentations of all major areas of technical progress achieved in the project (see [2] and additional papers listed in this reference!). With the FALCon-project now been finished, the paper provides a retrospective progress summary. The successful establishment of significantly refined simulation models and the definition of the development roadmap for the next steps in technology maturation are presented. Further, lessons learned from the complex authorization process of the UAVs to be used in the lab-scale flight demonstrations are discussed. Finally, an outlook on the intended follow-up activities is given, including an estimate of the relatively modest investments required.

References

- [1] Sippel, M.; Stappert, S.; Bussler, L.; Krause, S.; Cain, S.; Espuch, J.; Buckingham, S.; Penev, V.: Highly Efficient RLV-Return Mode “In-Air-Capturing” Progressing by Preparation of Subscale Flight Tests, 8th EUCASS, Madrid July 2019, [Download Link](#)
- [2] Sippel, M.; Stappert, S.; Singh, S.: “RLV-Return Mode “In-Air-Capturing” and Definition of its Development Roadmap”, 9th EUCASS, Lille, June 2022, [Download Link](#)