PhoenixH2: Improving Commercial Viability of Sustainable Aviation by Developing and Flight Testing a Clean Aircraft With Onboard Hydrogen Generation

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PhoenixH2 is dedicated to enhancing the feasibility of clean aviation by developing and flight-testing a small-scale aircraft powered by onboard hydrogen production. With aviation responsible for nearly a billion metric tons of CO2 emissions each year, alternative fuel strategies are urgently needed. This study explores the application of Liquid Organic Hydrogen Carriers (LOHCs), particularly Dihydrolevoglucosenone (Cyrene™), as a stable and practical method for hydrogen containment. Unlike traditional cryogenic systems, Cyrene™ enables hydrogen to be stored safely at ambient temperatures, removing the need for bulky insulated tanks. The project included hydrogen synthesis experiments, computational fluid dynamics modeling, and flight tests using a modified mini-jet engine to test LOHC combustion performance. Findings confirmed that Cyrene™ provides a well-rounded solution in terms of efficiency, safety, and scalability. When scaled to industry-standard aircraft dimensions, the prototype aircraft achieved a peak thrust of 260,000 N, exceeding the reference hydrogen aircraft by 4%. Estimates indicate a 9.1% increase in seating capacity and a much safer experience for passengers due to reduced risk of leaks, stress, and failure. Additionally, using Cyrene™ as a hydrogen storage solution can significantly increase airline revenue by increasing passenger capacity and reducing infrastructure costs by eliminating the need for cryogenic storage and refueling systems and simply using existing infrastructure. This research shows that LOHC fuels can overcome the issues with liquid hydrogen systems, offering a safer and more scalable solution for decarbonized flight. Future work will focus on improving the hydrogen weight percentage of the fuel and testing on full-scale prototypes

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