

# Aircraft Damage Tolerance Analysis

## KEYWORDS

Aircraft Structures

Fracture Mechanics

Fatigue Crack Growth

Damage Tolerance

Durability

Risk Analysis

Stress Intensity  
Calculation

Correlation to Test  
Results

Crack Growth  
Retardation

Automation of  
Analysis

Residual Strength

Finite Element  
Analysis

Material Testing

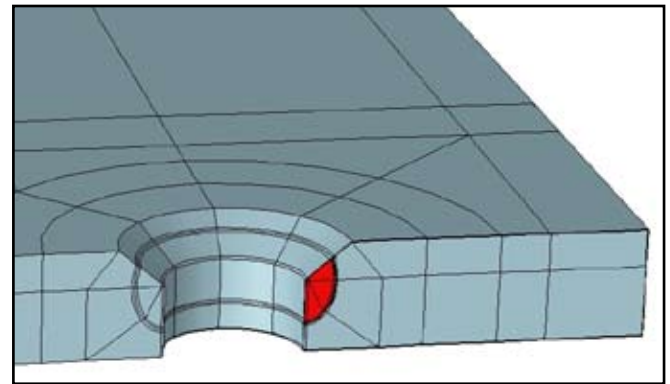
Component Test

Full-Scale Test

Southwest Research Institute® (SwRI®) structural engineers perform damage tolerance analysis for military and commercial aircraft to give clients the information necessary to safely and effectively manage the structural health of their fleets. SwRI has expertise using state-of-the-art tools such as AFGROW, NASGRO® and StressCheck® along with significant experience correlating analyses to crack growth test results. Proficiency with automating these tools allows for efficient and timely results.

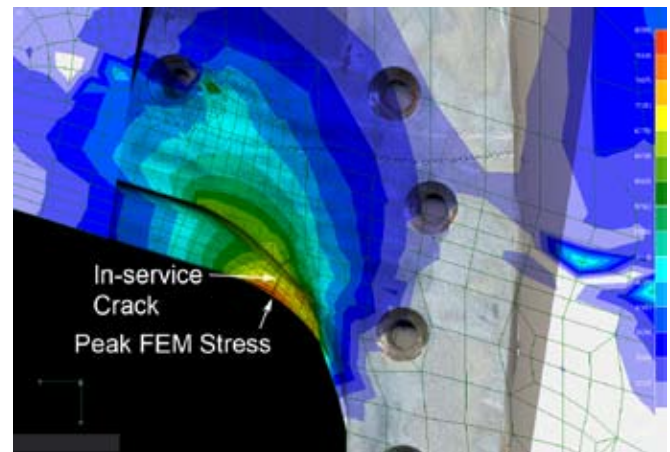
## Capabilities

- Crack growth analysis software tools (AFGROW, NASGRO®, CRACKS, etc.)
- Stress intensity calculation using finite element and boundary element tools (StressCheck®, NASBEM, etc.)
- Correlation to spectrum test results from coupon and full-scale tests to determine crack growth rates and crack growth retardation due to spectrum effects
- Automation for efficient and accurate analysis of large numbers of locations and/or variation of parameters
- Stress determination using hand stress analysis and finite element tools such as FEMAP and NASTRAN
- Risk and probabilistic crack growth analysis using state-of-the-art tools such as PROF and NESSUS®
- Material, component and full-scale testing
- Damage tolerance training/short course



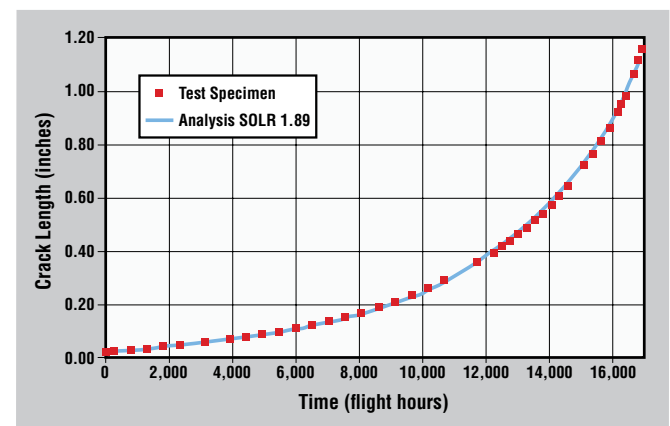
Parametric finite element model (FEM) of countersunk hole crack stress intensity factors

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Cracked aircraft structure image overlaid on finite element analysis (FEA) stress gradients

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Spectrum test correlation using AFGROW for determination of retardation parameter

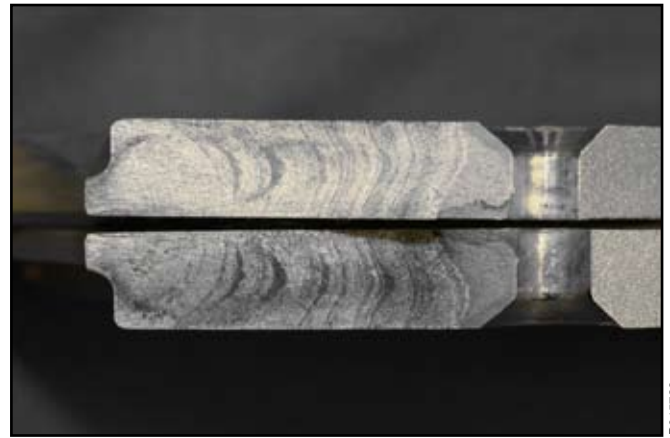
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## *Experience*

SwRI has performed damage tolerance and fatigue analysis for U.S. military aircraft (A-10, F-5, F-16, T-37, T-38) and for foreign military and commercial clients.

## *Facilities and Analysis Tools*

SwRI uses state-of-the-art crack growth analysis tools such as NASGRO® and AFGROW, as well as finite element modeling tools such as NASTRAN, FEMAP, and StressCheck® for the determination of stresses and stress intensities. SwRI has facilities to perform tests on structures ranging from coupons to components to full-scale aircraft.



*Aircraft structure with fatigue crack growing from radius to fastener hole*

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*Southwest Research Institute is an independent, nonprofit, applied engineering and physical sciences research and development organization using multidisciplinary approaches to problem solving. The Institute occupies 1,200 acres in San Antonio, Texas, and provides more than 2 million square feet of laboratories, test facilities, workshops and offices for more than 3,000 employees who perform contract work for industry and government clients.*

**We welcome your inquiries.**

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