3D Simulation of Wing fitted with Vortex Generators

Tanapat Paiboolsirichit
Defence Technology Institute
Nonthaburi, Thailand
tanapat.p@dti.or.th

***Abstract*—This paper uses wing characteristics from the Half Scale Unmanned Arial Vehicles (UAV) designed by Defence Technology Institute (DTI). It also demonstrates results from both plain wing and wing fitted with VGs simulation using a commercial Computational Fluid Dynamics (CFD) program. VGs designing processes (sizing and installed position) are also designed according to historical data. Furthermore, six different VGs configurations are tested to find effects to the wing aerodynamics. Stall angle, lift coefficient (CL), and drag coefficient (CD) are obtained through CFD, and they will be discussed.**

***Keywords*—Vortex generators, CFD, 3D simulation, Aerodynamics, Lift coefficient, Drag coefficient**

I. Introduction

Short take-off is a critical capability for aircrafts that operate from an airfield with short runways. Many designs and approaches have been researched and proposed to provide such capability to modern aircrafts. Vortex Generators (VGs) are one of the most common design features that can shorten the take-off distance by enhancing aerodynamics characteristics of the wings.

The concept of VGs is to create turbulence flow by inducing high energy air from the outside boundary layer into the low energy boundary layer near the surface which can be used to reduce the boundary layer height resulting in delayed flow separation as shown in figure 1. This concept is similar to the pinned holes on a golf ball. Consequently, this phenomenon can put to good use on a wing by increasing both stall angle and CL resulting in shorter take-off distance [1].

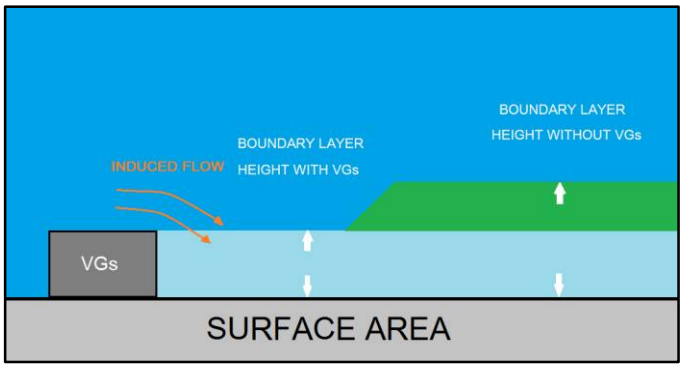

Fig. 1: VGs concrept

Fig. 2: VGs on RAF Javelin fighter [2]

Fig. 3: VGs on Stewart Headwind aircraft [3]

VGs technology is not a new thing and, in fact, it has been implemented on many well known aircrafts such as RAF Javelin fighter and Steward Headwind shown in figures 2 and 3. The benefits of VGs are not only increasing CL but also improving the effectiveness of control surfaces [4]. Figure 4 demonstrates that VGs can maintain the steady airflow over control faces.

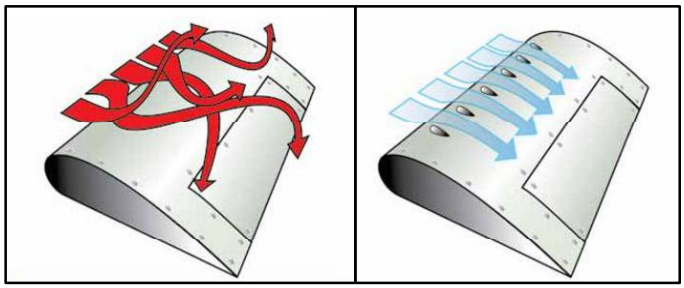

Fig. 4: Airflow over a wing: Without VGs (left) and with VGs (right) [4]