## TRACK 2: UAV

# ""HOW TO PREVENT A HYBRID VTOL FIXED-WING UAV FROM FLIPPING?" AN AERODYNAMICS PERSPECTIVE"

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## ABSTRACT

A hybrid VTOL Fixed-Wing UAV taps on the long endurance of a fixed-wing aircraft, while exploiting VTOL capability for launch and recovery. The aerodynamics of both platform types are fairly well-understood separately, but when operated on the same platform at the same time, the result is not simply the sum of its parts. This study seeks to characterize the aerodynamics of such a hybrid system, in order to improve flight dynamics prediction and better support flight control design.

Wind tunnel experiments and computational fluid dynamics (CFD) were used to study the aerodynamics of the UAV during its transition between VTOL and fixed-wing flight. Wind tunnel tests of a scaled model were performed to understand the key physics phenomenon and provide a validation case for CFD. Reynolds-averaged Navier-Stokes (RANS) turbulence modelling was used with two different setups – (1) an unsteady sliding mesh approach with full aircraft and rotor geometry, and (2) a momentum source approach that does not require detailed rotor geometry. A CFD-based aerodynamic model was built and implemented in a 6 degrees of freedom (6DoF) simulation for verification against flight trial results. The inclusion of these interference effects showed a marked improvement between simulation and flight trial results.

## BIOGRAPHY OF SPEAKER

Mr Goh Chian Yeh is an aerodynamics engineer at DSO National Laboratories. He works on external aerodynamics design and analysis, and has experience in both computational fluid dynamics and wind tunnel testing. He has been involved in the design and analysis of several UAVs, including fixed-wing and hybrid VTOL fixed-wing platforms.

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