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Unmanned Aerial Vehicle for Delivery of Low-Pressure Hydrogen Gas

The common approach for transportation of hydrogen - the least dense of all gasses - is to substantially densify it so it can economically suit existing transportation modes. Densification is achieved by compression (up to 700 bar), by liquefaction (cooling below -253 °C), or by chemical conversion. Conventional hydrogen transportation methods often require a sizeable investment in infrastructure. Not only does the transport require construction of a pipeline or the existence of a highway, the endpoints of a traditional hydrogen transport chain require specialized facilities at one or both endpoints for the purposes of compressing, liquefying, and/or chemically converting the hydrogen. This represents an additional cost above and beyond the investment required for typical petroleum-based combustible fuel or other competitive alternatives. These infrastructure requirements mean that establishing a new hydrogen supply chain can require a large investment in time and resources.

Researchers at Arizona State University have developed an unmanned aerial vehicle for transporting comparatively low-pressure hydrogen. Compared to ground-based transport of highly densified hydrogen, this vehicle substantially reduces infrastructure and operational costs through decreased labor requirements and high payload ratios. By enabling hydrogen delivery in scenarios currently considered technically or economically challenging, this vehicle may significantly expand hydrogen usage and markets.

H2UAV: Current prototype using a conventional airframe (left), and the next stage 100 kg H2 class conceptual design (right).

Benefits and Advantages:

- Cost effective
- Much less hydrogen compression (less than 100 bar) required compared to state-of-the-art
- No need for hydrogen liquefaction
- No chemical conversion needed (unlike chemically-bound shipping methods)

- Fast deployment times due to bypassing of ground-based infrastructure
- Geographically versatile and flexible operation - local to global hydrogen delivery
- Low fuel consumption per ton mile
- Payload ratio well in excess of that in compressed gas trailers
- Added safety due to comparatively low-pressure tanks at ambient temperature, separation from objects and people, and adoption of time-tested protocols from the airline industry