



CAME-GT

Internal Coatings for Gas Turbine Blades (Co-operative programme within Dutch VGT)

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CAME-GT THEMATIC NETWORK FOR CLEANER & MORE EFFICIENT GAS TURBINES
2nd WORKSHOP, Brussels - 1st October 2001



Aerial view NLR sites

Amsterdam

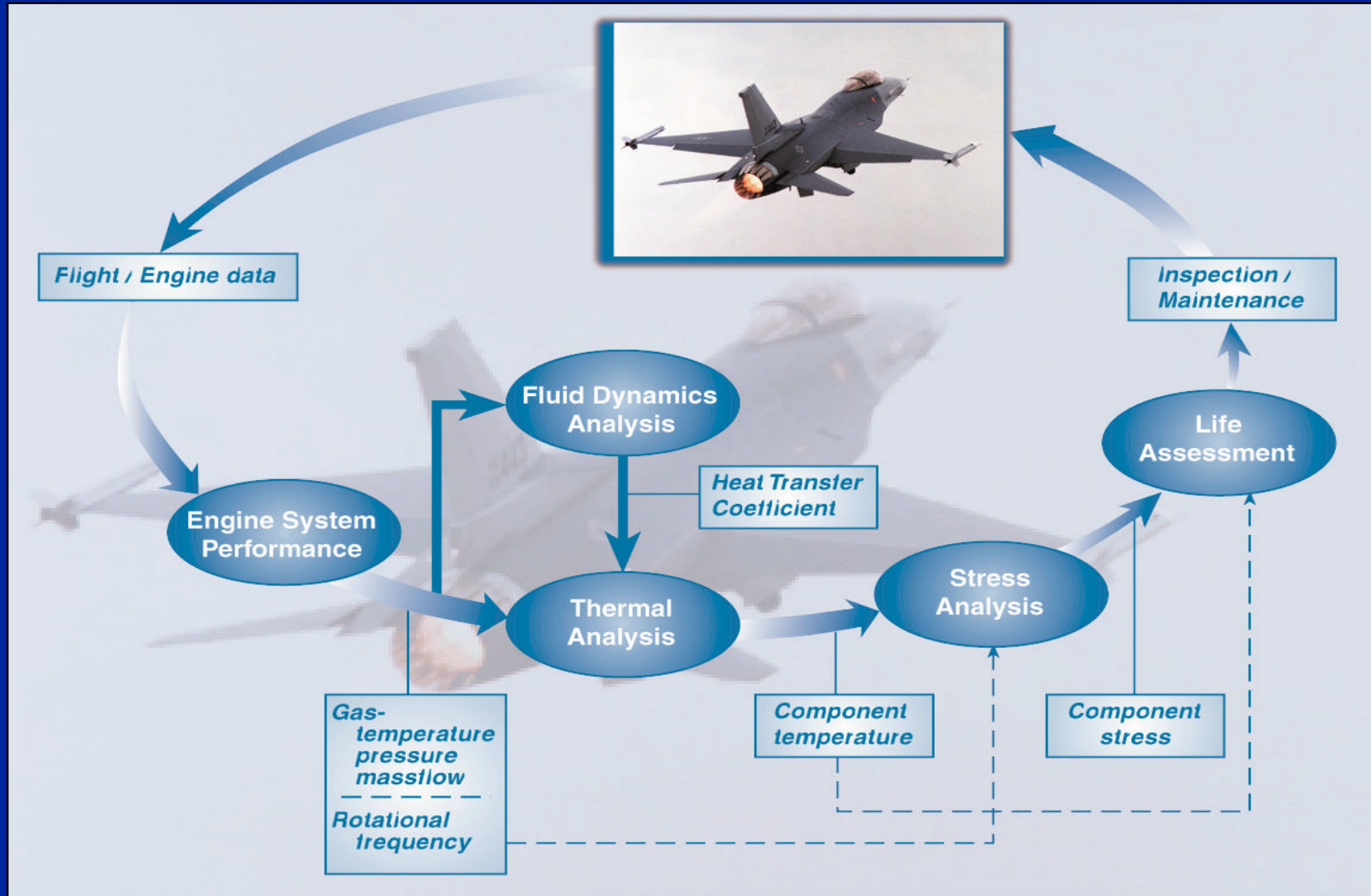


Noordoostpolder





Gas Turbine Research at NLR





Internal Coatings: background

- ✂ Uncoated internal cooling channels becoming life limiting factor in blade life (> 50 % rejected for specific blade/engine)***

- ✂ Introduction internal coatings***
 - ✂ Aero gas turbines for more than 10 years*
 - ✂ Industrial gas turbines recently introduced internal coatings*

- ✂ Mixed experiences with internally coated blades by operators***

- ✂ Operators and coating suppliers expressed need to extend knowledge***



Participants (1)

The logo for ECN (Energy Research Centre of the Netherlands) features a stylized red and white graphic above the text 'ECN' and the tagline 'energy-innovation'.	The logo for elbar consists of the word 'elbar' in a bold, black font, with a red and white striped graphic above it.	The logo for ELECTRABEL features the word 'ELECTRABEL' in a bold, blue font, accompanied by a blue circular graphic with a lightning bolt.
The logo for BABCOCK BORSIG POWER features the text 'BABCOCK BORSIG POWER' in a bold, blue font, with a small globe icon to the right.		The logo for CHROMALLOY HOLLAND B.V. features a black and white globe icon with a person figure, next to the text 'CHROMALLOY HOLLAND B.V.' in a bold, black font.
The logo for e-on Benelux features the text 'e-on' in a stylized, red and white font, with 'E.ON' and 'Benelux' in smaller text below it.	The logo for KLM consists of the letters 'KLM' in a bold, black font.	The logo for NVR features the letters 'NVR' in a stylized, blue and orange font, with an upward-pointing arrow.
The logo for interturbine Coating Center features the text 'interturbine Coating Center' in a black font, with a green and white graphic to the left.		The logo for KEMA features the word 'KEMA' in a bold, blue font, with a stylized graphic to the right.
The logo for NLR, identical to the one in the top right corner of the slide.	The logo for PHILIPS features the word 'PHILIPS' in a bold, white font on a blue rectangular background, with a small shield icon to the left.	The logo for VGT features the letters 'VGT' in a bold, black font, next to a stylized graphic of a turbine or engine component.



Participants (2)

✍ Research Centers

- ✍ National Aerospace Lab NLR
- ✍ KEMA
- ✍ ECN

✍ Support

- ✍ VGT
- ✍ NIVR
- ✍ TU Delft

✍ Industry

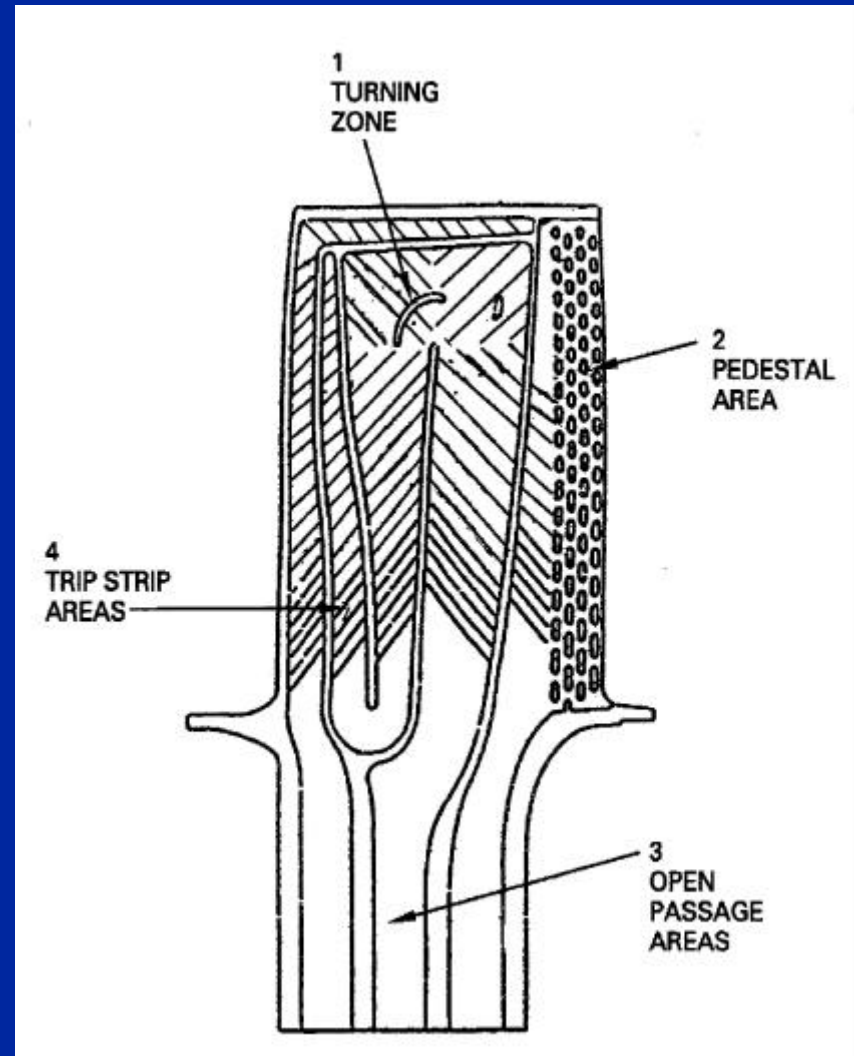
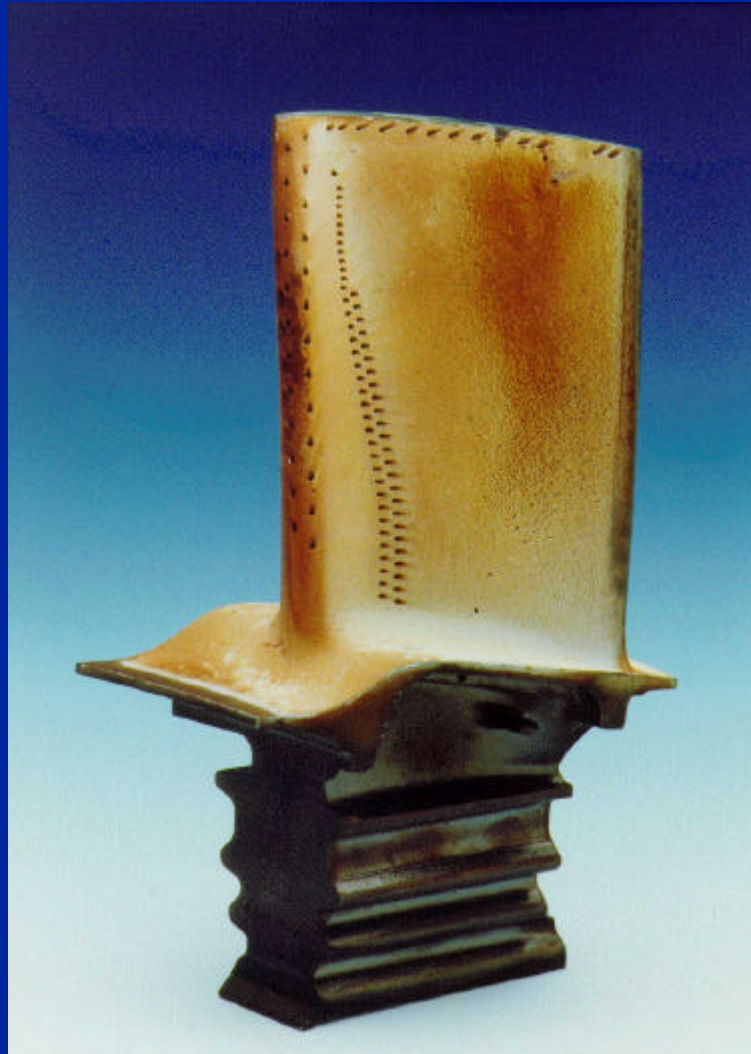
- ✍ Philips
- ✍ Babcock Borsig Power BBP
- ✍ Elbar
- ✍ SMC
- ✍ Chromalloy Holland

✍ Operators

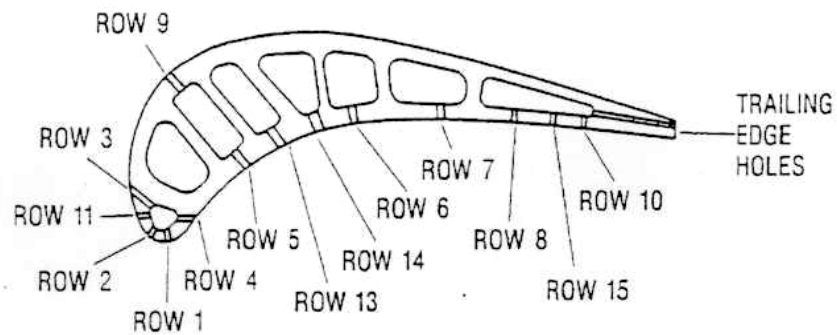
- ✍ KLM
- ✍ Electrabel
- ✍ E.on



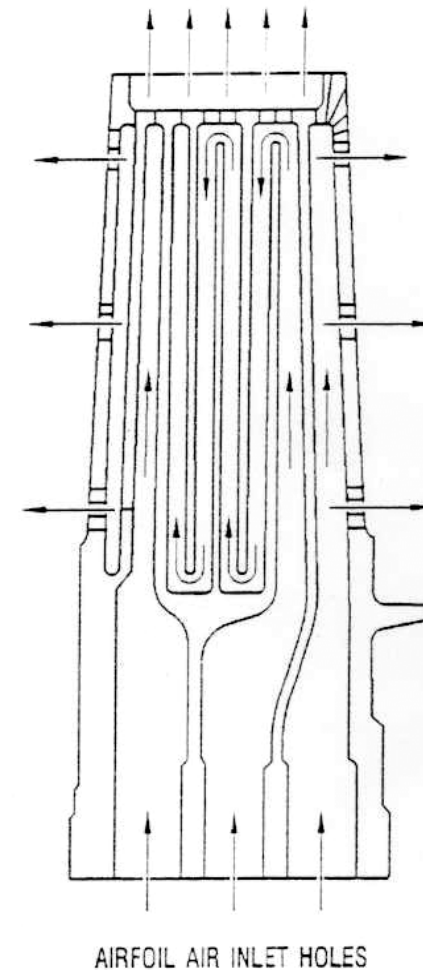
PWA-4000 1st HPT blade



CF6-80 1st stage HPT blade






SECTION B-B









Project outline

Phase I: Inventory

-  insufficient knowledge of the coating systems
-  not optimised application techniques and process control
-  claimed positive effects of internal coatings not always realised

Phase II: Process development

-  development/maturation coating processes (CVD, Pack, Slurry)
-  internal surface cleaning and repairability
-  ndi
-  detailed specification



Conclusive remarks

- ✍ Field experience and hardware evaluations gave much input to process application and process control improvements**
- ✍ Six application processes for internal coatings of turbine blades have been developed and/or evaluated**