

Operators Perspectives of Composite Repair Systems for Energy Pipelines

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Outline

- What Operators look for in composite repair systems
- What is the vision for repairing energy pipelines with composite sleeves, for the next 5-10 years?
- Perspectives for future developments and applications of composite repairs



What Operators Look for in a Composite Repair System

- Easy Installation & Durability Continue to be Top Priorities
 - Tightening of sleeves, banding and cure time
 - Stability of hardenable filler and its load transfer ability
- Some Concerns
 - Long term reliability of composites
 - Training and certification of installers...why the need for training the trainer?
 - Limitations of composite sleeves for repairing defects... promote products within their proven and intended design purpose



What is your vision and direction for composite sleeves?

- What do you see happening in the next 5-10 years to composite repairs for the energy pipeline market?
- What are the challenges and opportunities for composite repair sleeves in this industry?
- What can we start doing now to develop repair systems applicable to more severe and complex damage on pipelines rather than installing metal sleeves or performing cut outs?
- What can this group do?



Perspectives for Future Applications of Composite Repairs

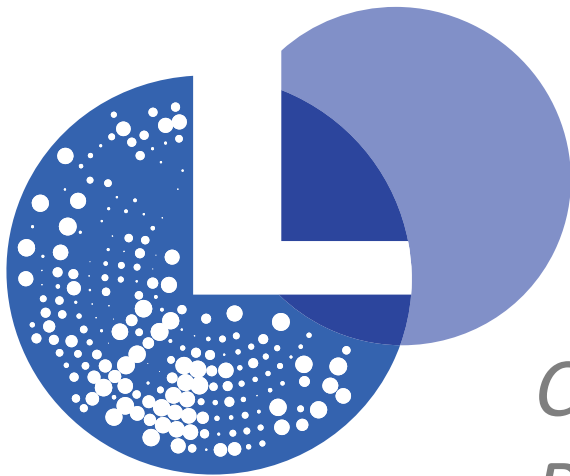
- Demonstrate the ability to repair crack-like indications and seam weld anomalies with composite sleeves
 - Type B sleeves: generally regarded as the standard
 - If the use of composite repairs for aircrafts have been proven and certified, why not proving and certifying composite systems for repairing cracks on energy pipelines?
 - What is it going to take to do this?
 - Where do we start?



Considerations When Developing Composite Repairs for Cracks

- Understand the physical behavior of cracks and seam weld anomalies on pipelines
 - Know the physics, science and engineering principles that describe and govern crack formation and growth in pipelines
- Demonstrate that the stiffness of composite sleeves will not allow operational cyclic or sustained stresses/strains to drive crack grow
- Know the principles that govern structural reinforcement of sleeve repairs on cracks on pipelines
 - With sleeve repairs, generally we are after restraining bulging at defect
- Demonstrate stability and durability of composite repairs under pipeline operational conditions
 - Approx 25 years since we started installing composite sleeves, what have we learned?
- Validate engineering analysis and meet expectations or applicable certification requirements through full scale testing program





*Committed to Enhancing
Pipeline Integrity*