Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Separation Control on a Cascade of Airfoils using Pulsed Vortex Generator Jets[1] R.J. VOLINO, U. S. Naval Academy, M.B. IBRAHIM, O. KARTUZOVA, Cleveland State University — Flow through a row of airfoils will separate if the loading (lift) on each airfoil is too high. This can happen if the airfoil turning angle or the spacing between airfoils is too high. If the boundary layers separate, the actual flow turning and lift drop, and aerodynamic losses increase. In applications, such as the flow through turbines, high lift airfoils are desirable, as the same power generation can be achieved using fewer airfoils, thereby saving weight and cost. Advances in understanding of separation and transition have led to high lift airfoils without separation problems, but further increases in loading will likely require flow control. In the present study, flow through a linear cascade of very high lift low pressure turbine airfoils is controlled using pulsed vortex generator jets. Without flow control there is a large unclosed separation bubble at low Reynolds numbers. Separation causes a 20% drop in lift and increases losses by up to a factor of seven. Transition of the separated shear layer does not guarantee reattachment. Vortex generator jets with very low mass flow successfully control the separation if the jet velocity and pulsing frequency are sufficiently high. Experimental pressure distributions and phase averaged velocity and turbulence results will be presented.

[1]Supported by NASA

R.J. Volino
U. S. Naval Academy

Date submitted: 30 Jul 2009 Electronic form version 1.4