Non-Destructive Evaluation of Composite Materials

Team 20 Project Technical Presentation to the 2018 IREC

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What is Non-Destructive Evaluation

- Critical role in assuring structural components and systems are reliable.
- Characterize material conditions & flaws
- Non-invasive testing
- Provides quality control cost effectively
- NDT methods
  - Visual
  - Ultrasonics testing
  - Thermography
  - Magnetic Particle Testing
  - Electromagnetic Testing
  - Radiography

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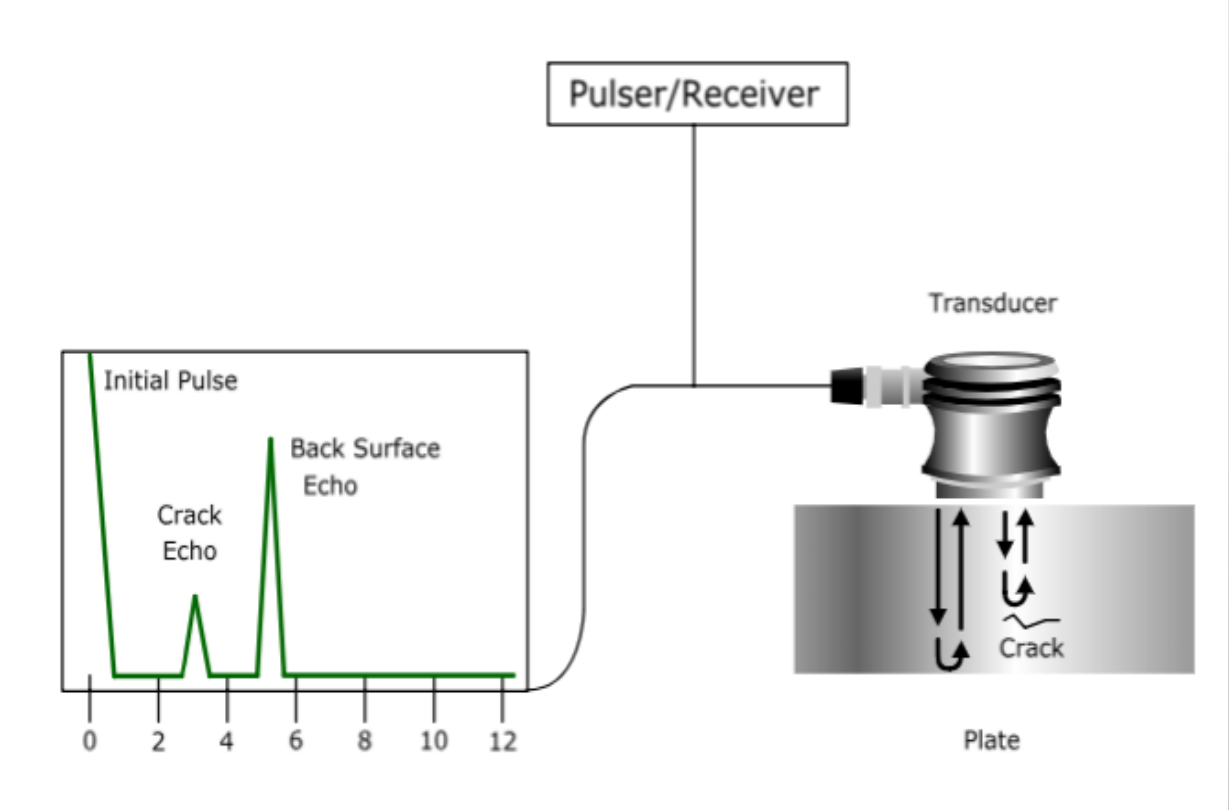
Ultrasonics

- Uses high frequency sound energy to conduct examinations and make measurements. (NDT Resource Center)
- Evaluate/detect flaws
- dimensional measurements
- material characterization
- Surface and subsurface defects
- Delaminations
- Techniques used
  - Phased array
  - Air coupled
  - Immersion



https://www.nde-ed.org/EducationResources/CommunityCollege/Ultrasonics/Introduction/description.htm

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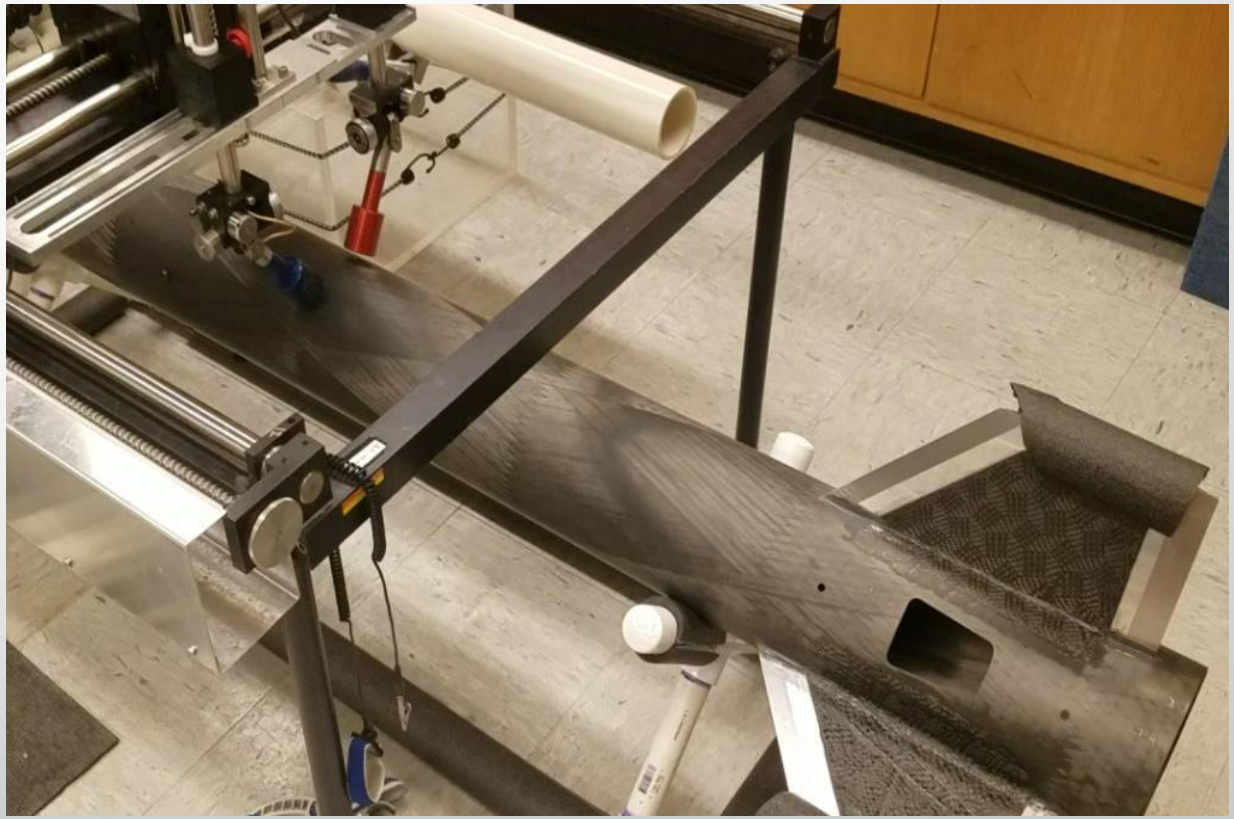
Air coupled Ultrasonics

- Experimental lamb-wave
- Very low acoustic impedance (1%)
- No Couplant needed
- Transducer and receiver
- 3D Robotic manipulator
- Detect delaminations in the carbon fiber structure



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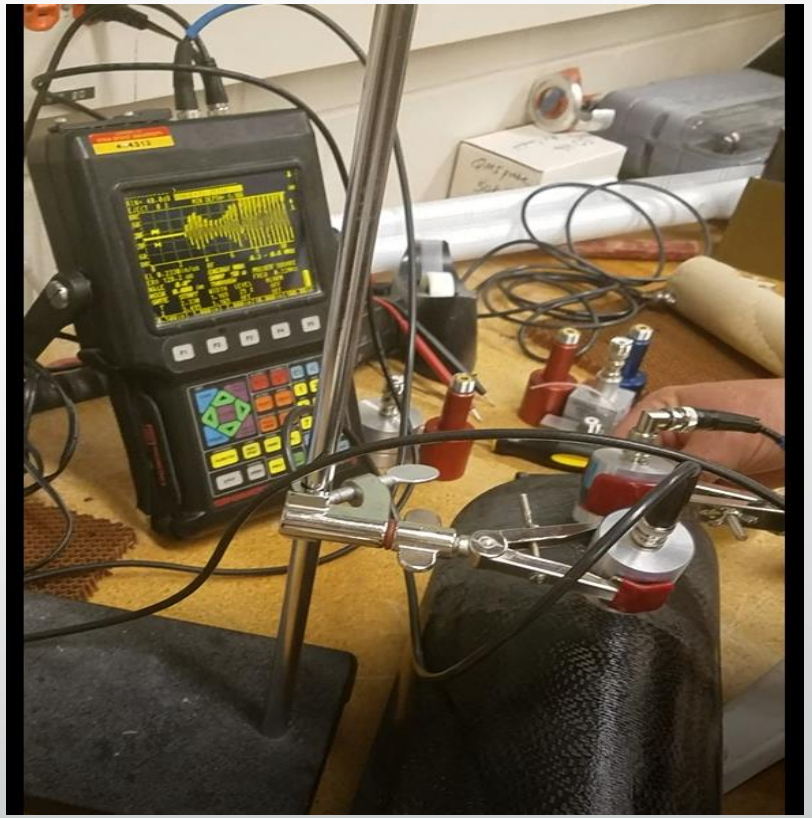
Air coupled Ultrasonics

- Experimental lamb-wave
  - Tensile, compression, and shear
- Engineered defects comparison
- Very low acoustic impedance (1%)
- No Couplant needed
- Measure amplitude differential
  - Dry fibers
  - Change of fiber density



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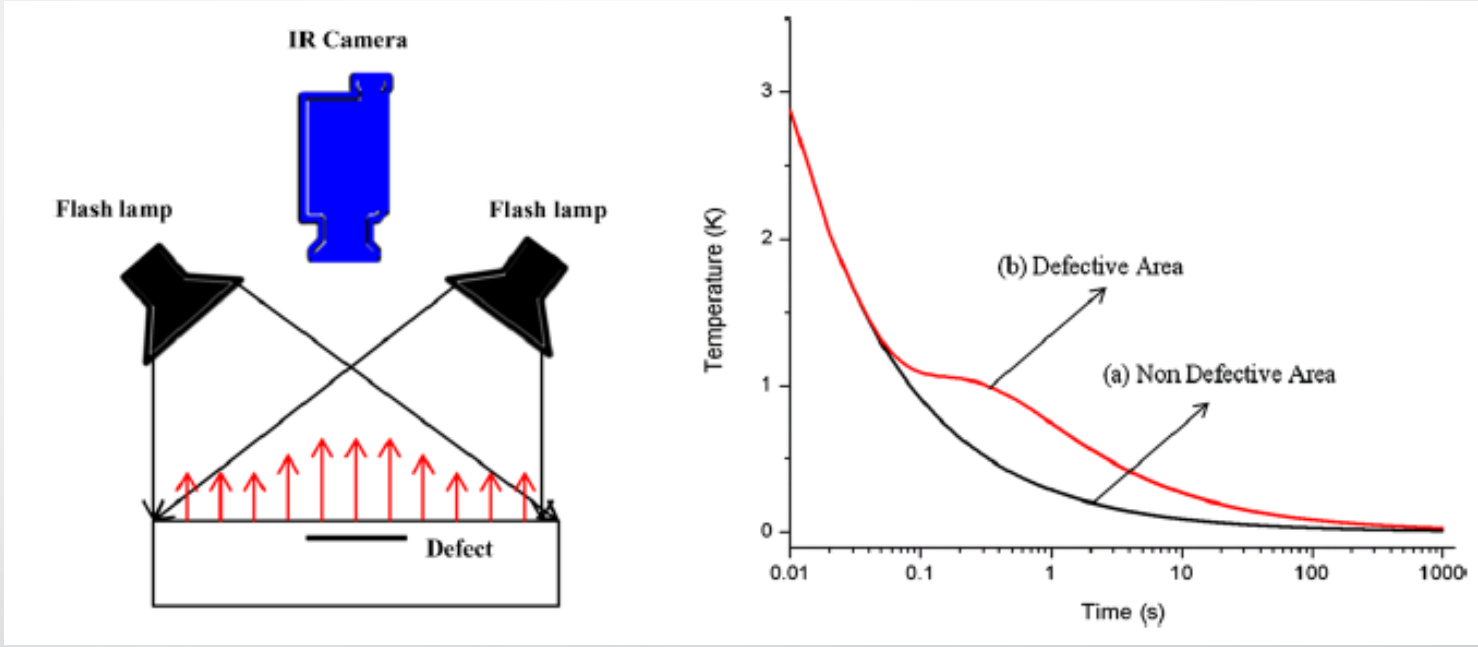
Pulse Thermography

- Time response of heat
- Carbon fiber pattern
- Delamination identification



D Sharath. Defect Characterization Using Pulsed Thermography

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Pulse Thermography Setup

- Sanding to reduce material emissivity
- Flash lamps, object, and thermal camera
- Isolate specimen from other heat sources
- Dataguzzler and Datacollect2 is used for post processing

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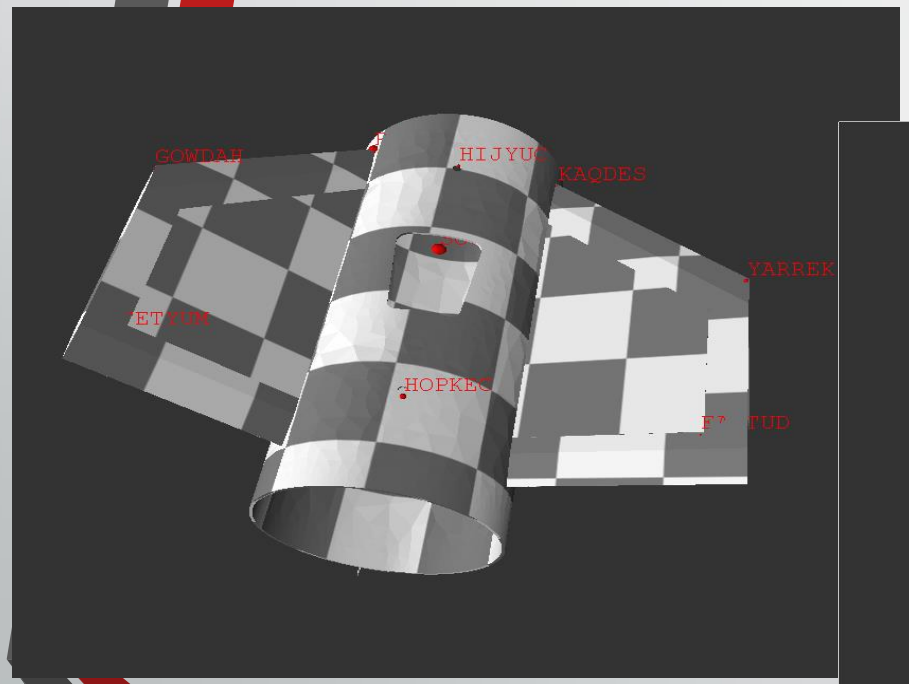
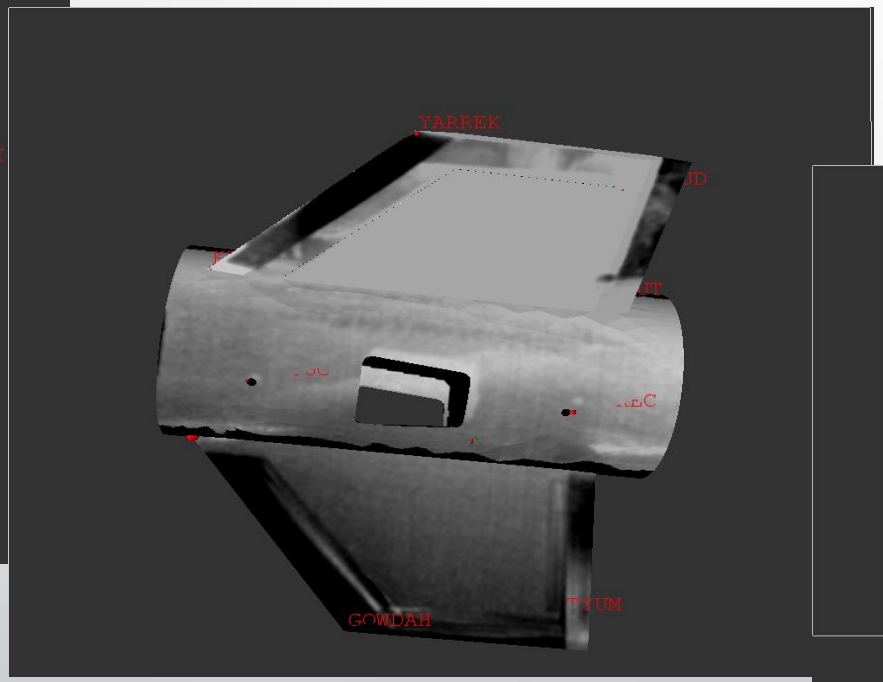
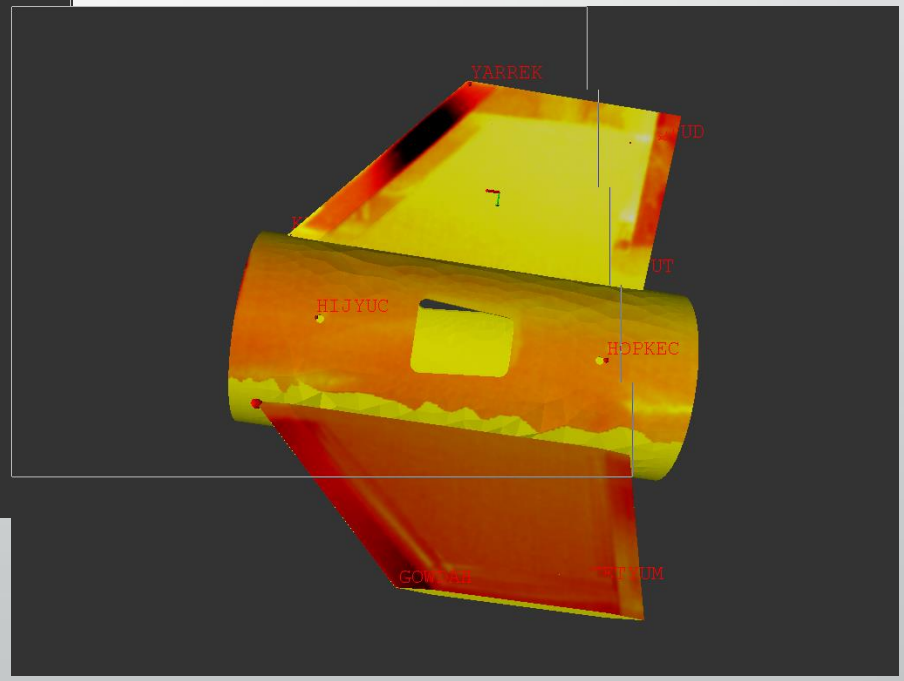
Pulse Thermography 3D CAD overlaid







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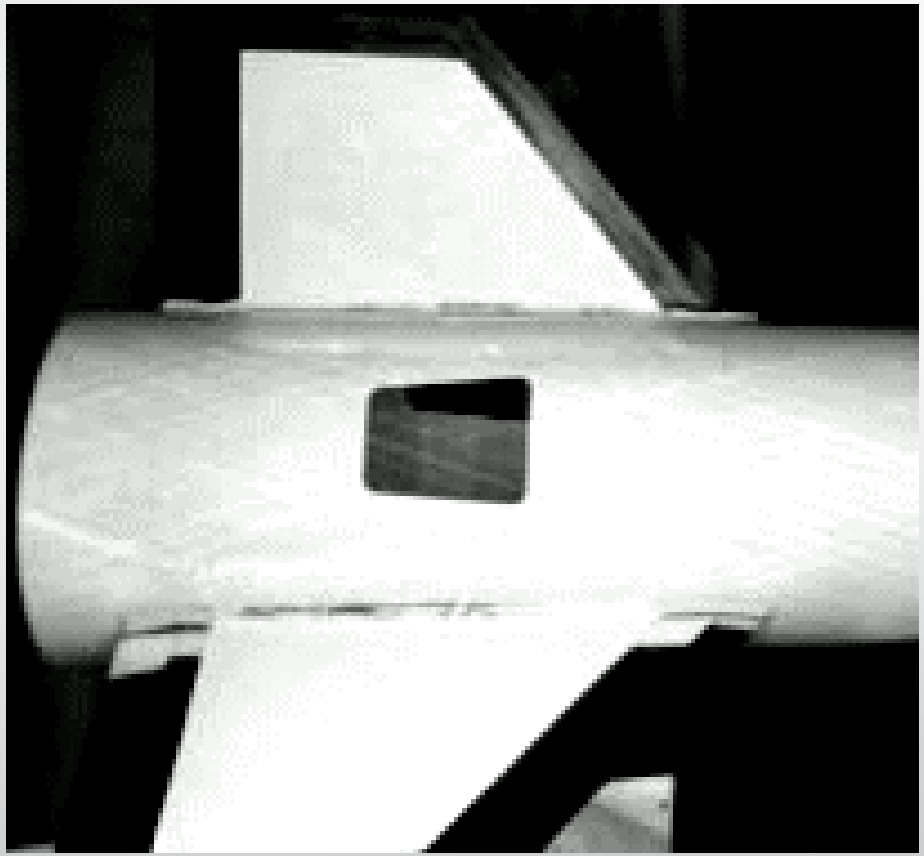
2D faces of the Rocket



Questions