Preparing NDE for Future Capabilities

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A4A NDT Forum

2023

Rolls-Royce

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Non-Destructive Evaluation at Rolls-Royce

Our business groups

Civil

35
types of commercial aircraft powered by us

12,700
installed base around the world

17,700
total employees

Defence

160
customers in over 103 countries

16,000
engines in service around the world

11,000
total employees

Power Systems

40,000
customers in 11 different industries

20,000
reciprocating engines sold per year

9,400
total employees

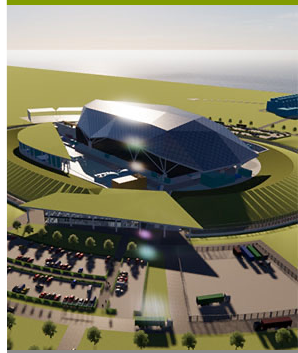
Electrical

NEW MARKET

£82m
Research & Development

≈ 500
total employees

SMR



NEW MARKET

£50m
Research & Development

≈ 500
total employees

Our NDT Function

NDT personnel across Aerospace, Nuclear, and Power Systems businesses.

Supply chain spanning 31 countries.

Plus Joint Ventures (eg MROs), contract resource (eg on-wing care), etc.

>600

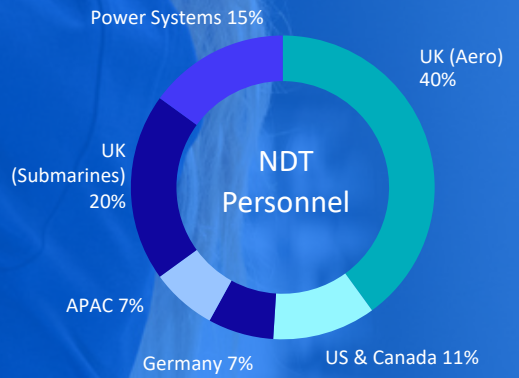
NDT Certified Employees

>500

NDT-approved suppliers

65

NAS410/EN4179 Level 3s



02

Tools Case Study: Remote Technology

Remote Task-Specific Training for On-Wing NDT

Covid travel restrictions impacted our ability to deliver task-specific training to airline Level 2s, for various bespoke on-wing NDT inspections.

As task-specific training, rather than NAS410 certification training, there was more flexibility for defining how this could be delivered.

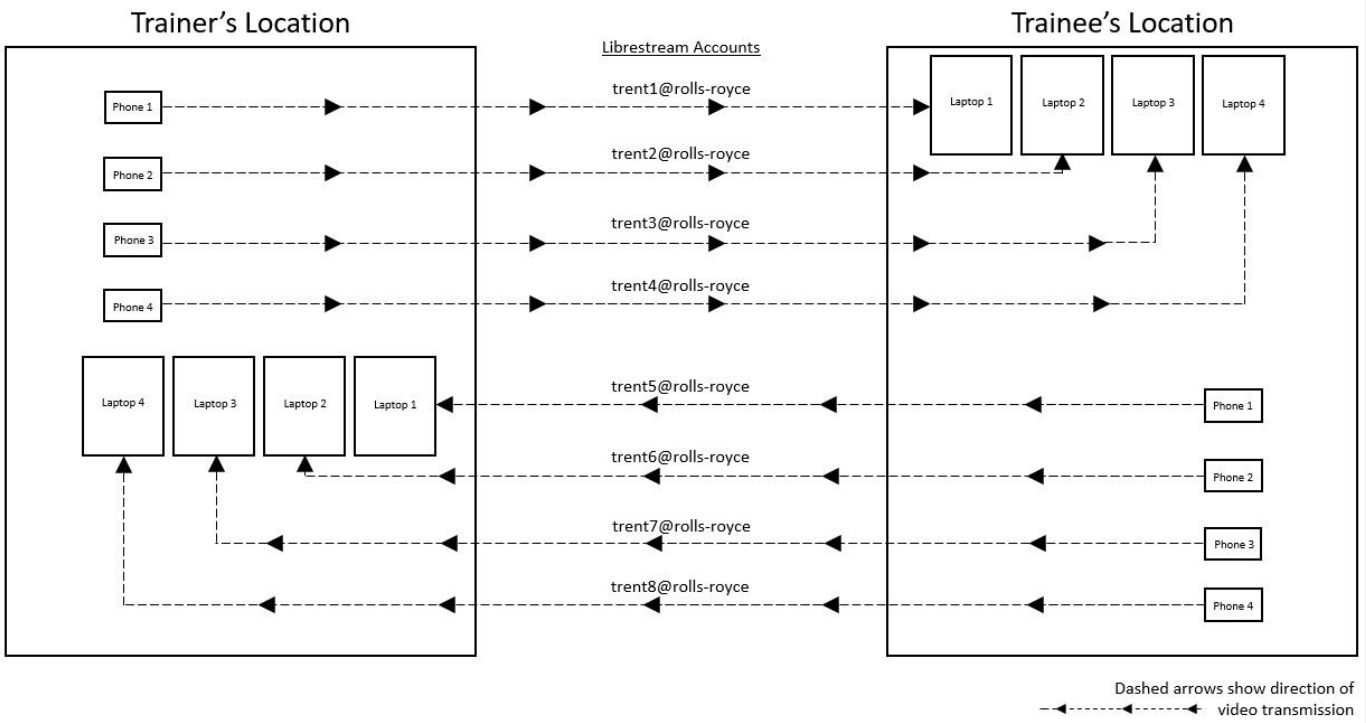
Derby NDE team used multiple-camera, multiple-screen set-ups and Librestream software (later, MS Teams) to develop remotely-delivered training & examinations.

Comprehensive risk reviews and process validation were undertaken to ensure training quality was maintained and that Level 2 inspectors with no prior experience of that inspection could then reliably detect defects of concern.

Assessment via live video stream, plus data interpretation & written theory exams.

Carried out blind trial examinations (on module containing notched blades) of inspectors trained remotely: 100% success rate with 0 false calls.

IT Schematic



Benchtop Set-up

Validation Set-up

Remote NDT

Extremely successful project, and continues to be used by RR where it's the right solution based on cost and response time required.

This then prompted the question:

Could the inspections themselves be carried out remotely?

- Data analysed by an experienced Level 2 or Level 3 at a central location,
- Data collected by an NDT technician with less experience and potentially lower level of certification.

Compelling list of potential advantages… rapid response… consistency of interpretation… lower training burden… lower cost…

But is it a good idea?

Remote NDT: UK NANDTB Policy

NANDTB 29: Policy on Remote NDT

https://www.bindt.org/NANDTB/UK-NANDTB-Documents/

Relevant regulatory and industry documentation was pretty silent on this subject, neither banning or allowing it.

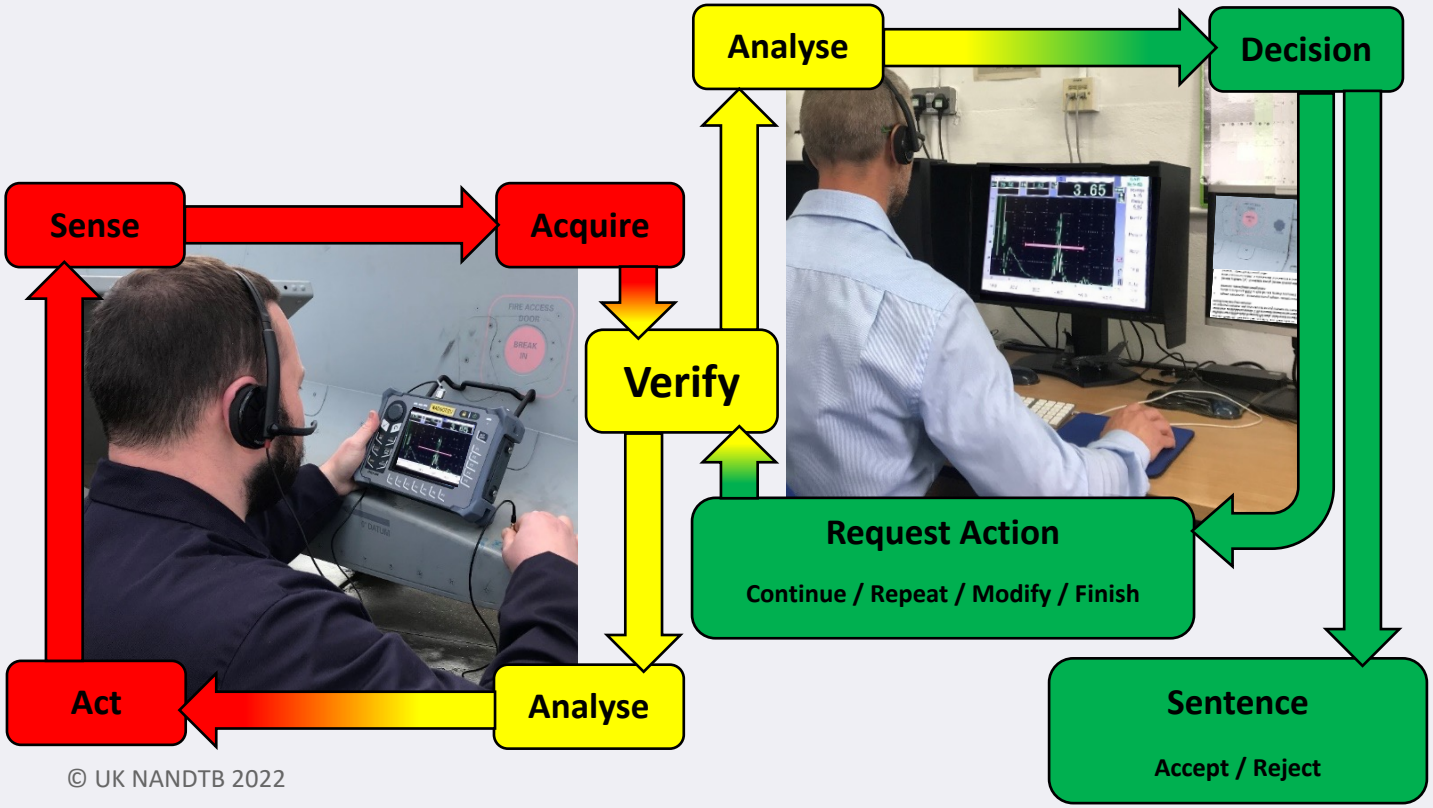
With the pace of technology adoption, the current state represented a risk of stifling innovation and/or leading to inappropriate deployment.

“Remote NDT” has been pretty established in X-Ray (and medical imaging) for some time, with a L1 shooting, and sending film to a L2 to analyse. But this would be “Live”…

UK NANDTB set up a working group to develop a principles-led policy, involving OEM, Customer, Service Provider and Regulator perspectives.

Except from NANDTB/29

Remote NDT: Concept



Except from NANDTB/29

UK NANDTB Remote NDT Policy Summary

- Enabling Innovation / Preventing Misuse
- Comprehensive: common & emerging methods, material evaluation, etc.
- Neutral (technologies, applications, organizations)
- Regulatory Requirements:
  - RNDT policy defined in Written Practice/Exposition
  - Establish verification model and meet/exceed minimum certification levels
  - Undertake task-specific risk assessment
  - Work instructions for RNDT need to be separate from non-RNDT, to fully define responsibilities, procedural steps, data transmission.
  - NAA approval prior to 1st use (for some synchronous RNDT)
  - Enduring record of test data (conditions, results, procedural compliance)
- Includes recommendations and guidance to aid implementation.
- Establishes a common “language” and framework for discussing and assessing Remote NDT.

03

Processes for Emerging Technologies

Preparing for Other Emerging Technologies

Current systems seem to be built round “traditional” NDT (5 Main Methods) and precedent. Is the regulatory, certification, etc landscape ready for emerging technologies?

- **Proliferation of advanced techniques.** Is the taxonomy structure of Techniques within a Method clearly, consistently, and fully defined, so that it’s easily understood what is within an approval scope (eg PAUT)? Industry consistency of approach eg for Computed Tomography.
- **Integration of NDT**: in-process monitoring (welding, additive manufacture), materials properties evaluation, “feeding the digital twin”.
- **Blurred borders:** metrology, visual inspection, lab tests, functional tests, assembly verification, in-process monitoring.
- **Automation:** Machine learning and Automated/Assisted Defect Recognition. Synthetic test data.

04

People and Skills

People and Skills

People are still the most important part of NDT.

Demographic shape of NDT industry means we need new entrants, particularly to develop the next generation of NDT Level 3 *Engineers*. And we need effective knowledge capture & transmission.

Emerging Technologies mean we need new skills… eg data analytics, AI.

Rolls-Royce experience of Apprenticeships is that they are vital to delivering a diverse, multi-skilled, early career pool of NDT engineers.

Supply chain and policy landscape are shared… opportunity for collaboration?

Derby NDE Team and Apprentices