Australian Government
Department of Defence
Defence Aviation Safety Authority

INTRODUCTION OF PHASED ARRAY ULTRASONIC CAPABILITY FOR THE ADF

WOFF Michael Gaugg

21 July 2017

SCOPE

DASA DAVENG CAPABILITY

INTRODUCING A PAUT CAPABILITY

TRAINING AND PROCEDURE DEVELOPMENT

FUTURE CAPABILITY

DEFENCE AVIATION SAFETY AUTHORITY

Non Destructive Testing and Composite Technology (NDT&CT) are sub branch of Directorate of Aviation Engineering (DAVENG).

NDT&CT primary role:

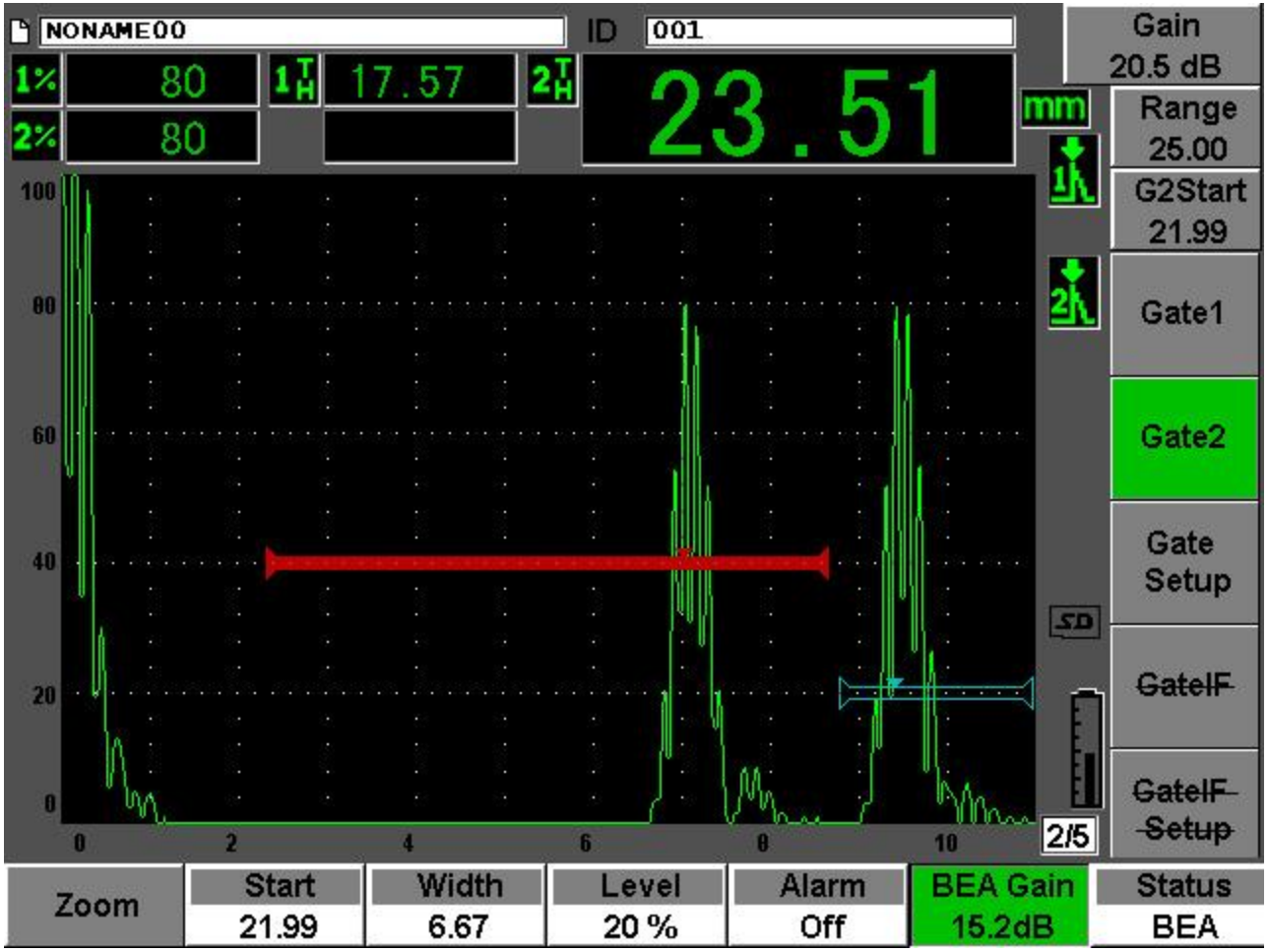
- **Training.** NDT&CT delivers specialist training in Non Destructive Testing (NDT) and Aviation Composite Technologies (ACT) to ADF and Industry, including re-certification's
- **Engineering Support.** NDT&CT design NDT procedures to support the continuing airworthiness and structural integrity of ADF platforms,
- **Subject Matter Experts** to the ADF on NDT & ACT.
- **Authority.** Prescribing AMC & GM for DASR

DASA - DAVENG (NDT&CT) CAPABILTY

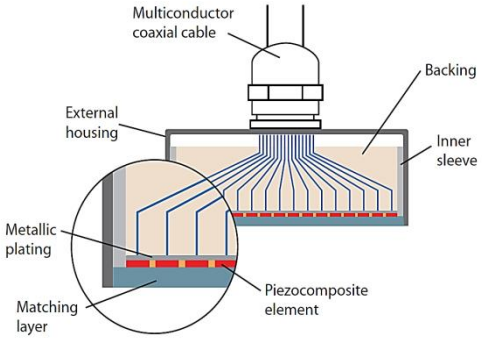
- Non Destructive Testing:
  - Training,
  - Procedure development,
  - Introduction of enhanced or new technology,
  - Sponsor for ADF Non Destructive Testing publication, and
  - SME advice.

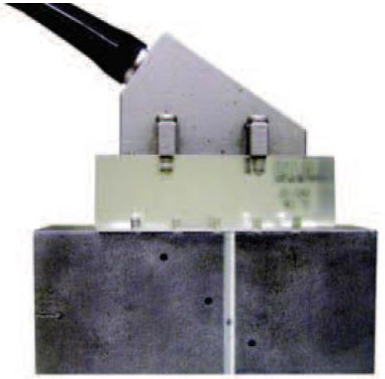
- Aviation Composite Technologies
  - Composite repair training,
  - Introduction of new composite repair practices, and
  - SME advice.

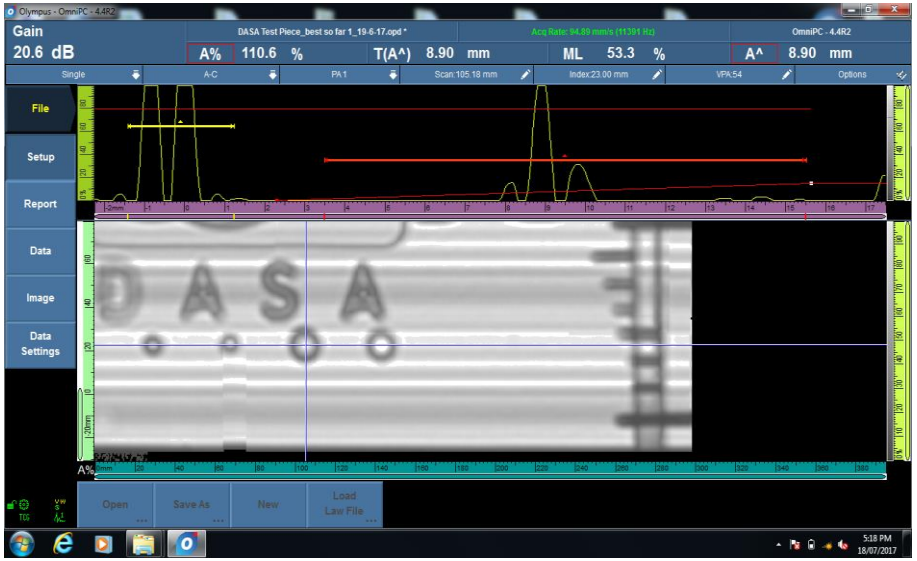
CONVENTIONAL ULTRASONICS

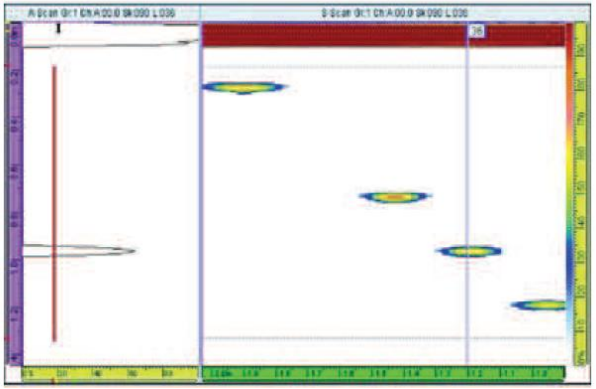


PHASED ARRAY ULTRASONICS (PAUT)









PHASED ARRAY ADVANTAGES AND DISADVANTAGES

Advantages:

- Large area scanning,
- Rapid data acquisition,
- Permanent record,
- Independent validation,
- Higher interpretation fidelity,
- Sizing and characterisation,
- Increased reliability and repeatability, and
- Improved Probability of Detection

Disadvantages:

- Additional training,
- Experience in ADF limited,
- Higher interpretation skill, and
- Equipment cost higher.

INTRODUCING A PAUT CAPABILITY

The three key elements (in this case):

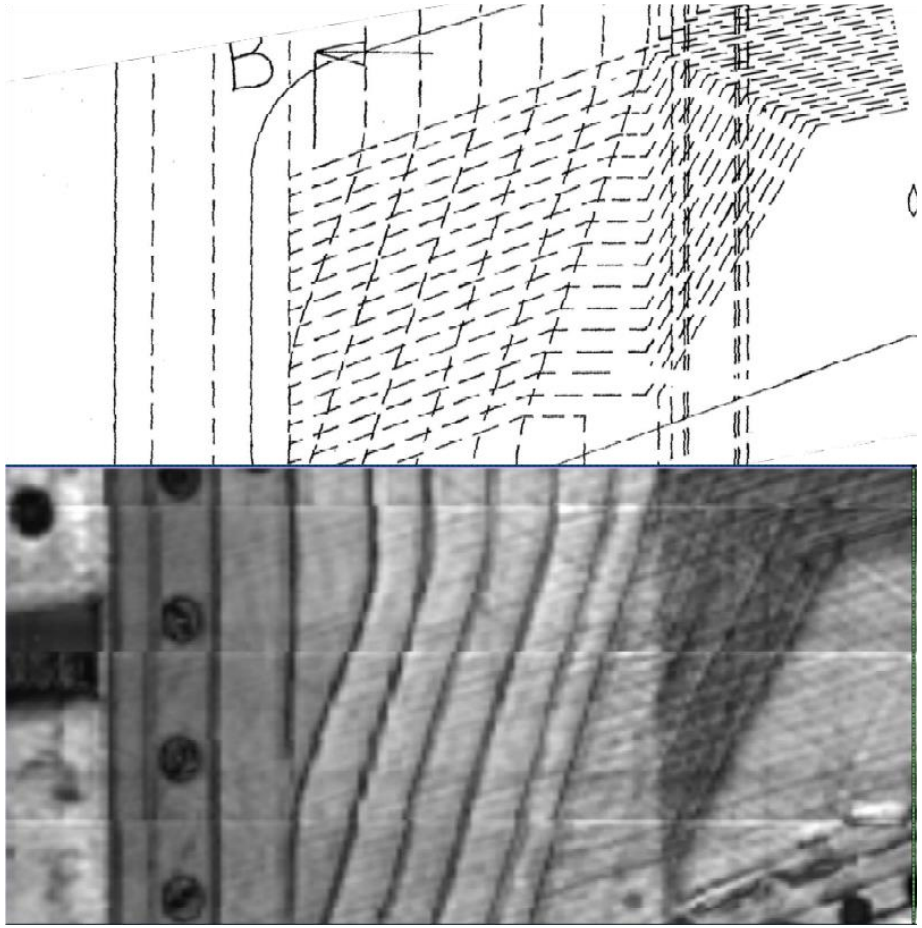
- Developing and Conducting Training Course.
- Developing Specific Inspection Procedures, and
- Engineering & Manufacturing Specific GSE & Reference Standards.

DEVELOPING AND CONDUCTING TRAINING COURSE

Considerations:

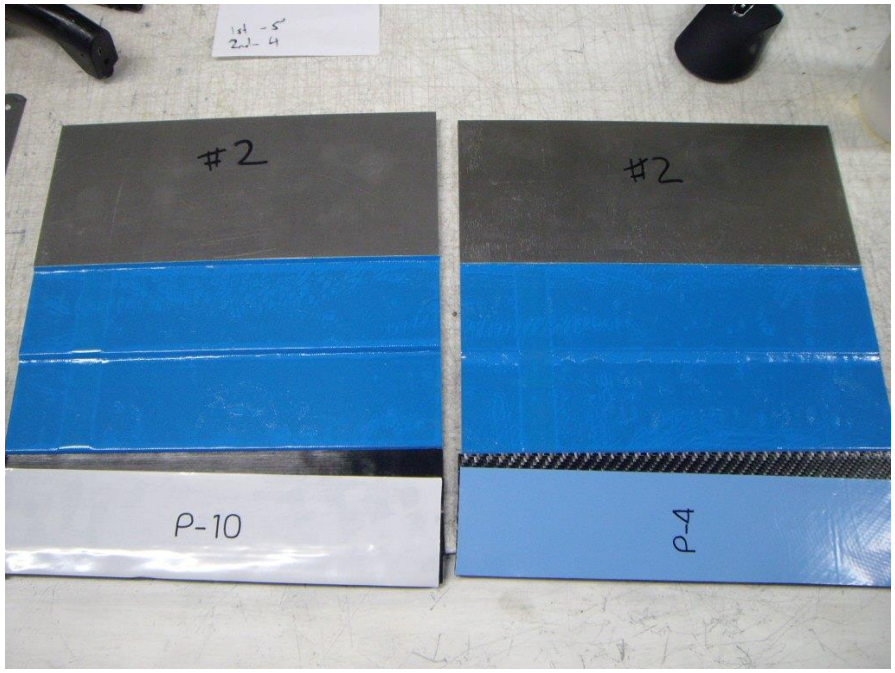
- Current ADF expertise in the technology,
- Industry support,
- Timeline – introduction / NDT procedure development / implementation,
- Budget – equipment / training aids, and
- ADF training governance and approval.

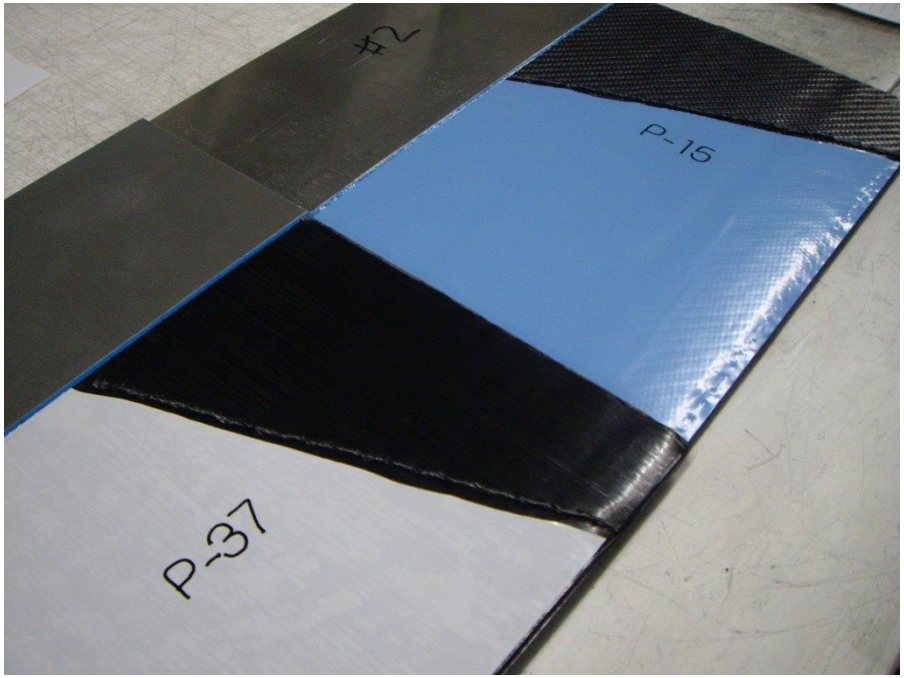
TECHNICAL DRAWINGS



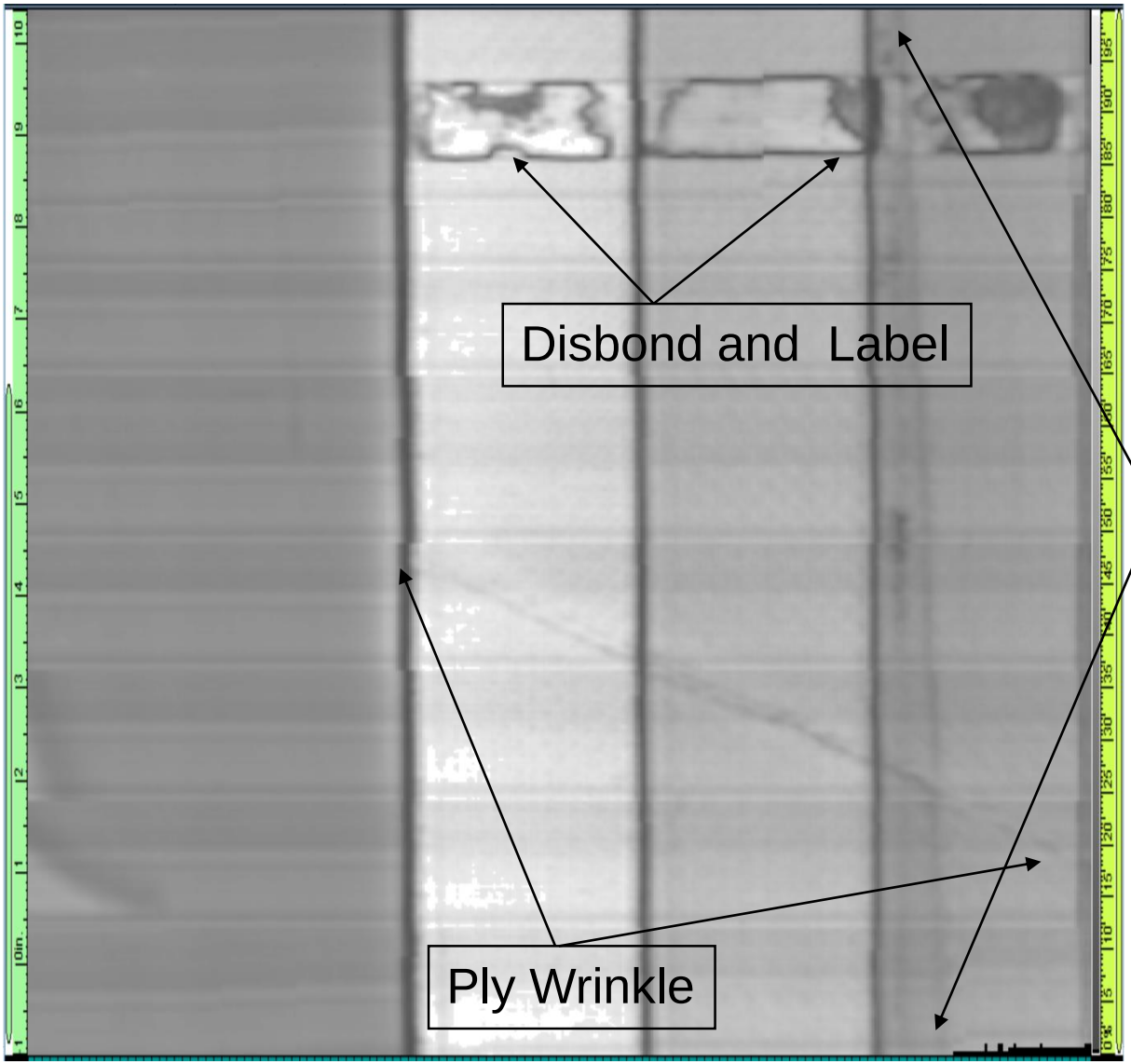
Technical Drawings and their support of PAUT data interpretation.

TRAINING AIDS AND REFERENCE STANDARDS





Composite training panel manufacture to simulate defects and likely manufacturing defects.



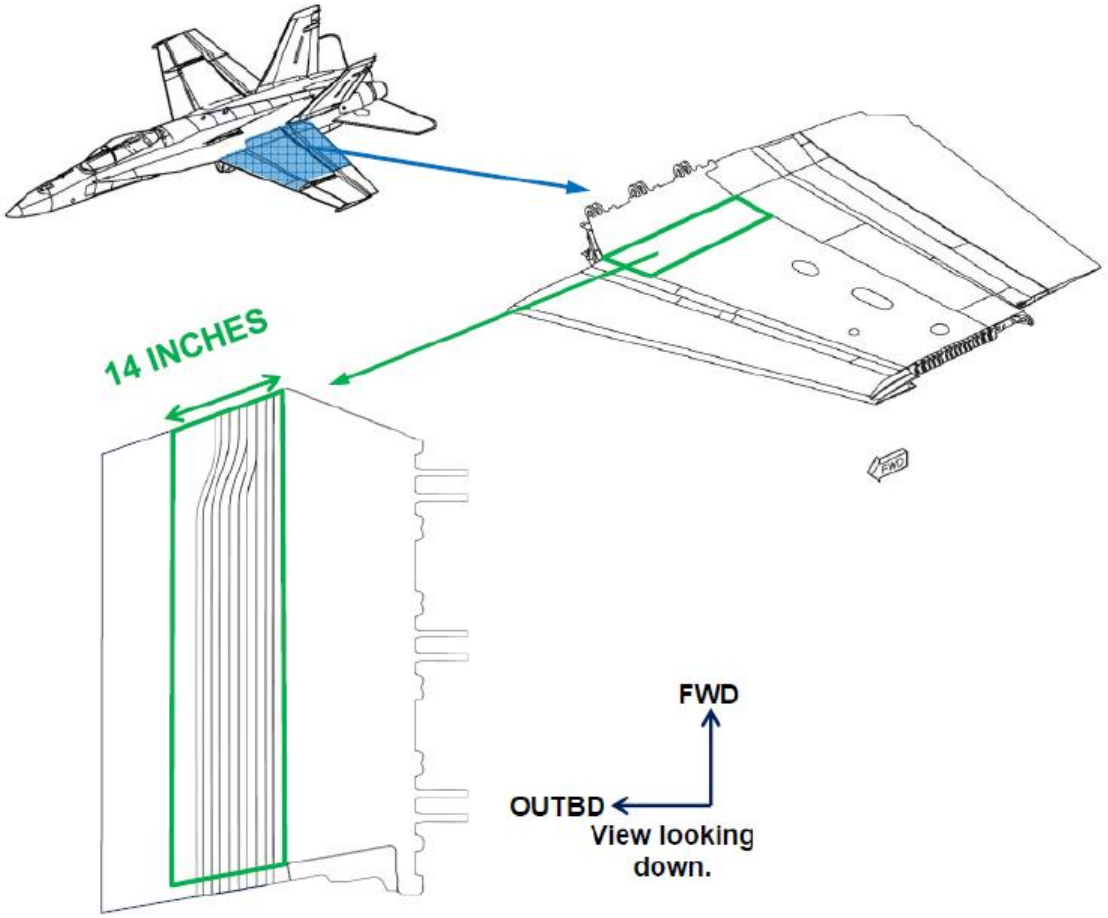
PAUT image of previous composite panel

Developing Specific Procedures

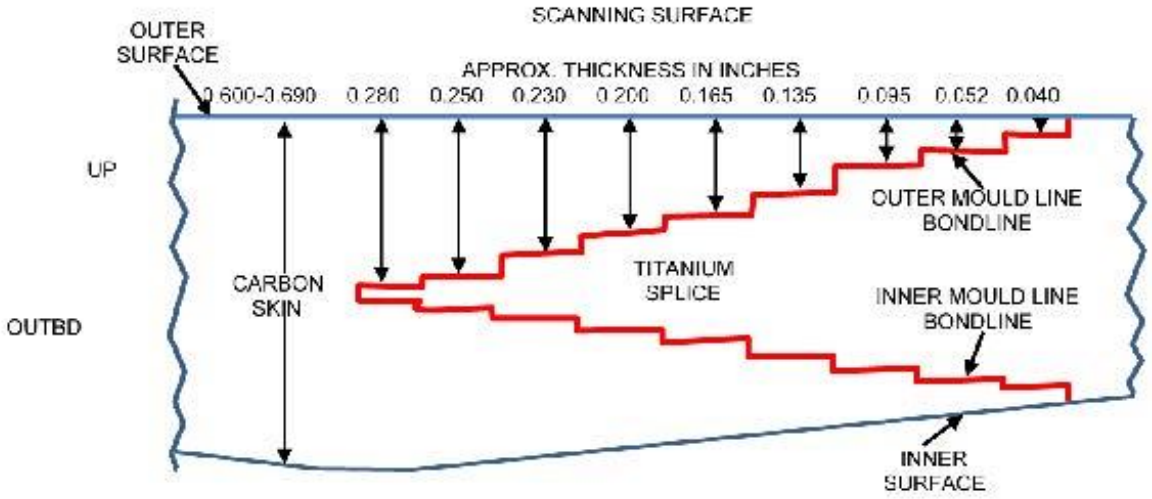
- To support F/A-18A/B & AP-3C Orion, NDT&CT has developed a range of Specific Procedures.
- Specific Procedures – A Specific NDT Procedure details the test method, equipment used to carry out the procedure, minimum size defect to be detected, and a specific test area including: type, location and orientation of defects to be detected.

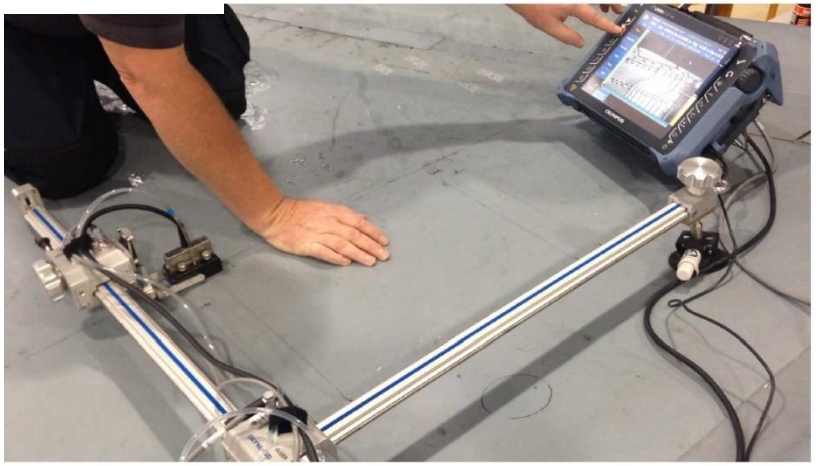
  – Examples:
    - F/A-18A/B Inner Wing Step Lap Joint,
    - F/A-18A/B Life of Type Extension (LOTEX), and
    - AP-3C Orion Risers and H Clips.

INNER WING STEP LAP JOINT (IWSLJ) CLASSIC HORNET



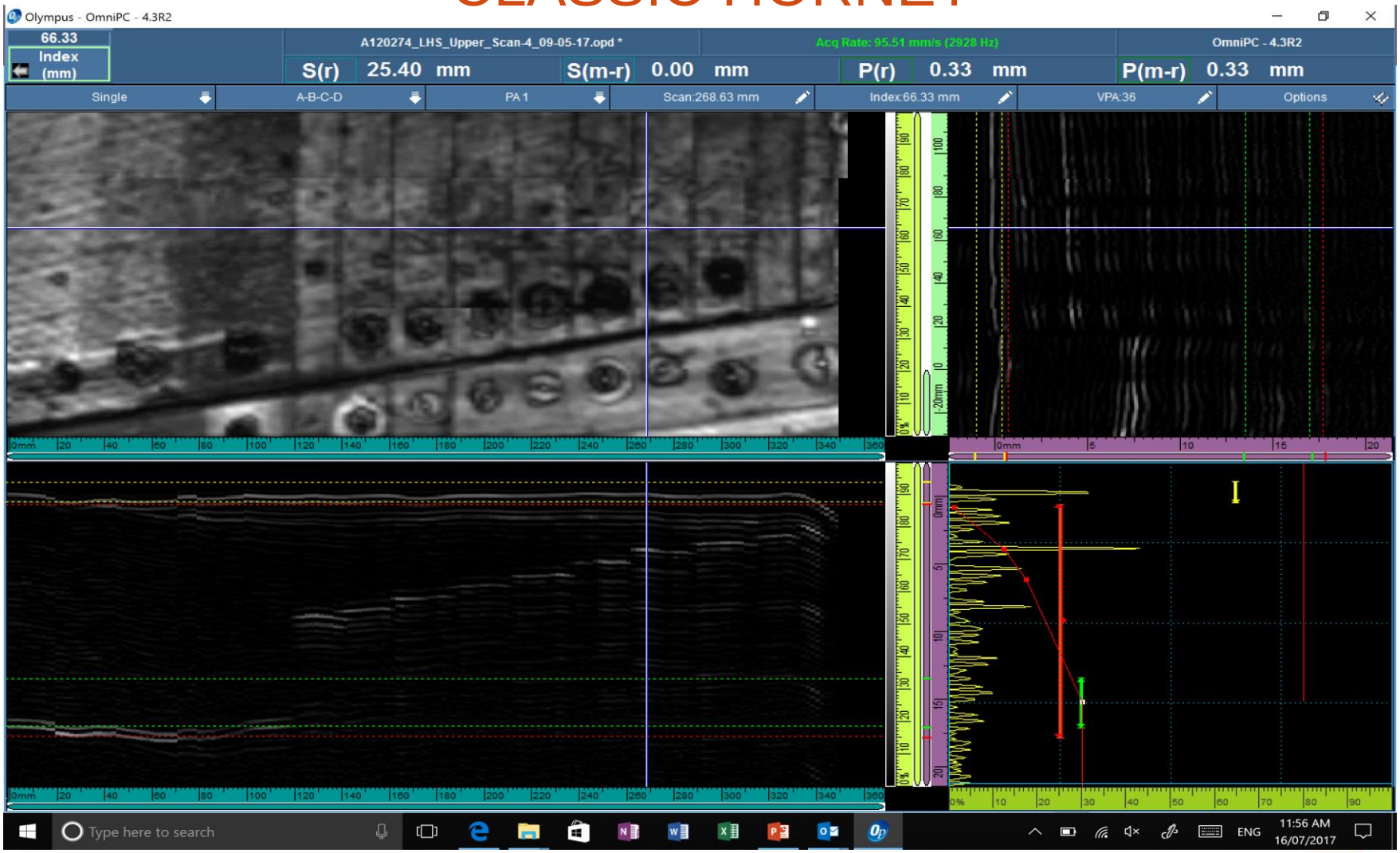
INNER WING STEP LAP JOINT (IWSLJ) CLASSIC HORNET



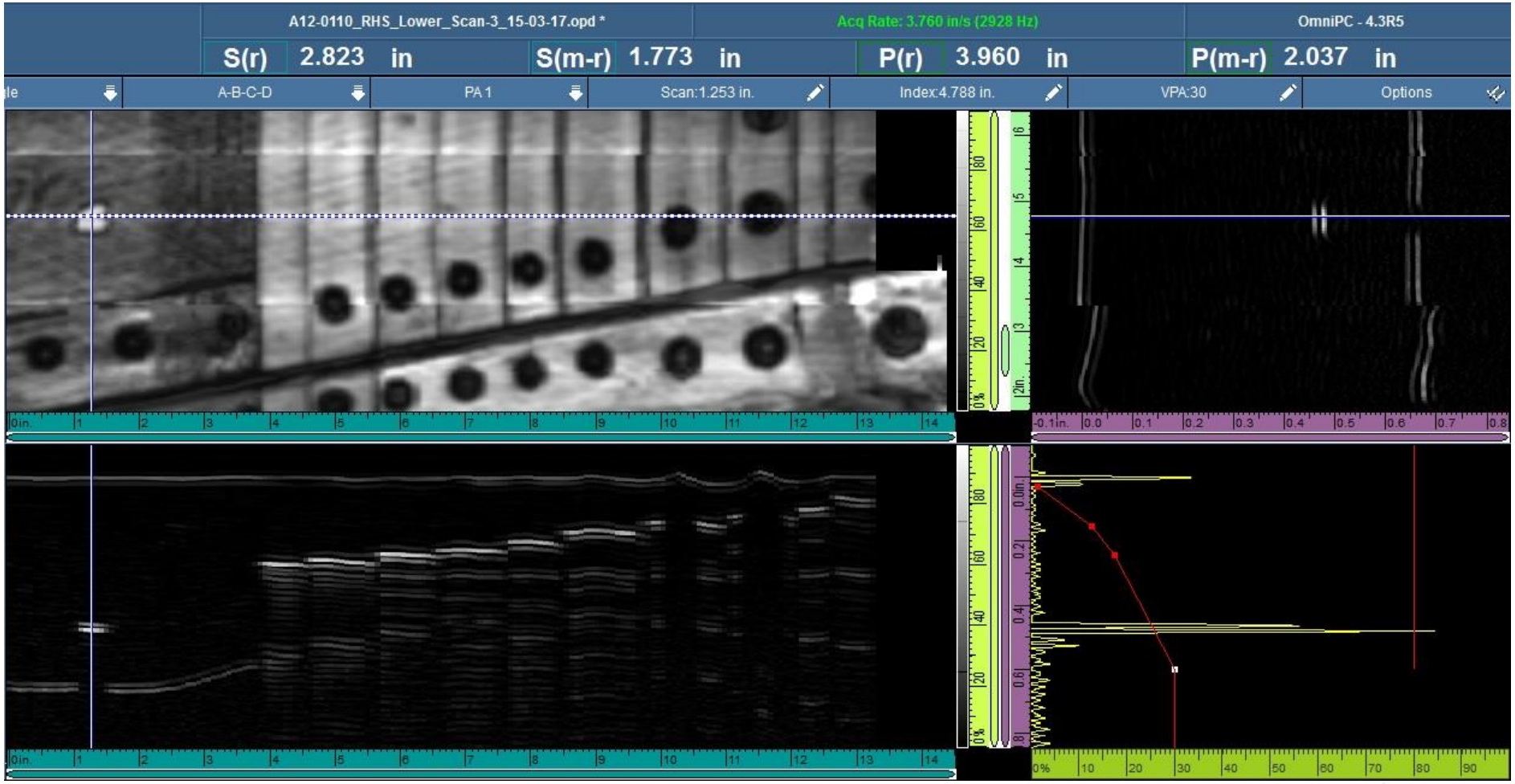


INNER WING STEP LAP JOINT (IWSLJ) CLASSIC HORNET

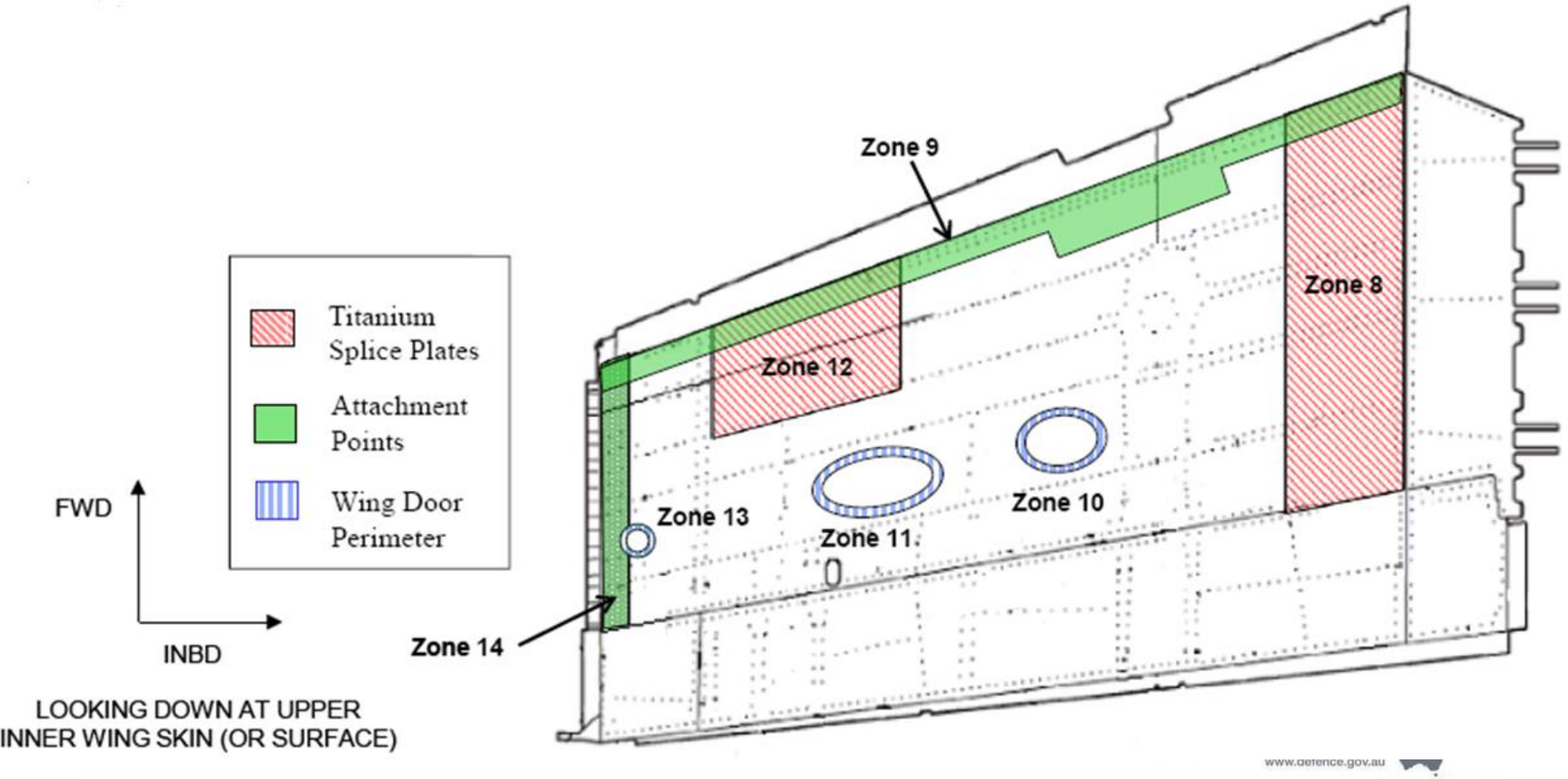
INNER WING STEP LAP JOINT (IWSLJ) CLASSIC HORNET



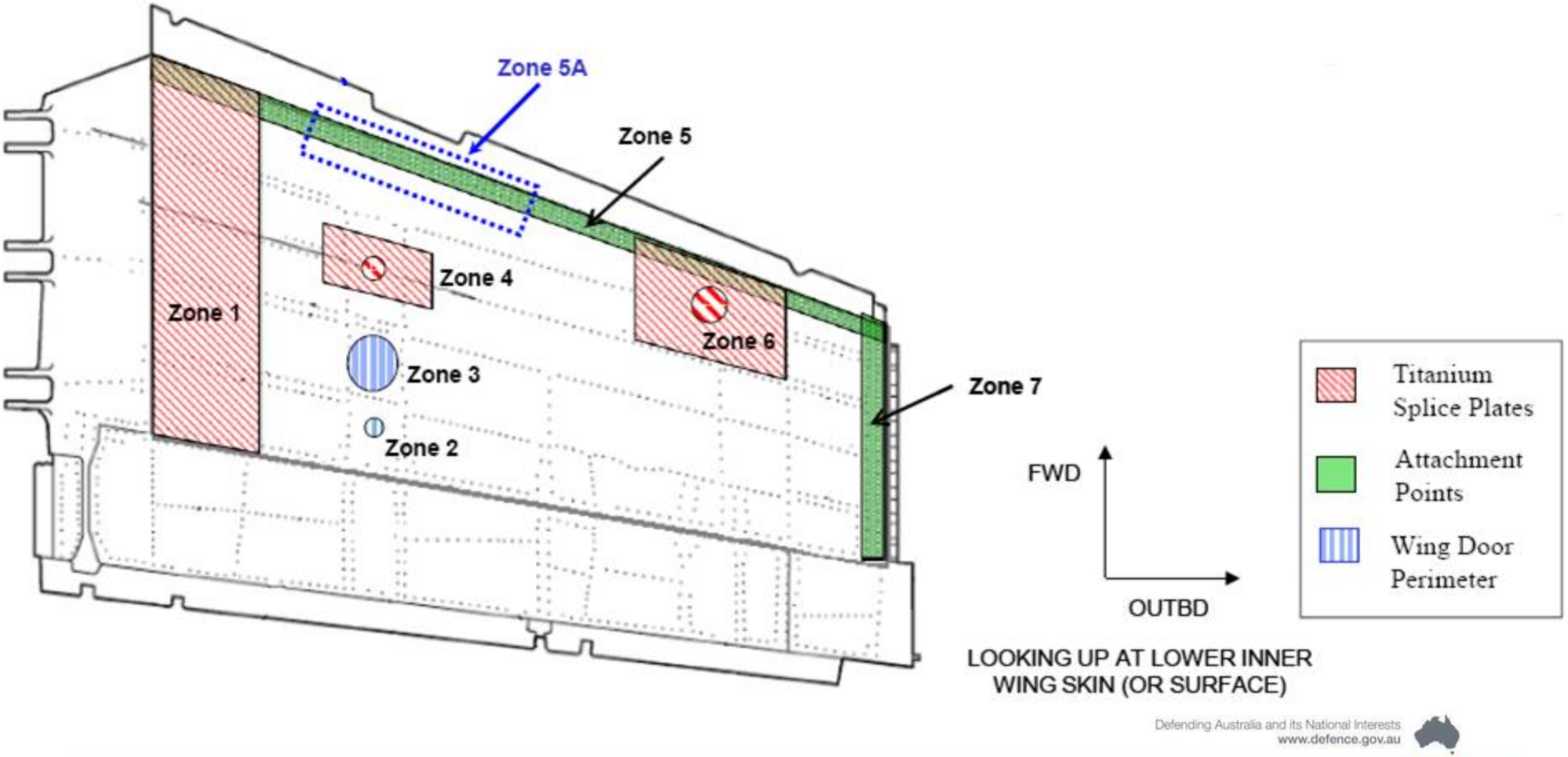
INNER WING STEP LAP JOINT (IWSLJ) CLASSIC HORNET



F/A-18A/B LIFE OF TYPE EXTENSION (LOTEX)



F/A-18A/B LIFE OF TYPE EXTENSION (LOTEX)



F/A-18A/B LIFE OF TYPE EXTENSION (LOTEX)

NDT&CT evaluated data provided by DASA - DAVENG and TFSPO.

- Leveraged from previous IWSLJ procedure.
- Reviewed USN procedures and equipment.
- Determined equipment requirements and budget for project.
- Ascertained ADF and Contractor support training gap.
- Evaluated complexity and volume of data capture for procedure.
- Determined LOTEX would require 11 individual PAUT procedures.

LOTEX IV&V TRIALS NDT&CT & 81WG

Independent Verification and Validation trials to ensure procedure, setup, equipment and GSE is appropriate and functional for task.

20170608raaf8143036a1

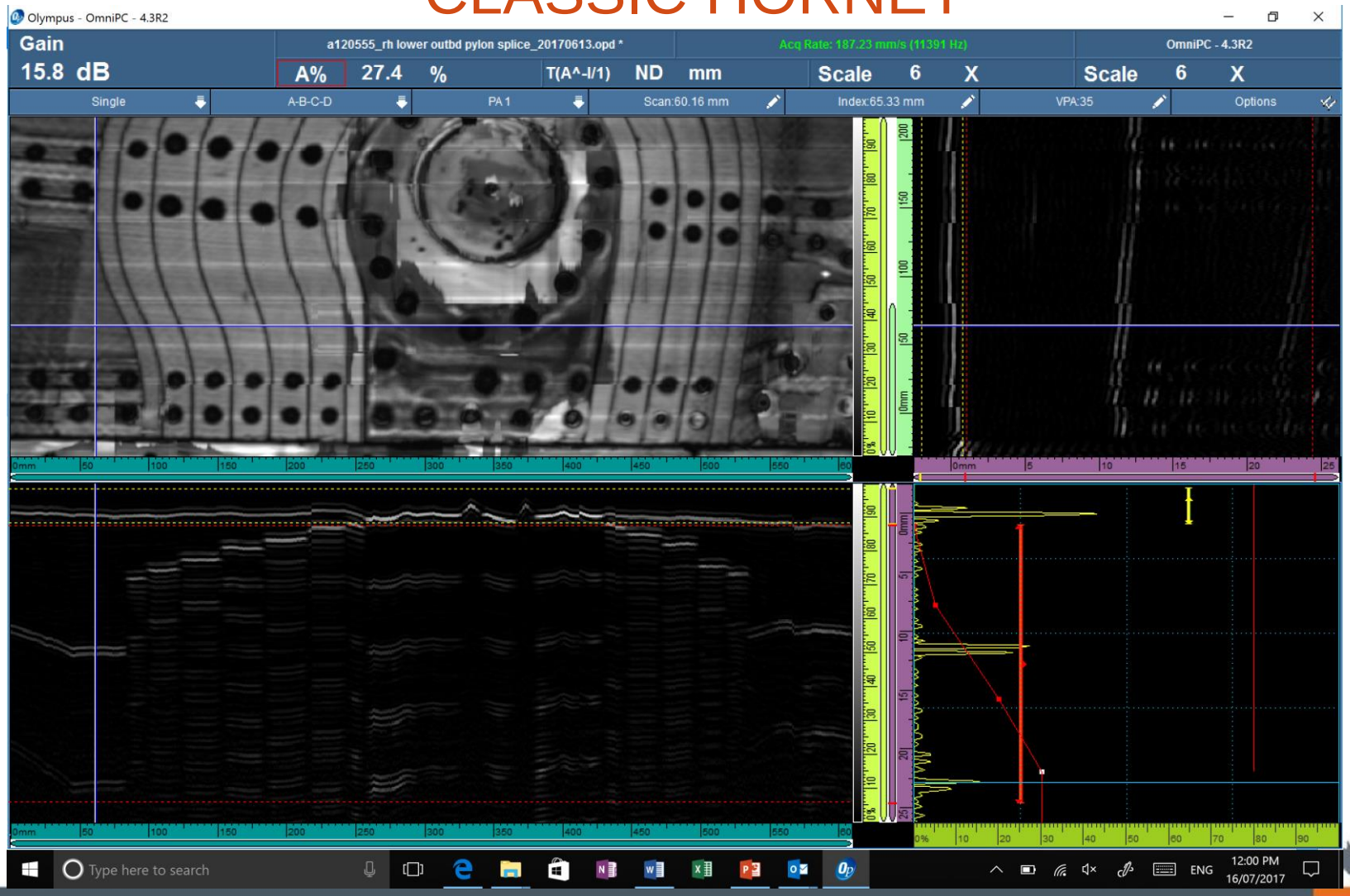
Phased Array Technology

Non Destructive Inspection on
F/A-18A/B Hornet wings

Dur: 1:30

AFIS: SGT Brett Sherriff

WING PYLON ATTACHMENT (LOTEX) CLASSIC HORNET



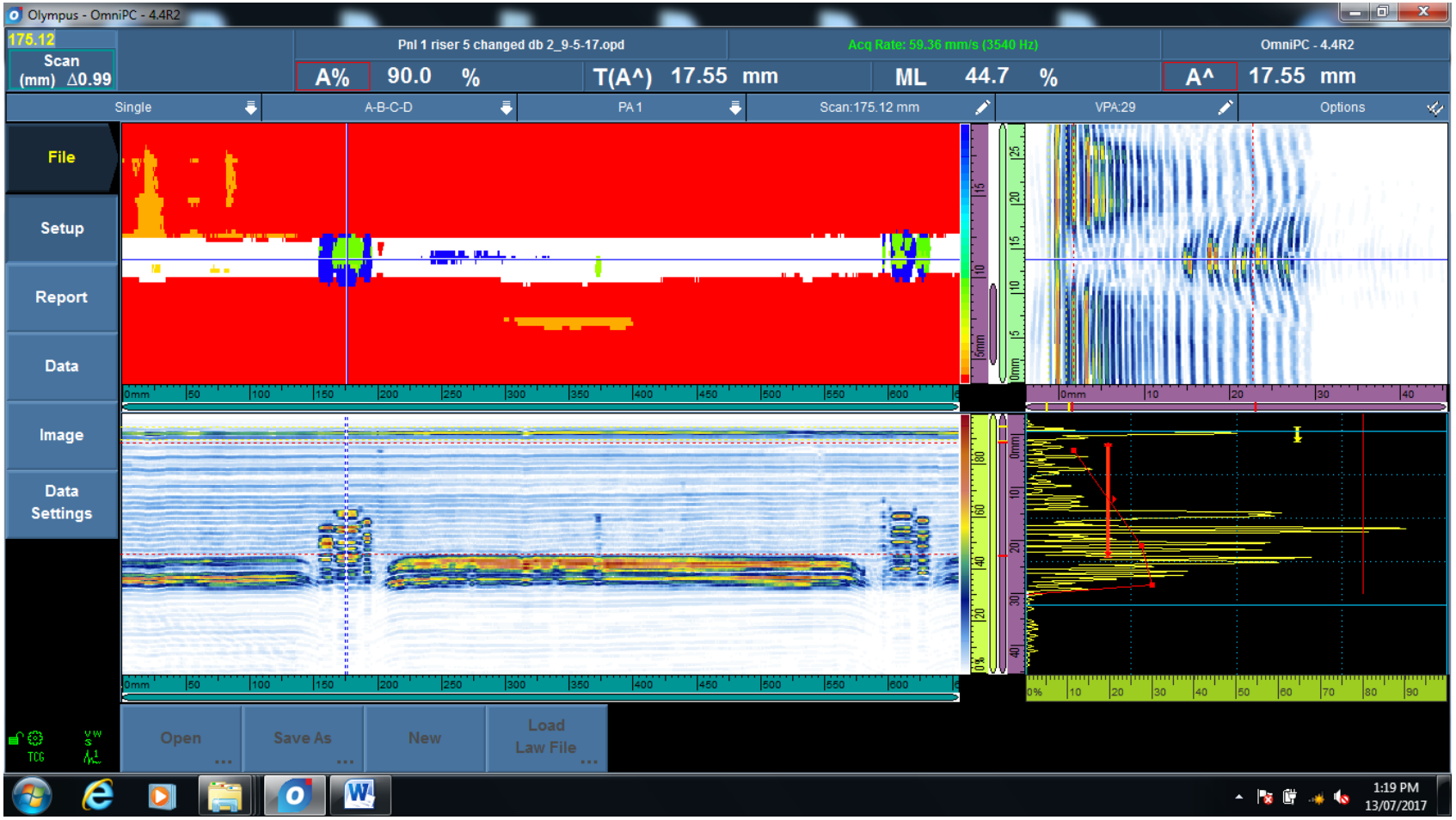
AP-3C ORION RISER and H CLIP

DASA – DAVENG (NDT&CT) are currently developing PAUT procedures for P3C.

- Will remove the requirement for tank entry,
- Enable sizing of reportable defects,
- Reduce inspection time, and
- Allow review of specific test areas at operation level.

AP-3C ORION RISER and H CLIP

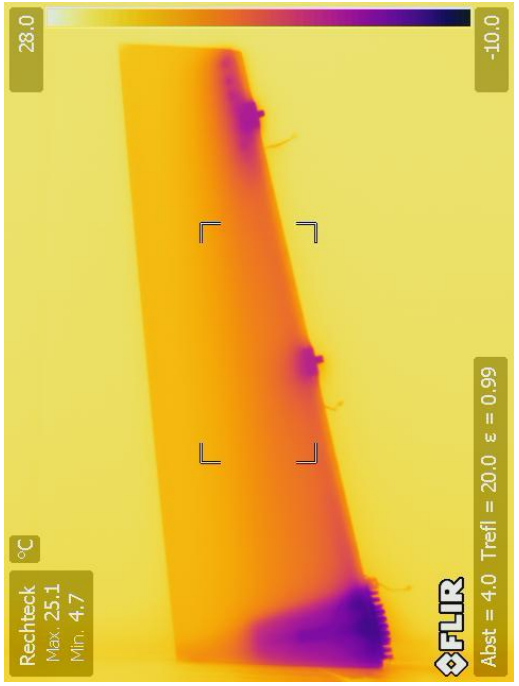
AP-3C ORION RISER and H CLIP



FUTURE ADF CAPABILTY

Future ADF NDT Technology

- Thermography (ARH and MRH),
- Digital Radiography (All Platforms),
- Shearography (JSF), and
- Investigating Phased Eddy Current inspections capability.



Summary

- Introducing new Non Destructive Testing Techniques involves:
  - Specialised Training,
  - Specific Procedures, and
  - Specific GSE & Reference Standards.

- DASA-DAVENG (NDT&CT) has extensive experience in NDT and aviation composite repair, please contact us should you require support.

QUESTIONS

WOFF Michael Gaugg
michael.gaugg@defence.gov.au
(07) 5361 3087