**Advanced Turbine System
Conceptual Design and Product Development**

**Quarterly Status Report (Draft)
for
February 1, 1998 through to April 30, 1998**

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I. Introduction

II. WBS 1 - Project Plan

The Project Plan for the subject program was submitted (mailed) to the Department of Energy (DOE) on May 18, 1995. This task is complete.

III. WBS 2 - NEPA Report

The information required for the NEPA Report was submitted (mailed) to the DOE on June 22, 1995. This task is complete.

IV. WBS 3 - GFATS Selection

The technical work on this task has been completed and presented to the DOE. Final report is in preparation for this task and was also be presented to the DOE.

V. WBS 4 - Conversion to Coal

Surveys of potential Task 4 CFATS cycles were completed by ABB Power Plant Laboratories (PPL). A brief overview of the results of this work to date were also presented at the September 27, 1995, briefing with the DOE. No further efforts will be expended on this task as indicated in the 5th quarterly report.

VI. WBS 5 through WBS 8 Replanned Tasks

The following tasks are included in the revised contract:

- Turbine Aerodynamics& Aero-Thermal Integration
- Advanced Steam Cooled Vanes
- Advanced Air Cooled Blading
- Thermal Barrier Coating and Steam Oxidation

The following tasks were referenced in the contract and the completion status was part of the monthly reports since July 1996. The references correlate with the contract and the task numbers with the monthly reports.

Ref. 3.4.1 - Turbine Aerodynamics and Aero-Thermal Integration (Task 8.5)

- Hardware Design and Manufacturing:
 - * The drilling of the cooling holes has been started.
 - * Hardware procurement for the cooling air supply is in progress.
- Instrumentation manufacturing and calibration:
 - * this task has been completed.
- The test matrix for the uncooled turbine stage has been completed. The results were very encouraging, the evaluation of the data obtained is ongoing. This has been a major breakthrough In the program.

- The development of computational procedures for data reduction is completed. Substantial time saving has been achieved by using a new software tool. Measurement data can now be translated into engineering units within 24 hours after the test. This had taken previously up to 10 days.

Ref. 3.4.2 - Advanced Steam-Cooled Vanes**(Task 8.6)**

- overall cooling flow circuit is defined as a two-pass airfoil cooling scheme reflecting the concurrent requirements for inner and outer platform cooling as well as steam delivery and sealing features.
- The proposed cooling concept is based on rectangular spanwise cooling channels with variable aspect ratios and spacing.
- The test apparatus design has been completed.
- First tests to measure heat transfer haven been conducted.
- A software tool to translate the measurement data into engineering units has been developed.

Ref. 3.4.3 Advanced Air Cooled Blading**(Task 8.3)**

- This task has been completed In December 1997. The final reports are in preparation.

Ref. 3.4.4 Thermal Barrier Coating and Steam Oxidation

- **Evaluation of TBC-Coating Systems in High Temperature Gradients**
 - * After relocation of the burner test rig testing has been resumed. First samples have been submitted to metallographic analysis.
- **Monitoring of Degradation of TBC Coating Systems**
 - * This task has been completed in January 1998. Final report has been issued.
- **Thermomechanical Fatigue (TMF) of TBC Systems.**
 - * Test rig was modified to simulate internal cooling
 - * Preoxidized test bars were prepared to simulate conditions closer to engine conditions. Testing has been done on advanced overlay coatings. Samples are now under metallographic analysis.

- **Kinetics of Oxidation in Steam.**

- * This task has been completed in January 1998. The final report has been issued.

VII. WBS 9 - Program Management/Reports

Work accomplished under this task during the subject period includes the following:

- ABB Monthly Status Reports including Summary Report, Milestone/Schedule Status, Labor Management Report, and Cost Management Report for the following months:
 1. January 1998 delivered (mailed to the DOE February 25, 1998
 2. February 1998 delivered (mailed) to the DOE March 20, 1998
 3. March 1998 delivered (mailed) to the DOE April 16, 1998
- ABB's twelfth Quarterly Technical Progress Report (Draft) was submitted (mailed) to the DOE on February 27th, 1997. Awaiting approval by DOE.
- Topical reports for:
 - Task 8.2.4.2 has been submitted to DOE on March 16, 1998
 - Task 8.2.4.4 has been submitted to DOE on March 10, 1998
 - Task 8.3 Advanced Air Transfer System has been submitted to DOE on April 10, 1998.

The Topical reports summarize the results that haven been achieved under this tasks. The tasks have been completed.

- Semiannual property report, high risk property report and subcontract report was delivered to DOE on April 22nd, 1998
- A technical proposal for future work was submitted to DOE on April 10th, 1998. Awaiting comment by DOE.
- A letter requesting a contract extension has been submitted to DOE on April 22, 1998

VIII. General Discussion

Technical highlights for the reporting period are:

- All tests with the uncooled turbine stage have been completed with very encouraging results. The hardware is now out for modification (cooling hole drilling)
- The work on advanced air cooling, steam oxidation and NDE techniques to evaluate bond coat degradation has been completed. The final reports are submitted to DOE.

IX. Program Redirection

Key Dates:

ABB Proposal mailed to DOE: January 26, 1996

DOE Concurrence received: April 29, 1996

Contract extension granted: May 29, 1997

The revised program has been implemented in all ABB's development plans and the monthly reports since May 1996 report on the progress and actual status.