SESSION VII. FLUID AND GAS DYNAMICS

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OVERVIEW

The objective of the Fluid and Gas Dynamic Working Group is to obtain a clearer understanding of the interactions of the hot gas flow with the structure in the duct system, the flow passages of the rotating machinery, and the thrust chamber nozzle for the purpose of finding ways and means to increase the life and performance of the systems.

The working group plan contains some tasks which have been with us for a long time. Due to the urgency of finding an improved hot gas transfer system, the Duct Flow Nonuniformity Study (H2) was started in 1981. The Aerothermal Loads Definition Study (H5) was introduced by Lewis Research Center. It contains numerous subtasks which are mainly dealing with turbine and pump improvements. The five presentations of this session are selected from these two tasks.

Let me describe briefly the rest of the tasks shown in the plan. The Transient Nozzle Flow Test (H1) is an inhouse task. The objective is to understand the shock-boundary layer interactions during transient flow and the resulting large side forces acting on the nozzle skirt. The Fluctuating Pressures in Ducts (H3) deals mainly with the fluid-structural interactions of the lox post tube banks in the injector. The Ablative Nozzle Insert Study (H4) has as its goal the performance improvement of the SSME.

Inserts of active and passive material are investigated. Depending on the results of the preliminary study a decision will be made to continue the investigation or terminate it.

The Duct Flow Nonuniformities and Injector Environment Study (H2) was let as a contract to Lockheed/Huntsville. The Rocketdyne Division of Rockwell International was subcontractor to the contract. They were charged with conducting appropriate scaled cold flow tests to anchor the computational fluid dynamics code (GYM code) of Lockheed/Huntsville. Geometric optimization studies could then easily be performed once a converged solution was obtained.

In order to improve the structural durability of the Shuttle turbo drive system, it is necessary to understand the aerothermodynamic behavior of the flow system. Current effort is directed toward the ability to predict the steady and unsteady pressure and temperature distributions. Development of three-dimensional viscous and inviscid computer codes along with experimental code validation is deemed essential to the achievement of that objective. The material presented in this session represents a part of the continuing effort to achieve an improved understanding of the aerodynamics and heat transfer through modeling and experimentation.

FLUID AND GAS DYNAMICS
WORKING GROUP PLAN
– KEY EVENTS –