

symposium

## an epicyclic gearbox ultrasound surveillance method



02/12/2014

Data Interpretation Limited 8th EASA  
Rotorcraft Symposium Version 141201.4 4:3

## presenters

- Peter Sharp.
- George Crowe.
- Data Interpretation Limited
- Norwich England.
- 55 minutes by air from Schiphol.
- 75 minutes by road to London Stansted.



# walk

- what led me to imaging with ultrasound.
- how I've imaged gears internally and externally, in motion.
- obstacles I've encountered.
- my team playing aspirations.



engineer



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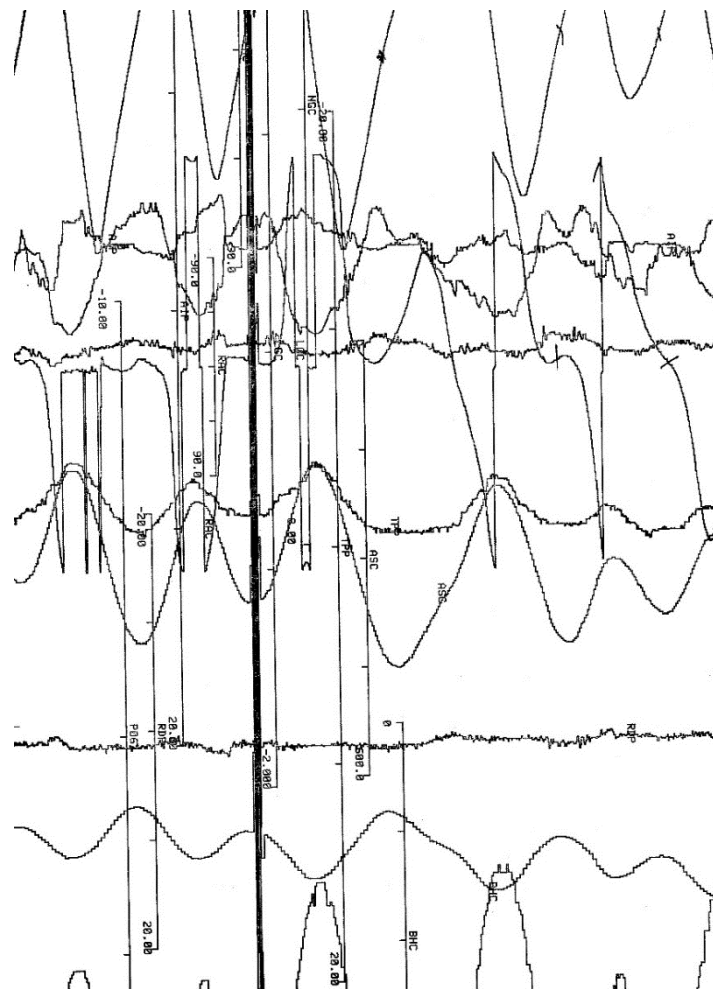
designer



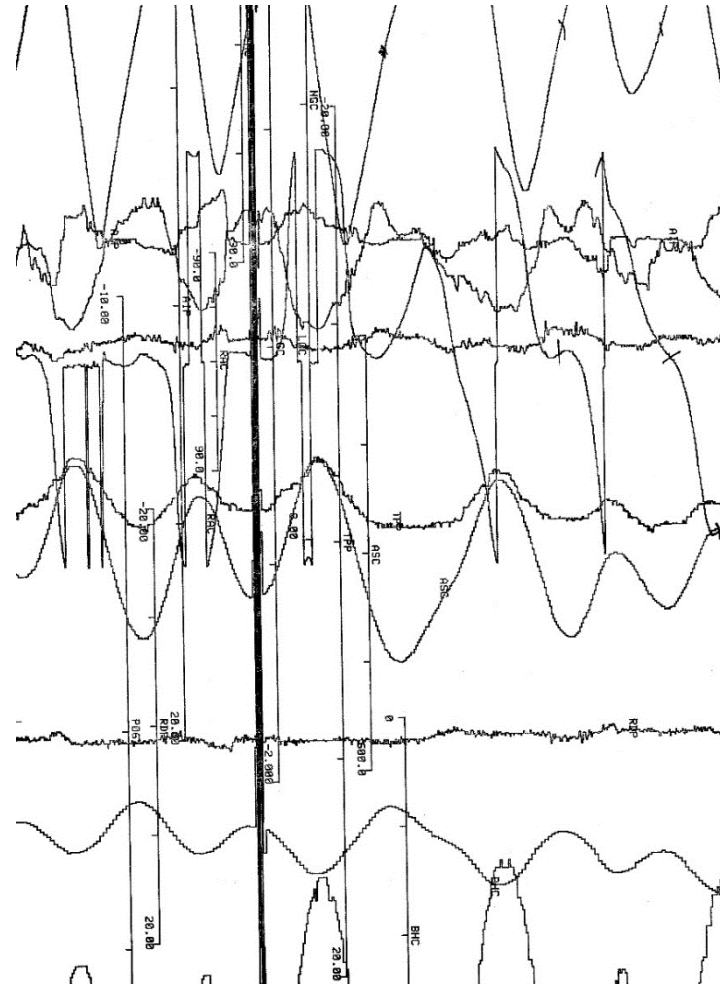
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# investigator



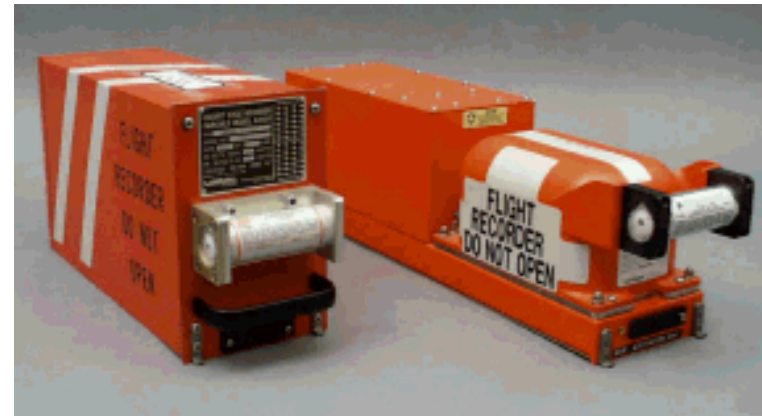
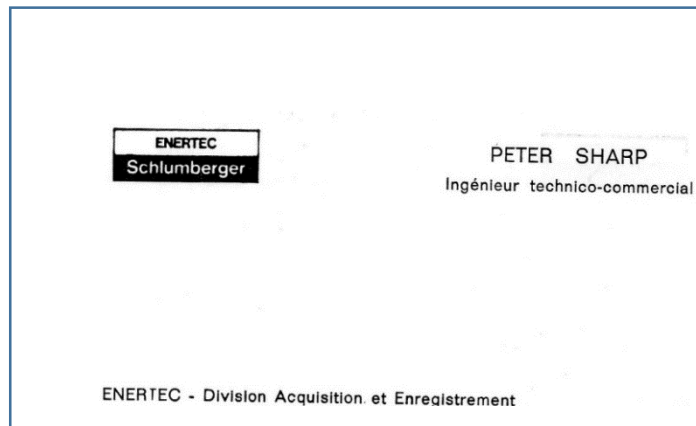
policy-maker



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# ingénieur

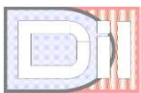


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wow!



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inaugural



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harp

- 06Nov86
- AAIB's Reg Feltham
- engines pristine
- gearbox failure
- Yeovil
- Stuart and Hughes
- HHMAG
- Redhill
- do you have anything to offer?



## options

- how do we test gearbox parts on the bench?
- visually
- dye penetrants
- eddy currents
- ultrasound imaging



# mummy's tummy

- listening
- imaging

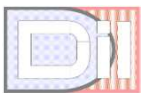
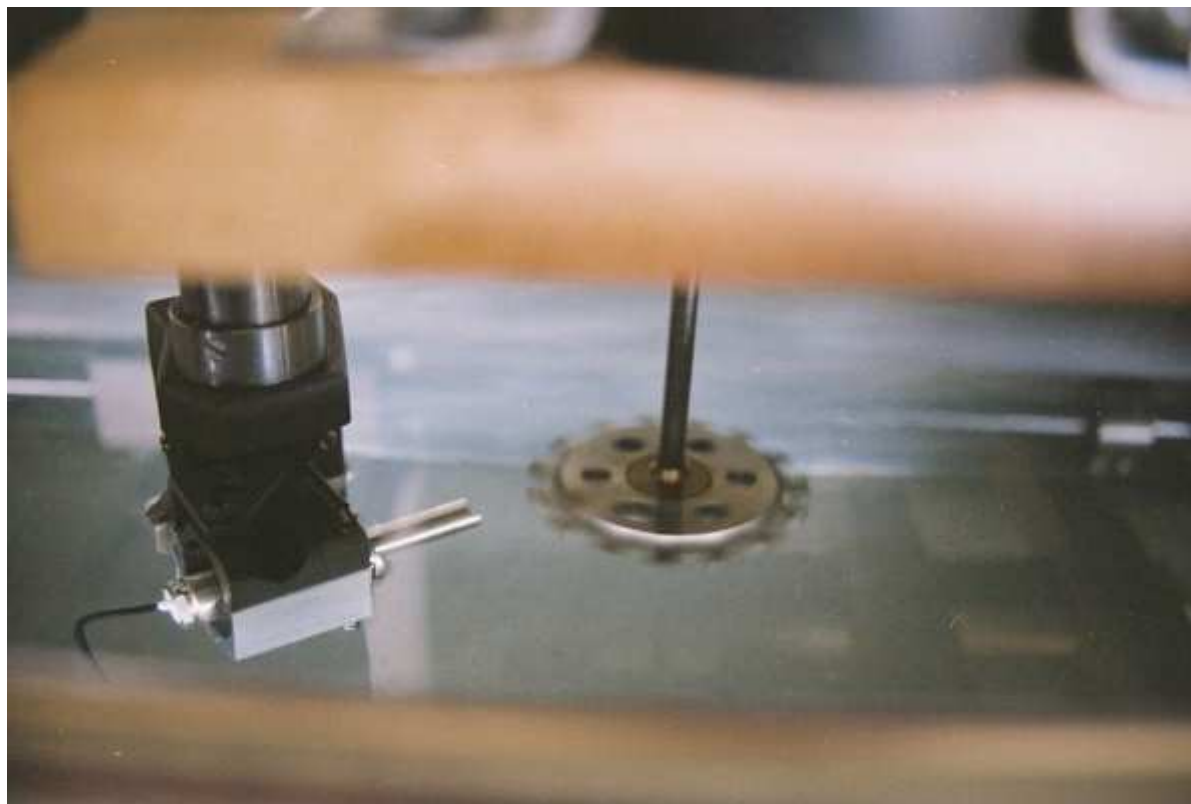


dera

- Roger Harris
- Prove the concept:
- imaging tooth shape with ultrasound in motion.
- do it closed-up inside a functioning gearbox.



immersion



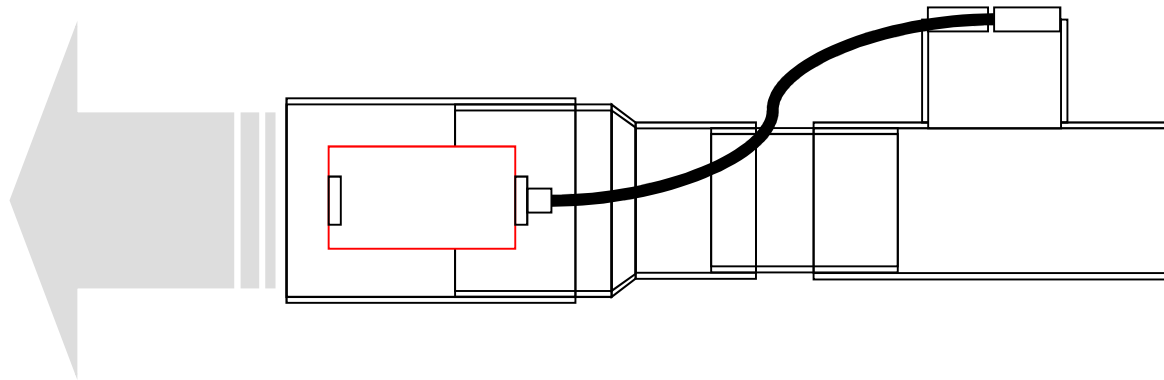
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# jetprobe





blip

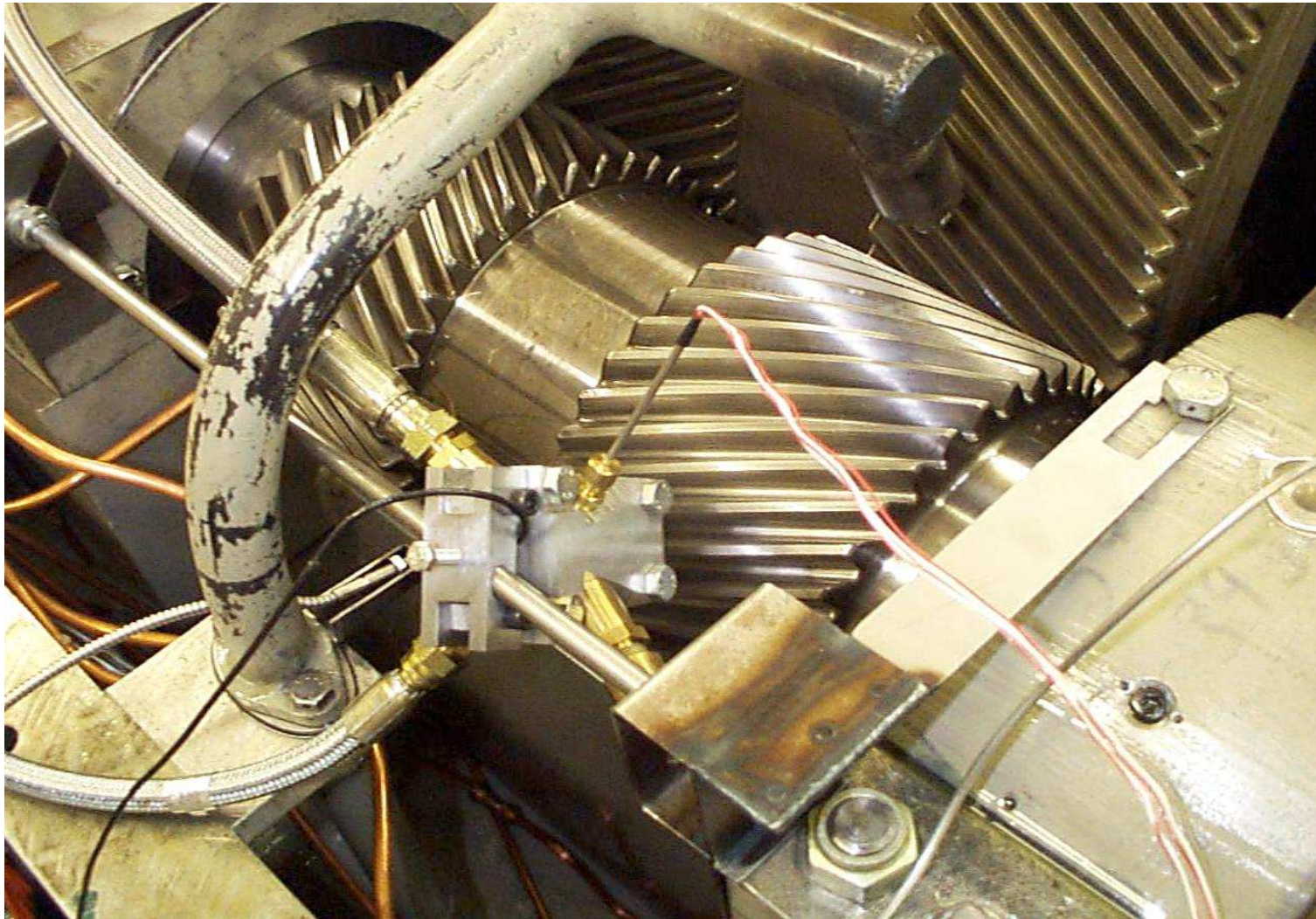


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scary



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functional

Oil supply (1)

Cogs(e)jp3 (2)

Bell Sungear (3)

P-E amplifiers (4)

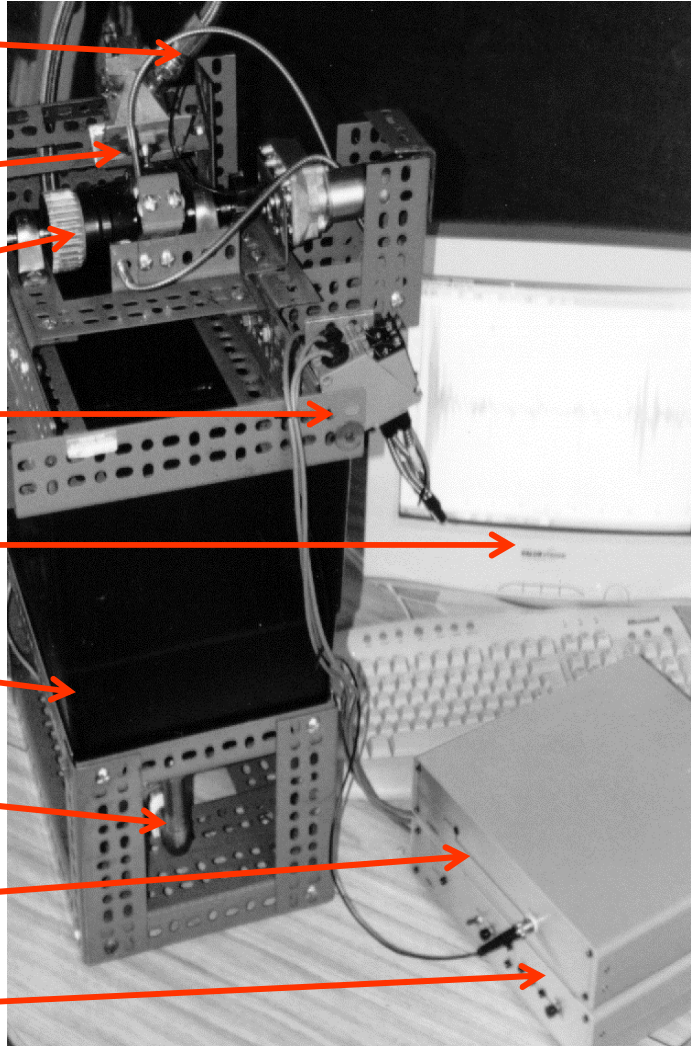
Oscilloscope(5)

Oil tank (6)

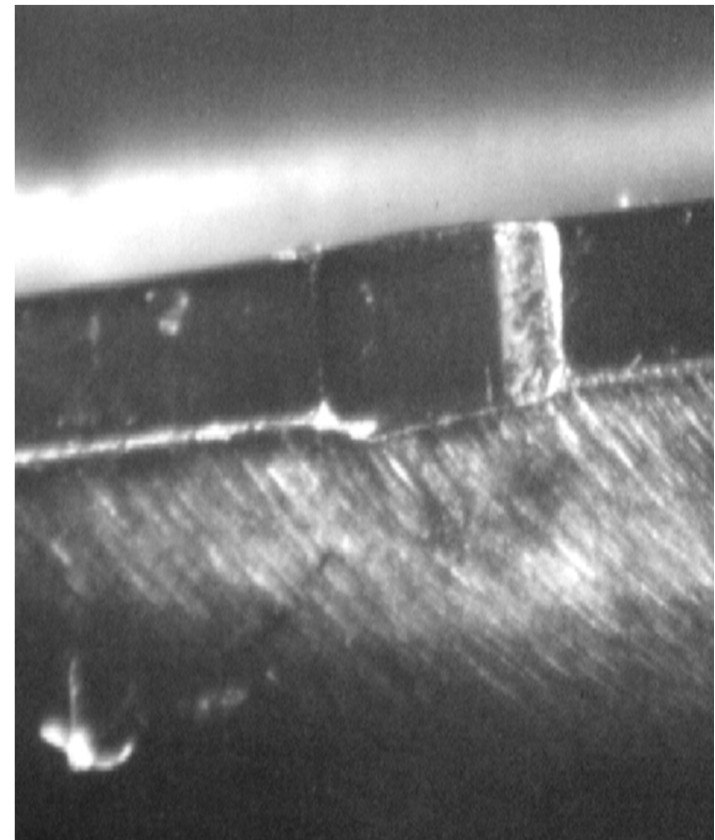
Oil pump (7)

diIEU (8)

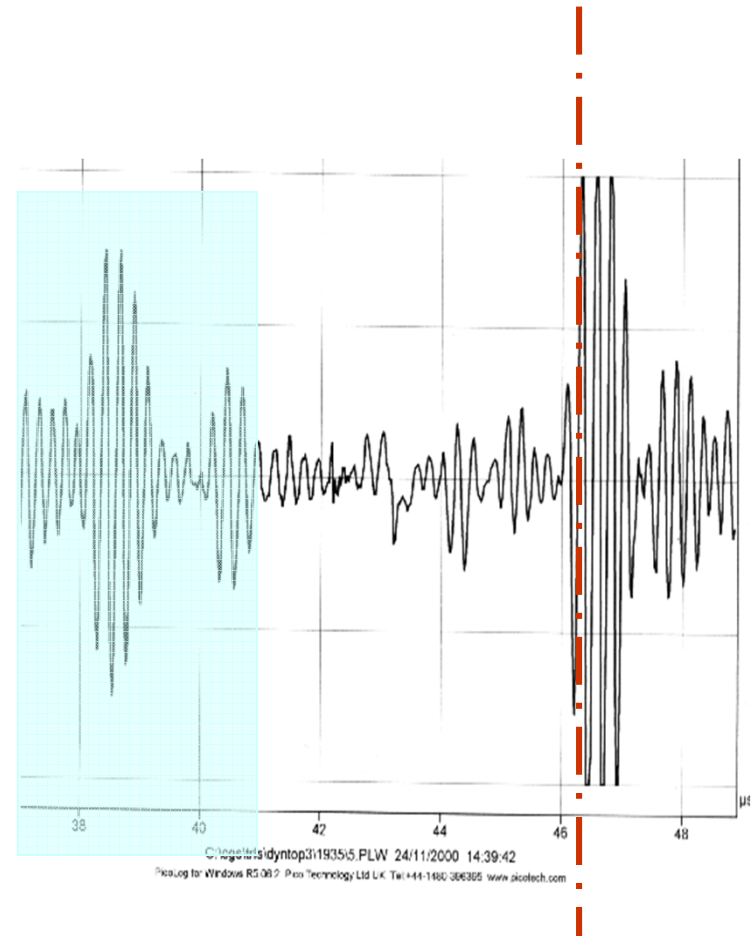
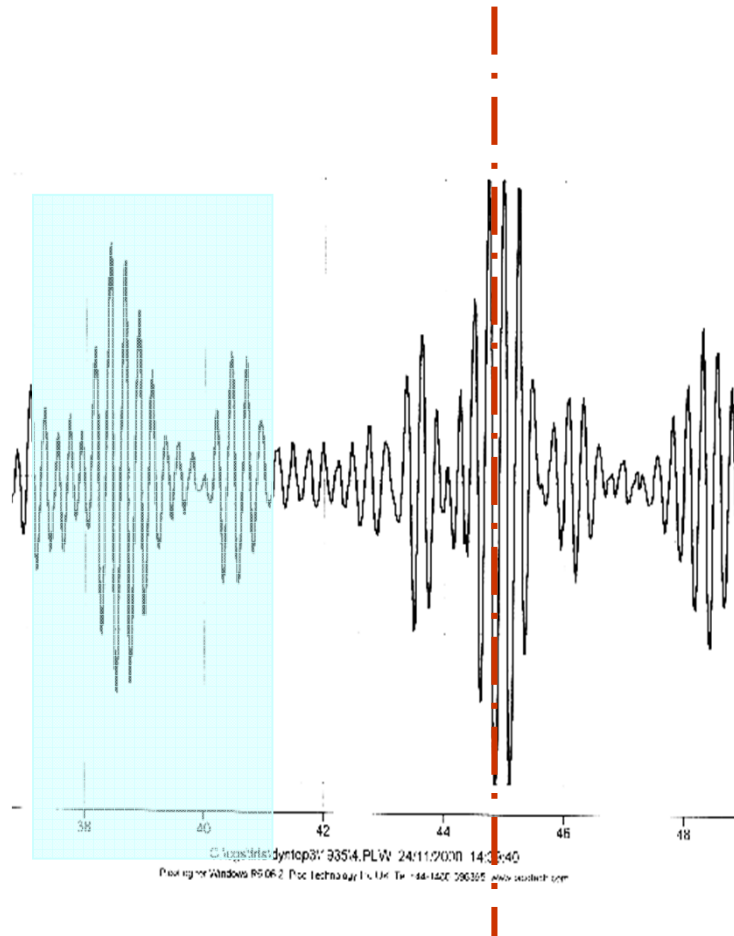
diIMU (9)



DERA Pyestock photograph  
Tooth 11 tip (10)



# traces



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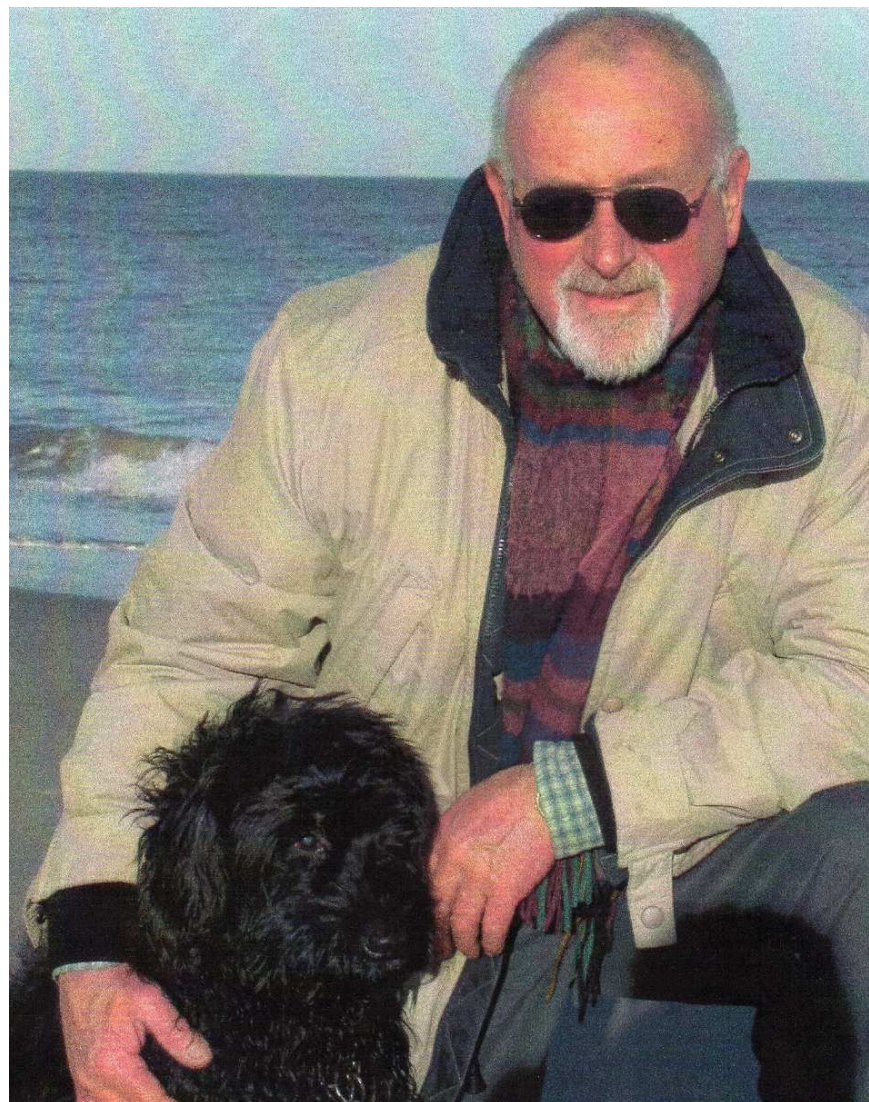
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# grip

- dera report Dil1011 06Dec00
- QinetiQ
- ships
- industrial grinders
- wind turbines
- railways
- got the message



r&r



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## winding-up

- its dominance has precluded business
- our ipr has no value
- report will be in the public domain
- potential for embarrassment
- “we didn’t know”
- please demonstrate
- introduction to Cranfield

Data  
Interpretation  
Limited

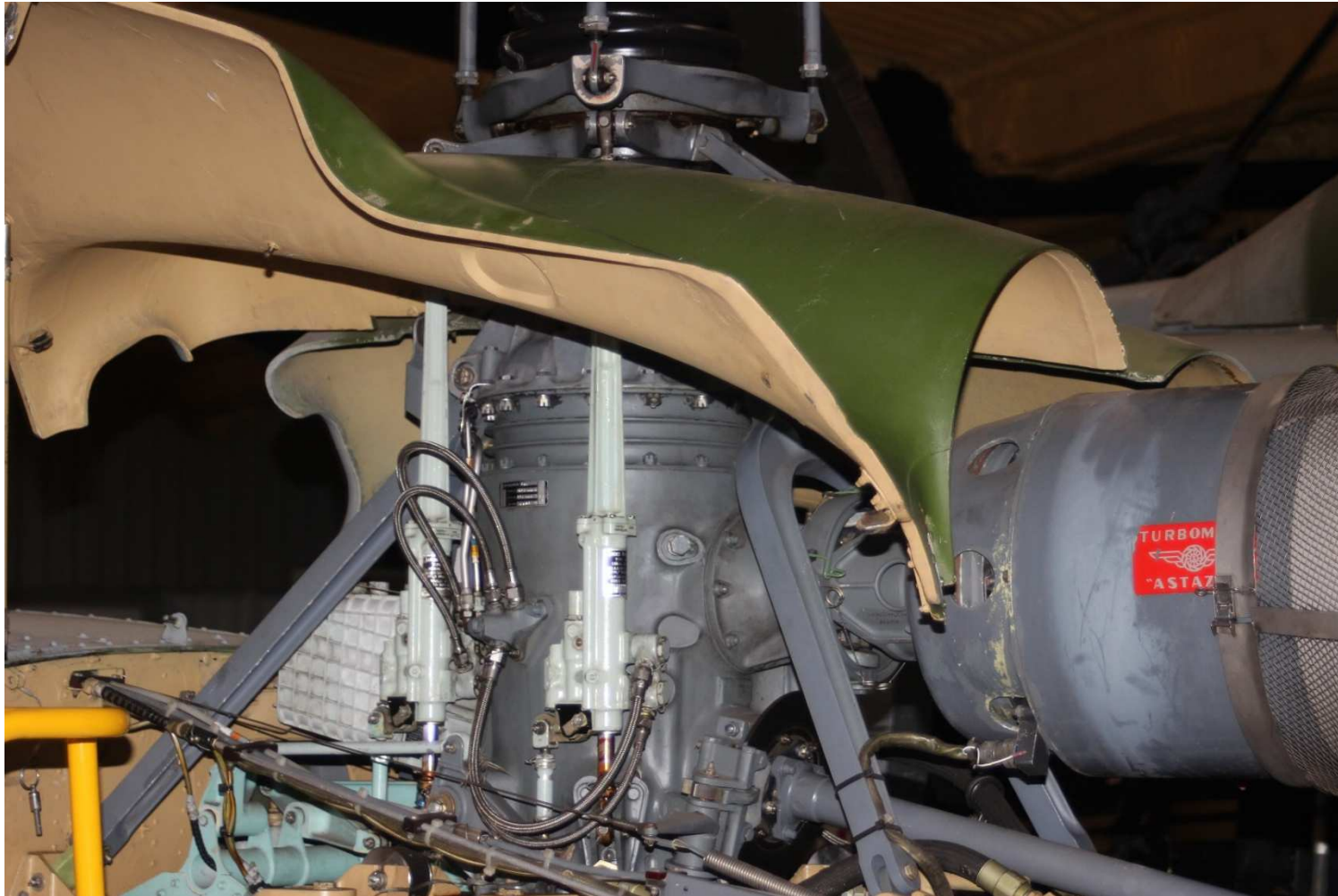
REPORT  
TO  
THE  
SHAREHOLDERS OF  
DATA  
INTERPRETATION  
LIMITED

12 September 2013

Peter Sharp



gazelle





serendipity



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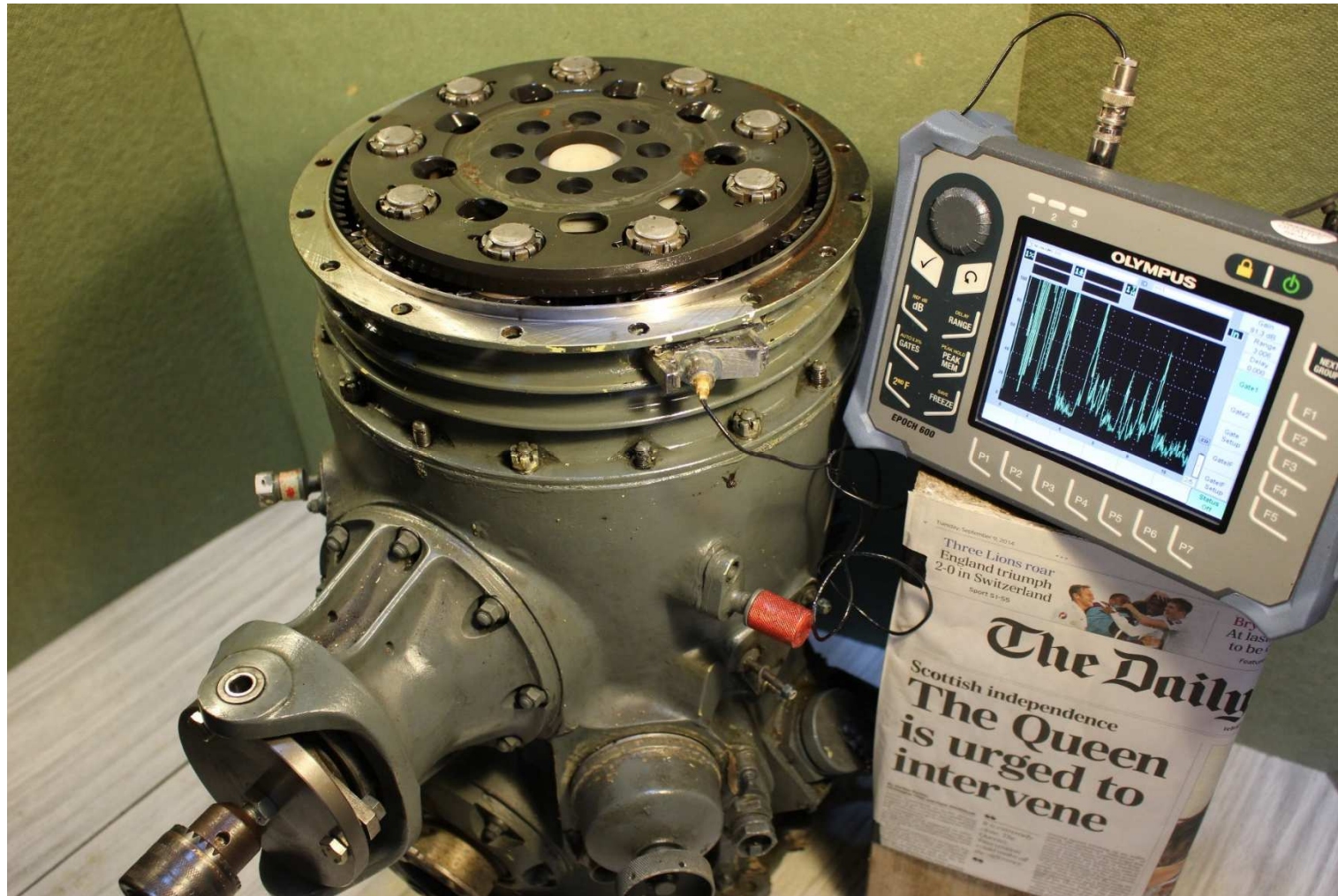
## challenge

- Stage I.
- Image interface
- i.e intercept an ultrasound pulse from the ring gear outer casing at each pinion tooth engagement.
- Stage II.
- Image internals
- i.e. determine what's happening in the pinion.





motion

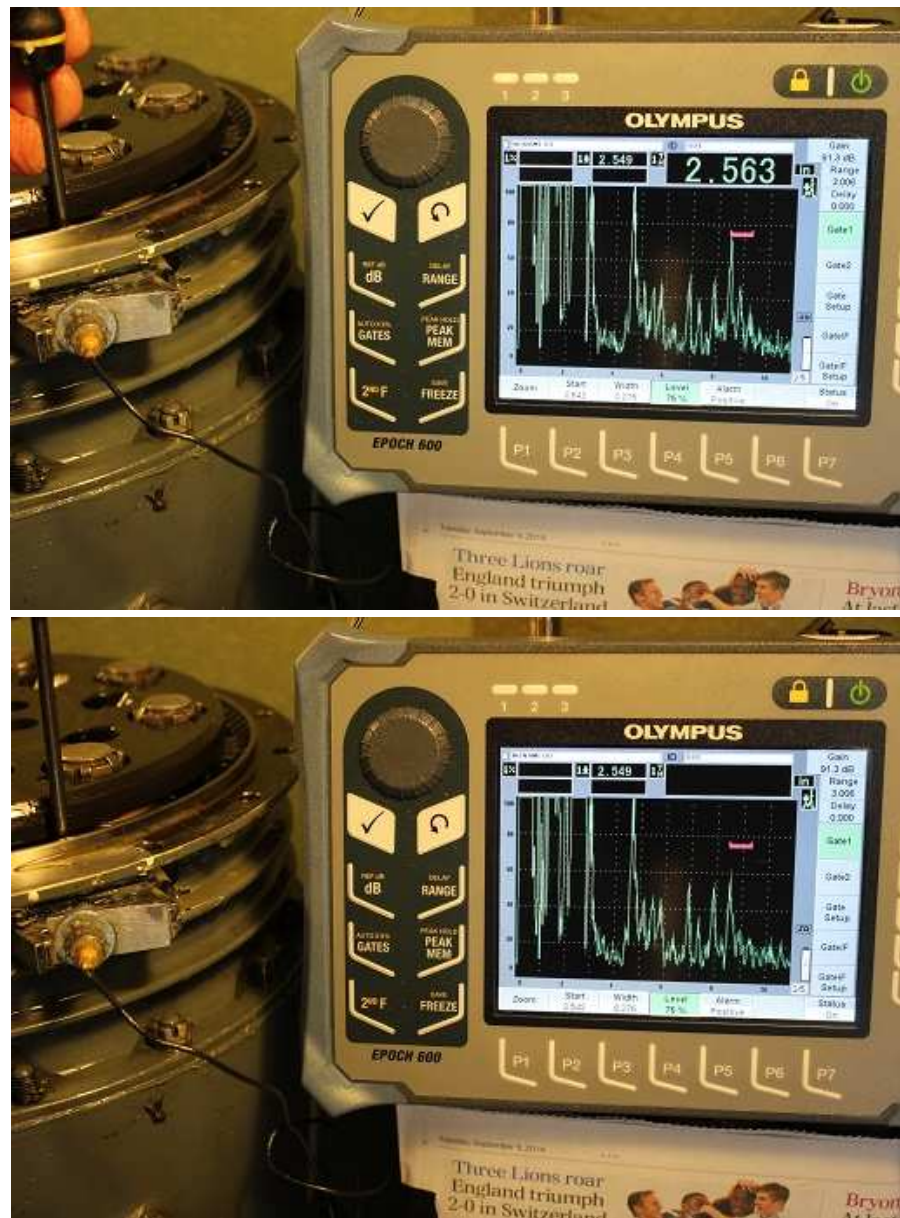


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axial



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# report

- wev'e:
- shown imaging of each rolling engagement.
- intercepted each engagement in motion (hunting).
- demonstrated "axial" detection.
- Mark Swan suggests the 8th EASA RS.

Data  
Interpretation  
Limited

An  
Epicyclic  
Gear  
Ultrasound  
Surveillance  
Method

diltld\_report\_140825v6.4



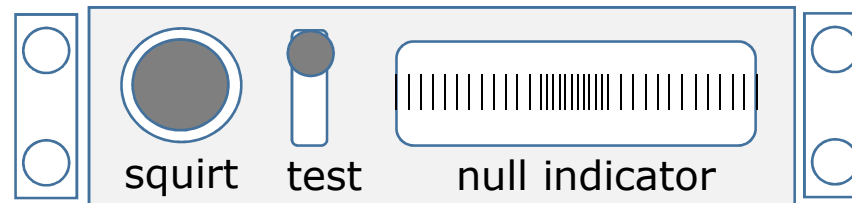
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to do

- secure investment to:
- trial bespoke probe.
- model function in Lab.View.
- trial filter hardware and comparator software.
- build and trial the cockpit prototype.



- involve EPSRC in stage II - bearings?





choose

- stethoscopic with no imaging:
- status quo.
- 70 % effectivity.
- approaching its plateau.



- stethoscopic and imaging:
- introduce a tandem approach.
- complementary.
- team player rather than “game changer”.



thanks

- chairman
- caa
- easa
- max & team



- you for bearing with me
- and of course my great grandson Harry

