**Parametric Aerodynamic study of the Cargo UAV based on Blended Wing Body Configuration**

Reni Varghese1, Dr. Santosha Kumar Dwivedy\*2

1Department of Design, IIT Guwahati, India

**2** Mechanical Engineering Department, IIT Guwahati, India

E-mail: vreni@iitg.ac.in, dwivedy@iitg.ac.in

**Abstract**

The Unmanned aerial vehicle (UAV) market is rapidly growing, and it is expected to triple in the 21st century from the current annual $4 billion to $14 billion (Zaloga et al.,2015). In the current scenario, there is a massive demand for UAVs, especially Cargo UAVs. One of the most efficient configurations is the Blended-Wing Body (BWB). It is a fixed-wing aircraft consisting of an outer section (wing), an Inner section (fuselage), and a middle section (in between section) in which the fuselage smoothly connects (blends) into the wing geometry. It has numerous advantages like less fuel consumption, large internal volume, high Aerodynamic efficiency, elliptic lift distribution, and lower operating expenses than traditional design configuration (Liebeck 2004, Smith 2000, NASA fact sheet, Airbus).

Hardly any parametric study is available in low subsonic speeds for Cargo UAVs based on BWB configuration. Due to this lack of data, the designer finds it challenging to design and draw the layout of BWB for Cargo UAVs for a low subsonic speed regime. Another challenge for the designer is that some of the traditional methods used for conventional configurations can only be used for BWB configuration with modifications. Therefore, the present study deals with the Parametric Aerodynamic study of the Cargo UAV based on the Blended-Wing Body configuration for a low-speed regime. This study will explain the effects of some of the essential parameters which affect the optimum performance and layout design for this category of BWB.

CFD methodology is employed to calculate the critical Aerodynamic design parameters like sweep angle, lift-to-drag ratio, Aspect ratio, Etc. The CFD analysis was carried out using the ANSYS CFX commercial software. To ensure high accuracy, the Reynolds-Averaged-Navier-Stoke (RANS) equations were solved, coupled with a low-Reynolds turbulence model. The Spalart-Allmaras and k-omega SST turbulence models were used as they are reliable for external flow conditions. This study showed that a higher sweep angle leads to a lower lift curve slope. It also showed that the lift curve slope and lift-to-drag ratio increase by increasing the Aspect ratio. Current work provides insights about the BWB Cargo UAV Aerodynamic design parameters for low speeds and its aerodynamic benefits. These parameter details will provide trends to the designers for designing BWB Cargo UAV at low speeds.

**Keywords:**Blended Wing Body, Cargo, Unmanned Aerial Vehicle

**References**

S.J. Zaloga, D. Rockwell, P. Finnegan, “World Unmanned Aerial Vehicle Systems Study – 2015 market profile and forecast”, Teal Group Corporation.

R. Liebeck, Design of the blended wing body subsonic transport, J. Aircraft. 41 (1) (2004) 10– 25.

H. Smith, College of aeronautics blended wing body development program, in: ICAS Congress, 2000, pp. 1–10.

[NASA - Blended Wing Body Fact Sheet](https://www.nasa.gov/centers/langley/news/factsheets/FS-2003-11-81-LaRC.html)(Accessed on 19/4/2023)

[www.airbus.com/en/newsroom/press-releases/2020-02-airbus-reveals-its-blended-wing-aircraft-demonstrator](https://www.airbus.com/en/newsroom/press-releases/2020-02-airbus-reveals-its-blended-wing-aircraft-demonstrator)(Accessed on 19/4/2023)