



For October 27, 2009

ASNT Section Meeting & News

GREATER SALT LAKE SECTION OF THE AMERICAN SOCIETY OF NONDESTRUCTIVE TESTING



A-10 Factsheet

Role: Close air support, and ground-attack aircraft

Manufacturer: Fairchild-Republic

Designed by: Pierre Sprey

First flight: 10 May 1972

Introduction: March 1977

Status: In service

Primary user: US Air Force

Number built: 715

Unit cost US\$11.7 million (average)

<http://en.wikipedia.org>

Our Speakers/Presenters : **Scott Carlson & Robert Pilarczyk**

Scott Carlson and Robert Pilarczyk each graduated from Utah State University with degrees in Mechanical Engineering and were hired by the United States Air Force through the PALACE Acquire (PAQ) Program. Through this program each returned to school at the University of Utah and received a Masters of Science in Mechanical Engineering with an emphasis in fracture mechanics and solid mechanics. Robert

and Scott both currently work at Hill AFB in the A-10 Aircraft Structural Integrity Program's Advanced Structural Analysis Group.

The research that will be presented will highlight the effects of split sleeve cold expansion on the fatigue crack growth behavior of aerospace grade aluminum alloys and the development of an analytical Beta Correction to modify the base-

line crack growth prediction to predict the physical crack growth behavior of cracks propagating through the cold expansion residual stress field. In modeling the physical behavior of cracks propagating through a three-dimensional residual stress field one is able to more accurately predict the fatigue life of a component and therefore develop a more precise time and method for inspection.

ABSTRACT—Using a Beta (β) Correction to Improve the Life Predictions of Cold Expanded Holes in 2024-T3 & 7075-T6 Aluminum Alloys

Fastener holes represent one of the most common fatigue details found in airframe structures. In order to minimize the impact fastener holes have on the fatigue behavior of critical aircraft components, many are processed by cold expansion. Cold expansion imposes a residual compressive stress field around a hole that retards fatigue crack growth from the volume of cold working and increases the fatigue life of the component. According to the current USAF guiding documents a damage tolerance analysis can take advantage of cold expansion by reducing the initial flaw size to a minimum of a 0.005 inch corner crack. This approach is a "one size fits all" method for dealing with cold expansion which leads to predictions that vary in degrees of accuracy to predict the crack growth behavior and fatigue life of materials that have been processed using cold expansion.

A more physically based approach was investigated to take analytical advantage of the cold expansion process. The authors explored the development of an empirical correction factor β for 2024-T3 and 7075-T6 aluminum alloys. This method takes into account the interaction of the fatigue crack and the residual stress field found in the body. Many common current methods are unable to account for this critical interaction. The β correction factor can be used in fatigue crack growth and damage tolerance analysis to provide an accurate model of the crack growth behavior at cold expanded holes.

In order to develop da/dN versus ΔK plots for the cold expanded specimen configuration accurate stress intensities along the crack front were required. Finite element models were used to calculate stress intensities for different lengths and shapes of the propagating fatigue crack. By using the fracture mechanics based similitude principle, the noncold expanded and cold expanded da/dN versus ΔK plots were compared and β corrections that represented the residual stress field in the body were calculated. It will be shown that this empirical process and analytical method was successful in predicting the crack growth behavior. This approach has been shown to predict more accurate crack growth life that can possibly influence the time between inspections at critical locations on the airframe. Examples of empirical test results and analytical applications will be presented and discussed.



Section Meeting Details:

Date: Tuesday Oct. 27, 2009

Time: 6:30 p.m.

Place: [Joyluck Restaurant](#).

566 W 1350 So., Woods Cross, UT 84010

Cost: \$15/person (\$7/NDT Student).

Please RSVP
Click Here or txt:
Cell 435-401-1386



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Greater Salt Lake Section of ASNT

Brad Hoskins — Section Chair
435-863-2128
brad.hoskins@atk.com
(NDT Services at ATK Launch Systems)

Jeremy Felker — Vice Chair
801-499-7984
jeremy.felker@atk.com
(RSRM/Ares NDT Engineer—ATK Launch Systems)

Chuck Garner — Treasurer
801-775-1538
Chuck.Garner@atk.com
(NDI Process Engineer—ATK Aerospace Structures)

Dave Eldredge — Secretary/Newsletter
435-401-1386
de@naltic.com
(Owner of NALTIC Industrials)

***Section Chair Notes** - Last month I mentioned that we were trying to increase the value of our meetings to the membership by putting together quality meetings. If meeting attendance is any validation of this value, we are right on track as we believe the September meeting had the best attendance of any meeting ever held. Thanks to those who attended and for those who didn't, please consider attending. I am excited to see advertising return to this announcement and soon on the website. The money that is generated from the advertisements will go directly into our section budget, that will be wisely used to improve our monthly meetings and tours. So better attendance/exposure will lead to increased advertising, which will lead to increased revenues and ultimately better meetings/value to the members.*

Brad Hoskins

For more meeting info find us on the web at:
<http://asnt-greatsaltlake.tech.officelive.com>

GSL SECTION NEWS

Right here is the place to post your company news. Send us a short write up of anything note worthy for our local section to learn more about. Spotlight a new employee, announce a new joint venture or product along with a photo. Email to de@naltic.com

Also new... we are now offering ad placement on our section website as well as our section newsletter. Visit our [website for ad rates](#). All proceeds will go towards enhancing our section meetings, bringing in more quality speakers like Ward Rummel and to promote NDT awareness in our local schools and universities. Our current readership is approximately 500

Includes 85 registered ASNT Section members, Engineering, Physics/Math/Chem departments and many students at all the major Utah Universities and other related NDT companies.

September's Meeting

It was a great pleasure and honor having Ward Rummel, speak to a gathering of 29 regular section member attendees and 29 University of Utah engineering graduate students. Mr. Rummel is respected and regarded as one of the pioneers in POD (Probability of Detection). His entire presentation is viewable on our [section website](#). Brad Hoskins of ATK was voted in as Section Chair at our last gathering in May succeeding



Doug Fowers of Barnes Aerospace. Other officers were voted in at our September meeting. During the gathering Ward Rummel and University of Utah Professor, David W. Hoepfner P.E. Ph.D along with a few others representing their fields in NDT opened an important dialog concerning the need for better and more concurrent engineering for NDT. As happens so often, structures and materials are designed and engineered without as much regard to NDT until the product or project is in production or in the market. When this happens, more challenging and exotic types inspections are required. Resulting from this section meeting Ward Rummel, University of Utah's Engineering department and other section members feel more strongly about resolving the barriers the stand in the way of better concurrent engineering and NDT and plan to make it a much higher priority.

