Mist/air Film Cooling for Gas Turbine Blades

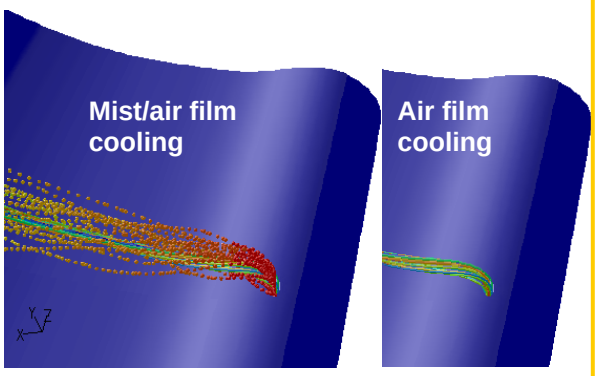
Energy Conversion & Conservation Center

UNIVERSITY of NEW ORLEANS

MOTIVATION and ACHIEVEMENT

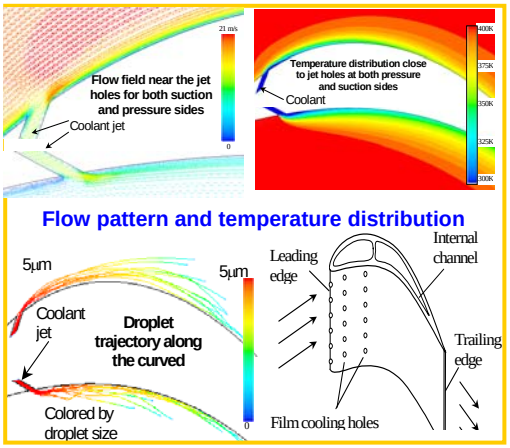
➢**High efficiency Gas Turbines demand efficient cooling technology to protect hot components from flue gas.**

➢**The mist film cooling enhancement increases from 20% to 230% when the mist injection ratio increases from 2% to 20%.**



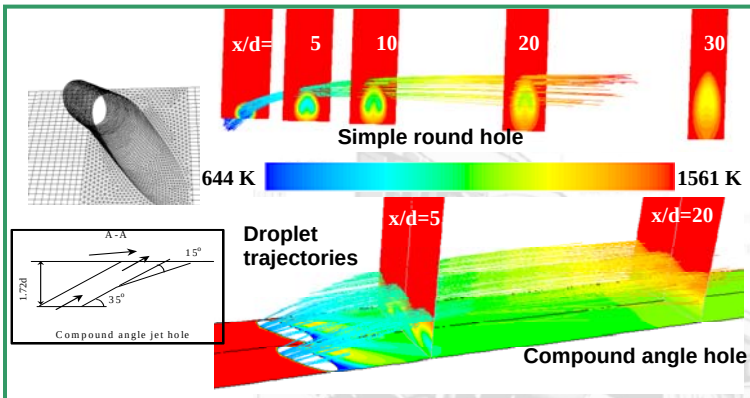
Mist Cooling Mechanism

➢**Latent heat of evaporation as heat sinks**
➢**Direct contact of droplets with the cooling wall**
➢**Higher specific heat of steam and water than air**
➢**Droplets-boundary layer interaction and propulsive momentum induced by near-wall droplet evaporation**

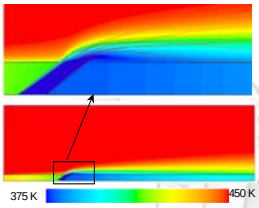


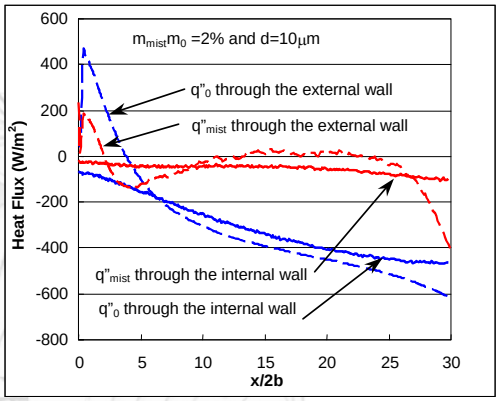
Flow pattern and temperature distribution

Mist/air film cooling on flat plate with conjugate heat transfer without rotation



Temperature Field with Droplet Trajectories with the 3-D compound-angle Hole

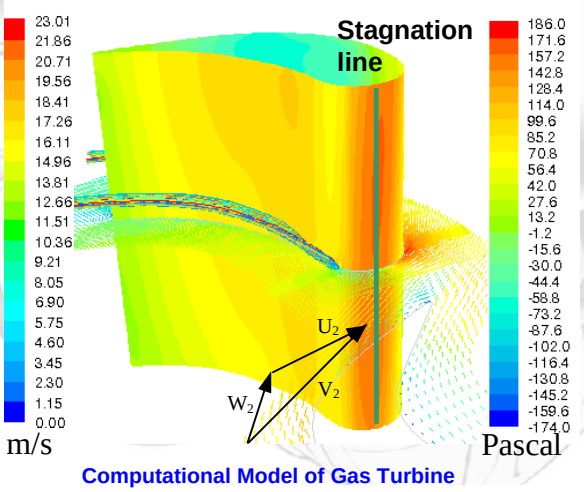




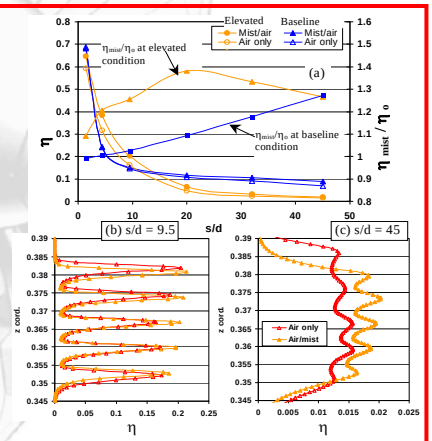
Heat Transfer Result of Mist Film Cooling of a 2-D Slot Jet with a Conjugated Wall Cooling

Mist/air film cooling on rotating gas turbine blades

Gas Turbine Blades with Film Holes



Computational Model of Gas Turbine



Mist/air Film Cooling Enhancement on Rotating Turbine Blade Blades with Film Holes