

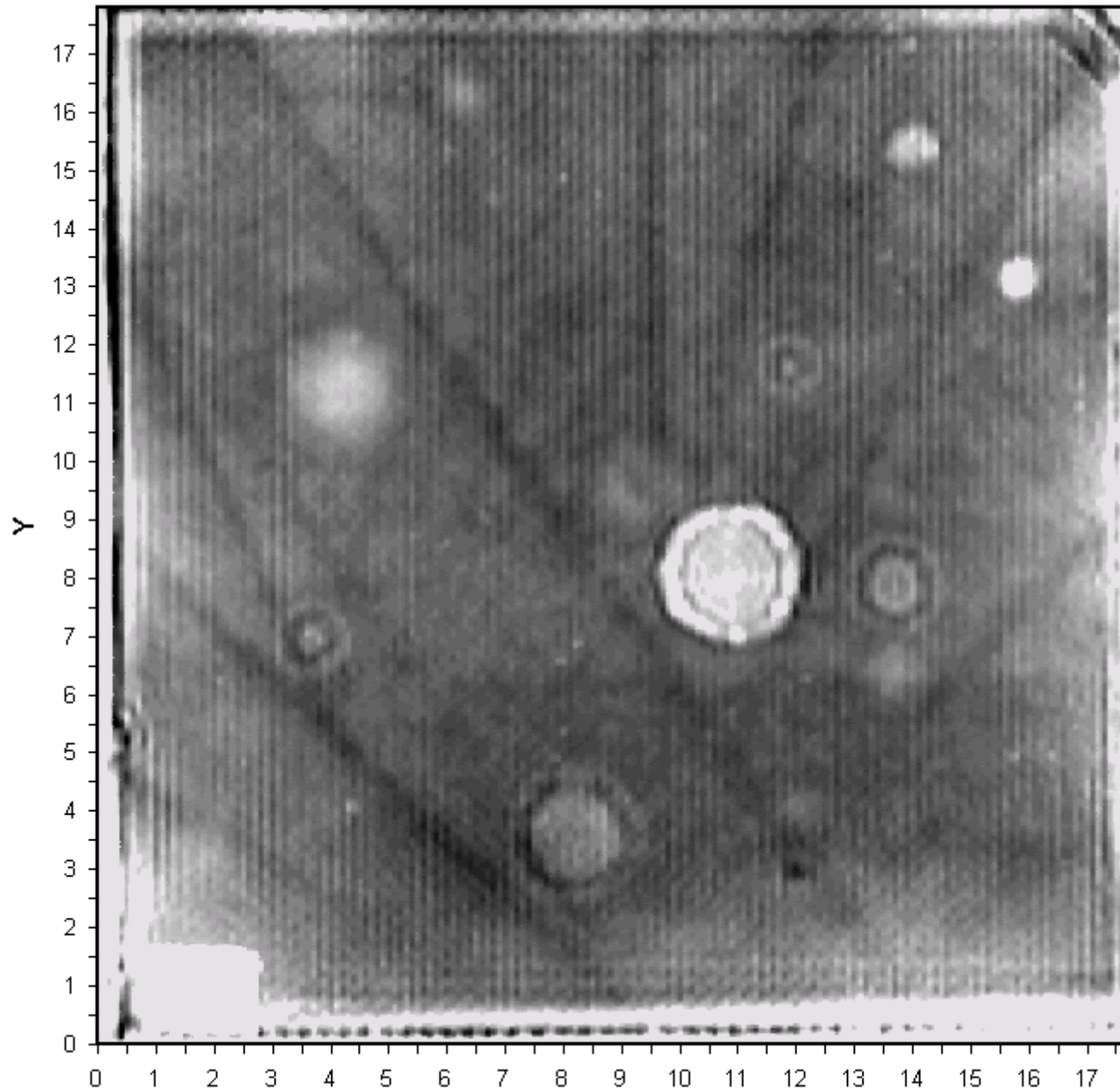
# Inspecting Aerospace Composites Using Evisive Scan™ Technology



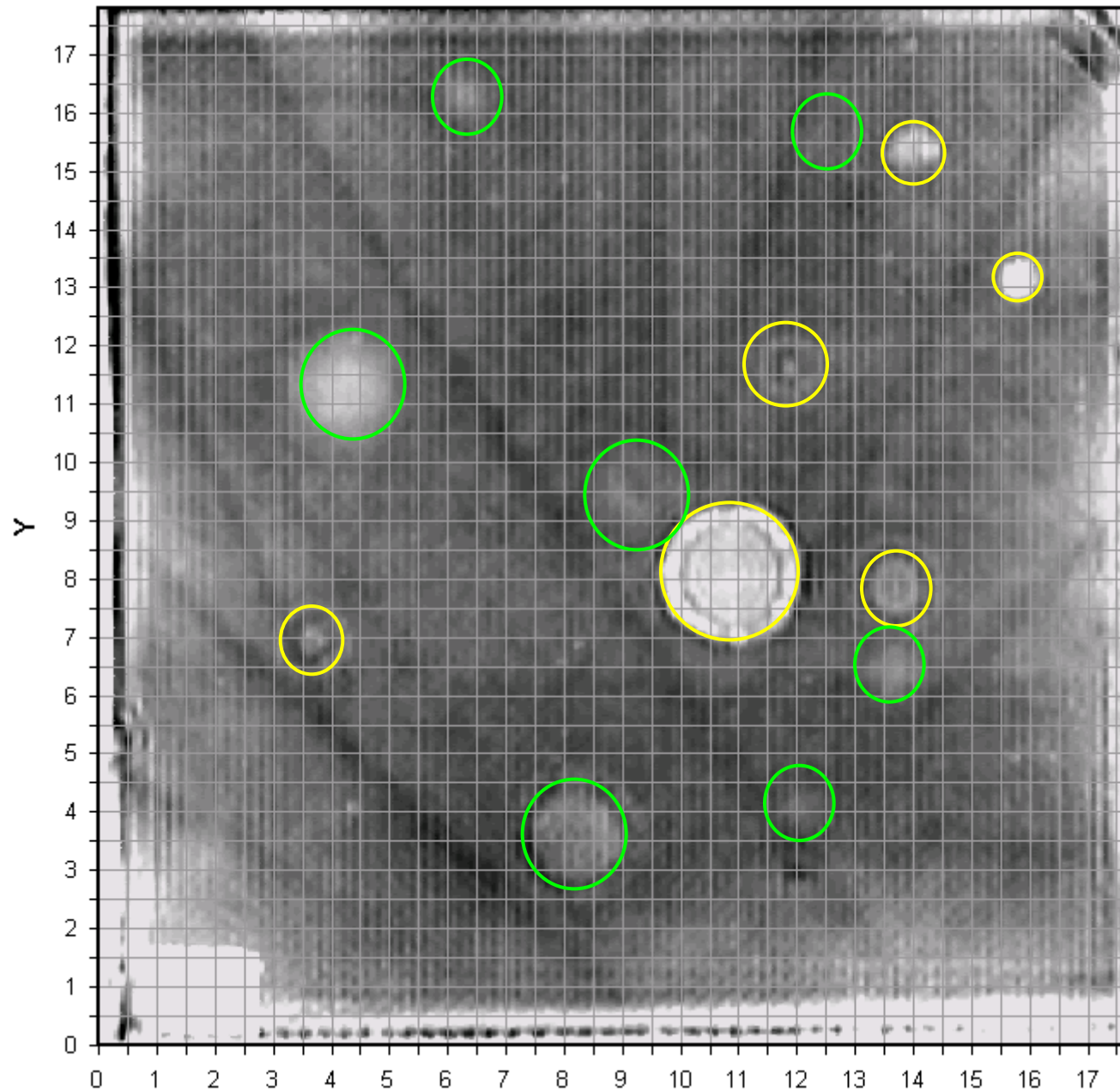
- Modern aircraft are increasingly being manufactured using strong, light composite materials including both organic and ceramic composites.
- These materials have many advantages over the more traditional metal fabrication materials. These include;
  - absolute weight,
  - weight for a given stiffness
  - performance at high temperatures in some cases and
  - chemical resistance to oxidation and corrosion.
- The structures of these materials are often complex, involving multi-layer laminates and reinforcing fiber.
- The materials are used exclusively and with metal in honeycomb and other 3-dimensional structures.
- The geometrical complexity of these structures, coupled with the embedded fibers and fabrics make non-destructive examination (NDE) very challenging.
- The ability to examine the volume of a structure, beneath the outer laminate, with access from one surface only is highly desirable.

- The ability to detect and size “stacked” defects, where a second delamination or similar defect lies beneath a first is critical to examination from one surface.
- Inspection performed in-situ, from a single side, while the part is installed on the aircraft makes in-service inspection practical, and reduced maintenance time and cost.
- This presentation will examine an emerging technology whereby microwave interferometry is used to image just such deep and stacked defects in modern aerospace composite structures.

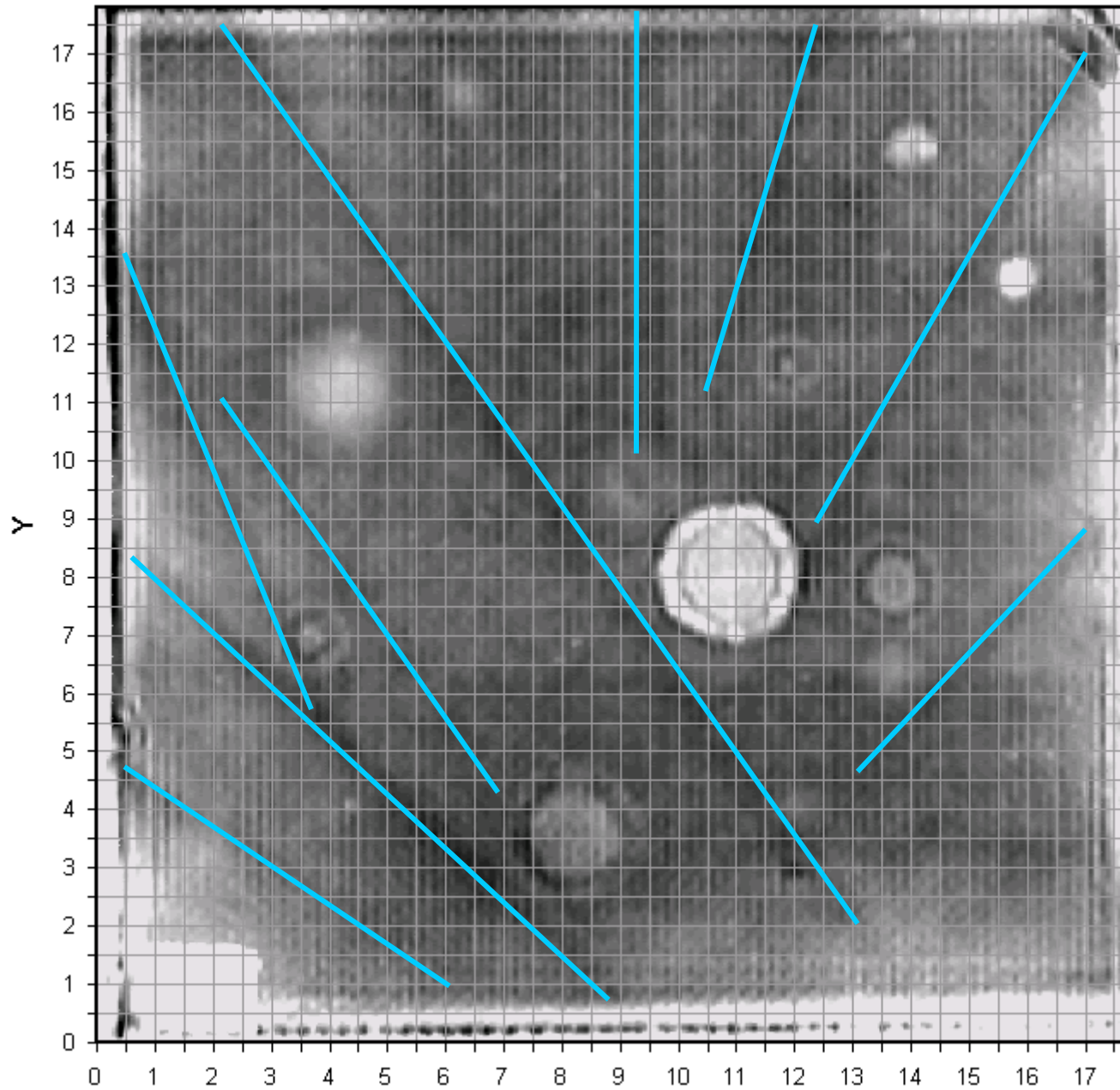
# Inspection Results – 6-ply Aerospace Coupons



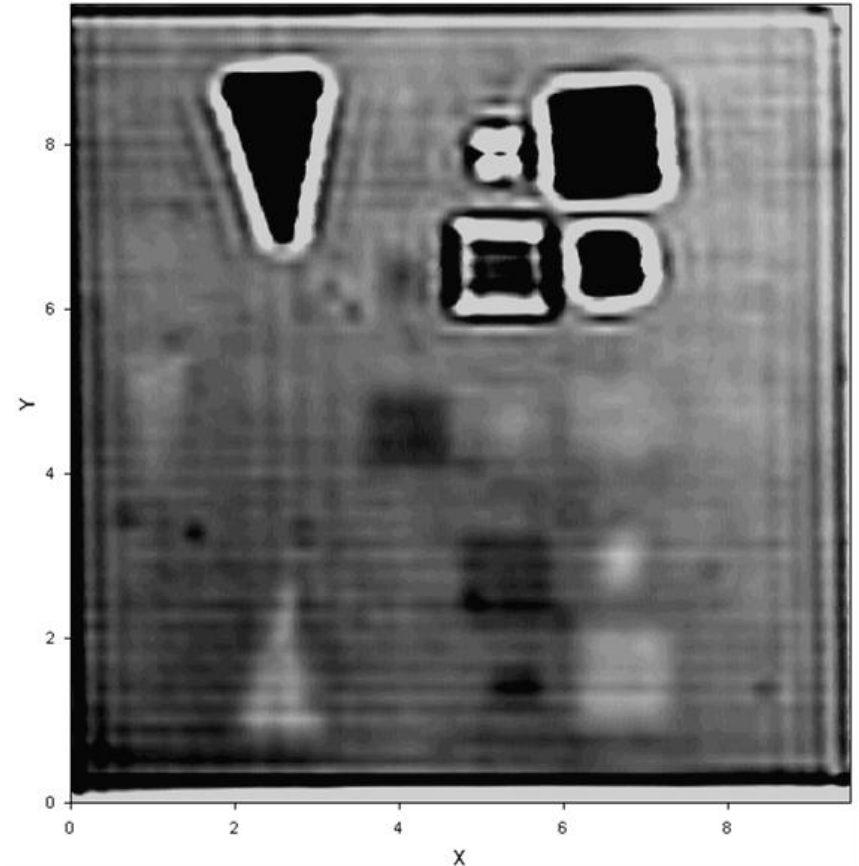
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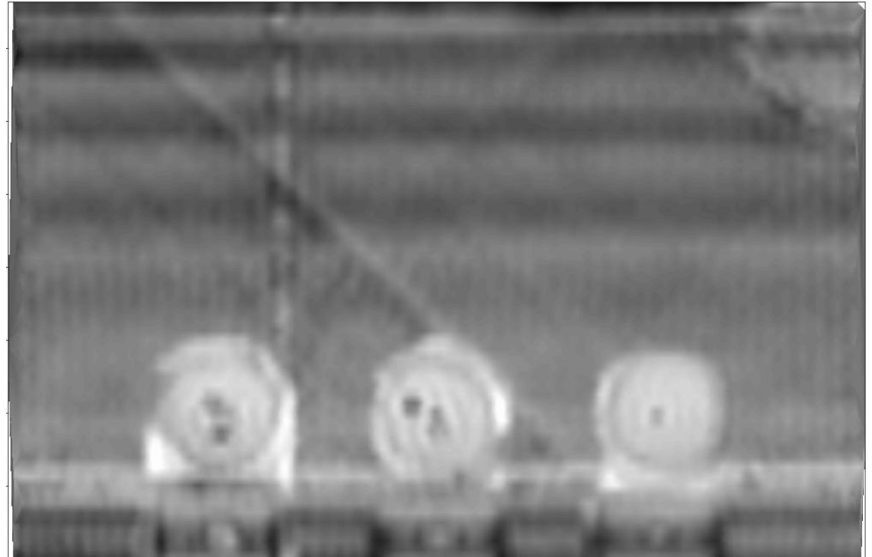


# Inspection Results – Helicopter Manufacturing



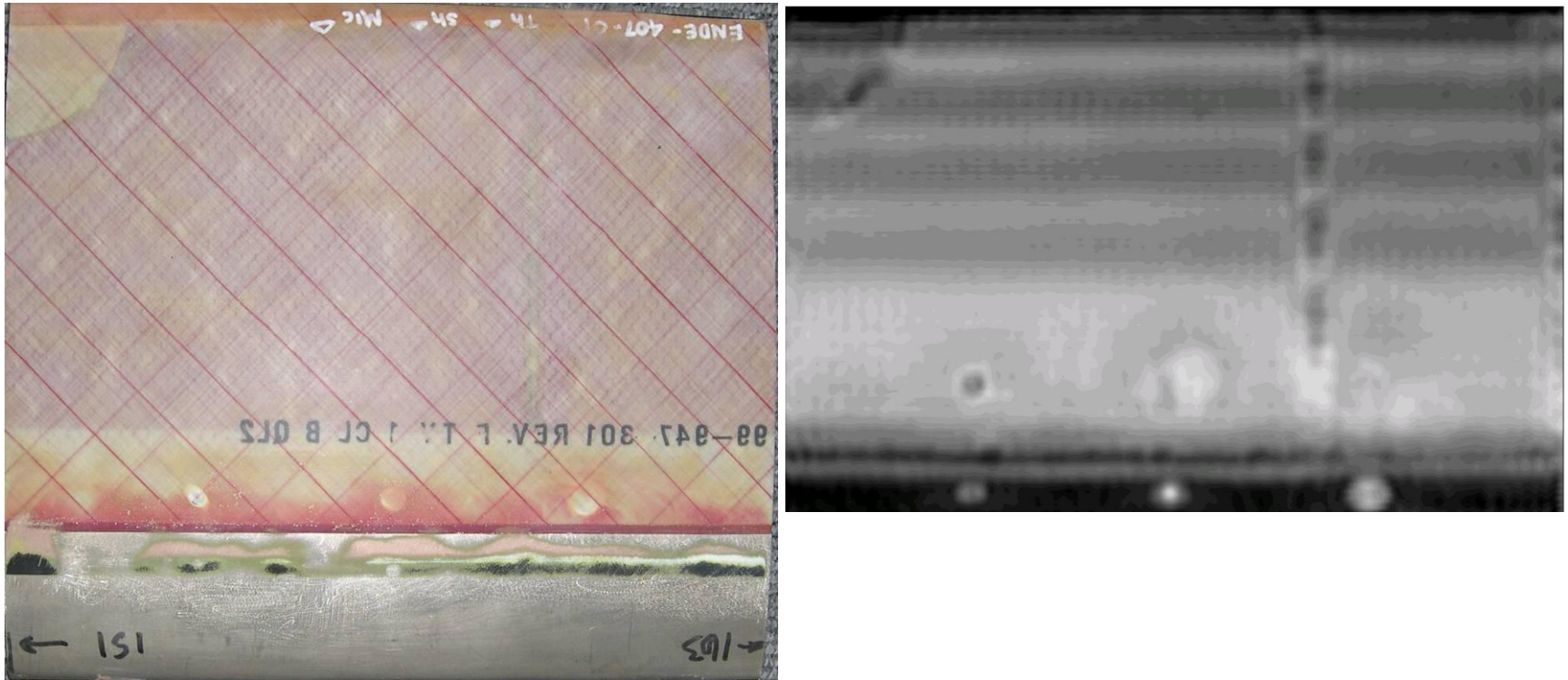
Pre-impregnated GRP helicopter fuselage materials showing interlaminar backing material. Backing material left on during manufacture virtually ensures in-service failure due to disbond.

# Inspection Results – Helicopter Rotor



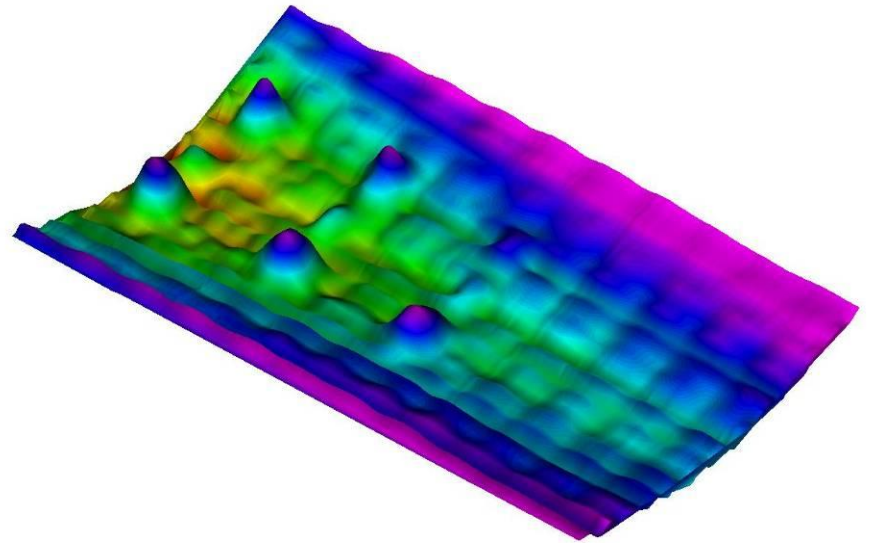
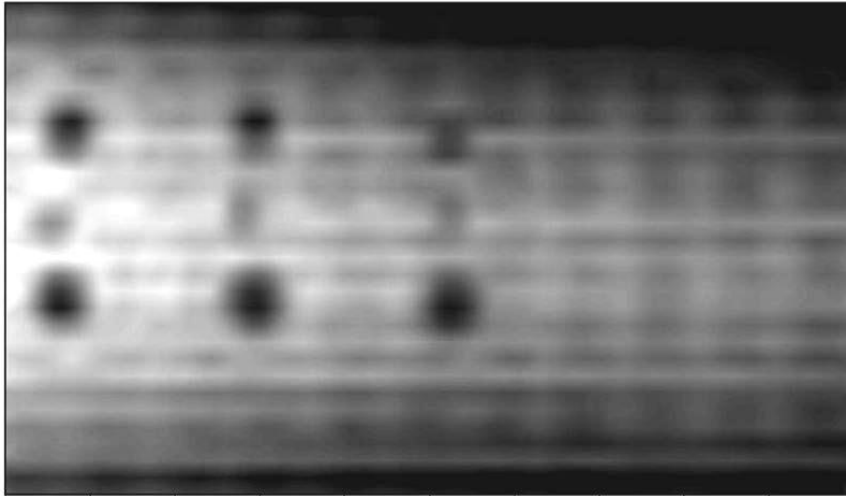
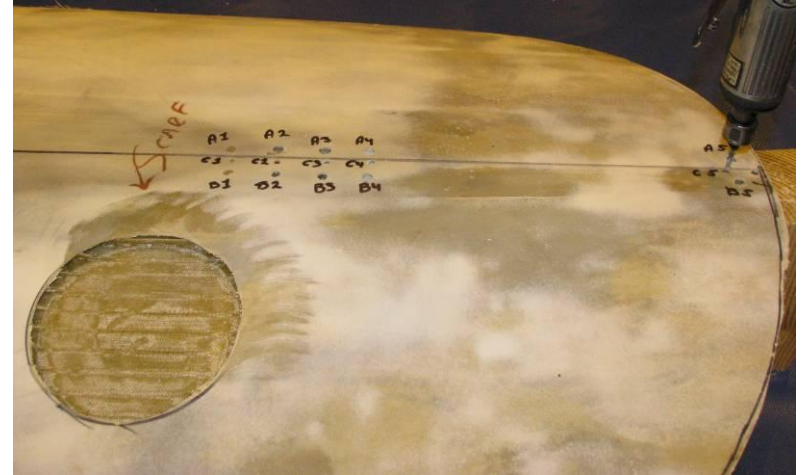
Inspection coupon built by a major US helicopter manufacturer. MW Scan showing embedded defects at right.

# Inspection Results – Helicopter Rotor



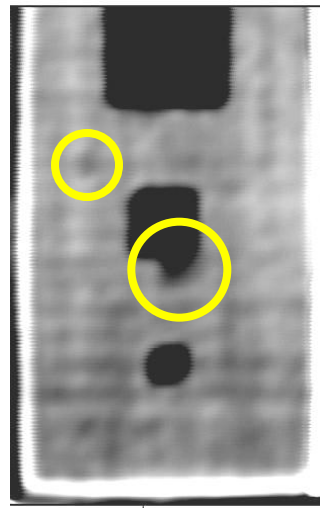
Inspection coupon built by a major US helicopter manufacturer. MW Scan showing embedded defects at right.

# Inspection Results – US Military Aircraft Radome

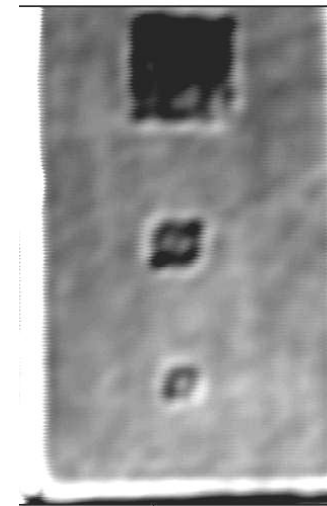
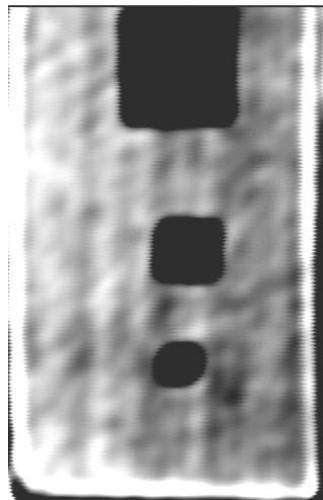


# Comparison of Inspection Results – Ceramic Test Coupons

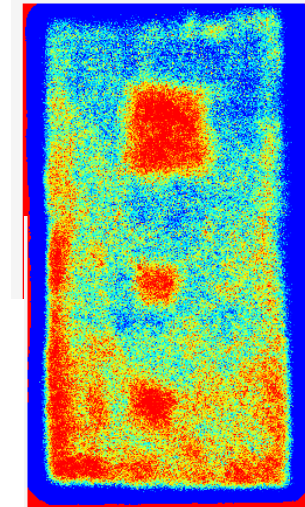
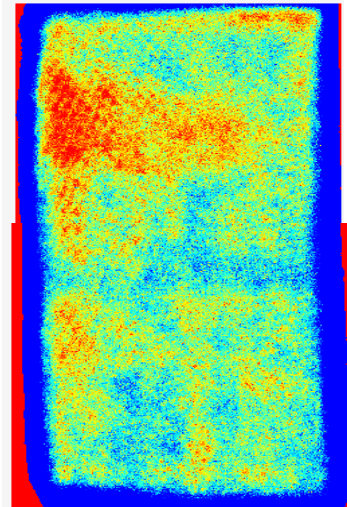
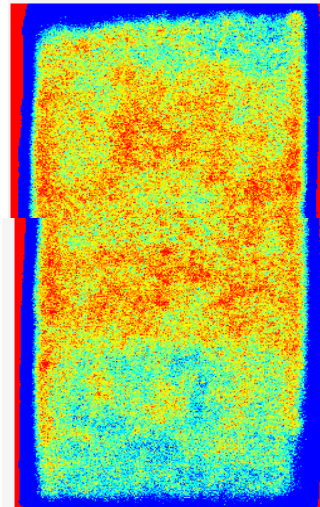
Microwave Inspection Results for 3 test coupons containing intentional defects



Yellow circles indicate unintentional defects detected by microwave NDE method



Flash Thermography Results for the same 3 test coupons containing intentional defects



# Summary

- Modern aircraft are increasingly being manufactured using strong, light composite materials.
- These materials present challenges to traditional NDE methods
- Microwave scanning can provide good results when searching for interlaminar as well as deep structural defects in composite components.
- Microwave scanning is effective on new, modern composite forms, including honeycomb composites and ceramic matrix composites
- Flaws like delaminations, fluid intrusion and mechanical damage can be detected, imaged and monitored over time.
- Microwave scanning can be manual or fully automated.
- Microwave scanning is non-contact, requires no couplant and requires access to only one side of the part.



Defense and Aerospace Applications

**Advanced materials require advanced NDE methods.**

**Let Evisive, Inc. help you push your envelope.**

