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### Title

## Design of the Scramjet Hypersonic Experimental Vehicle

### Authors

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### Abstract

In the frame of the “SPACE-IPERSONICA-TEC” project, funded by the national program PRORA and “Research and Development of a hypersonic demonstrator”, co-funded by the Italian Aerospace Agency (ASI), the Italian Aerospace Research Center (CIRA) is working at the design of a propelled hypersonic demonstrator, the Scramjet Hypersonic Experimental Vehicle, and its flight experimental mission.

The paper presents the feasibility analysis performed for the definition of the flight mission where different launch scenarios have been considered. The result is an air-launch based on the use of a carrier aircraft and of a launch vehicle capable of guiding the demonstrator to the target altitude and velocity of the flight experiment.

Starting from this analysis, the launch vehicle has been preliminarily defined and sized.

At the same time, work has been done on the development of the demonstrator configuration, which takes advantage of the experience and the configuration study carried out in the two EU co-funded projects HEXAFLY [1] and HEXAFLY-INT [2].

A first assumption on the scale of the demonstrator has been done, and its materials layout, its avionics, airframe and the components of propulsive subsystems, including the on-board fuel tanks (hydrogen) for the scramjet engine properly sized, are presented.

Finally, various points along the trajectory have been simulated using CFD for the purpose of verifying the aeropropulsive balance and defining the aerothermal loads and aerodynamic coefficients which will be used for the flight mechanics analysis and trajectory calculation, and for the thermal analysis.

The previous points have allowed for the definition and assessment of a first set of system and mission requirements.

### References

- [1] J. Steelant et al., “Conceptual Design of the High-Speed Propelled Experimental Flight Test Vehicle HEXAFLY”, AIAA-2015-3539, 20th AIAA International Space Planes and Hypersonic Systems and Technologies Conference, Glasgow, Scotland, U.K., July 6-9, 2015.
- [2] Di Benedetto S., Di Donato M.P., Schettino A., Scigliano R., Nebula F., Morani G., Cristillo D., Marini M., Cardone S., Steelant J., Villace V., “The high speed experimental flight test vehicle of HEXAFLY INT: a multidisciplinary design”, CEAS Space Journal, published online on 5 January 2021, DOI: 10.1007/s12567-020-00341-5.