N89-12878

HOST INSTRUMENTATION R&D PROGRAM OVERVIEW

D.R. Englund
NASA Lewis Research Center
Cleveland, Ohio

The HOST Instrumentation R&D program is directed at the development of two categories of instrumentation. One is instrumentation capable of characterizing the environment imposed on turbine engine hot-section components. This category includes instruments for the measurements of gas flow, gas temperature, and heat flux. The second category is instrumentation to measure the effect of the environment on the hot-section components. This category includes strain measuring instruments and an optical system capable of providing interior views of a burner liner during operation. The program was formulated to concentrate on critial measurements that could not be made with available instruments or with instruments under development via other NASA- or DOD-funded programs or via Industrial Research and Development programs.

The HOST instrumentation program for fiscal years 1984 through 1989 is shown in the accompanying figure. There are no additions to the program this year, and two contracts have been completed within this past year. One is the development of the dynamic gas temperature measurement system. This work has included the demonstration of the frequency response of the system and improvements in the data-reduction software that speeds up data reduction and makes the system work on a general-purpose computer. The second completed contract is the demonstration of the laser speckle photogrammetry system on the structural components response rig. Results from this work were limited by the inability of the measurement to account for errors due to out-of-plane distortion and rotation of the test sample. Further use of optical instrumentation on the structural component response rig is anticipated for measurements of test sample surface deflection and, we hope, strain.

Other parts of the HOST instrumentation program have either been completed in previous years or are continuing. The development of the turbine blade and vane static strain gauge is progressing, with the major effort directed at thin-film gauges made from the palladium-base alloy. Development of a wire strain gauge system will also be undertaken when wire becomes available. Work on a process for drawing the palladium-base alloy into suitable wire is underway at Battelle-Columbus. We are also looking at alternative materials that may have potential for high-temperature strain gauge applications through a research grant to Northwestern University. The emphasis here is on the high-temperature resistance properties of materials, including alloys, nitrides and carbides of transition metals, and silicon carbide. Work at Lewis on high-temperature strain gauges has included the establishment of an automated strain gauge test laboratory and work on application techniques. The automated strain gauge laboratory is now operational. Contract work to develop heat flux sensors for combustor liners and blades and vanes was completed in 1985. Additional work on heat flux sensors and the establishment of an in-house heat flux sensor calibrator is continuing under non-HOST funding. The experiment on turbulence measurement in the exhaust stream of an atmospheric burner uses the dynamic gas-temperature measurement system and a laser anemometer to

determine the instantaneous product of density and velocity. Analysis of data from an initial set of measurements is in progress; an additional test is being planned in which heat flux sensors will also be tested. Finally, the work on laser anemometry is continuing with a goal of operating a two-axis anemometer on the warm turbine rig early in 1987.

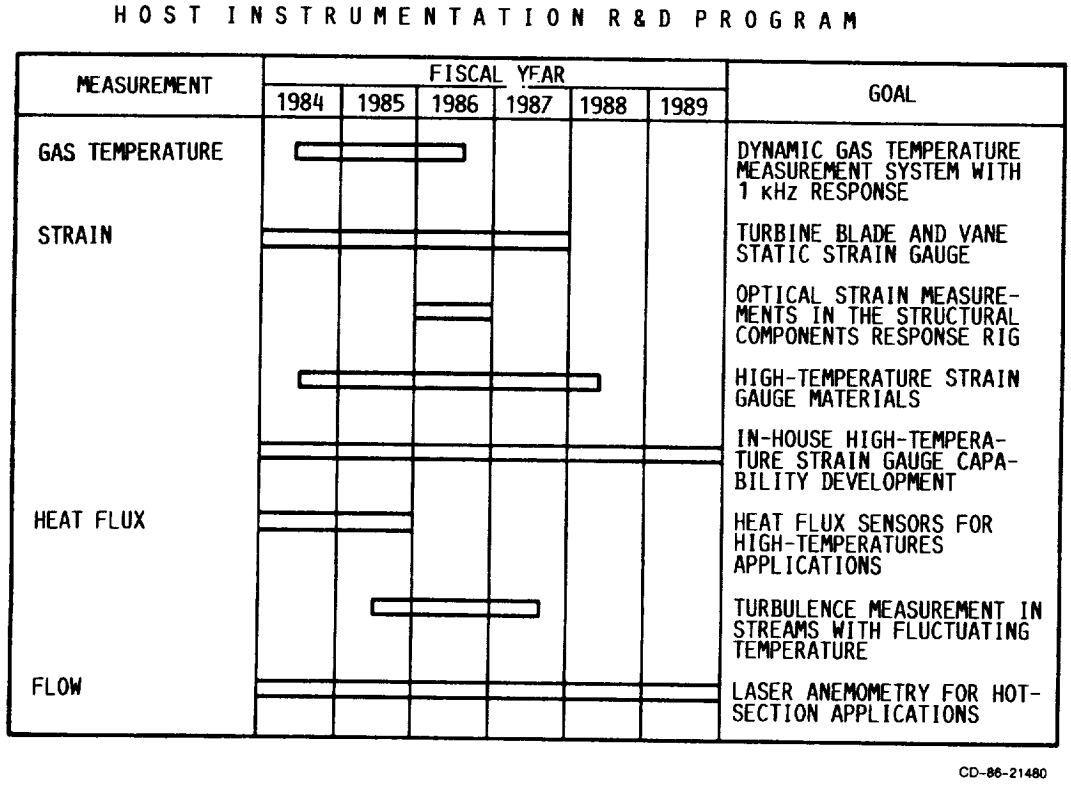

Figure 1