

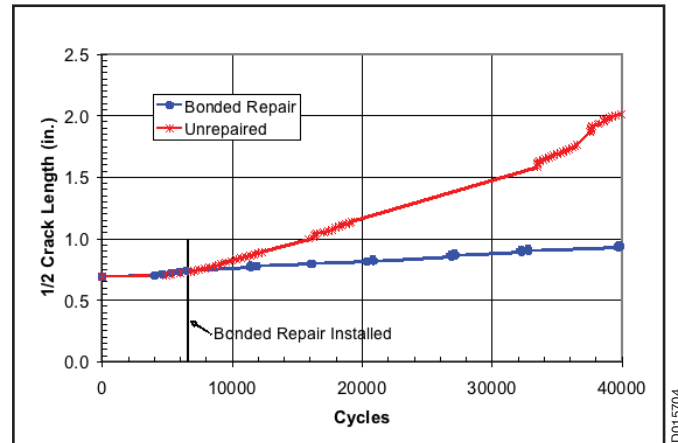
Aircraft Bonded Repair of Metallic Structures

As military and commercial aircraft age, they become progressively more susceptible to fatigue cracking and other forms of structural damage. These aging aircraft are continually evaluated for their ability to meet structural life requirements.

Bonded composite repair technology can be used to economically repair aging aircraft structures, often without removing components from the aircraft. Bonded composite repairs can be installed without creating additional damage, unlike conventional metal repair doublers that add fastener holes in an already fatigued critical part. Composite doublers also have the advantage of allowing tailoring of the doubler stiffness for applied loads and stress fields at the repair site.



SwRI curved fuselage panel test facility being used to test a bonded repair with combined structural, pressure and thermally induced loads.



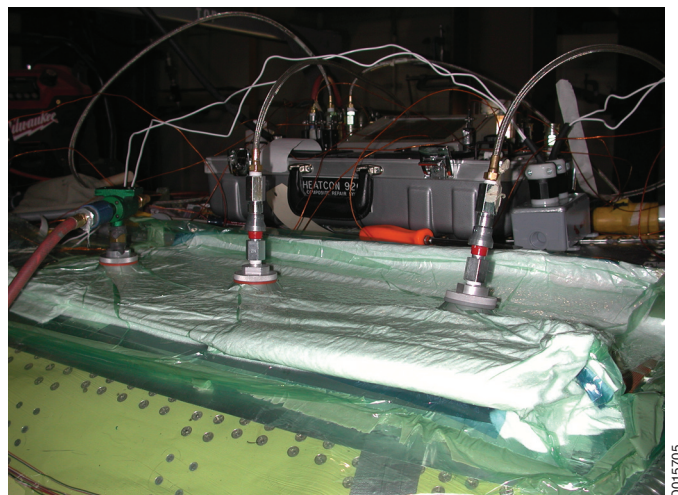
Crack growth test results for a crack with a bonded repair and an unrepaired crack over a frame in a transport fuselage skin.

Capabilities

Southwest Research Institute® (SwRI®) has designed, analyzed, tested and installed bonded repairs for various aircraft since the mid-1990s. SwRI has designed both metallic and composite bonded repairs for wing skin planks, pressurized transport fuselage structures, and complex three-dimensional fighter bulkheads. Software design and analysis capabilities include Pro/ENGINEER®, UGS® NX/NASTRAN, Graphite, MSC. NASTRAN®, ABAQUS®, StressCheck® and CRAS.

Experience

- Helped develop bonded repair guidelines for shape, thickness and material for USAF
- Designed and developed a curved panel test facility for testing bonded repairs of transport fuselage curved sections under combined loadings
- Designed, analyzed and tested a composite bonded repair on a large fuselage frame
- Developed and installed a prototype bonded repair for the F-16 341 bulkhead
- Designed, analyzed and installed a bonded repair on a full-scale fatigue test aircraft



Co-curing of a boron repair on the dorsal longeron of a full-scale test aircraft at SwRI.

KEYWORDS

Aircraft Bonded Repair

Composites

Structural Design

Stress Analysis

Life Enhancement

Fatigue

Damage Tolerance

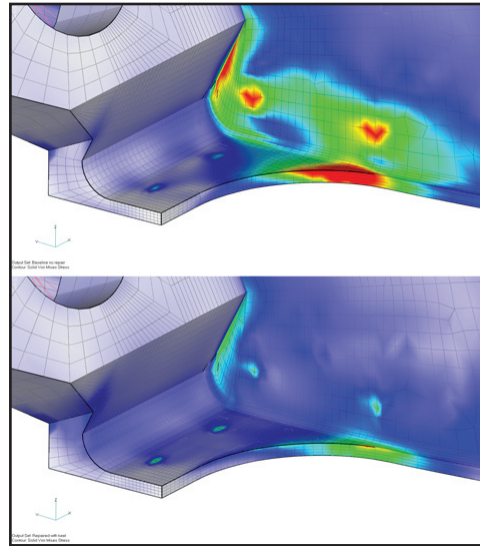
Prototype Fabrication
and Assembly

Component Test

Full-Scale Test

Facilities

- Materials Test Lab
- Combined Loading Curved Panel Test Facility
- Large-Scale Structures Test Facility
- Research autoclave
- Machine shop
- Grit blasting enclosure
- Hot bonders
- Heat blankets
- Cold storage
- Composite doubler buildup facility



Stress contours in an F-16 bulkhead flange before (top) and after (bottom) application of a bonded doubler (doubler not shown for clarity)

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Prototype installation of F-16 bulkhead bonded repair on an in-service aircraft

D015707



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