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Hydrogen Drone Research Aircraft

Photo: HYDRA test flight

Problem area

By its high specific energy and zero-emission, hydrogen, in case produced from solar or wind power, is considered as a ideal solution for sustainable aviation. However, a major disadvantage is that hydrogen requires bulky and heavy storage in the form of high-pressure or cryogenic tanks that largely counterbalances the high specific energy advantage. Hydrogen is also extremely reactive and therefore requires appropriate safety measures to eliminate the risk of explosions. Despite these difficulties, hydrogen systems offer significant advantages for electric aircraft compared to batteries as demonstrated by the hydrogen drone project HYDRA (HYdrogen Drone Research Aircraft), see Figure. It was initiated by the Royal Netherlands Aerospace Centre NLR to gain, at a relatively low cost level, practical experience with fuel cell systems for aviation as well as know-how about drone platform optimization, hydrogen infrastructure, test facility for ground performance testing and flight demonstrations.

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Description of work

One of the objectives of HYDRA, described in this paper, is to demonstrate significantly increased endurance with respect to batteries. The explosion safety analysis and associated hardware modifications are described.

Results and conclusions

An initial flight test with HYDRA-1A, performed in October 2019 at NLR's Drone Test Centre, demonstrated 39 minutes endurance with a small hydrogen tank. With relatively minor modifications, it is expected that 90 minutes endurance is demonstrated early 2020 (HYDRA-1B).

Applicability

For HYDRA-2, planned in 2020, a further extension of the endurance up to several hours will be demonstrated, with a similar hydrogen power system mounted on a Vertical Take Off and Landing (VTOL) fixed-wing drone.

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