VOLUME 5
ISSUE 1

ERSI SCREAMER

MARCH 2024

This Issue:

The Engineered Residual Stress Implementation (ERSI) Screamer is a recurring newsletter to help facilitate communication to all stakeholders in the aerospace community that have an interest in the implementation of residual stresses.

Purpose of ERSI

1) Develop a roadmap for the implementation of engineered residual stress (ERS) for calculation of initial and recurring inspection intervals for fatigue and fracture critical aerospace components.
2) Identify and address gaps in state-of-the-art.
3) Define the most effective way to document requirements and guidelines for fleet-wide implementation.

Organization

The ERSI working group is broken up into 3 major committees with a chair for each, as shown below.

COMMITTEE NAME	CHAIR(S)
EXECUTIVE COMMITEE Dr. Dallen Andrew (Hill Engineering)	
ANALYSIS & TEST	Robert Pilarczyk (Hill Engineering) Dr. Kevin Walker (QinetiQ)
RESIDUAL STRESS CHARACTERIZATION	Dr. Eric Burba (USAF AFRL) Dr. Adrian DeWald (Hill Engineering)
NDI, NDE, DATA MANAGEMENT, & QUALITY ASSURANCE	Dr. Eric Lindgren (USAF AFRL)

Screamer Editor:

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7th Annual ERSI Workshop

ERSI as of December 2023

Countries Involved: **5**
US Govt Organizations: **4**
USAF ASIP Managers: **10**
National Laboratory: **2**
Universities: **6**
OEMs: **3**
Industry Partners: **34**
ERSI Participants Total: 152

The 2023 ERSI Workshop was held on 19-20 April 2023 at the United States Air Force Academy. Attendees included representatives of all three major airframe OEMs, both the USAF and USN, ASIP engineers from A-10, B-1, B-52, C-5, F-15, F-16, F-22, F-35, KC-135, and T-38, with much representation from industry partners and academia.

This issue of the ERSI Screamer provides an overview of the 2023 ERSI workshop, which was held 19-20 April 2023 at the United States Air Force Academy (USAFA) and included participants across the spectrum of ERSI members. The first day included an early morning meeting for the committee leads to have a focused discussion of ERSI objectives. This was followed by the formal beginning of the workshop, with opening remarks and a welcome to the USAFA given by Col. Cooper. A tour of the lab facilities was then provided, with participants being bused around to different areas of the USAFA. After lunch, the first session of the workshop began, with committee updates being provided by the Analysis & Test committee. The second and final day included summaries from the other committee leads and an open town hall discussion for the entire working group.

The different sessions provided a well-rounded summary of ERSI related activities and highlighted the accomplishments over the past year, which included recent publications resulting from ERSI collaborations and round robin activities. A high level summary of the open discussions from the workshop is also included.

We welcome further expertise, participation, and input to the ERSI Working Group. Any individuals or entities interested in participating in ERSI please contact:
Dr. Dallen Andrew at dlandrew@hill-engineering.com

Analysis & Test

Key Objectives

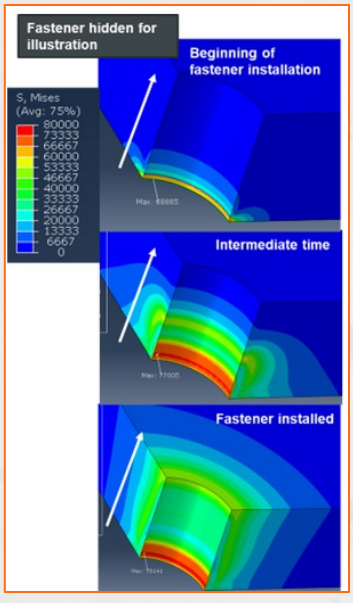
- Develop & document best practices for integration of ERS in crack growth prediction methodologies
- Establish testing requirements considering the impacts of residual stress on fatigue crack growth
- Develop datasets and case studies to support analysis methods validation
- Identify, define, and enable the resolution of gaps in the analytical methods state-of-the-art
- Support the development of an implementation roadmap

Focus areas;

- **Spectrum loading and retardation**
  - Active working group, ~10 members
  - Collaborate to understand load interaction effects on crack growth using simple spectrum loading (spike overload) and spectrum loading
  - Validate and understand limitations of proposed modeling for plastic tip constrain loss

- **Interference fit fasteners (IFF) and residual stress (active)**
  - Active working group, 13 members
  - Collaborate to establish validated analytical methods for Interference Fit Fasteners (IFF)

- **Durability testing and fatigue life benefits (not active)**

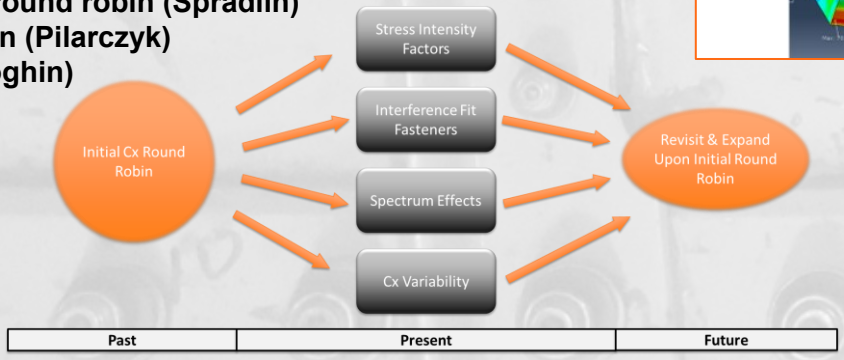


Key focus areas for 2023-2024

- Re-visit initial ERSI Cx round robin
- Continuation of IFF work
- Extend spectrum effects work into cases with Cx and IFF

Presentations from ERSI Workshop 2023

- **Spectrum loading / Spike overload (Ocasio-Latorre)**
- **Cx variability round robin (Spradlin)**
- **IFF round robin (Pilarczyk)**
- **IFF update (Loghin)**



These presentations can be found on the ERSI website at:
https://residualstress.org/images/7/7c/2023_ERSI_Workshop_-_Analysis_%26_Test.pdf

Committee POCs:
Robert Pilarczyk (Hill Engineering), rtpilarczyk@hill-engineering.com
Dr. Kevin Walker (QinetiQ), kfwalker@qinetiq.com.au

Residual Stress Characterization

Key Objectives

- The Residual Stress Characterization Committee is dedicated to empowering the pursuit of fit-to-purpose residual stress implementation efforts while maintaining the highest standards of quality, precision, and statistical integrity with a dynamic assembly of experts proficient in an extensive array of residual stress measurement and process modeling techniques
- Provide unwavering support to ERSI stakeholders, encompassing end users and aircraft programs, as they navigate the intricate landscape of designing and executing tailored residual stress implementation initiatives.
- Recently re-organized to include the previous focus areas of Residua Stress Process Simulation, Residual Stress Measurement, and Uncertainty Quantification

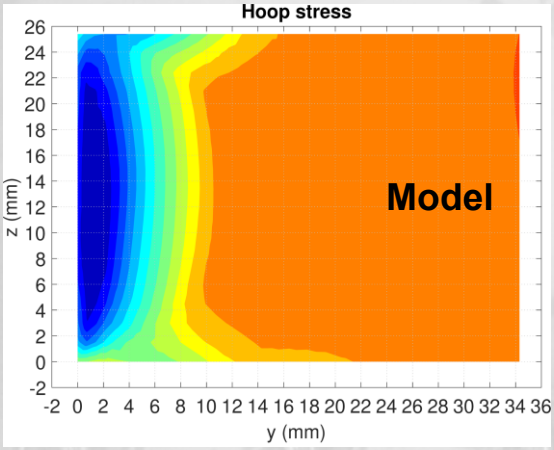
Support for the ERSI Community

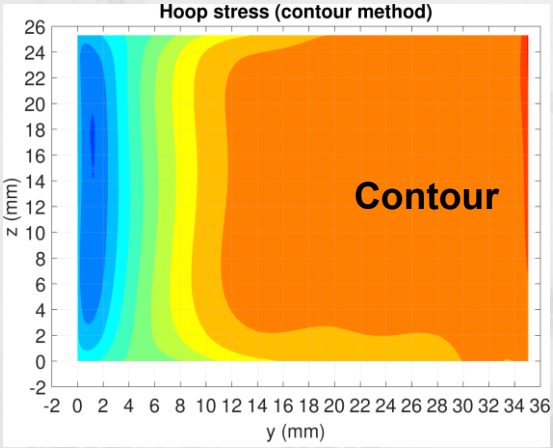
As a well-established group of professionals specializing in residual stress measurement and process modeling, we offer a comprehensive suite of services that includes:

- Repeatability of Residual Stress Measurement Data (In-lab Variability)
- Reproducibility of Residual Stress Measurement Data (Lab-to-lab Variability)
- Inter-Method Residual Stress Comparisons (e.g., ND to X-ray to Contour)
- Measurement Model Comparisons (e.g., for CX Holes)
- Uncertainty Quantification (UQ) and Statistical Methods Relative to Residual Stress Data

Presentations from ERSI Workshop 2023

- **2 inch Cx Residual Stress Determination for Process Simulation Validation (Carlson)**
- **Bulk RS Measurements in Cx Geometrically Large Holes (Hill)**
- **Texture and Anisotropy Sub Team (Ward)**





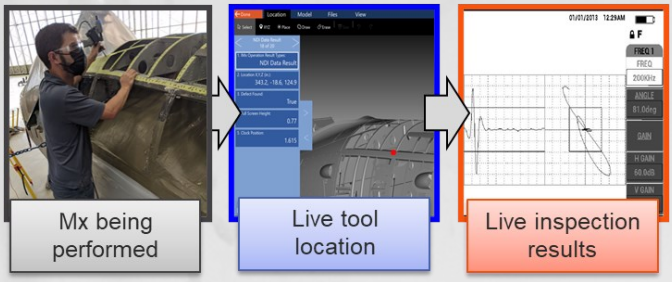
These presentations can be found on the ERSI website at:
https://residualstress.org/images/0/02/2023_ERSI_Workshop_-_Residual_Stress_Characterization.pdf

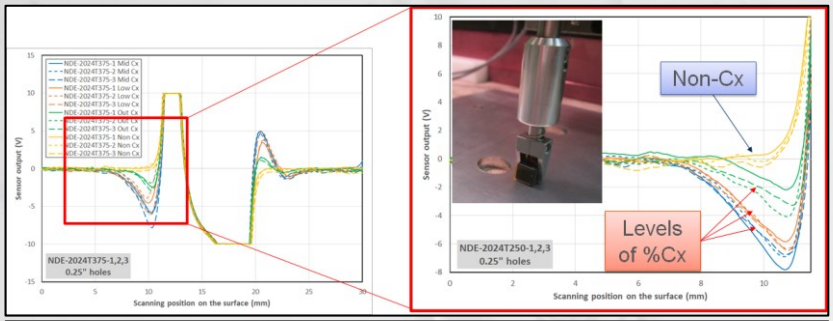
Committee POCs:
Dr. Eric Burba (USAF AFRL), micheal.burba.1@us.af.mil
Dr. Adrian DeWald (Hill Engineering), atdewald@hill-engineering.com

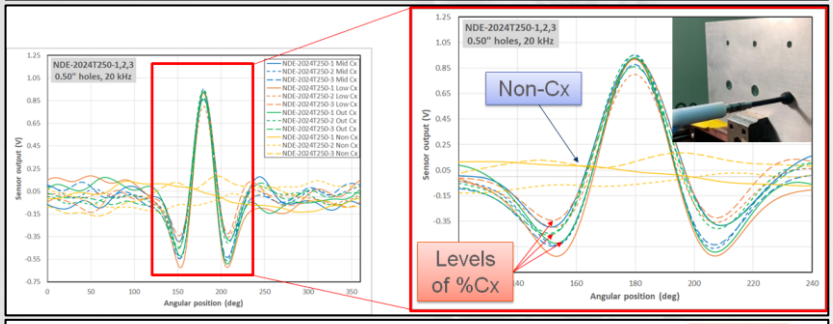
NDI, NDE, Data Management, and Quality Assurance

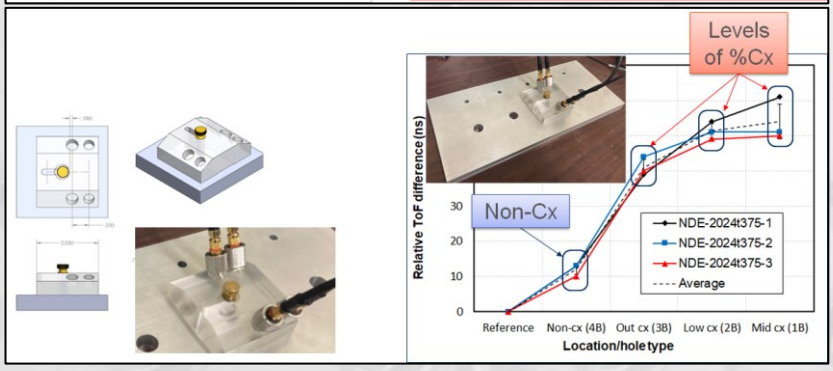
Presentations from ERSI Workshop 2023

- **NDE for Quality Assurance and Surveillance of Cx Fastener Holes (Lindgren)**
- **The IMx+: A Digital Thread Tool to Enable Effective ASIP (Andrew)**







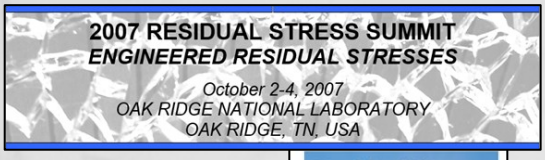


These presentations can be found on the ERSI website at:
https://residualstress.org/images/d/d7/2023_ERSI_Workshop_-_NDI%2CNDE%2CQA%2CDataMan.pdf

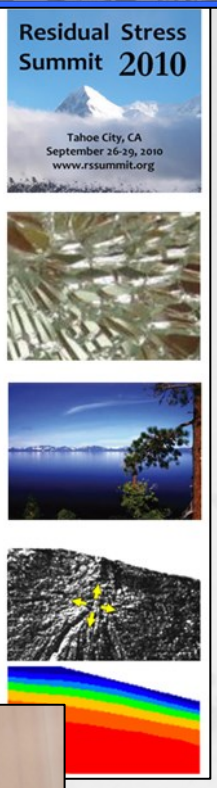
Committee POC:
Dr. Eric Lindgren (USAF AFRL), eric.lindgren@us.af.mil

Bonus: Residual Stress Summit

Residual Stress Summit History



- Originally conceived as a North American conference on Residual Stress
- Six total Summits have been held
  - Los Alamos, NM 2003 (Hytec Inc)
  - Vancouver, BC 2005 (University of British Columbia)
  - Oak Ridge, TN 2007 (ORNL facilities)
  - Lake Tahoe, CA 2010 (conference center)
  - Idaho Falls, ID 2013 (at a hotel)
  - Dayton, OH 2017 (University of Dayton Research Institute)
- Attendance has been 40-80 people



Non-traditional Conference Ideas

- **Objective is to bring together residual stress users (who have "problems" and are in search of "solutions") and developers (who have "solutions" and are in search of "problems").**
- Single track, with all participants attending each talk
- Facilitate discussion amongst participants
- Themed topics where possible (multiple speakers on one topic)
- All speakers are invited to maintain specific focus points
- Typically longer talks than standard conference (30 minutes)
- If an industrial facility, involve local technical support for topic and tours

RS Summit 20XX

- Location
  - An industrial site with tours and RS work ongoing
  - Support for organizing the venue AND the technical content
- Volunteers/organizers for this and future Summits
  - Current organizers have tentatively agreed to do 1 more
- Sessions
  - Revisit past sessions (measurement techniques)
  - Other industrial problems (casting RS, airplane industry)

Presentation from ERSI Workshop 2023

- **Residual Stress Summit (Steinzig)**

This presentation can be found on the ERSI website at:
https://residualstress.org/images/0/0f/2023_ERSI_Workshop_-_Residual_Stress_Summit.pdf

Residual Stress Summit POC:
Mike Steinzig (Los Alamos National Lab), steinzig@lanl.gov

Announcements

Upcoming ERSI related events:

- ERSI Workshop, April 2 – 3, 2024, San Antonio, TX
- ASTM E08 Committee Week, May 6 – 9, 2024, Philadelphia, PA
- AA&S Conference, Aug. 19 – 22, 2024, San Antonio, TX
- ASTM E08 Committee Week, Nov. 11 – 15, 2024, Orlando, FL
- ASIP Conference, Dec. 2 – 5, 2024, Austin, TX

ERSI committee participation

- We encourage you to continue to discuss ERSI-related topics with colleagues, at conferences, and in other technical interchanges. If you find there are others who would like to participate, please refer them to the applicable committee chair(s).

ERSI website

- All ERSI Screamers, workshop slides, and committee information is now located on the ERSI website, www.residualstress.org. Go check it out!