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Turbine Tip Clearance Active Flow Control using Plasma Actuators[1] DANIEL VANNESS, THOMAS CORKE, SCOTT MORRIS, University of Notre Dame — A low-speed linear cascade was used to examine the tip gap leakage flow and leakage vortex that exists within the low pressure turbine stage of a gas-turbine engine. The cascade array is composed of nine Pratt & Whitney "PakB" blades, with the center blade having a variable tip gap up to five percent chord. Reynolds numbers based on axial chord varied from 10^4 to 10^5. Static pressure taps located at the midspan and near the tip of the blade were used to characterize the blade pressure distribution. A five-hole probe was also traversed in the downstream blade wake to ascertain velocity vectors and total pressure loss. Flow control in the form of a single-dielectric-barrier plasma actuator mounted on the blade tip was used to alter the leakage vortex by acting on the blade tip separation bubble, the blade tip shear layer instability, or the gap flow jet instability through the production of high frequency unsteady disturbances. The flow was documented through measurements with and without flow control for varying tip gaps and Reynolds numbers. The effect of the actuation on the tip leakage vortex and efficiency are investigated.

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