

# Towards the elaboration of the European Code of Practice for TMF crack growth

S. Stekovic<sup>1</sup>, M. Whittaker<sup>2</sup>, C. Hyde<sup>3</sup>, O.M.D.M Messé<sup>4</sup>, S. Pattison<sup>5</sup> and J. Moverare<sup>1</sup>

<sup>1</sup>Department of Management and Engineering, Linköping University, Sweden

<sup>2</sup>College of Engineering, Swansea University, Swansea, United Kingdom,

<sup>3</sup>Faculty of Engineering, the University of Nottingham, Nottingham, United Kingdom,

<sup>4</sup>Department of Materials Science & Metallurgy, the University of Cambridge, United Kingdom

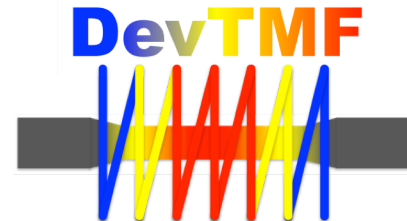
<sup>5</sup>Rolls-Royce plc., Derby, United Kingdom.



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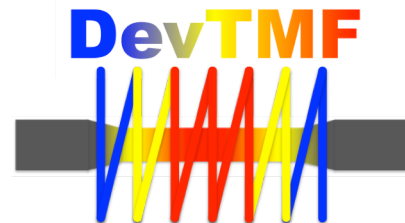
# Content of presentation

- Scope
- What is DevTMF
- Objectives
- Partners
- Approach towards standardisation
- Contact information



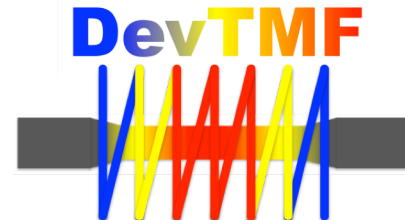
# Scope

- Promotion of standardisation of TMF CG method
- Exchange of scientific results and knowledge relating to the field
- Dissemination of the project and its results
- Way forward



# DevTMF

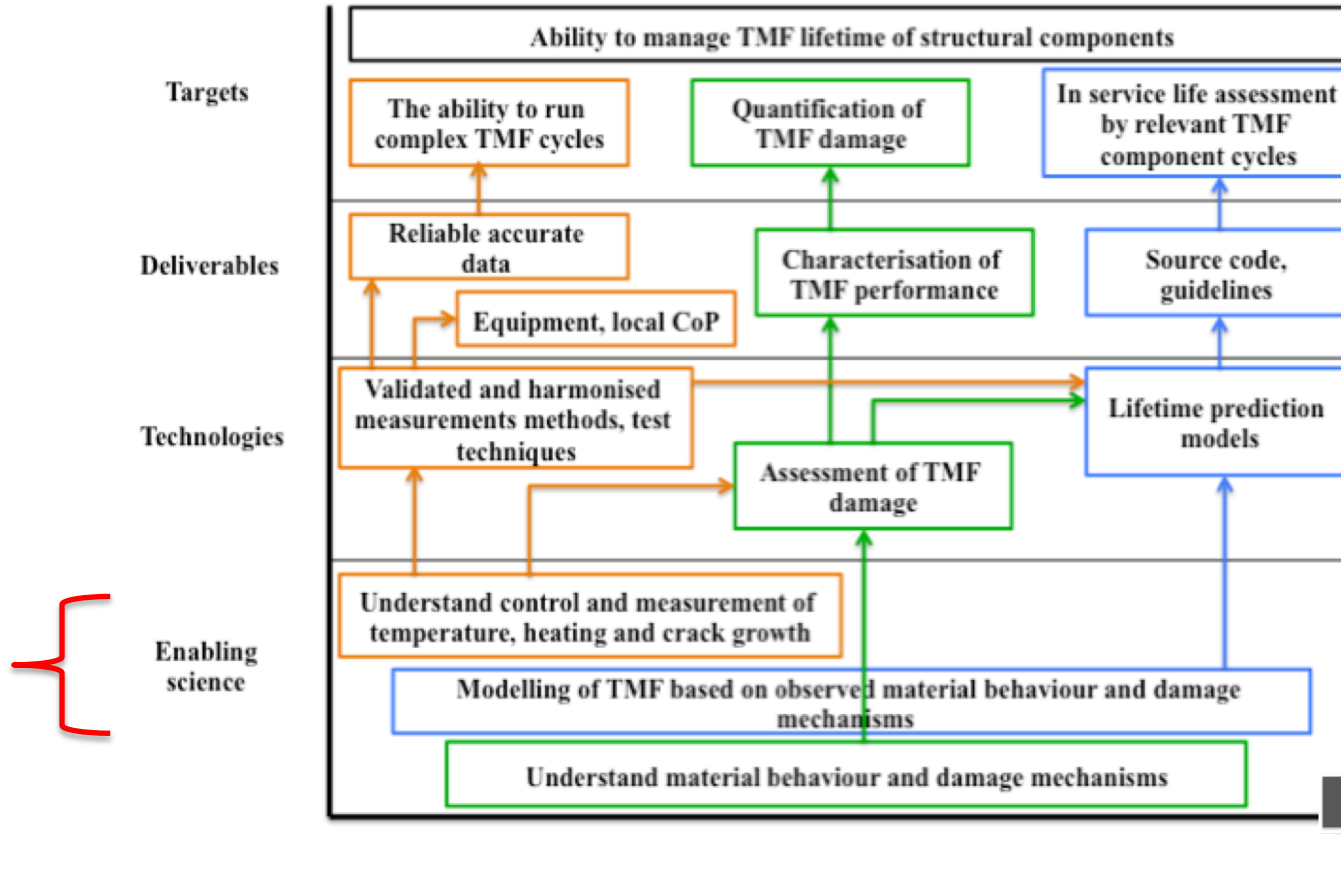
- Objectives:** Development of Experimental Techniques and Predictive Tools to Characterise Thermo-Mechanical Fatigue Behaviour and Damage Mechanisms
- Funded:** Horizon 2020 and Clean Sky 2
- Start date:** 1<sup>st</sup> of Feb 2016
- Duration:** 48 months
- Consortium:** 3 partners and one topic manager
- No of tests:** ≈100 including 15 for back-to-back testing



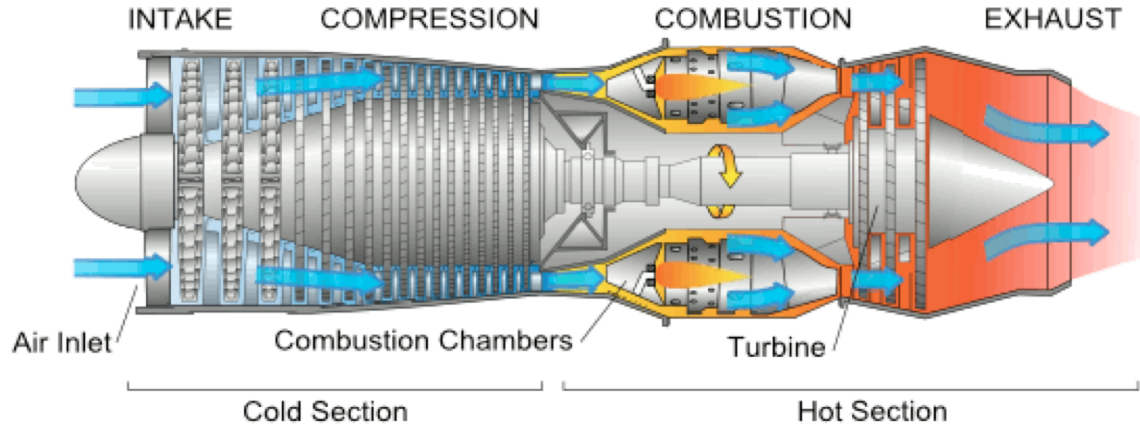


## DevTMF roadmap

Drivers (benefits): environment impact (reduced), sustainability (increased lifetime), competitiveness (improved materials, fuel consumption, market share)



# Grand vision



Higher turbine temperature

Cost effective product

Enhance competitiveness

Market advantage

Increase of operation and service life

Optimised performance and efficiency

Reduced overhaul and replacement costs

Lower fuel consumption and environmental impact

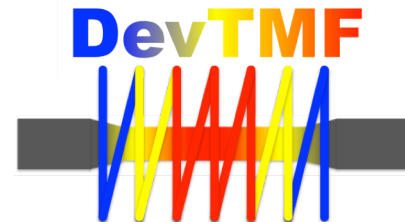
# Grander vision

## Clean Sky 2: Drivers and technical challenges

- Reduce perceived external noise by 50% by 2020 and 65% by 2050
- Reduce fuel consumption and CO<sub>2</sub> emissions by 50% by 2020 and 75% by 2050
- Reduce No<sub>x</sub> emissions by 80% by 2020 and 90% by 2050



Vision 2020 and Flight 2050 targets are for new aircraft technology relative to 2000 performance



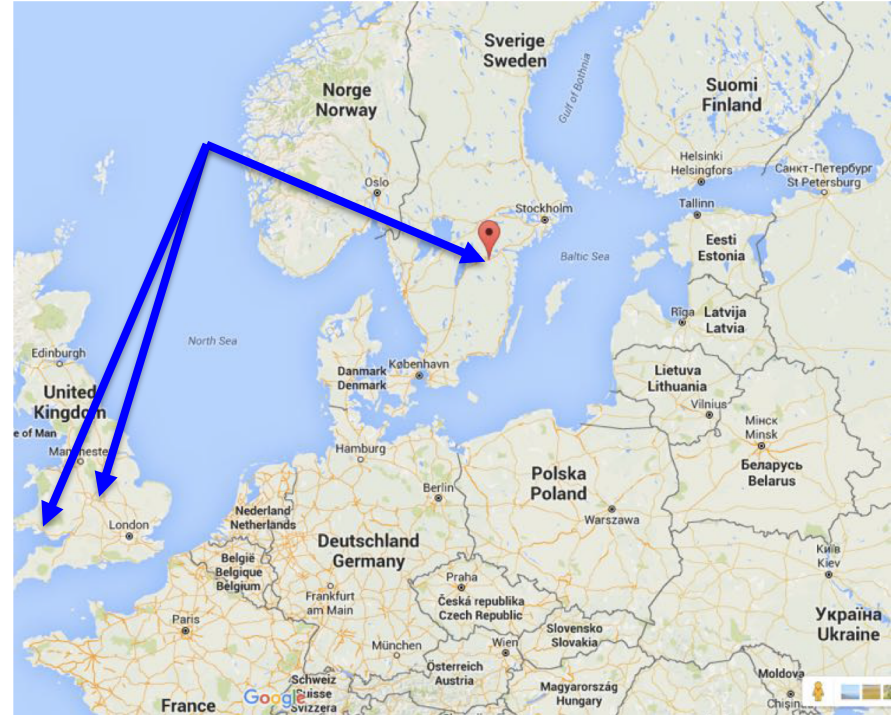
# The Partners



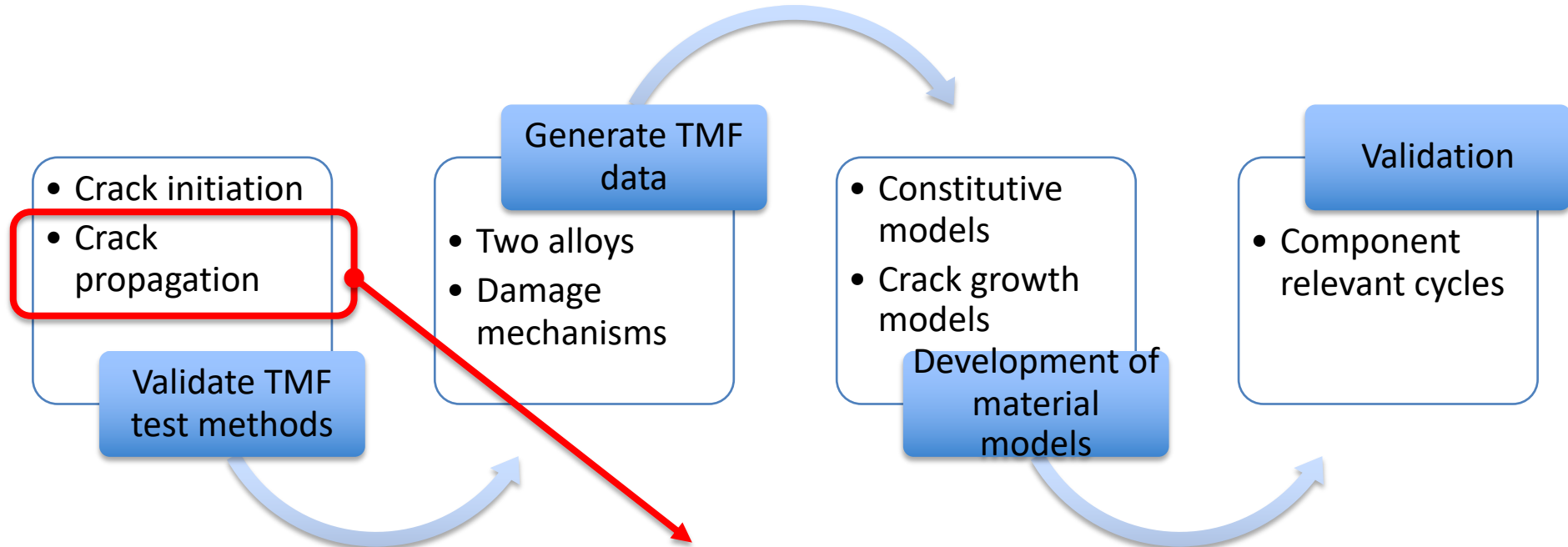
The University of  
Nottingham



Rolls-Royce

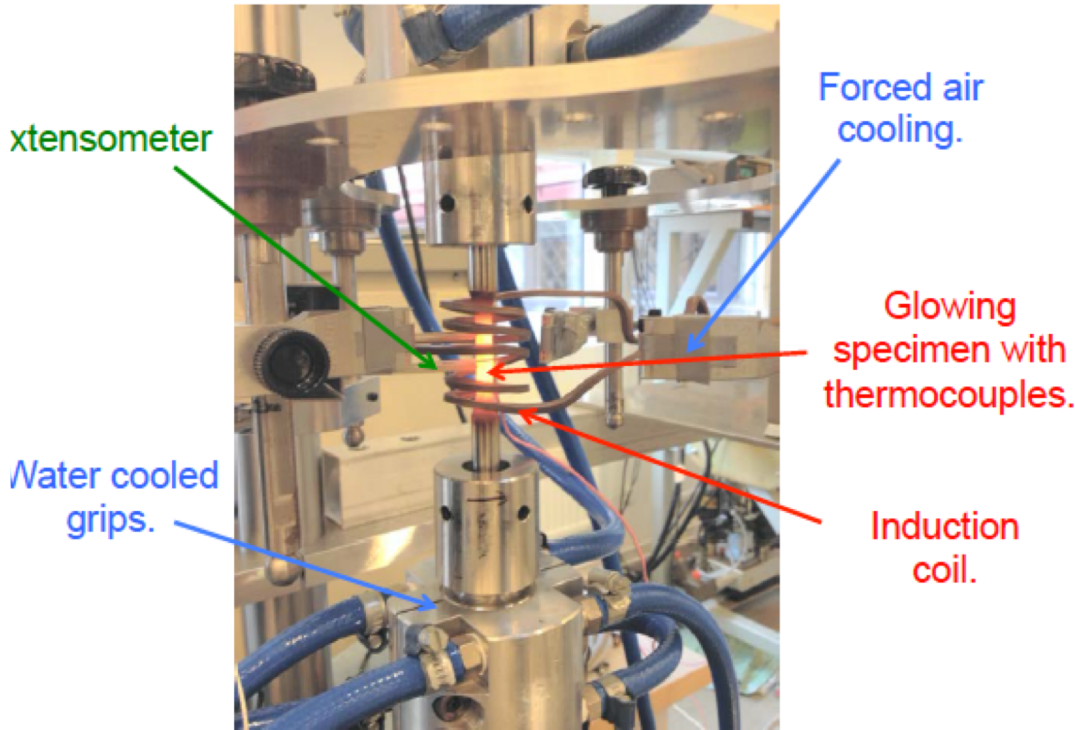


# Specific content addressing TMF CG



Local validation of the TMF CG method

# Thermo-mechanical fatigue



Existing standards:

Strain controlled TMF:

EU CoP

ASTM E2368 – 10

ISO 12111:2012

Force controlled TMF:

A CoP developed by Rolls-Royce  
MTOC

TMF crack growth:

Not covered by CoP or standard  
Investigated in isolation and with  
limited conditions

# Approach towards standardisation

Standardisation of procedures and methods between the partners:

1. Agree on [specimen design](#): CC specimens, may run SEN design,
  2. Agree on suitable [crack monitoring](#) techniques: ACDP and DCPD,
  3. Agree on [heating/cooling](#) method: radiant lamp heating and induction heating,
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1. Use of [temperature](#) measurement methods: TCs, thermography and pyrometry,

# Approach towards standardisation

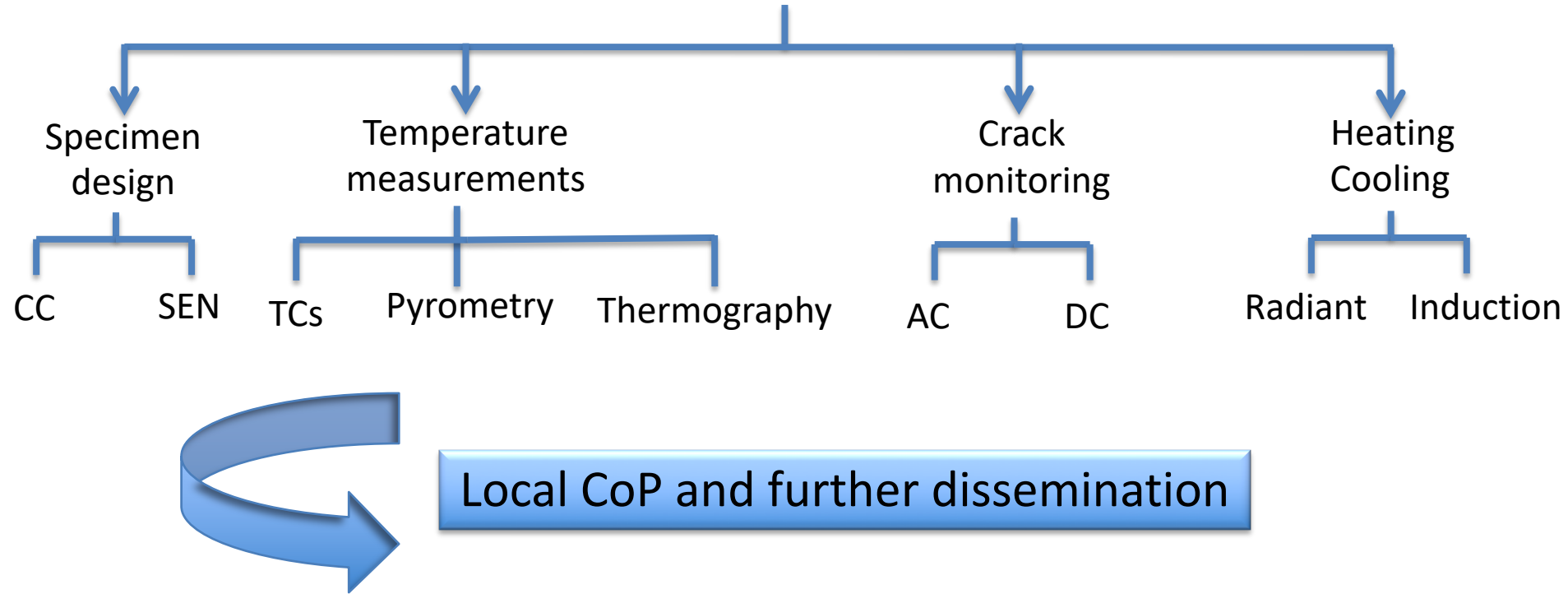
Standardisation of procedures and methods between the partners:

5. Use of [existing standardised protocols](#) for strain controlled TMF and isothermal crack growth testing,
6. Local [round robin](#) with 5 tests with same conditions at each lab,
7. Establish a local CoP at the consortium level to ensure repeatability and consistency, and
8. Dissemination through the TMF community and further meetings to decide a way forward



# Approach towards standardisation

## TMF CG

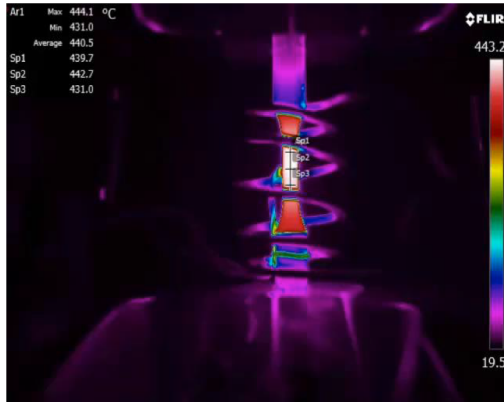


# Approach towards standardisation

Assessment of:

1. Thermal gradients,
  2. Ability to heat specimens using conventional furnaces and induction heating,
  3. Stability of existing high temperature measurement methods,
  4. Interaction of heating methods with crack growth measurements, and
1. Applicability of crack detection methods.

# Final words



Images from Swansea University

Starting of with thermal profiling and  
a local back-to-back testing

Most of the TMF CG tests to be done at SU

An international seminar will be organised  
at the end of the project (SU lead) to define  
further actions but

We are happy to collaborate before the end!

# Contact details

## **For the project:**

Svjetlana Stekovic

E-mail: [svjetlana.stekovic@liu.se](mailto:svjetlana.stekovic@liu.se)

Phone: +46 13 28 69 55

## **For standardisation of TMF CG:**

Mark Whittaker

E-mail: [m.t.whittaker@swansea.ac.uk](mailto:m.t.whittaker@swansea.ac.uk)

Phone: +44 1792 295 573