Direct Measurement of Initial Wake Separation (bo) Using Pulsed Lidars. Hadi Wassaf, Volpe Center / DOT (USA); David Burnham, Scientific & Engineering Solutions Inc. (USA); and Frank Wang, Volpe Center / DOT (USA).

ABSTRACT

The initial separation distance (bo) between the counter-rotating vortex pair behind aircraft is a fundamental parameter affecting wake turbulence decay. Unfortunately, in spite of its recognized importance, bo measurements are extremely challenging to perform outside a laboratory environment. Field measurements using pulsed Lidars in a side-looking scan configuration have large errors due to poor range resolution. This configuration has traditionally been used in part due to the large standoff distance requirement of some Lidars. More recently, compact pulsed Lidars with short standoff distances for wind energy applications were introduced. This paper makes use of this short standoff distance attribute of a compact Lidar by positioning the scanner directly under the aircraft's path with an upward looking RHI scan. Unlike the side-looking configuration, this scanning strategy leverage the high cross-range resolution and eliminates the range induced coupling between the aircraft vortex pair. An algorithm validated with simulation and real data that accurately estimates bo from wake positions using mean velocity data is presented. An approach to carefully correct for the effects of ambient wind, as well as detect and remove cases with horizontal shear is also presented. Finally, the selection of highest quality bo estimates based on mean squared errors between corrected wind profiles from subsequent wake scans is presented.