Repairing the repair: when previous blade work fails

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Revisiting a failed blade repair brings its own challenges. Missing records, unfamiliar materials and uncertainty about the original laminate can make it difficult to establish what went wrong and how best to put it right.

Not every blade repair starts with the original structure. Technicians are increasingly finding themselves working on areas that have already been repaired, sometimes years earlier and with little information about what was done.

Repairing damage to an original blade structure is one thing. Going back over a previous repair, particularly one that has failed, is another. Before any new work can begin, technicians need to find out what has already been done, why it may have failed and how much of the existing material can safely be removed.

When the history is missing

One of the biggest difficulties with previous repairs is finding out exactly what was done.

Some repairs date back to the manufacture of the blade, while others have been carried out during years of operation. The original documentation is not always available, making it harder to establish why a repair has failed.

The materials used may no longer be available either, which can complicate decisions about how to tackle the damaged area.

Sometimes the cause of failure is obvious. Other times, it is much harder to pin down. Removing the visible damage and repairing it again may not solve the problem if the original cause has not been identified.

The following repair illustrates just how useful the history can be.

Cracks had appeared in the topcoat. When the area was inspected more closely, the resin underneath was found to be crumbly. The repair needed to be completely redone and, as the damaged material was removed, it became clear that the whole area had been scorched by excessive heating.

Fortunately, the original repair report was available. It showed that a basic heat blanket had been used without a controller to set the temperature. That helped explain what the technicians were finding in the blade.

Without the report, working out what had gone wrong would have been much more difficult.

Knowing where the repair ends

Before removing a failed repair, technicians need to know where the repair finishes and the original laminate begins.

Sometimes the difference is easy to see. In other cases, it can be extremely difficult.

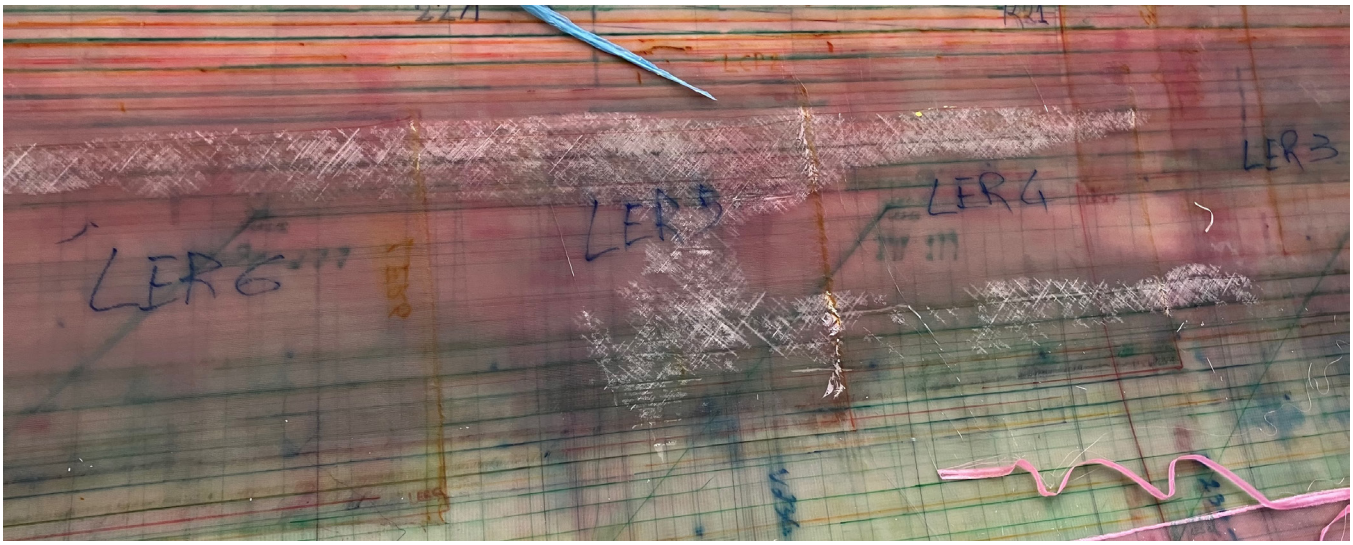
This is particularly true when an infusion repair has been carried out using the same resin and glass as the original blade. The repaired area can look almost identical to the surrounding laminate, making it difficult to identify exactly which material belongs to the repair.

Without the original equipment manufacturer's technical drawings, mapping the laminate layup becomes harder still. Getting this right matters. Removing the failed material is necessary, but damaging sound laminate underneath can create an entirely new problem.

Removing the old repair

Grinding away an existing repair takes particular care.

There may be no way of knowing exactly how much material was removed the first time or whether the remaining laminate was already close to its allowable tolerance. Grinding too far can damage the material underneath and turn a relatively small job into a much larger repair.



The technician is not necessarily starting with the original blade structure. Someone else's earlier work may already have changed what is there.

That is why removing a previous repair is not simply a case of grinding everything away and starting again. Each layer needs to be approached carefully.

Why repairs fail

Some failures are easier to explain than others.

One problem seen in the field is a repair delaminating from the original laminate. Good surface preparation is essential, but it can be overlooked or difficult to carry out properly in certain conditions.

The scorched repair was a different problem. What initially appeared to be cracking in the topcoat turned out to involve badly damaged resin underneath. In that case, the original report helped explain how the damage had occurred.

The visible defect does not always tell the whole story. Sometimes the real problem only becomes clear once the repair is opened up.

And finding the cause is only part of the job. The next question is how much of the previous repair actually needs to come out.

When is a complete rework necessary?

If a previous repair is badly compromised, as with the scorched resin, removing it completely and starting again may be the only sensible option.

But not every defect means the entire repair has to be removed.

The size and position of the defect matter, as does the way the repair was originally constructed. If only a small area is affected, technicians need to consider how much material would have to be removed and where the new laminate overlaps would sit.

There is little point in having a 50 mm overlap within the final 100 mm of a layer, for example. On repairs with many layers, having several overlaps stacked directly on top of one another is also best avoided.

The size of some repairs makes these decisions particularly important.

Repairs can be more than 50 layers deep and extend for 20 metres. If a small area involving only two or three layers has a minor defect, such as aeration, removing and rebuilding the entire repair may achieve very little.

A local rework can save a considerable amount of labour and material. It also avoids the unnecessary risk of damaging more of the original laminate.

There is no single answer that works for every failed repair. Technicians have to look at the defect, consider where it sits within the laminate and decide what removing the surrounding material would involve before deciding how far the rework needs to go.



The record matters

Another problem with previous repairs is the amount of useful information that never makes it into the repair report.

For someone returning to the blade years later, simply knowing that a repair was completed is not enough. The details of how it was carried out can be just as important, particularly when something has gone wrong.

One area that is often overlooked is curing data.

A photograph of a controller only shows what was happening at the moment the picture was taken. An infrared temperature gun can provide useful readings, but much depends on how often those readings are taken. There is still no record of what happened between checks.

In my experience, a better approach is to use a heat blanket that records curing data continuously in real time. This provides a record of the whole cure rather than a series of individual readings or photographs.

That information may not seem particularly important when the repair is first completed. Years later, it could make all the difference.

The scorched repair is a good example. Because the earlier report was available, the technicians had something to work from when trying to establish what had happened.

Without those records, the next team may be left trying to piece together the history from what they find inside the blade.

Repairing for the next technician

Previous repairs are becoming an increasingly important part of blade maintenance. The technician arriving onsite may be dealing not just with the original blade construction, but with work carried out by someone else years earlier.

That makes good records, careful material removal and an understanding of the previous repair essential.

A failed repair should not automatically be treated as a new, isolated defect. The first job is to understand what is already there and, as far as possible, why it has failed.

Sometimes the previous repair will need to be removed completely. In other cases, a smaller, carefully planned rework may be the better option, particularly if removing sound material would create more work and increase the risk of further damage.

A good repair does more than address the damage in front of the technician. It also leaves a clear record of what was done and why. If that area needs attention again in the future, the next technician would not have to start from scratch.

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