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6. AUTHOR(S)
John E. LaGraff

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
DEPARTMENT OF MECHANICAL, AEROSPACE, AND MANUFACTURING ENGINEERING
Syracuse University
Syracuse, New York 13244

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
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Steady-state and time resolved heat transfer rates were measured on a first stage vane of a modem high pressure aircraft turbine. The tests were conducted in the blow-down (transient) Turbine Research Facility (TRF) at the USAF Wright Laboratories in Dayton, Ohio. The heat transfer instrumentation was designed, fabricated, and installed on the test vane at the Oxford University Osney Turbomachinary Laboratory. Tests were conducted in the TRF with an array of instrumental blades in addition to the present test blade allowing comparisons to be made with steady and unsteady measurements, aerodynamic data, and other techniques to measure heat transfer. Ultimately, comparisons with prediction techniques were made. Full technical results have been reported in the literature (Refs. 1, 2).

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AASERT Supplement Grant

[Parent Proposal USAFOSR F49620-92-J-0079
Turbulent Spot Generation and Growth Rates in a Compressible Boundary Layer]

Title of AASERT Grant:	**Unsteady Heat Transfer on the Turbine Research Facility at Wright Labs**
Dates: of AASERT Grant:	**1 July 1994 – 30 September 1998**
Amount of Grant:	**$121,139**
Principal Investigator:	**John E. LaGraff**

Department of Mechanical, Aerospace, and Manufacturing Engineering
Syracuse University
Syracuse, New York 13244
(315) 443-1189

June 2000

Abstract

Steady-state and time resolved heat transfer rates were measured on a first stage vane of a modern high pressure aircraft turbine. The tests were conducted in the blow-down (transient) Turbine Research Facility (TRF) at the USAF Wright Laboratories in Dayton, Ohio. The heat transfer instrumentation was designed, fabricated, and installed on the test vane at the Oxford University Osney Turbomachinary Laboratory. Tests were conducted in the TRF with an array of instrumental blades in addition to the present test blade allowing comparisons to be made with steady and unsteady measurements, aerodynamic data, and other techniques to measure heat transfer. Ultimately, comparisons with prediction techniques were made. Full technical results have been reported in the literature (Refs. 1, 2).

Introduction

The AASERT Program was designed as a supplemental grant to an existing USAFOSR grant that would support an additional graduate student to conduct a specific research project closely related to the original grant. The funding was to cover only the cost of supporting this student. The parent proposal included developing a new type of sputtered thin film gauge to be used in the detection and tracking of high-frequency unsteadiness associated with transitional boundary layers. These thin film gauges had the ability to measure absolute surface heat transfer levels on complex surfaces at wide bandwidths. The AASERT proposal made by the principal investigator was to instrument a real vane on a stage of a modern high-pressure turbine being proposed for testing in the recently commissioned Turbine Research Facility (TRF) at Wright Laboratories.

The AASERT Student spent two periods of residence at Oxford to learn the new techniques and oversee the instrumentation of the vane. He also spent an extended period of time at Wright Labs to learn the operation of the TRF and relevant instrumentation and data acquisition systems. He also, of course, completed his residency requirements for the Syracuse University M.S. degree and successfully defended his thesis in June 1997.

Results

Full technical results of this project are described in the M.S. thesis of Christopher Joe, the AASERT student supported by this grant (Ref. 1). A technical paper was also produced which relates this work to other measurements and predictions conducted for the TRF project (Ref. 2).

Student Supported

Christopher Joe - BSAE 1995, Syracuse University
MSAE 1997, Syracuse University
Thesis Title: Unsteady Heat Transfer on the Turbine Research Facility at Wright Laboratory

Transitions to Industry

The supported student, Christopher Joe, was offered a job by Pratt & Whitney Engine Company before he had finished his thesis. The company, whose engine was being tested as part of the test in the TRF, was interested in the experimental technique and knowledge of the subject of turbine heat transfer that Christopher had developed and subsequently offered him a position with their company. The technical publication (Ref. 2) including this research was published as part of the findings of a larger Pratt & Whitney/USAF program.

References

1 - Joe, C. R., "Unsteady Heat Transfer on the Turbine Research Facility at Wright Laboratory," M.S. Thesis, Syracuse University, 1997.

2 - Joe, C. R., Montesdeoca, X .A., Soechting, F. O., MacArthur, C. D., and Meininger, M., "High Pressure Turbine Vane Annular Cascade Heat Flux and Aerodynamic Measurements with Comparison to Predictions," ASME Paper 98-GT-430, 1998.