THE BROADENED-SPECIFICATION FUELS COMBUSTION TECHNOLOGY PROGRAM AT PRATT & WHITNEY AIRCRAFT

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Under Phase I of the Broadened-Specification Fuels Combustion Technology Program, Pratt and Whitney Aircraft will be conducting combustor tests to evaluate the impact of the use of broadened-specification fuels on combustor design. Particular emphasis will be placed on establishing the viability of various combustor modifications to permit the use of broadened-specification fuels while meeting exhaust emissions and performance specifications and maintaining acceptable combustor operational and durability characteristics.

The reference engine for this program is the JT9D-7F shown in figure 1. Three different combustor concepts will be evaluated under the program. The simplest concept, the basic single-stage combustor, will consist of the current production model and an advanced version of the combustor in the JT9D-7F engine. These combustor configurations are shown in figures 2 and 3. The second concept is the advanced Vorbix combustor shown in figure 4. This concept, currently being established under the National Aeronautics and Space Administration/Pratt & Whitney Aircraft Energy Efficient Engine Program, incorporates several improvements over the configurations evolved under the Experimental Clean Combustor program. The most advanced concept is a variable geometry single-stage combustor with a simplex fuel injection system. Figure 5 shows a conceptual definition of a variable geometry combustor designed for modulation of the primary-dilution zone airflow split. Under Phase I of the program, this concept will be evaluated in a series of fixed geometry configurations with the intent of introducing variable combustor components in Phase II.

The combustor evaluation tests will involve assessment of various design modifications on the operating capability of each of the combustor concepts with Experimental Referee Broadened-Specification Fuel (ERBS). The modifications that will be evaluated include perturbations of the combustor airflow schedules to alter local stoichiometry and residence time histories, revisions to the fuel injectors, and variations in liner cooling including the use of thermal barrier coatings and/or advanced cooling concepts.

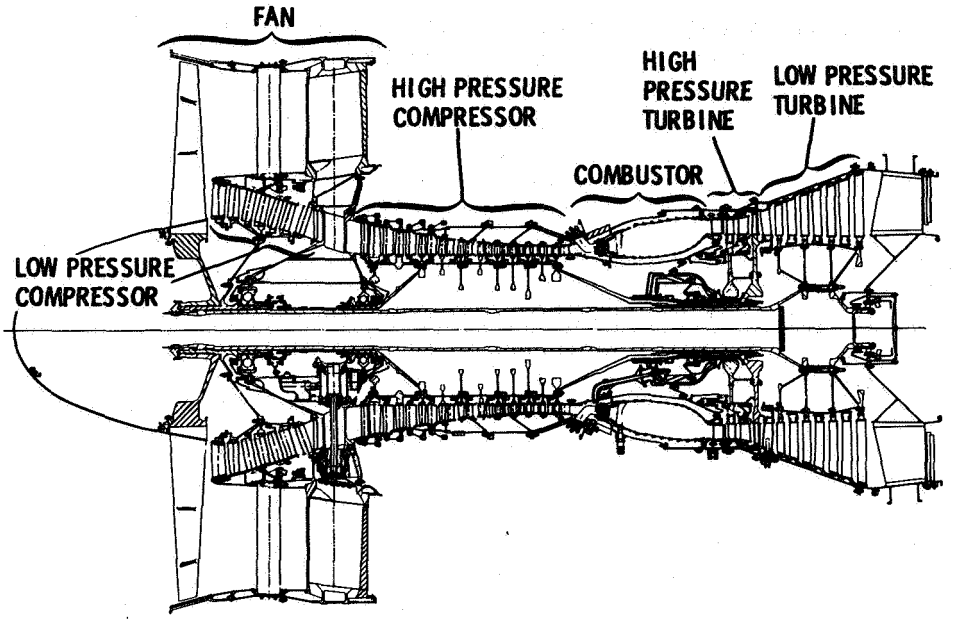

FIGURE 1 The JT9D-7F Reference Engine

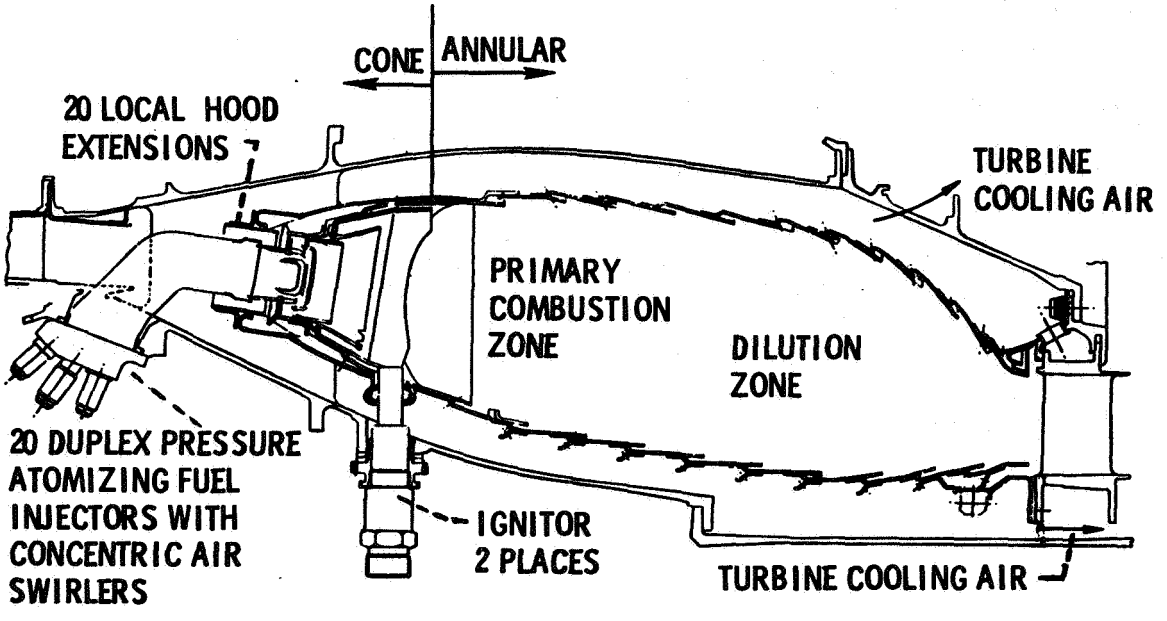

FIGURE 2 Current Production Configuration of the JT9D-7F Single Stage Combustor

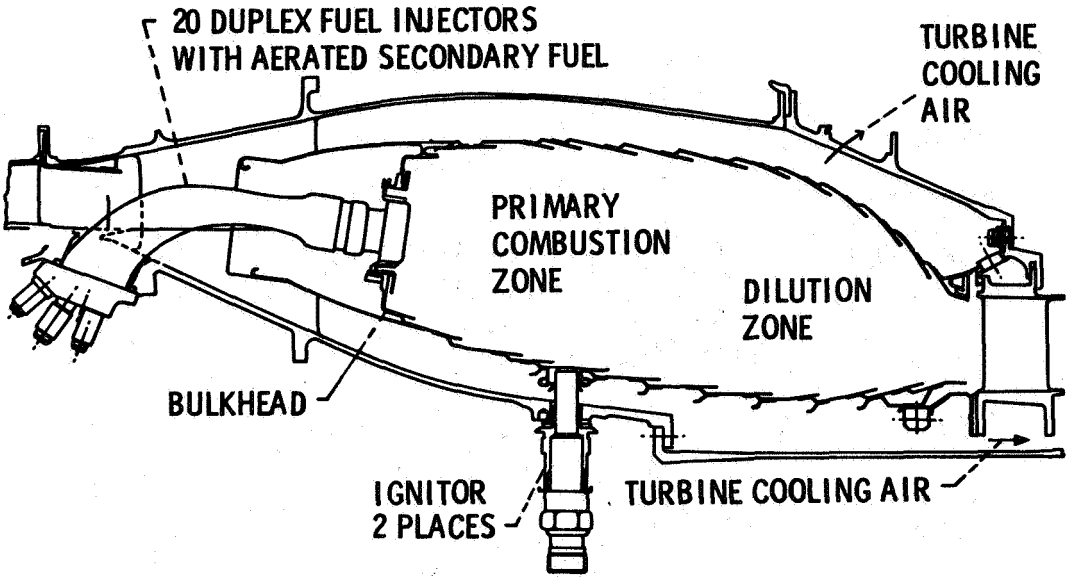

FIGURE 3 Advanced Single Stage Combustor

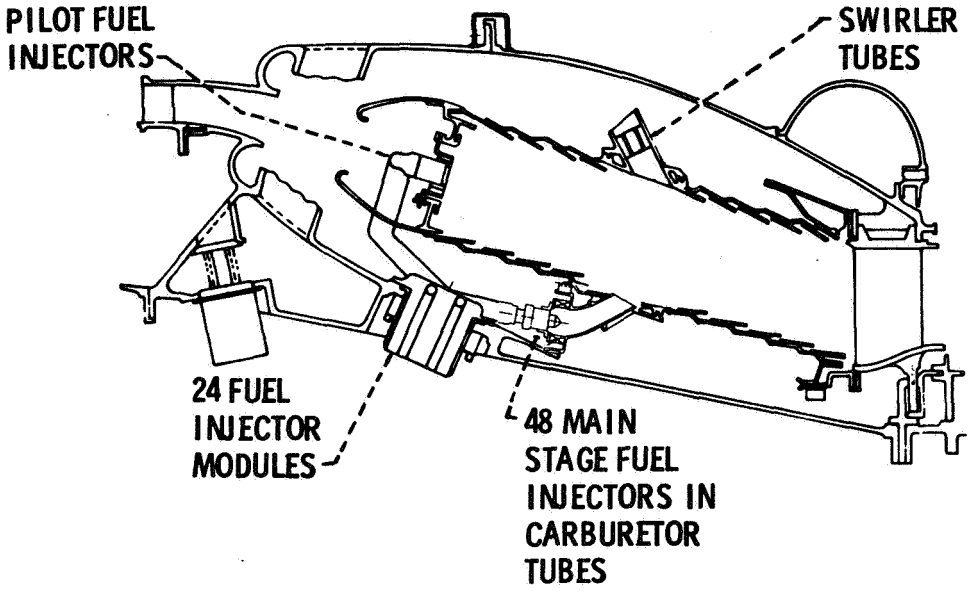

FIGURE 4 Advanced Vorbix Combustor Concept

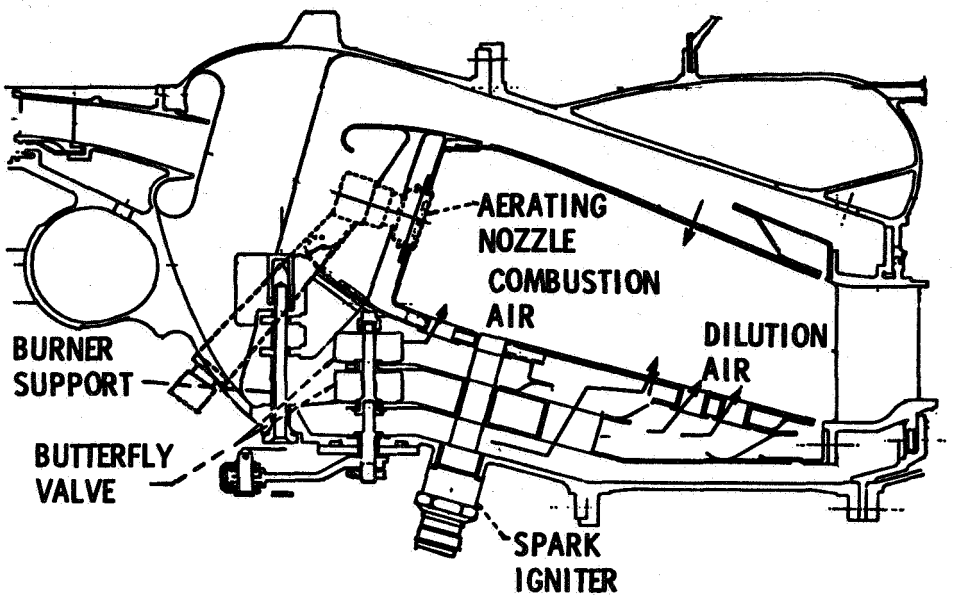

FIGURE 5 Variable Geometry Combustor Concept