

Carbon composite repair

Why visual inspection is insufficient

A clean surface cannot establish the internal integrity of a laminated carbon structure. Visual inspection is the first screen. It is not a complete characterization of damage or repair quality.

The technical point

Carbon composite structures can contain damage below an apparently intact surface. Impact, heat, poor bonding, voids, porosity and earlier repair work can affect layers or interfaces that the eye cannot directly reach.

FAA guidance for composite aircraft structures states that visual indications give limited detail about hidden damage and that further investigation is generally required for complete characterization. The automotive component, geometry and acceptance criteria may differ, but the evidence principle remains useful: appearance is one observation, not a structural conclusion.

What visual inspection can establish

Controlled visual examination can document surface cracks, dents, scratches, discoloration, coating changes, exposed fibres, geometry changes, contamination and visible repair boundaries. Lighting, access, cleanliness and viewing angle materially affect what can be seen.

These observations are valuable because they define where the investigation should start. They do not, by themselves, define the full depth or lateral extent of a defect.

What it cannot establish alone

Visual inspection cannot reliably exclude subsurface delamination, disbonding, trapped voids, internal fibre damage or an inadequately executed bond. Nor can a smooth cosmetic finish prove that the correct materials, preparation, cure cycle and repair geometry were used.

A defensible assessment sequence

First identify the component, its structural function and the applicable manufacturer information. Then map known impacts, repairs, heat exposure and previous refinishing. Conduct the visual and tactile examination under controlled conditions before selecting a suitable non destructive method.

Ultrasonic inspection, radiography, thermography, mechanical impedance or other methods may be appropriate depending on material, thickness, geometry and access. No method is universal. The procedure, equipment, calibration, operator competence and acceptance criteria matter as much as the instrument name.

What a repair file should contain

A useful file records the pre repair damage map, repair design, materials used, preparation and cure information, process controls, photographs, technician responsibility and post repair inspection. It also states what could not be inspected and which assumptions remain.

An undocumented repair is not automatically defective. It is, however, harder to evaluate. That uncertainty can affect safety decisions, future maintenance, insurability, market confidence and value.

KUKUK conclusion

The correct question is not whether the carbon looks good. The question is whether the evidence is sufficient for the decision being made. Visual inspection starts that enquiry. It rarely completes it where structural integrity or repair quality is material.

Sources and scope

[FAA Advisory Circular 20 107B Composite Aircraft Structure](#)

[FAA Advisory Circular 21 26A Quality System for Composite Structures](#)

Technical principles from aviation guidance are used here as an evidence framework. Vehicle specific manufacturer procedures and qualified engineering judgment govern the actual inspection and repair decision.