HOST COMBUSTION R&T OVERVIEW

Raymond E. Gaugler
NASA Lewis Research Center
Cleveland, Ohio

The overall objective of the Turbine Engine Hot Section Technology Combustion Project is to develop and verify improved and more accurate numerical analysis methods for increasing the ability to design with confidence combustion systems for advanced aircraft gas turbine engines.

The objective is being approached from two directions: computational and experimental. On the computational side, the approach was to first assess and evaluate existing combustor aerothermal analysis models by means of a contracted effort initiated during fiscal year 1982. This effort has quantified the strengths and deficiencies of existing models. The results of this assessment were summarized at a previous HOST Workshop. Next, phase II contracts were let in fiscal 1984 to develop new/improved numerical methods for the analysis of turbulent viscous recirculating flows, with the prime objectives being improved accuracy and speed of convergence. Progress reports under two contracts and a University Grant will be presented at this workshop. The third part of the computational approach ties very closely to the experiments. It will consist of incorporating improved physical models into the computational codes.

On the experimental side, three types of experiments can be identified; first, fundamental experiments directed toward improved understanding of the flow physics and chemistry; second, experiments run to provide data for the empirical modeing of complex phenomena; and third, benchmark experiments for computer code validation.

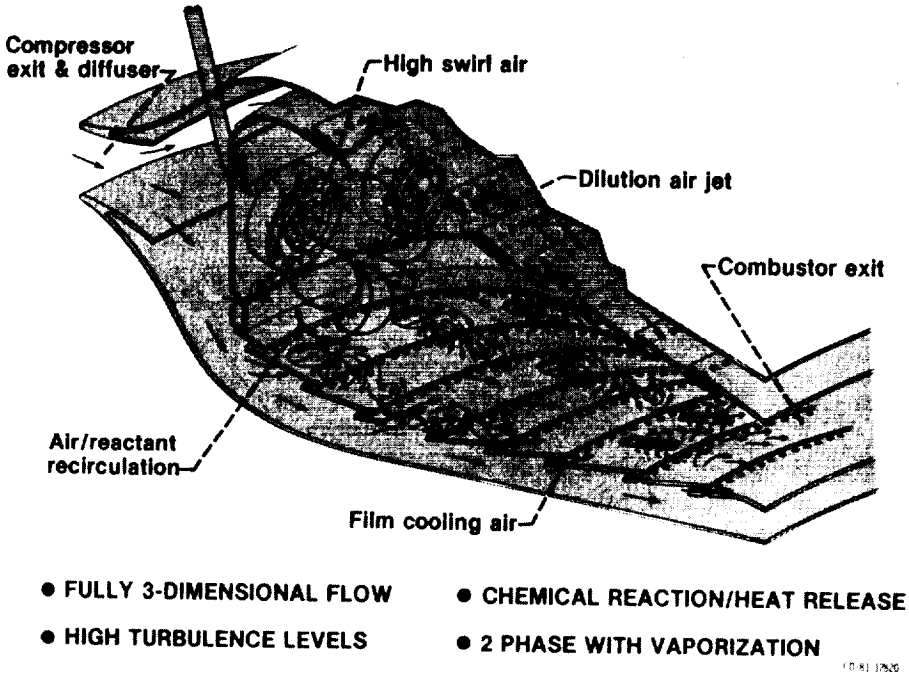
Four experimental efforts have been completed and reported on previously, and three are still under way. Progress reports will be presented on those three at this workshop.

The completed experimental programs were aimed primarily at obtaining a basic understanding of the flows and improving empirical models. Two programs that concentrated on the interaction of dilution jets and the main stream flow field have added substantially to the understanding of such flows. A third experimental program examined in detail the mass and momentum transport in swirling and nonswirling coaxial jets. The fourth effort was an investigation of the radiative heat loading in an advanced high pressure gas turbine combustor.

The other three experimental programs are concentrating on the generation of benchmark quality data for use in validating new computer codes and models.

The phase III efforts are planned to get under way this year. Since last year's workshop, discussions have been held with representatives of a number of engine manufacturers, and, based on those meetings and the constraints of the HOST program, it was decided that phase III will concentrate on generating benchmark data for a reacting flow. The data will be used to verify computer codes and physical models.

COMBUSTOR FLOW PHENOMENA



- FULLY 3-DIMENSIONAL FLOW
- HIGH TURBULENCE LEVELS
- CHEMICAL REACTION/HEAT RELEASE
- 2 PHASE WITH VAPORIZATION

Figure 1

COMBUSTION

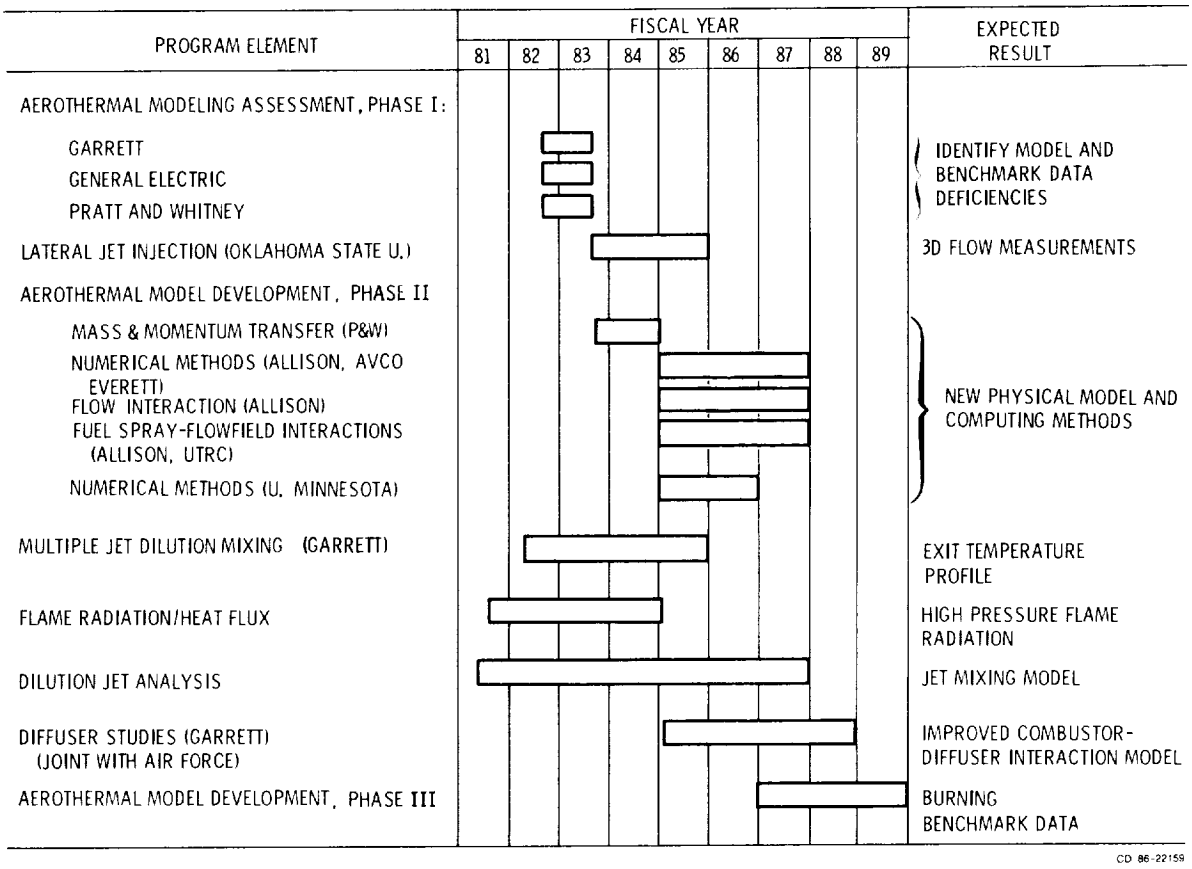


Figure 2

AEROTHERMAL MODEL DEVELOPMENT PHASE-III

- FORMAL ANNOUNCEMENT OF INTENT MADE LAST APRIL.
- DETAILED DISCUSSIONS HELD WITH A NUMBER OF GAS-TURBINE-ENGINE MANUFACTURERS.
- CURRENTLY DEFINING THE SCOPE OF PHASE III, CONSTRAINED BY INDUSTRY NEEDS AND NASA HOST RESOURCES.
- MAJOR EMPHASIS WILL BE ON GENERATION OF BENCHMARK-QUALITY REACTING FLOW DATA.
- THIRD QUARTER FY '87 IS NOW TARGET FOR CONTRACT INITIATION.

CD-86-22158

Figure 3