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LOW-NOX FLOX COMBUSTOR
FOR HIGH EFFICIENCY GAS TURBINES

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CONTRACT N°: ENK5 - CT 2000 - 00114

COORDINATOR: - ISRAEL INSTITUTE OF TECHNOLOGY (TECHNION)

CONTRACTORS:

- **Israel Institute of Technology (Technion)**
- **Imperial College of Science Technology & Medicine (ICSTM)**
- **CINAR Ltd. (CINAR)**
- **Instituto Superior Tecnico - (IST)**
- **Institute of Fundamental Technological Research (IPPT-PAN)**
- **ANSALDO Ricerche - Srl. (Ansaldo)**
- **B&B AGEMA Gmbh (B&B-AGEMA GmbH)**
- **Rheinisch-Westfaelische Technische Hochschule Aachen (RWTH)**

DURATION: December 1st 2000 - november 30 2003

Kick-Off Meeting, Brussels,

Feb 9 2001

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Goals:

A. Reducing global and local environmental impact
   a. Low NO_X emission levels
   b. CO_2 reduction
   c. Capability of using lower grade fuels
   d. Improving acceptability and integrating renewable energies (including waste)

B. Improved efficiency of gas turbines
C. Lower running cost
D. Improved reliability and availability
E. Ability to retrofit existing power plants
F. Increase in the competitiveness of European industry.

PROJECT SUMMARY

Objectives: To develop innovative combustors for small gas turbines, suitable for safe and reliable operation at high temperatures while maintaining low NOx levels.

Other objectives are:

- to improve the internal combustor aerodynamics in order to obtain a more uniform wall temperature for lower thermal stresses,
- to lower the values of the exhaust gas pattern factors for better circumferencial uniformity at the combustor exit
- to gain advanced engineering expertise in modelling of combustion, chemistry–turbulence interaction, integrated wall cooling and combustion aerodynamics, high momentum and uniform fuel stream injection and more

The major goal of this project will be to produce an advanced, tested and validated, operating pilot combustor.

Description of the Work:

The method in the FLOXCOM project is based on a technologically innovative combustion solution, **the FLameless OXidation (FLOX)** method.

The investigation is directed toward the completion of the studies required to validate the engineering feasibility of the Flameless Oxidation technology and to produce operating pilot combustors that will show its improved performance.

This project will test and verify the new combustor technology. However it should be noted that, some optimisations of various design parameters and endurance testing will still have to be performed to complete the combustor design.

The technological objectives of the present project are to design, build and test a pilot combustor using the FLOX combustion concept.

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The methodology includes the following tasks:

1. To improve combustion modelling
2. To improve fuel injection and distribution.
3. To improve wall cooling techniques.
4. To get physical insights of the main vortex
5. To design an optimal combustor.
6. To perform combustor sector testing.
7. To assemble the pilot combustors.
8. To perform pilot combustor testing.
9. To deduce conclusions.

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Consortium Overview

Technion **- Project Coordination and Integration**

1 1. Project guidance and supervision

2. Work integration and exploitation

3. Mediation with subcontractors

- Design & Manufacture of two Combustor Sectors.

- Design & Manufacture of Pilot Combustor

- FLOX Fundamentals Investigations

4. FLOX fundamentals analysis and laboratory investigation.

5. NOx prediction model development.

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ICSTM 2 - **Combustion Model Development**

1. Develop an advanced combustion model.
2. Validation of the developed model.

CINAR 3 - **Engineering Evaluation of the Combustor**

1. Improved code implementation
2. Internal reactive flow simulations (CFD analysis)
3. Parametric combustor assessment
4. Combustor design optimisation
5. Tests data and expected results estimation.

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IST - **Fuel Injection System Design**

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1. Numerical and experimental investigation of combustor performance for different fuel injection methods.
2. Test of injection and flow-field interactions in a sector combustor

IPPT-PAN **- Recirculation Patterns Validations**

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1. Optical diagnosis of vortex structure
2. Geometric combustor optimisation

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- **High Pressure Combustor Sector Tests**

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1. Design of the combustor interface
2. Testing campaign
3. Modelling and assessment

- **Wall Cooling Technology**

B&B

AGEMA

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1. Modelling and optimisation of combined wall cooling and ejection momentum.
2. Experimental technology demonstration

RWTH

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- Full Scale Combustor Running Tests

WORK STRUCTURE