The logo for the Joint Advanced Materials and Structures Center of Excellence (JAMS) is displayed in a stylized, blue, textured font. It is positioned above a large, curved graphic consisting of a yellow upper band and a dark blue lower band, which resembles a wing or a structural element.

JAMS

Development of Reliability-Based Damage Tolerant Structural Design Methodology

Kuen Y. Lin, Chi Ho Cheung, and Phillip Gray
Department of Aeronautics and Astronautics
University of Washington

March 16, 2010



The Joint Advanced Materials and Structures Center of Excellence

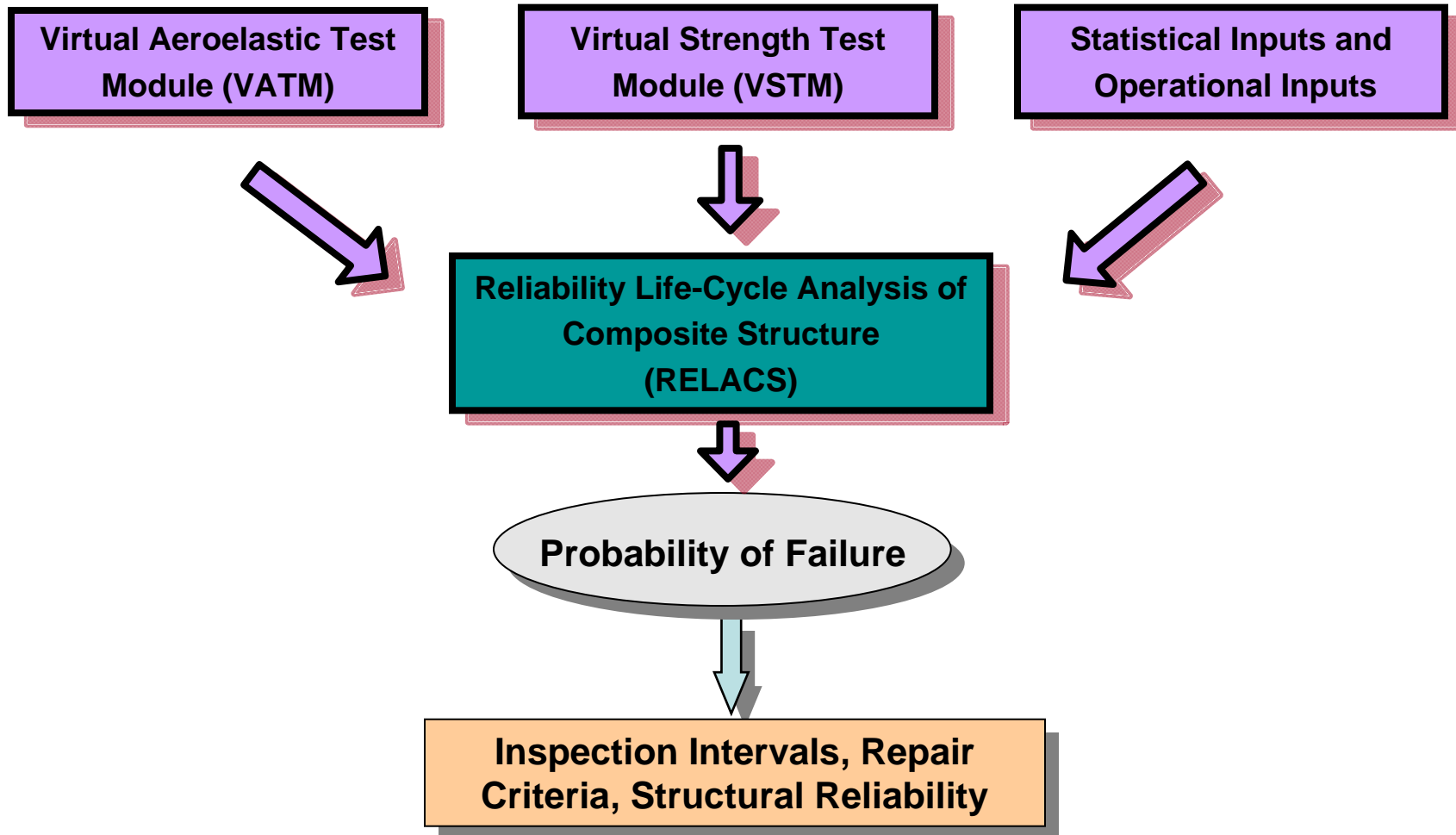


FAA Sponsored Project Information

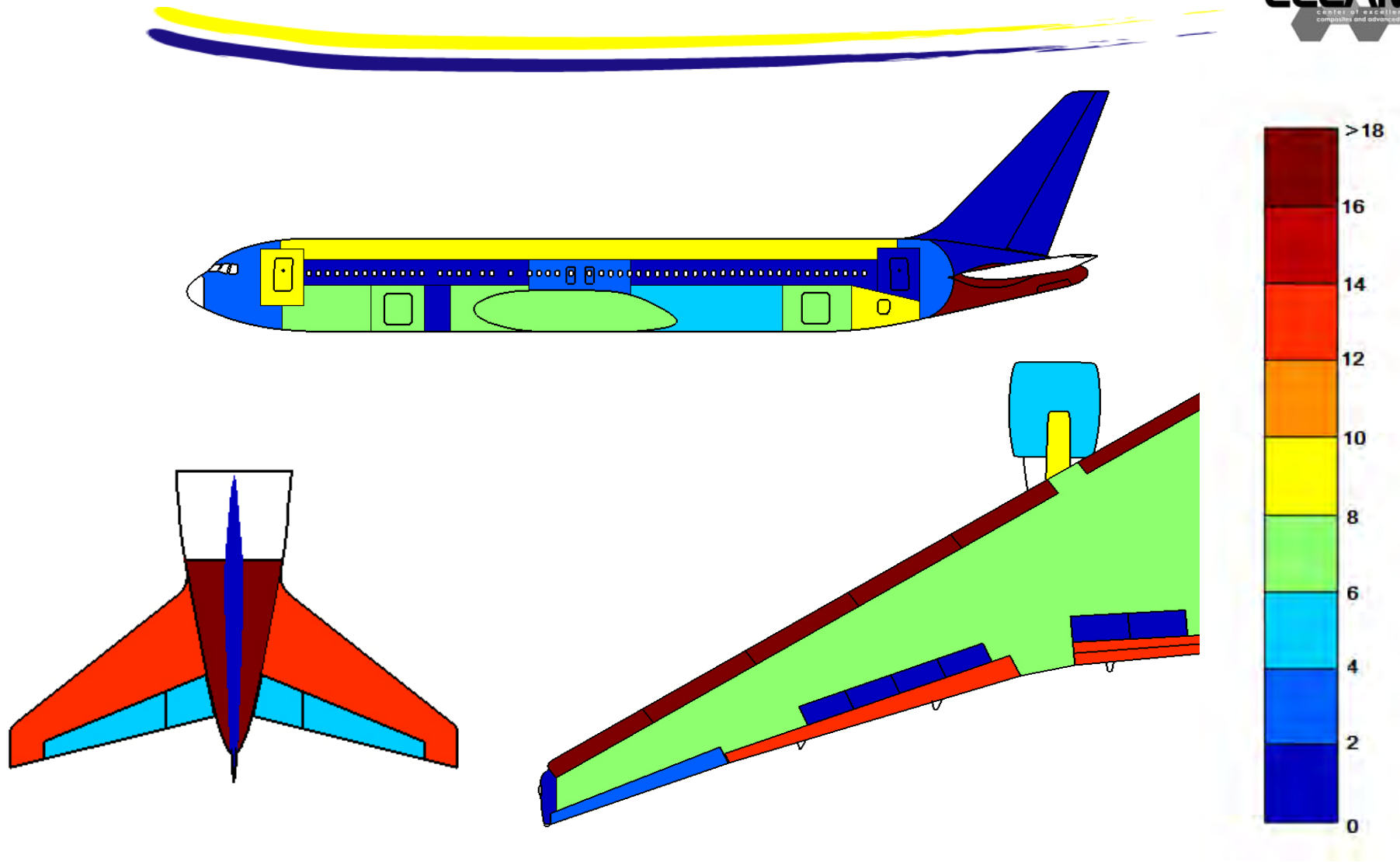


- **Principal Investigator:**
 - Dr. Kuen Y. Lin, Aeronautics and Astronautics, UW
- **Research Scientist:** Dr. Andrey Styuart, UW
- **Pre-Doctoral Research Assistant:** Chi Ho “Eric” Cheung, UW
- **Undergraduate Research Assistant:** Phillip Gray, UW
- **FAA Technical Monitor:** Curtis Davies
- **Other FAA Personnel:** Larry Ilcewicz
- **Industry Participants:** Gerald Mabson, Eric Cregger, Marc Piehl, Lyle Deobald, Gerardo Pena, Alan Miller (All from Boeing)
- **Industry Sponsors:** Boeing

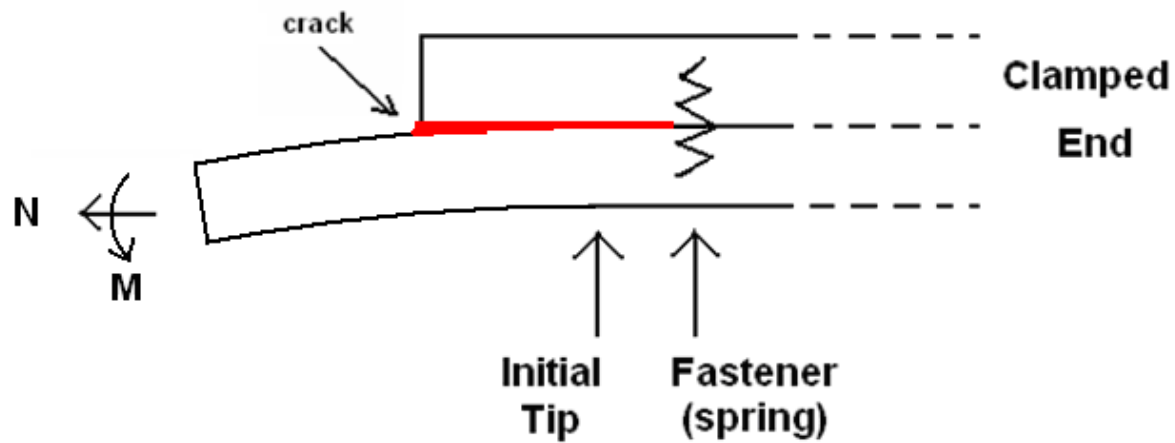
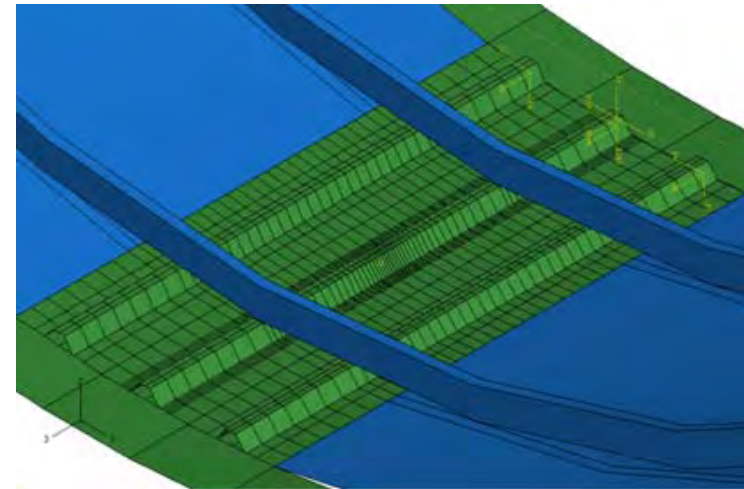
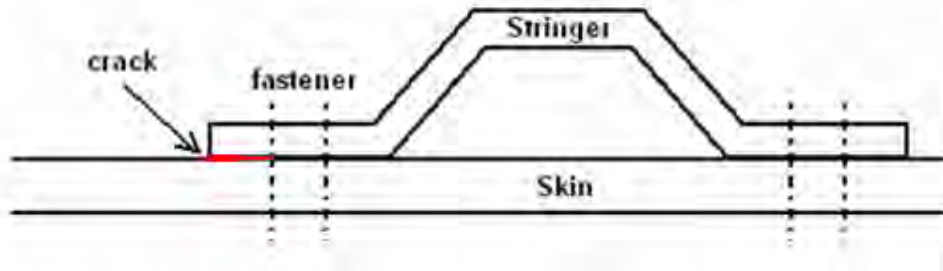
UW Virtual Test Lab (VTL)



SDR: External Damage Map

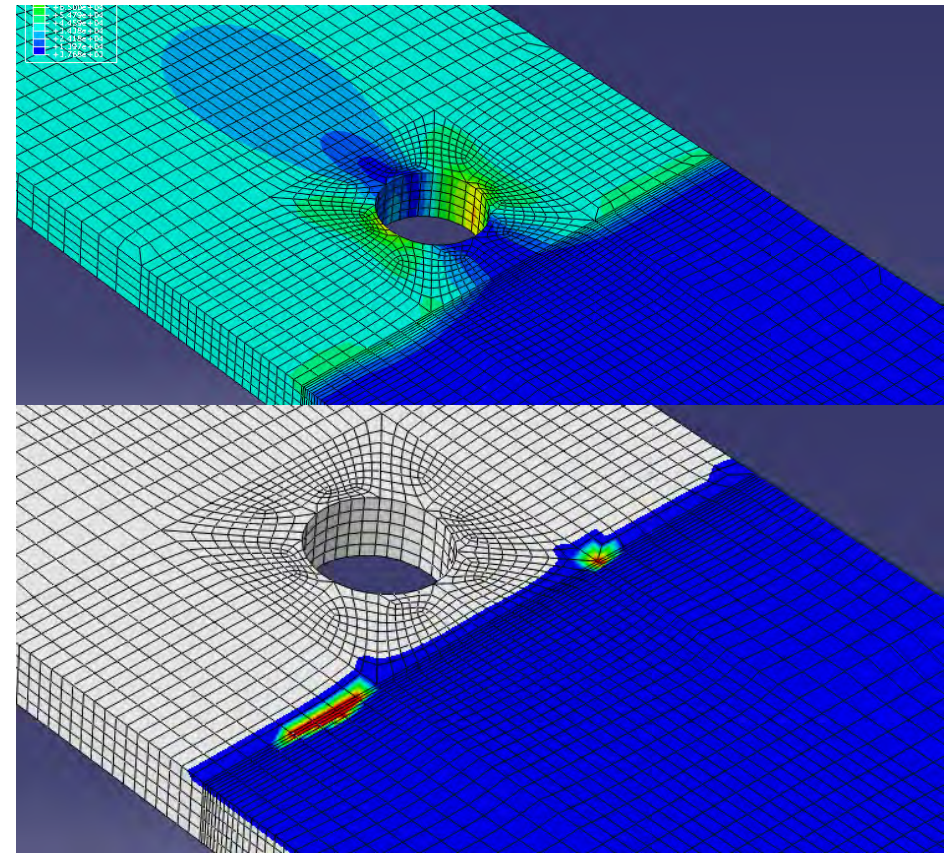
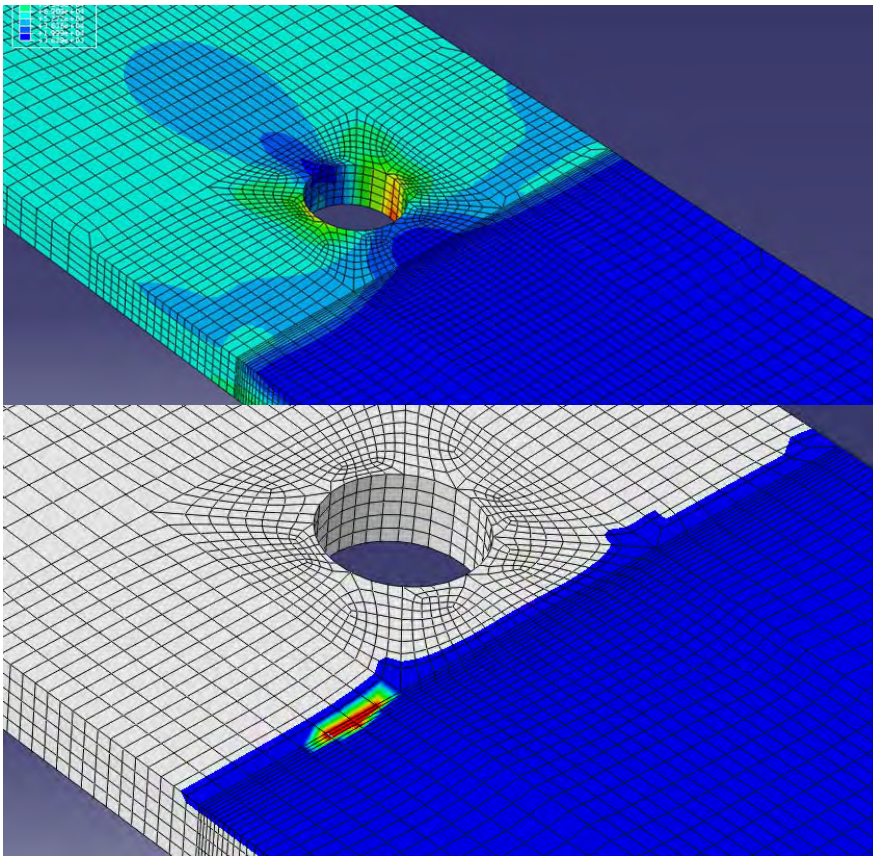


JAMS Bonded Skin/Stiffener with Fasteners



Fastener (not shown)

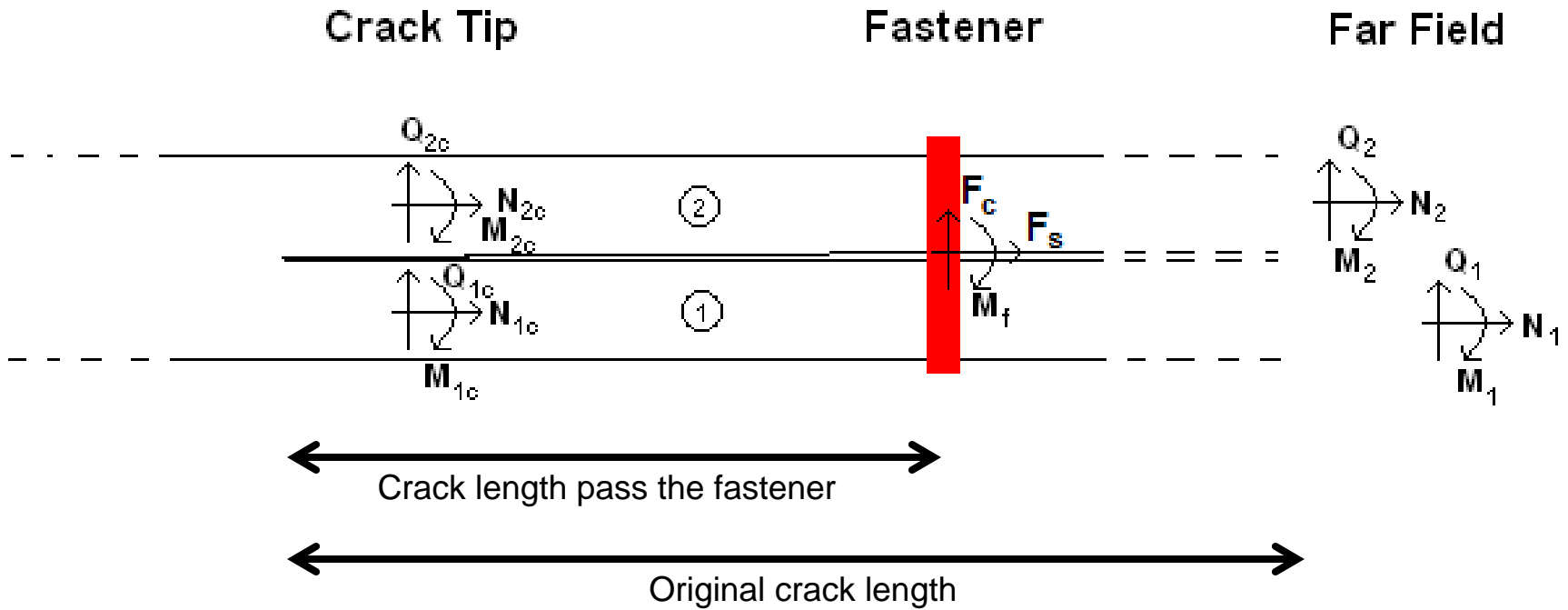
Fastener (not shown)



$N = 8421 \text{ lb}$ (8829 lb w/ 0.25 friction)

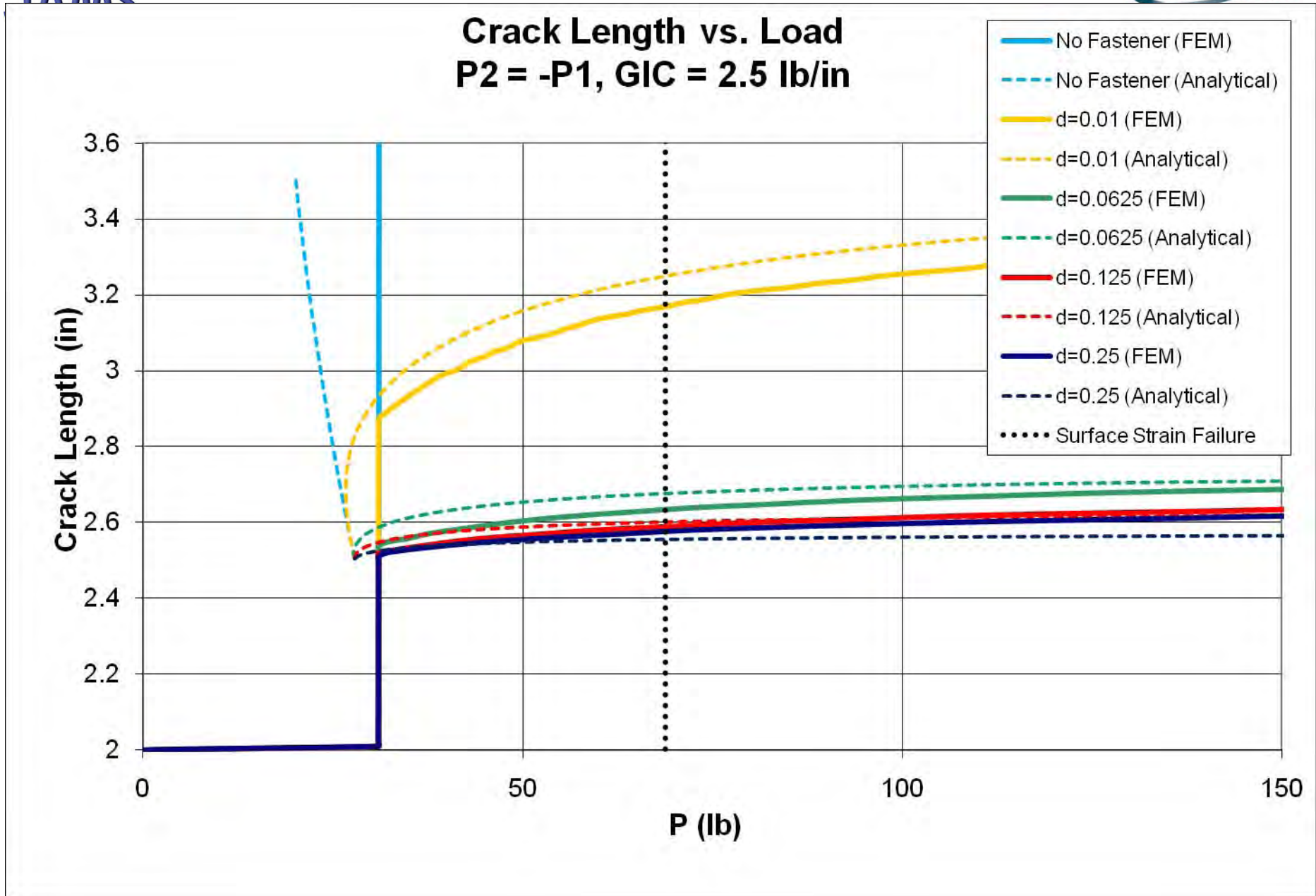
$N = 5477 \text{ lb}$

Analytical Model



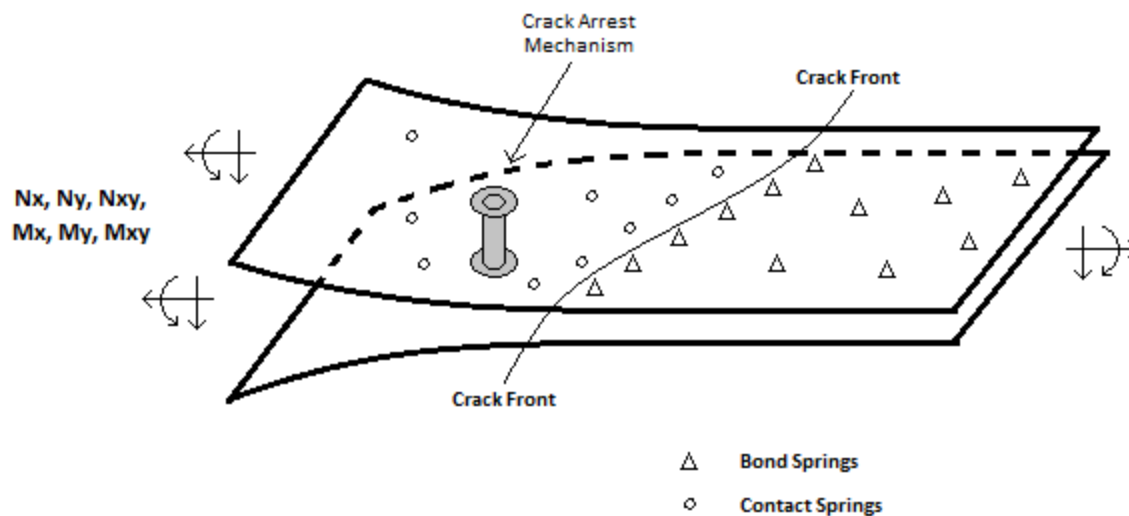
Mode I: FEM vs. Analytical Fracture Analysis A Center of Excellence **AMTAS**

LAAS



Work in Progress / Future Work

- Continual development of 1-D analytical method
 - Coupling of displacements and forces
- Develop 2-D plate-based analytical method
 - Varying crack front
 - Include Mode III and more general loadings



Student Perspectives AMTAS Experience

- **Training in conducting independent technical research**
 - Real-life problem → Goal
 - Develop original solution
 - Critical thinking skills
- **Opportunity to interact with**
 - Industry experts
 - Regulatory officials
 - Fellow researchers/ professors
 - Different perspectives for the same problem
- **Funding**
 - Multi-year project → stability
 - Opportunity to focus on research
 - Significant contribution to the field

Student Perspectives AMTAS Experience

- **Conclusion**
 - Great education experience
 - Exposure to real-life engineering beyond the academics
 - Opportunity to make significant contributions to modern engineering

