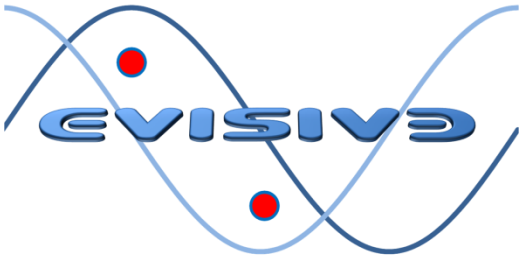
Inspecting Aerospace Composites Using Evisive Scan™ Technology



•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.

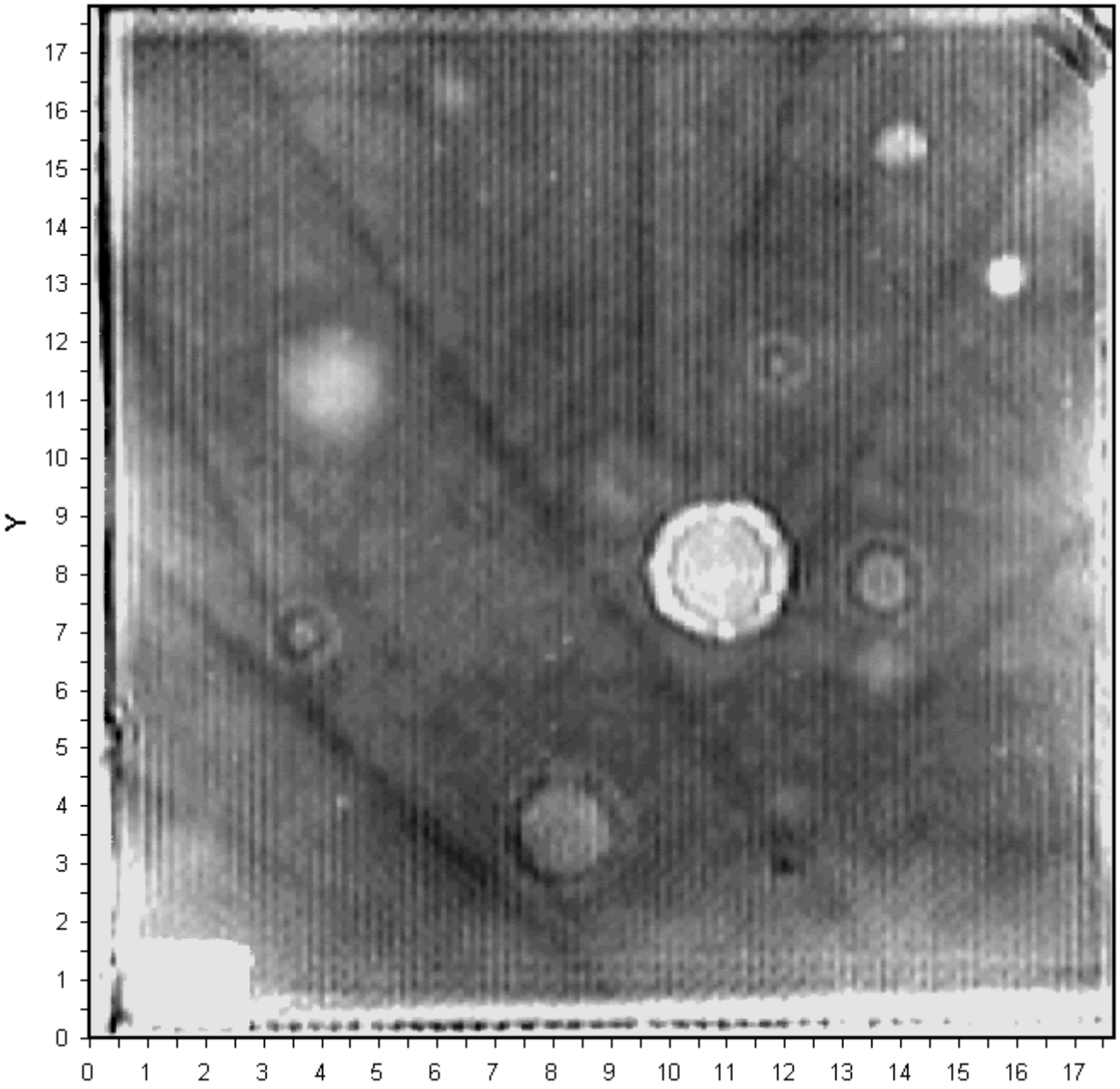
•The materials are used exclusively and with metal in honeycomb and other 3-dimensional structures.

•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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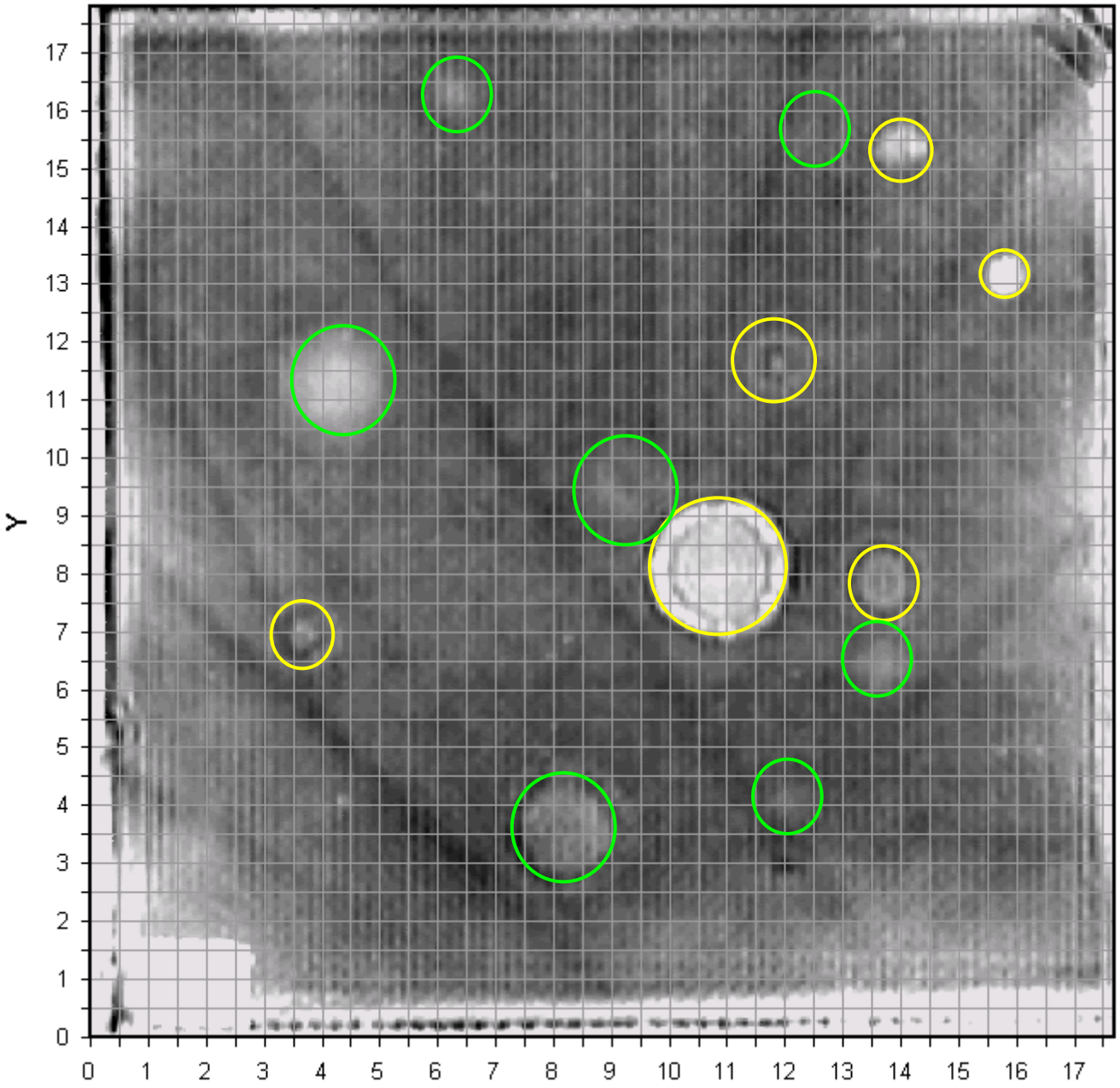

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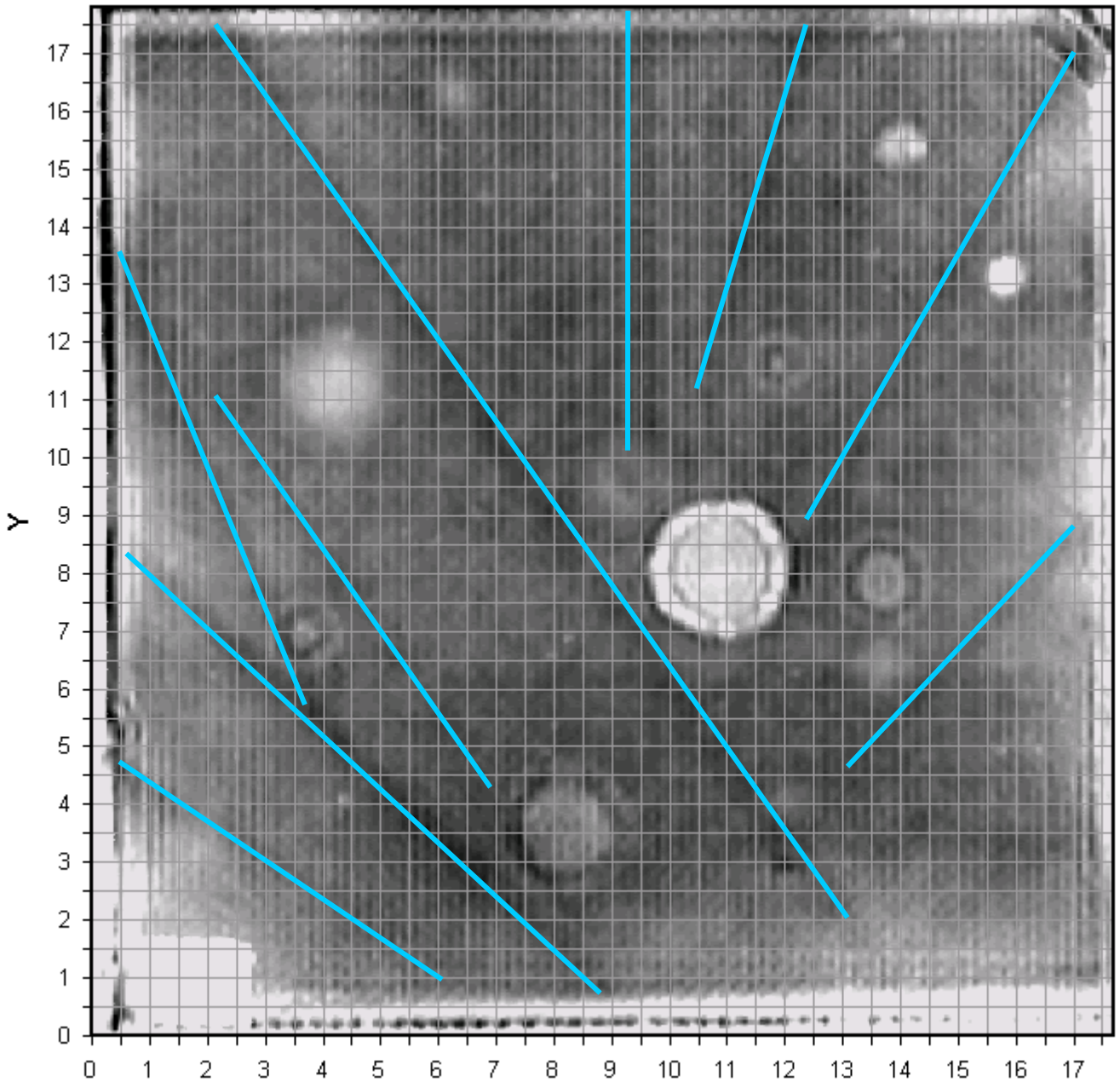
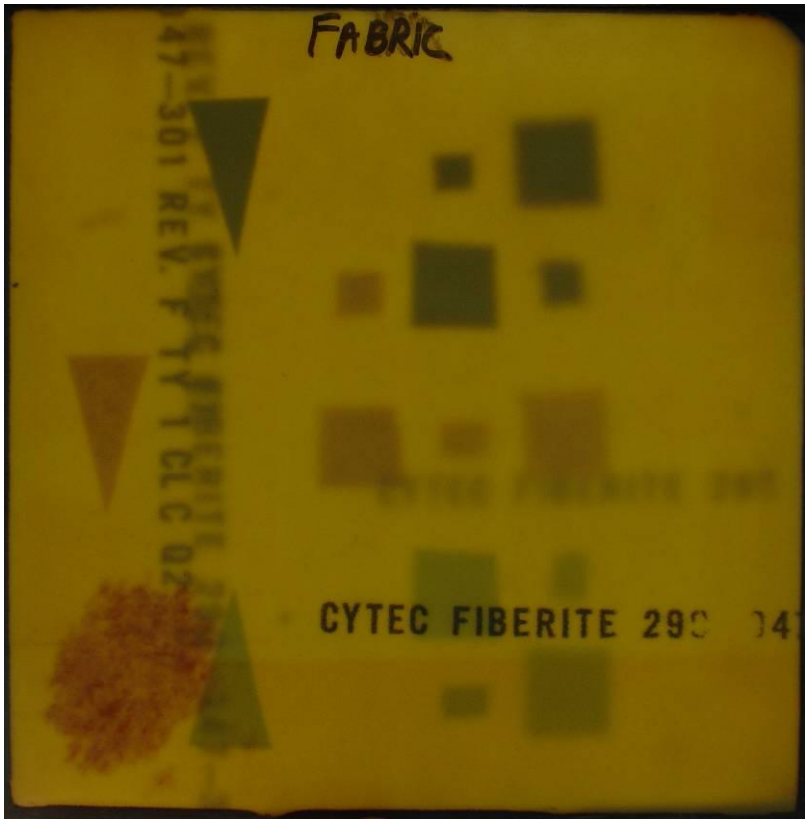
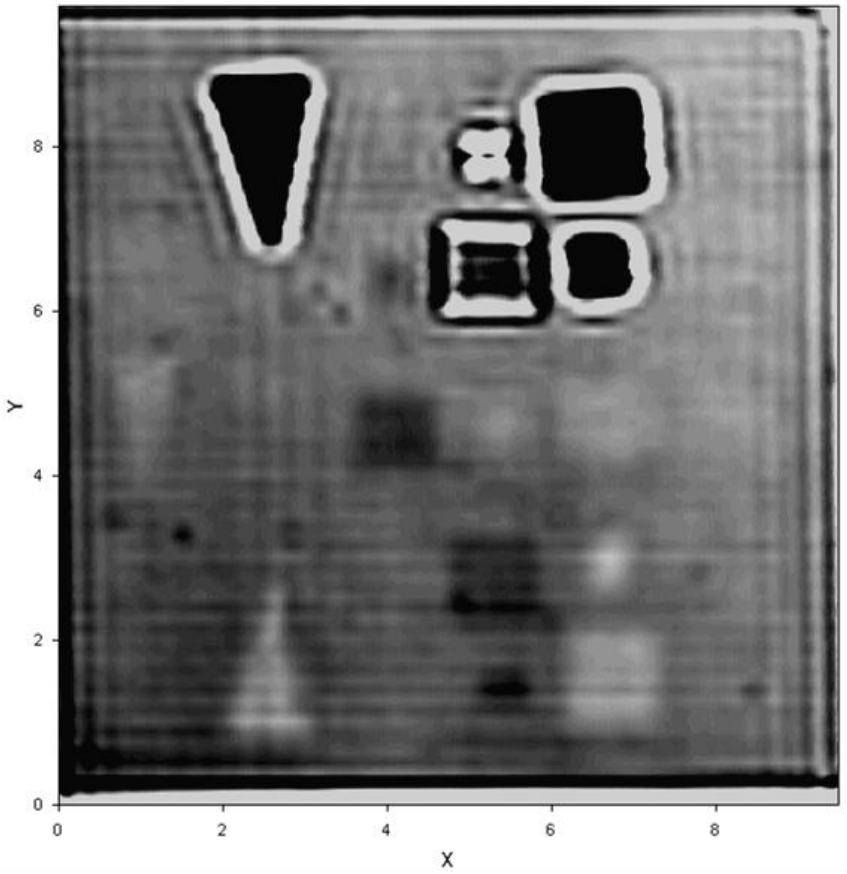


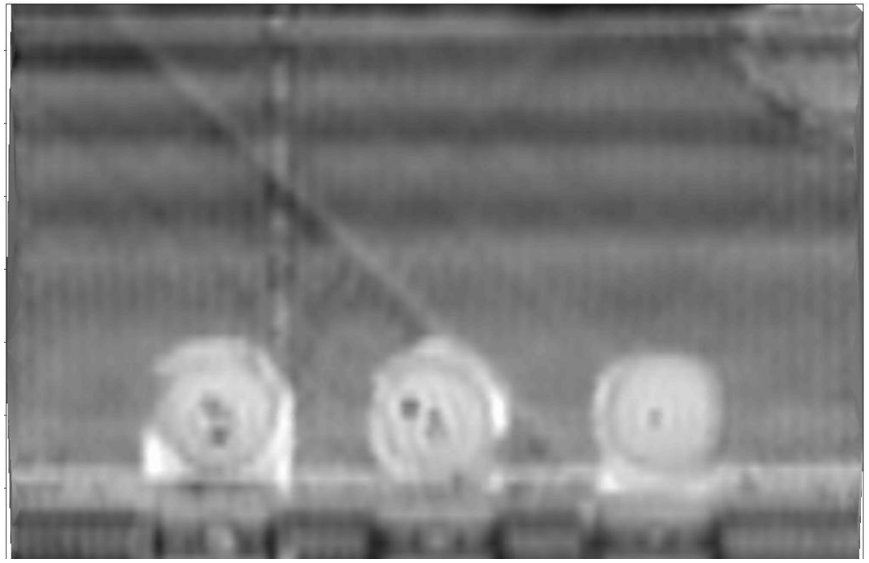
Inspection Results – Helicopter Manufacturing





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.

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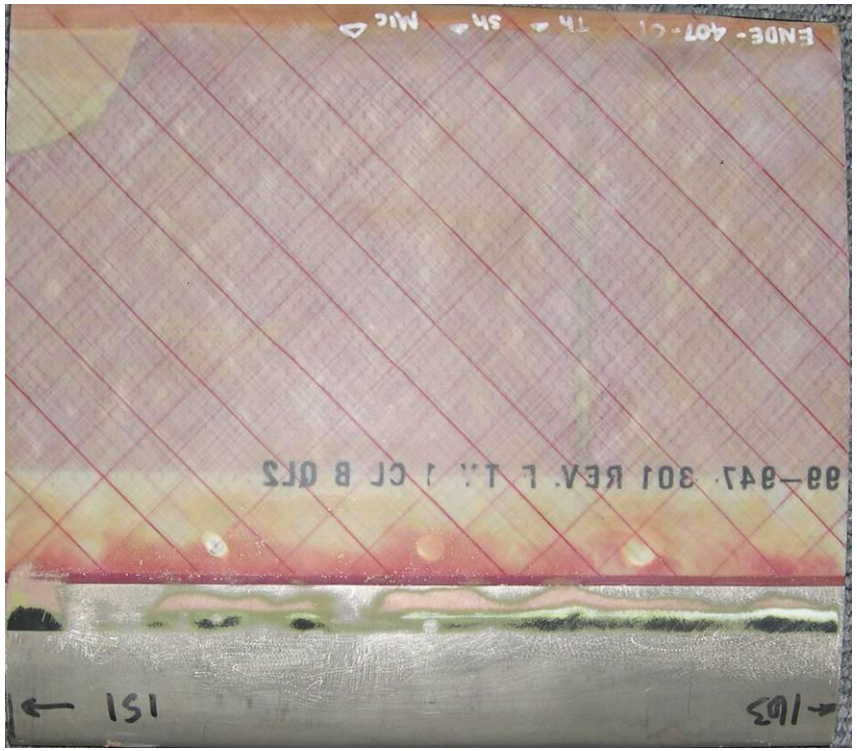

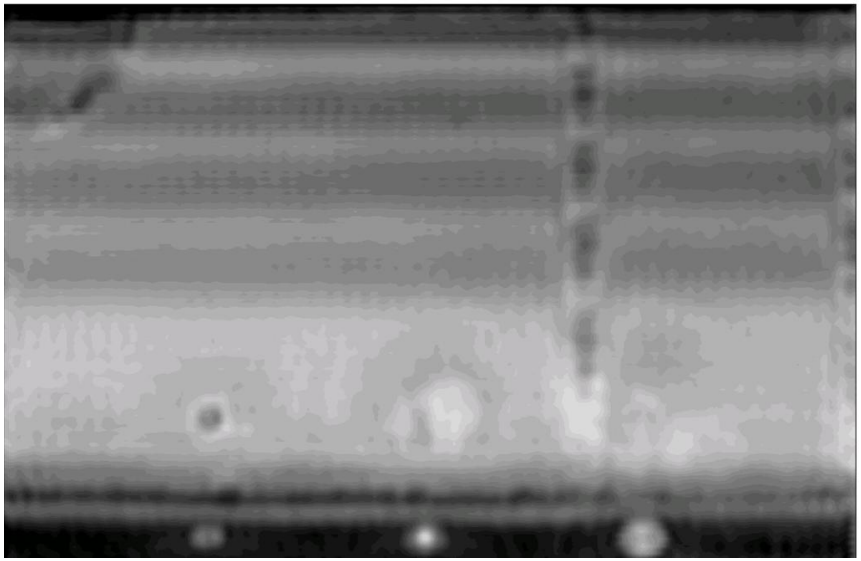

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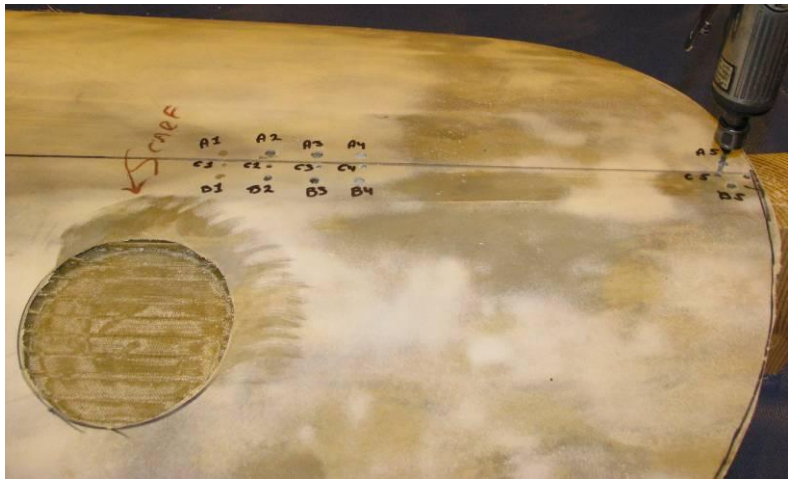
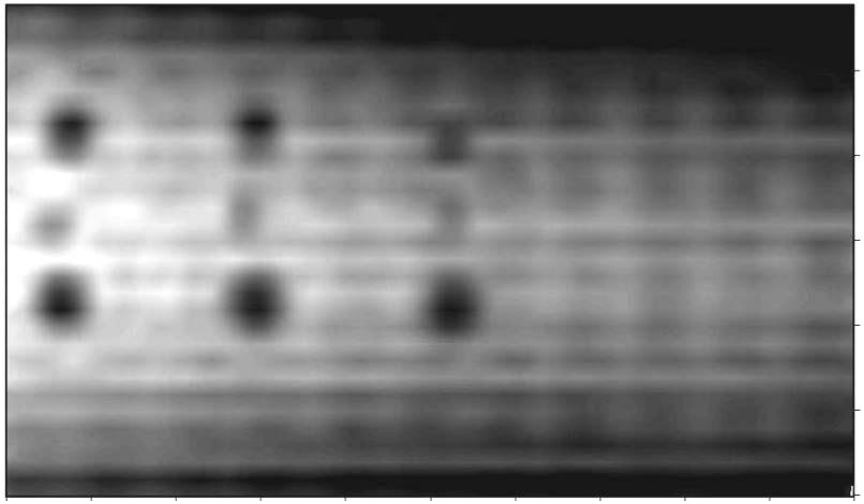
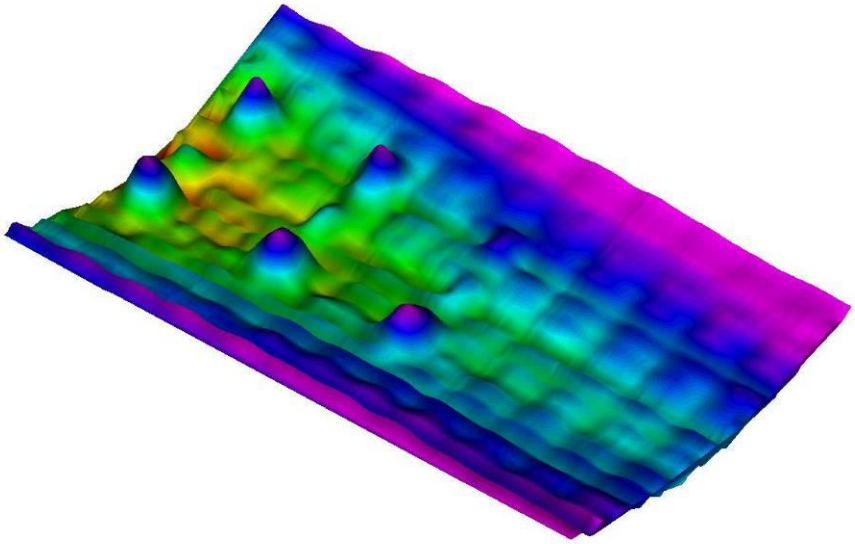
Inspection Results – US Military Aircraft Radome

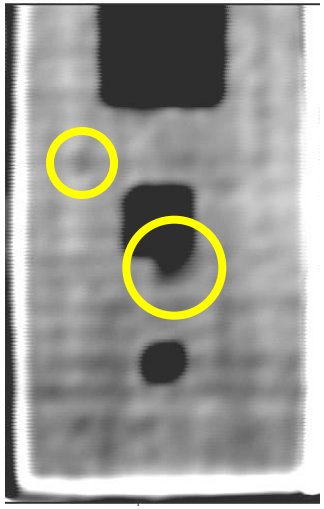




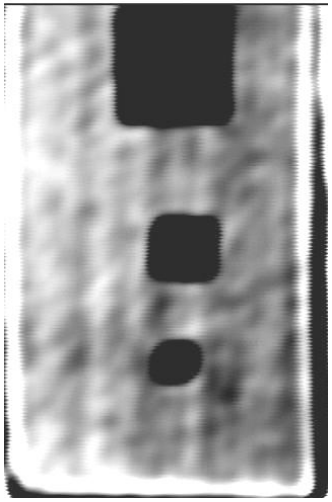


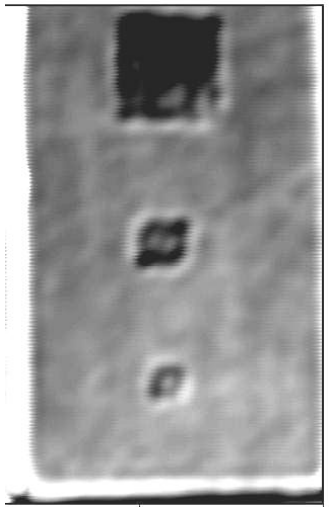
Comparison of Inspection Results – Ceramic Test Coupons

Microwave Inspection Results for 3 test coupons containing intentional defects

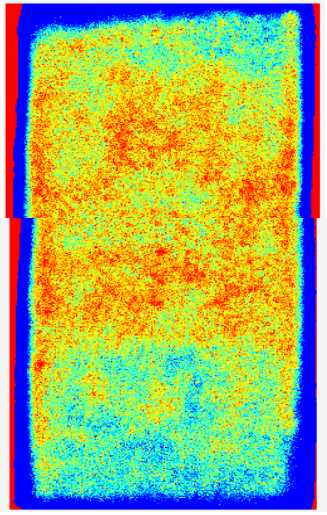


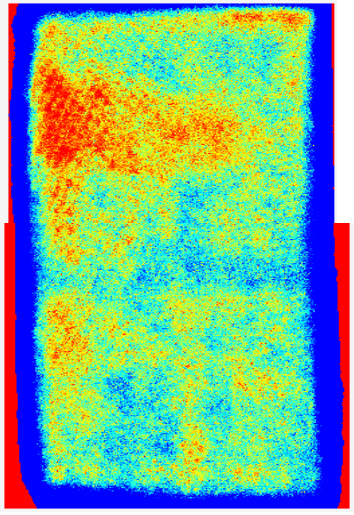
Yellow circles indicate unintentional defects detected by microwave NDE method

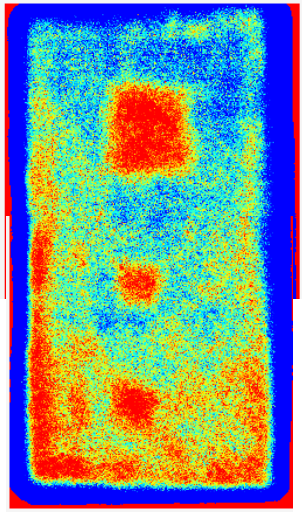




Flash Thermography Results for the same 3 test coupons containing intentional defects







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.

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