10. INTRODUCTION TO NASA CONTRACTS

Erwin E. Kempke, Jr.

Lewis Research Center
National Aeronautics and Space Administration
Cleveland, Ohio

The division of activities that was agreed upon between the FAA and NASA is described in paper 6. When NASA agreed to participate with the FAA in the joint program previously described, NASA also decided to investigate more advanced technology concepts for exhaust emissions reduction. As a first step, the NASA Lewis Research Center issued Requests for Proposal (RFP) to Avco Lycoming and Teledyne Continental Motors (TCM) for a contractual effort to establish and demonstrate engine modifications to reduce exhaust emissions safely with minimum adverse effects on cost, weight, and fuel economy. In addition, although the emphasis of the effort is on emissions reduction as a primary thrust, it has at the same time, the secondary objective of reducing fuel consumption. NASA structured the program such that, according to the RFP, an initial task would be to screen and assess 10 concepts with emissions reduction potential. A preliminary list of candidate concepts contained in the RFP is shown in figure 10-1. The three most promising concepts would be designed, fabricated, and installed on an experimental engine or engines. Verification testing would then be performed by the contractor at his facilities. One other RFP requirement was that one of the three concepts require a major engine design modification and the other two concepts require relatively minor engine modification.

Cost-shared contracts to TCM and Avco Lycoming were let October 10, 1975. Each contract has a total estimated cost of $1.2 million, with the contractors share being 20 percent. The period of performance for each contract is approximately 3 years. One difference from what was previously stated is that Avco Lycoming elected, prior to the award of contract, to perform the screening and assessment task using their own funds. Accordingly, at the start of the contract, it was mutually agreed as to which three concepts Avco Lycoming would pursue. These are discussed in more detail in paper 12.

CANDIDATE EMISSION REDUCTION TECHNIQUES

1. ENGINE GEOMETRY MODIFICATIONS
   - A. COMBUSTION CHAMBER CONFIGURATION
   - B. COMPRESSION RATIO
   - C. INTAKE MANIFOLD
   - D. VALVE TIMING, INCLUDING VARIABLE CAMSHAFT
   - E. IGNITION TIMING
   - F. IMPROVED COOLING

2. FUEL DISTRIBUTION AND IGNITION SYSTEM
   - A. ULTRASONIC FUEL VAPORIZATION
   - B. THERMAL FUEL VAPORIZATION
   - C. CRACKING CARBURETOR
   - D. IMPROVED FUEL INJECTION SYSTEM
   - E. HIGH ENERGY-MULTIPLE SPARK IGNITION

3. EMISSION CONTROL ADD-ON
   - A. AIR INJECTION
   - B. WATER/ALCOHOL INJECTION
   - C. THERMAL REACTOR
   - D. CATALYTIC REACTOR

4. FUEL ADDITIVES
   - A. HYDROGEN INJECTION
   - B. METHANOL

Figure 10-1