PROJECT facts

U.S. DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY

High Efficiency Engines and Turbines

12/2002

TIP CLEARANCE HEAT TRANSFER AND DESENSITIZATION IN HIGH PRESSURE TURBINES

PRIMARY PARTNER

University of Central Florida

TOTAL ESTIMATED COST

$ 239,865

CUSTOMER SERVICE

800-553-7681

STRATEGIC CENTER FOR NATURAL GAS WEBSITE

www.netl.doe.gov/scng

Description

Under the Advanced Gas Turbine Systems Research (AGTSR) program, the University of Central Florida is evaluating control of adverse effects on rotor blade performance and life due to leakage flows in the clearance between rotating blade tips and the turbine casing. Figure 1 illustrates the test facility originally planned for the project. Although the project is under evaluation due to lack of availability of the proposed test facility, the plan has been to advance thermal and pressure sensitive paint techniques to measure temperature and pressure distributions on side and tip surfaces of blades with and without tip blowing. An inverse heat conduction method determines the effects of blowing on heat transfer coefficients for the tip region. Multi-probe pressure sensors are used to calculate aerodynamic efficiency benefits of blowing.

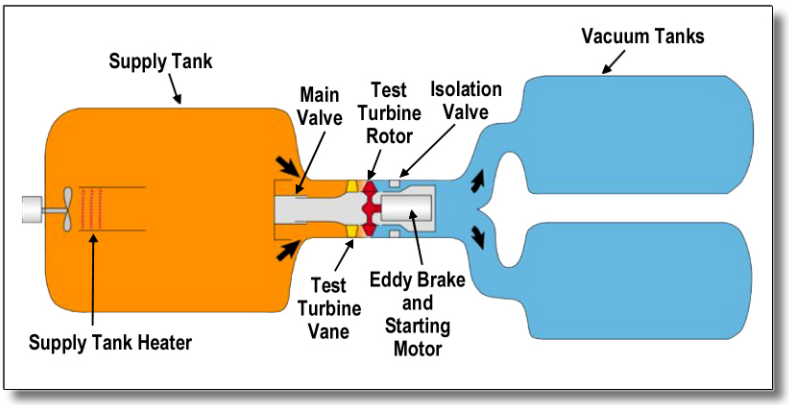

Figure 1. Rotating blade test facility

Tip Clearance Heat Transfer and Desensitization in High Pressure Turbines

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Duration

36 months

Goals

Leakage of flows through the gaps between rotor tips and casings are responsible for a significant portion of efficiency losses in gas turbines. Leakage flows also contribute to large thermal loading at rotor tips that have caused accelerated oxidation and burnout of the blade tips. This project has the goal of using pressure and temperature sensitive paints to evaluate control of rotor tip leakage effects by blowing air into rotor tip clearance and thereby alleviate rotor tip pressure losses and high thermal loading.

Benefits

The project will advance the technology of pressure and temperature paints for aerodynamics and heat transfer measurements. Successful demonstration of tip clearance blowing could provide a turbine design approach to improve rotor performance and life.