

FY 2002 Gas Turbine Peer Review

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Presentation Outline

- **Program Objectives**
- **Program Structure**
 - Improved Catalyst Module Economics
 - Low-Emissions Preburner Technology
 - Extension to Back-Up Diesel Fuel
- **Implementation Approach**
- **Technical Progress**
- **Practical Application**
- **Collaborations**

Program Objectives

- To investigate the feasibility of potential products
- To test the potential products which show feasibility
- To provide production designs where applicable for commercialization

Program Structure

- **Improved Catalyst Module Economics**
 - Catalyst Life Extension
 - Catalyst Module Cost Reduction
- **Low-Emissions Preburner Technology**
 - Catalytic Secondary Burner
 - Catalytic Pilot for Lean Premix Burner
- **Extension to Back-Up Diesel Fuel**

Improved Catalyst Module Economics

Catalyst Life Extension Objectives

- Validate operating life predictive model
- Identify new materials with increased life performance
- Test to validate catalytic and physical material properties

Milestone Accomplishment

- Design model validated
- Selection of advanced material complete
- Subscale rig test validation of advanced materials complete



2-in subscale catalyst test facility



2-in subscale catalyst test reactors

Improved Catalyst Module Economics

Catalyst Module Cost Reduction Objectives

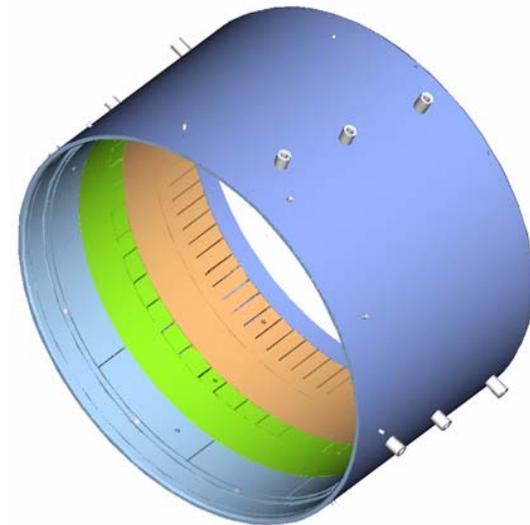
- Conceptualize/design lower cost catalyst axial support configurations
- Develop cost effective container design

Milestone Accomplishment

- Design specifications for low cost axial support and container complete
- Test of new designs complete (full scale or analytical)
- Final module design complete



Catalyst Axial Support



Catalyst Module Container Design

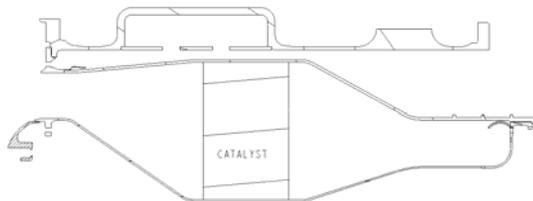
Low-Emissions Preburner Technology

Catalytic Secondary Burner Objectives

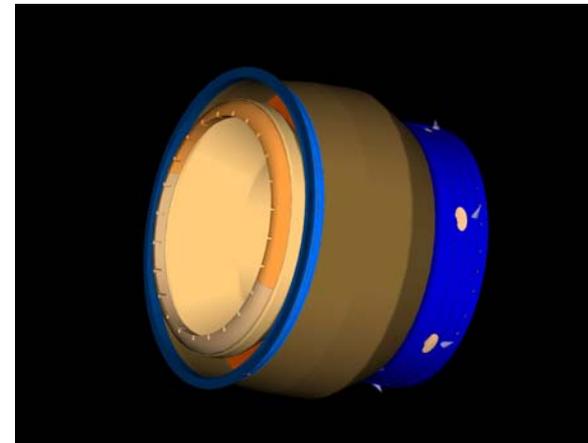
- Develop appropriate catalyst to extend preburner operating range
- Design for larger temperature rise without generating higher NO_x

Milestone Accomplishment

- Catalyst design complete
- Subscale rig validation test complete
- Conceptual design for preburner with catalytic secondary complete



Preburner with Secondary Catalyst



Solid Model Characterization of Preburner

Low-Emissions Preburner Technology

Catalytic Pilot for Lean Premix Burner Objectives

- Develop design concepts for catalytic pilot
- Test selected concept in high pressure rig to simulate engine operation

Milestone Accomplishment

- Performance estimate complete
- Catalyst design complete
- Subscale rig validation test complete
- Full scale high pressure rig test complete



Catalytic Pilot Test Hardware



Test Facility

Extension to Back-Up Diesel Fuel

Extension to Back-Up Diesel Fuel Objectives

- Develop a novel approach to convert diesel fuel to gas
- Determine economic viability of approach
- Demonstration of technology with subscale test

Milestone Accomplishment

- Approach selected
- Economic study completed

Implementation Approach

- **Concept Analysis**
- **Subscale Rig Testing**
- **Full Scale Rig Testing**
- **Structural Analysis**
- **Mechanical Design**

Technical Progress

Catalyst Life Extension

Advanced material available for production design

Catalyst Module Cost Reduction

Commercial design complete and in manufacturing process

Catalytic Secondary Burner

Conceptual design being converted to full scale rig test design

Catalytic Pilot for Lean Premix Burner

Final testing in progress leading to engine hardware design

Extension to Back-up Diesel Fuel

Initial economic analysis indicates non-economic solution

Practical Application

Catalyst Life Extension

Commercial use in Xonon catalytic combustion systems

Catalyst Module Cost Reduction

Commercial use in Xonon catalytic combustion systems

Catalytic Secondary Burner

Commercial use in Xonon catalytic combustion systems

Catalytic Pilot for Lean Premix Burner

Commercial use in industrial gas turbines with lean premix DLE systems

Extension to Back-up Diesel Fuel

Commercial use in Xonon catalytic combustion systems

Collaborations

- UCI – rig testing of various pilot designs
- Solar Turbines – high pressure testing of selected pilot design