

Fast REsponse Temperature Sensor for GAs Turbine Efficiency (FRETSGATE)

Lead Partner – Oxsensis

Collaborators – Rolls-Royce and
Siemens Industrial Turbines (UK)

Project Outline

Overall Aim:

Development of an optical temperature sensor system capable of measuring gas path temperature to at least 1200°C (stretch target 1700°C) in Gas Turbines.

Purpose:

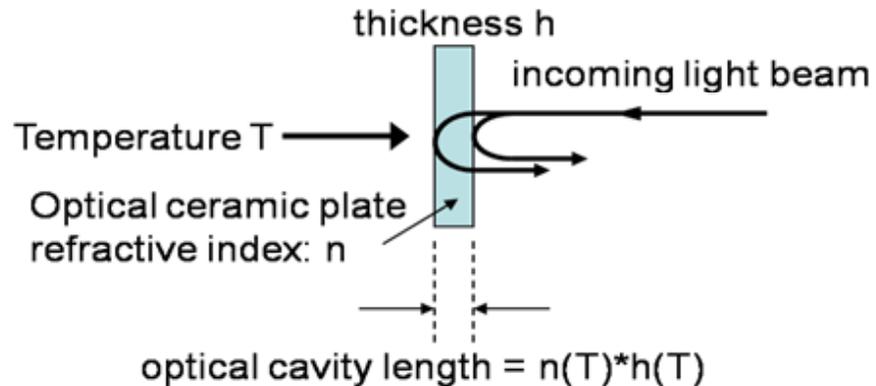
For use in combustion monitoring and control initially for engine development with the aim of moving into operational control systems. Targeted improvements include improved overall efficiency (specific fuel consumption), prevention of damaging events (e.g. flashback) and as part of a condition based monitoring scheme for operational turbines.

Key Technology Targets:

Attribute	FRETSGATE TARGET
Response Time	≤0.1s (stretch target ≤0.05s)
Sensor Lifetime	150 hrs (development sensor) 25,000 hrs (production sensor)
Max Continuous Temperature	1200°C (stretch target 1700°C)
Max Short Term Temperature	1400°C (stretch target 1700°C)
Accuracy	<1% of measurement

Technology Starting Point

Fabry-Pérot Interferometer Sensor



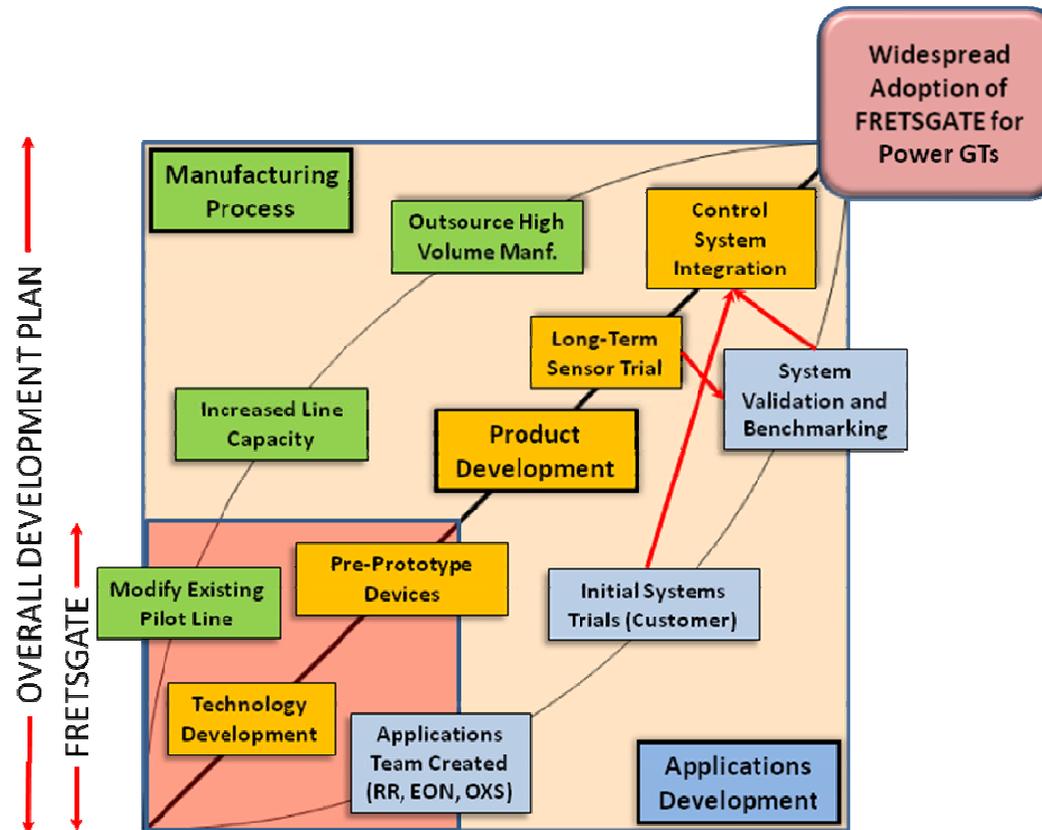
- Optical cavity length changes in response to temperature by:
 - Expansion ($\Delta h \propto \Delta T$)
 - Refractive Index change ($\Delta n \propto \Delta T$)
- For fast response:
 - Thermal mass is small
 - Sensor element geometry is critical

Technology transfer from Oxensis existing dynamic pressure sensor system



New interrogator under development for T sensors which may (with adaption) have application for multiple parameter measurements (e.g. Pressure and Temperature).

Where Does the FRETSGATE Project Fit?



Additional Benefits From FRETSGATE

- Fast response offers potential benefits in flexible fuelling conditions, particularly with H₂ rich fuels
- When coupled with dynamic and static pressure sensors FRETSGATE can form part of a more complete 'portfolio' of optical sensors for Gas Turbines

Collaboration Opportunities

- Testing opportunities for sensors and/or optical interrogators – interrogator testing can include pressure sensor running instead of/in addition to temperature sensors.

Testing opportunities on a variety of engines and locations will be of significant value both for technology development and to ensure maximum progress towards commercialisation within the project timeframe.

- Specification discussions – a broader specification investigation will help centre the project on the most promising applications as well as understanding the feasibility of tackling further uses (including outlier points)
- Potential for technology collaboration in specific areas, most likely to be additional elements arising from the broader specification discussion.
- These are the readily identifiable collaboration opportunities in the *short term*. There may well be others identified by discussion for both short term (between existing projects) and longer term (new collaborations).