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HOST TURBINE HEAT TRANSFER OVERVIEW

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The HOST Turbine Heat Transfer program is focused on improving methods of predicting airfoil local metal temperatures. Improved methods of predicting airfoil local metal temperatures require advances in the understanding of the physics and methods of analytically predicting the following four aerothermal loads: hot gas flow over airfoils, heat transfer rates on the gas-side of airfoils, cooling air flow inside airfoils, and heat transfer rates on the coolant-side of airfoils. A systematic "building block" research approach is being pursued to investigate these four areas of concern from both the experimental and analytical sides. Experimental approaches being pursued start with fundamental experiments using simple shapes and flat plates in wind tunnels, progress to more realistic cold and hot cascade tests using airfoils, continue to progress in large low-speed rigs and turbines and warm turbines, and finally combine all the interactive effects in tests using real engines or real-engine-type turbine rigs. Analytical approaches being pursued also build from relatively simple steady two-dimensional inviscid flow and boundary-layer heat transfer codes to more advanced steady two- and three-dimensional viscous flow and heat transfer codes and unsteady two-dimensional viscous flow and heat transfer codes. These advanced codes provide more physics to model better the interactive effects and the true real-engine environment.

HOST TURBINE HEAT TRANSFER PROGRAM

OBJECTIVES:

- OBTAIN A BETTER UNDERSTANDING OF THE PHYSICS OF THE AEROTHERMODYNAMIC PHENOMENA OCCURRING IN HIGH-TEMPERATURE TURBINES
- ASSESS AND IMPROVE ANALYTICAL METHODS USED TO PREDICT THE FLOW AND HEAT TRANSFER IN HIGH TEMPERATURE TURBINE

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Figure 1

TURBINE AEROTHERMAL DESIGN SYSTEM

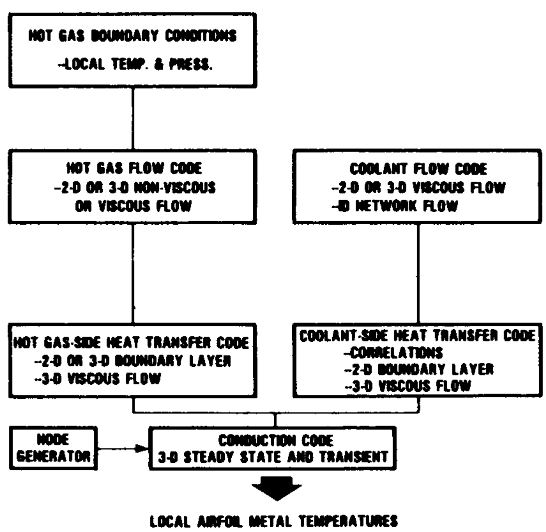

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Figure 2

BUILDING BLOCK AEROTHERMAL TURBINE RESEARCH APPROACH

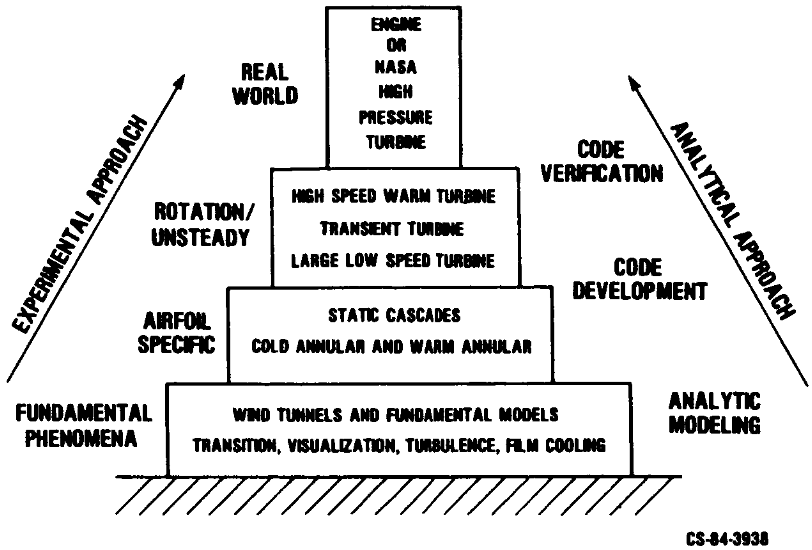

Figure 3

ASSESS TURBINE AEROTHERMAL DESIGN SYSTEM

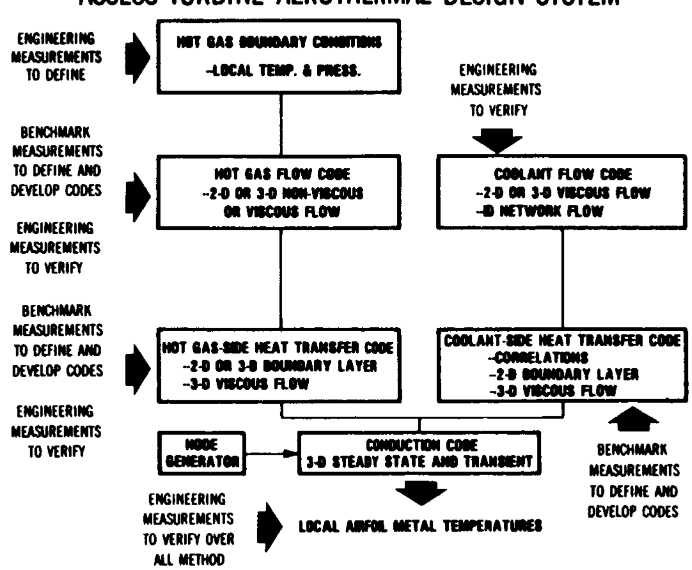

Figure 4

RANGE OF TURBINE AEROTHERMAL DESIGN SYSTEM CODES

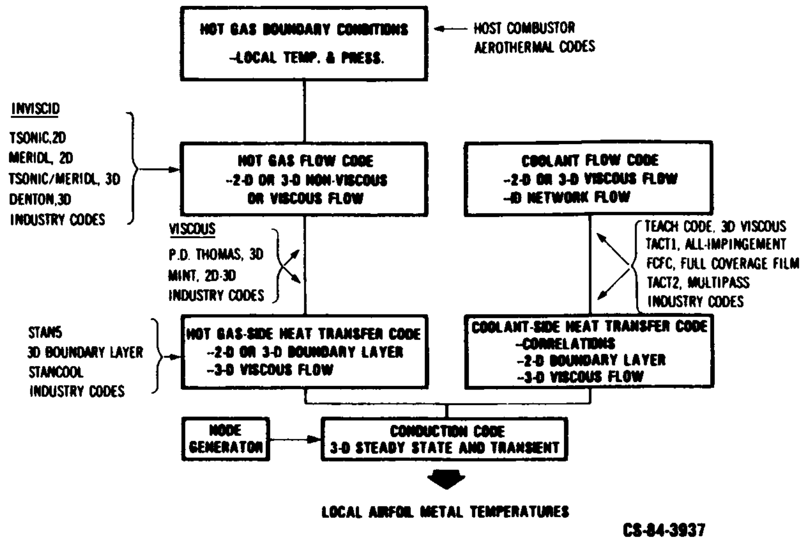

Figure 5

TURBINE HEAT TRANSFER SUBPROJECT SCHEDULE

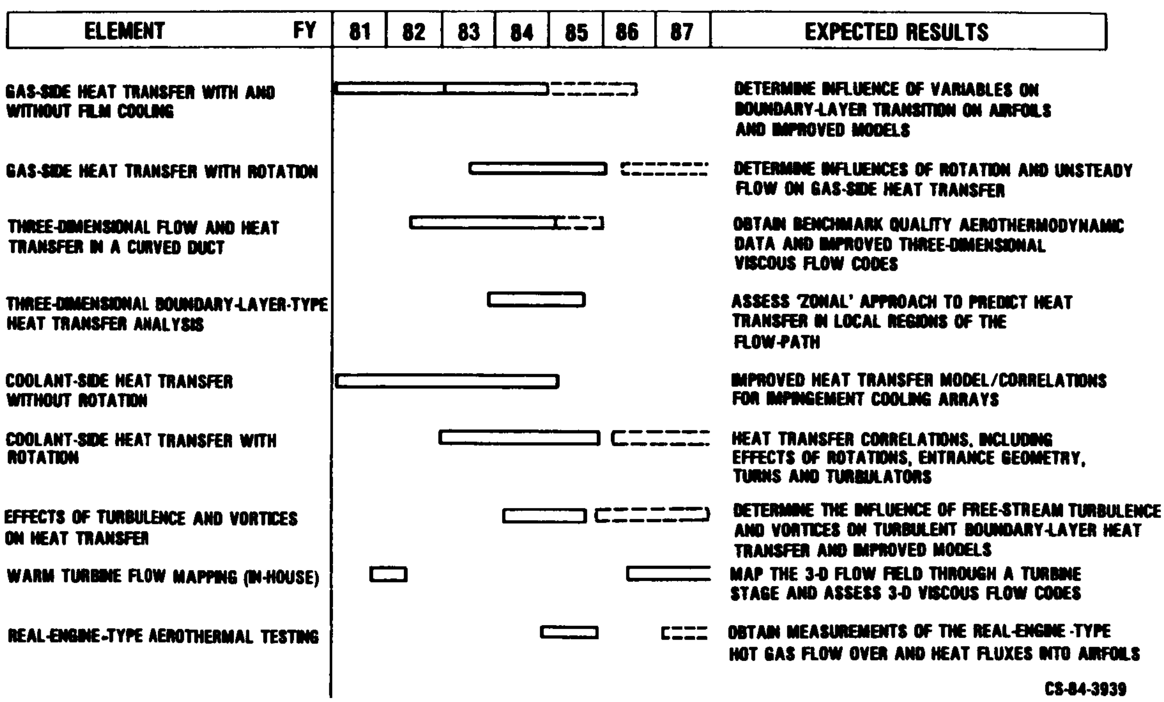

Figure 6

TURBINE HEAT TRANSFER SESSION AGENDA

GAS-SIDE HEAT TRANSFER	E. TURNER, ALLISON B. WEINBERG, SRA
GAS-SIDE HEAT TRANSFER IN A TURBINE STAGE WITH ROTATION	R. DRING, UTRC
EFFECTS OF HIGH TURBULENCE AND VORTICES ON HEAT TRANSFER	R. MOFFAT, STANFORD
THREE-DIMENSIONAL VISCOUS FLOW AND HEAT TRANSFER	R. CRAWFORD, UTSI
ASSESSMENT OF THREE-DIMENSIONAL BOUNDARY LAYER CODE	O. ANDERSON,UTRC
COOLANT-SIDE HEAT TRANSFER WITH ROTATION	F. KOPPER, P&W

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Figure 7