**ADVANCED THERMAL BARRIER
COATING SYSTEM DEVELOPMENT**

CONTRACT # DE-AC05-95OR22242

TECHNICAL PROGRESS REPORT

to the

U.S. DEPARTMENT OF ENERGY

Oak Ridge Operations Office

Oak Ridge, Tennessee

October 15, 1999

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Advanced Thermal Barrier Coating System Development

Program Objectives

The objectives of the program are to provide an improved TBC system with increased temperature capability and improved reliability relative to current state of the art TBC systems. The development of such a coating system is essential to the ATS engine meeting its objectives.

The base program consists of three phases:

Phase I: Program Planning - Complete

Phase II: Development

Phase III: Selected Specimen - Bench Test

Work is being performed in Phase II and III of the program.

Technical Progress Report

Task II.2 Bond Coat Development - Task Complete

No work performed during reporting period.

Task II.3 Analytical Lifing Model - Task Complete

No work performed during reporting period.

Task II.4 Manufacturing Process Development - Task Complete

No work performed during reporting period.

Task II.5 NDE, Repair and Maintenance - Task Complete

No work performed during reporting period.

Task II.6 New TBC Concepts

- In the previous reporting period, thermal fatigue life of one new ceramic composition deposited by EB-PVD was found comparable to that of EB-PVD 8YSZ. However, the coating composition did not match the ingot chemistry. In the last two months, new coatings were deposited after modifying the deposition parameters and an exact composition match was obtained. These are currently being evaluated for their thermal fatigue life and sintering behavior.
- Another new chemistry was deposited with the modified deposition conditions and to date has accumulated a thermal fatigue life equivalent to that of EB-PVD 8YSZ. Furnace exposure tests are continuing. This is the **second** new chemistry to have thermal fatigue life equivalent to EB-PVD 8YSZ.
- This reinforces the advantages identified with regards to the new deposition parameters determined in this program. Additional new 2 chemistries are scheduled to be deposited within the next two weeks. Results from thermal fatigue evaluation and sintering behavior are expected to be available by mid-November.

III.6 Blade and Vane TBC Monitor - Feasibility Study

- To pursue the feasibility of conducting online monitoring of TBC coatings on operating turbine blades, a major milestone was successfully completed with the real time imaging of a thermal target using an infrared camera. With the triggering software and hardware designed by SWPC, the camera was able to capture the images of the targets mounted on a flywheel. The image was sharp, even up to the maximum rotational speed of 3600 rpm, demonstrating that the camera and the trigger device

were capable of detecting thermal features of sizes of interest on a rotating turbine blade. The next step forward is an evaluation of the system installed in an engine. The Dow Chemical Plaquemine 501D5 engine has been identified for a demonstration scheduled for the second quarter of 2000. Preparations are underway to interface the camera with the Dow unit. A detailed plan for the engine feasibility demonstration will be presented to the Department of Energy during the next scheduled program review.