Comparison of high camber airfoil with high lift devices in light unmanned aerial vehicles

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Abstract:

This work will discuss the issues and efficiency problems related to the usage of high lift solutions in unmanned aerial vehicles. Such devices and relatively high camber airfoils used especially in low Reynolds number flow had been analyzed.

Unmanned aviation is significantly different from manned aviation in few important features such as strength characteristics and aerodynamic characteristics. Unmanned aerial vehicles are usually built with bigger safety factor than in any other aircraft. Airfoils used in UAVs are not commonly used in passenger aviation or any other type of aircraft due to small efficiency at high Reynolds flow number. This phenomenon is caused by the low ratio between inertial and viscous forces within the fluid in comparison with normal aviation where the Reynolds number during the flight is higher. This situation allows using airfoils with bigger camber than the ones occurring in passenger aviation. The difference between the efficiency of each airfoil at various values of Reynolds number within the flow was discussed. The lift coefficient characteristics were compared for the typical Reynolds number for the take-off of a UAV and general aviation aircraft as shown in figure one.

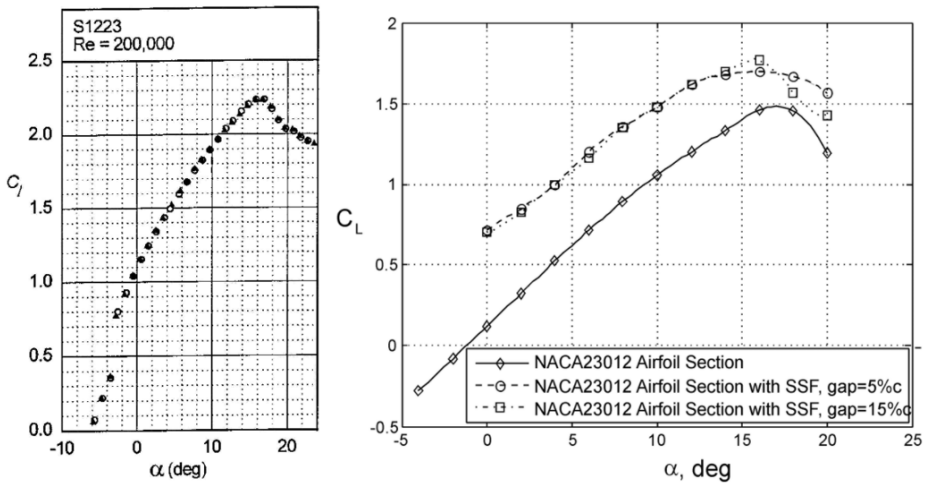

Figure 1 - Comparison of lift coefficients of high camber airfoil and low camber airfoil with flap

As seen from characteristics the maximum lift coefficient is greater in the case of high camber airfoil than a commonly used airfoil in general aviation with the flap improvement.

In this work, the difference between high camber and widely used airfoils with flaps was carried out. Taking into account the benefits coming from not applying wing mechanization such as lower mass was also discussed and taken into account during comparison. The difference in aerodynamic characteristics was also discussed in the field of devices that can cause such change. The increase in the mass of a wing of an unmanned aerial vehicle is not desired as we can perform all flight stages using high camber airfoil.

The analyses of this research were focused on finding the best possible solution for increasing lift in unmanned aerial vehicles.

[1] https://www.researchgate.net/
[2] Anderson, John D. *Fundamentals of Aerodynamics.* 3rd ed. New York, NY: McGraw-Hill, 2001. ISBN: 0072373350