

Abstract Submitted  
for the DFD19 Meeting of  
The American Physical Society

**Direct Numerical Simulations of Separated Flow over a Bump<sup>1</sup>**

RICCARDO BALIN, University of Colorado Boulder, PHILIPPE SPALART, The Boeing Company, KENNETH JANSEN, University of Colorado Boulder — A turbulent boundary layer over a Gaussian bump is computed by direct numerical simulation (DNS) of the incompressible Navier-Stokes equations. The two-dimensional bump causes a rapid succession of favorable-to-adverse pressure gradients that can lead to shallow separation on the downstream side, both of which are characteristic of the flow over the flap of an aircraft wing in high-lift configurations. At the inflow, the momentum thickness Reynolds number is approximately 1,000, and the boundary layer thickness is 1/8 of the bump height. Results from DNS are discussed, describing the complex flow physics observed and the effects of variations to the inflow mean profile. Data from this study will be used for the development of lower fidelity turbulence models through data driven approaches.

<sup>1</sup>This work is supported by the National Science Foundation (NSF), award number CBET-1710670, and by the National Aeronautics and Space Administration (NASA), award number 80NSSC18M0147. Resources of the Argonne Leadership Computing Facility, a DOE Office of Science User Facility, and of the NASA HECC facilities were used.

Riccardo Balin  
University of Colorado Boulder

Date submitted: 31 Jul 2019

Electronic form version 1.4