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Abstract #XXX *(to be filled by the organizers)*
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Corresponding author: NANGIA, Raj
nangia@blueyonder.co.uk
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# Developing Certifiable Liquid Hydrogen "Gondola" Airliner, Design Innovations & Challenges

**Authors :** ***Dr. Raj NANGIA [1]*, Mr. Les HYDE [2], Prof. Jonathan COOPER [3]***

** Corresponding author*
*[1] University of Bristol, Consulting, BRISTOL, UK,* ***nangia@blueyonder.co.uk***
*[2] Consulting, Welwyn Garden City, UK, e-mail*
*[3] Sir George White Professor, Aerospace, University of Bristol, Bristol, UK, e-mail*

## Abstract

***Environmental*** *considerations* are focusing attention towards using LH2 designs for commercial aircraft. But LH2 has unwanted properties, being cryogenic, low density and potentially explosive near Oxygen. Thus, aircraft designs incorporating LH2 must be innovative, with safety / certification issues being paramount [1, 2].
For LH2 designs, low energy density / unit volume and heavy cryogenic tank requirements incur performance penalties compared to kerosene or SAF powered aircraft. Overall, the flight experience with LH2 is very limited, in particular knowledge gaps exist on safety and hence significant work is required on the technology implementation.
***Bearing in mind the LH2 Certification & Crashworthiness Issues,*** the obvious over-arching constraint is that LH2 containment and pipes etc. must be well separated from the passengers (ground or air), with evacuation exits not being obstructed. The aircraft structure should be able to survive engine disc-failure or tail scrapes, and the configuration must respect emergency landing regulations including undercarriage collapse or hitting objects on runway. None of the previously publicised [3-6] LH2 airliner configurations appear to satisfy the certification / crashworthiness criteria.

***This paper will consider the "Gondola" Concept, Fig.1 which*** represents a medium-range, LH2 powered airliner (160 seats capacity, c.f. A320-Neo). A **twin-fuselage** layout features one fuselage with passengers and the other with fuel tanks. The clear advantages of the concept in passenger experience, crashworthiness, evacuation, fuel management, ground handling are considered including CFD simulations and load computations, **Fig.1**. including further optimisation and balance of the wing planform. The updated efficiency metrics for LH2 aircraft are compared with conventional aircraft, signifying a vision of future. As a reminder, asymmetry is not unusual and Twin-Fuselage layouts are "ever-green" and feasible in structural / Aeroelastic terms, **Fig.2** (just a challenge for systems). Several areas of future theoretical / experimental work are suggested for continuing development of the concept.

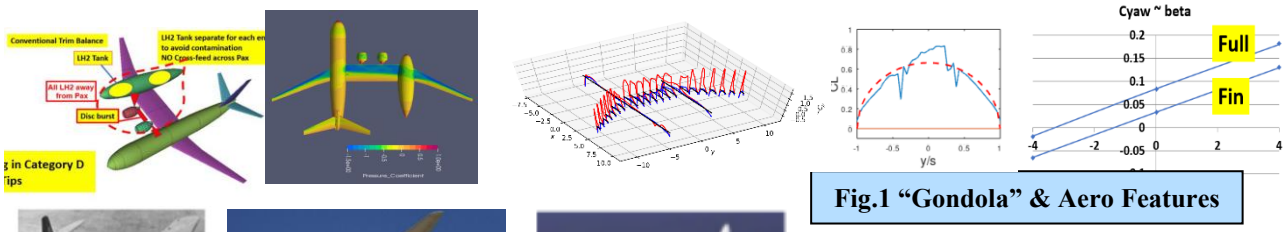


**Fig.1 "Gondola" & Aero Features**

**Fig.2 Asymmetric & Twins**

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