

# The Application of Advanced Non-Destructive Testing

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# Overview

- A. Australian Defence Force Non-Destructive Testing
- B. NDT Accounting
- C. Examples of advanced Non-Destructive Testing Techniques:
  - 1. Phased Array Ultrasonic Testing
  - 2. Eddy Current Array
  - 3. Thermography
- C. Advantages and Disadvantages









# A. Australian Defence Force – Non-Destructive Testing

In addition to authority roles, the Defence Aviation Safety Authority also provides Specialist Engineering Services, including:

- DASR 21J approved Engineering product
- Structural Integrity Subject Matter Expert Advice, and
- Training.

Non-Destructive Testing is an <u>essential enabler</u> to Defence Aviation Safety Authority's structural integrity capability, for the Australian Defence Force.

# B. NDT Accounting

As an industry group, we all have our own perceived costs for NDT.

### Basic Accounting Perception

Aircraft availability – Unnecessary downtime

- ≻ Non-productive no defects found
- > Overhead costs are prohibitive



# **B. NDT Accounting**

### The Accounting Reality

➢ Aircraft availability

Limited warranty claims (Manufacturing)

- ➤ Maintenance cost control early detection
- ▶ Public and Government confidence
- ≻ WHS/OHS No loss of life or limb

The perceived and real costs provide constant pressure to do things better, faster and hopefully, more cost effectively.

This creates the opportunity for advanced NDT technologies onto existing and new platforms to improve asset availability, platform life extension and safety.

C. Examples of Advanced **Non-Destructive Testing Techniques** 

- Phased Array Ultrasonic Testing 1.
- Eddy Current Array 2.
- Thermography 3.



### C.1. Phased Array Ultrasonic Testing: **Conventional Ultrasonics Explanation**







### C.1. Phased Array Ultrasonic Testing







FA-18 Hornet Inner Wing Step Lap Joint





FA-18 Hornet Inner Wing Step Lap Joint Phased Array Ultrasonic Testing Image Defending Australia and its National Interest



### C.1. Phased Array Ultrasonic Testing



AP-3C Orion wing skin risers with H Clip brackets in-situ.



# C.1. Phased Array Ultrasonic Testing: Data Analysis



H Clip attachment holes, cracking between holes.

H Clip attachment holes, no cracking.

# C.1. Phased Array Ultrasonic Testing: Results

- F/A-18A/B Hornet:
  - Platform could safely achieve planned withdrawal date
- AP-3C Orion:
  - Eliminated tank entry risks (Work Health & Safety)
  - Increased aircraft availability
  - Improved data detail and retention.
  - Ensured safety of platform









Conventional Eddy Current Testing



Eddy Current Array Testing





KC-30A Multi Role Tanker Transport Refuelling Hose Failure





Refuelling Hose showing Corroded braid and Eddy Array Probe





Scanned Image of Refuelling Hose

# C.2. Eddy Current Array: Results

KC-30A Multi-Role Tanker Transport:

- Reduction of cost of ownership:
  - Acceptance check on purchased hoses
  - Speed of inspection
- Improved asset availability



# C.3. Thermography (1/4)





Two main Types:

- Passive Technician looks at the heat from an object, at an instant.
- Active Technician looks at the heat dispersion from an object, over time.



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# C.3. Thermography: Active Thermography (2/4)



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### D. Advantages

Defence Aviation Safety Authority's application of advanced Non-Destructive Testing techniques has:

### Ensured Airworthiness

- Reduced life cycle cost
- Improved asset availability &
- Improved data fidelity



## D. Disadvantages

The application of advanced Non-Destructive Testing techniques has complicated the determination of Airworthiness:

### ≻ <u>Manufacture</u>

- ➢ Un-documented repairs identified
- Erroneous processes identified



Application of new technologies versus old technology at time of manufacture



### D. Disadvantages

### Excess Data

Data captured requires more in depth review and material/structural knowledge



### WHAT IS SEEN CANNOT BE UNSEEN !



## Summary

### > NDT Provides an Opportunity to:

- ➢ Improve asset availability
- Decrease costs
- Ensure Safety.

### ≻ DASA (NDT&CT)

Can assist you, whether an ADF organisation or Defence contractor to better manage your platform with the use and management of Non-Destructive Testing.



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# QUESTIONS

