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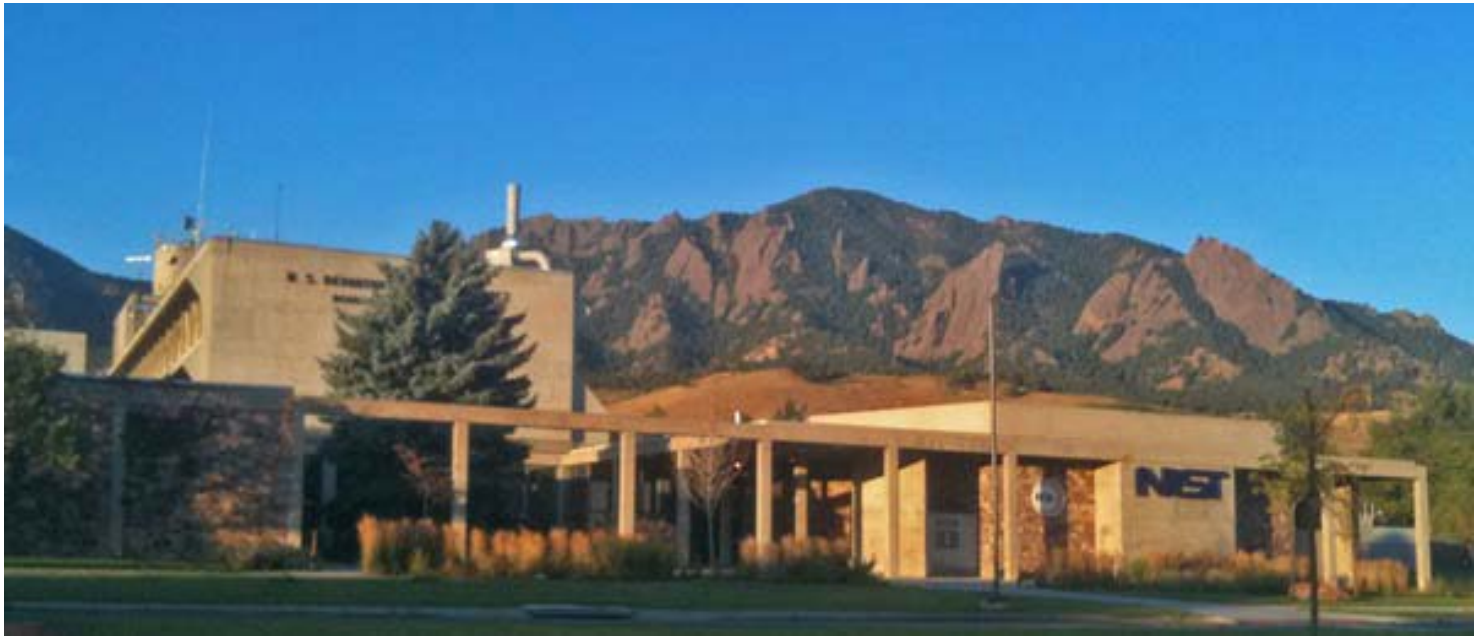

Welcome to Virtual Boulder, CO!

Characterization of Modern High Toughness Steels for Fracture Propagation and Arrest Assessment

Steering Committee – Project Road Mapping Meeting – March 25, 2014

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AGENDA

1.	**9:50 AM**	**Connect to WebEx and Dial-in**
2.	10:00 AM	Attendee Introduction
3.	10:05 AM	PHMSA's Perspective
4.	10:15 AM	Project Administration
5.	10:20 AM	Project Overview
6.	10:55 AM	Break
7.	11:00 AM	Medium-Scale Test Development
8.	11:40 AM	Modelling of Medium-Scale Test
9.	12:20 PM	Possible Future Work – Next Steps
10.	12:30 PM	Adjourn

NIST Research Team
Structural Materials Group

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- Jim Fekete – Group Leader
- Dash Weeks – Pipeline Safety Project Leader
- Chris McCowan – Charpy Project Leader
- Dave McColskey – Research Scientist
- Robert Amaro – Research Scientist
- ?? – Post-Doc Position Open
- Ross Rentz – Engineering Technician
- Ken Talley – Engineering Technician

Steering Committee

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Name	Organization
David Johnson	Paragon Industries / AIST
Matt Merwin	US Steel
Su Xu	CanmetMATERIALS
Brian Leis	BN Leis Consultant
Kip Findley	Colorado School of Mines
David Horsley	Horsley Consulting
David Taylor	Technical Consultant toTransCanada

Project Sponsor

- Jim Merritt
  - DOT/PHMSA R&D Manager
  - james.merritt@dot.gov
  - (303) 638-4758

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PHMSA's Perspective

- Jim Merritt

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Project Administration

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- 3 Year Project
- $300k
- Official Start Date: 7/15/13
- DOT/PHMSA Project Number: 489
- Contract Number: DTPH56-13-X-000013

- Work to Date: Getting up to speed
  - Review of past and current testing
  - Review of past and current modeling

Project Overview

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- Development of high-strength high-toughness linepipe materials is reducing the relevance of current material test methods, modeling efforts and their application to design and lifetime assessments.
- Current fracture mechanics models and test methods are inadequate to determine the crack arrest capacity.

Project Overview

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- What does success look like?
  - Material Property (ranking)
  - Design Specification
- What is the impact?
  - Legacy Pipe
    - Remaining life
    - Retro-fit/Replace
  - New pipeline designs

- What's been tried but deserves more attention?
- What's your "Star Trek" vision?

Project Overview

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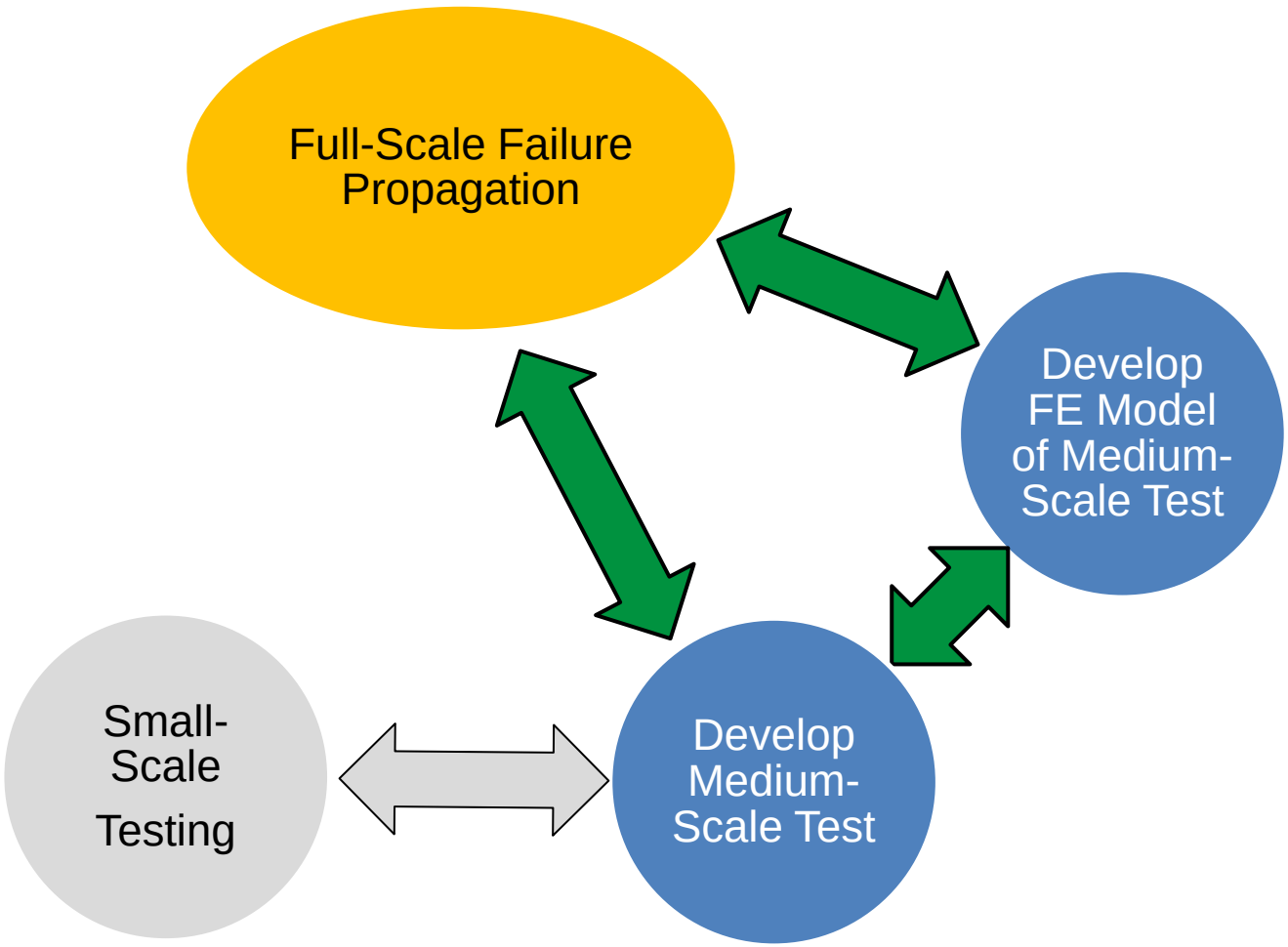

Project Overview - Testing

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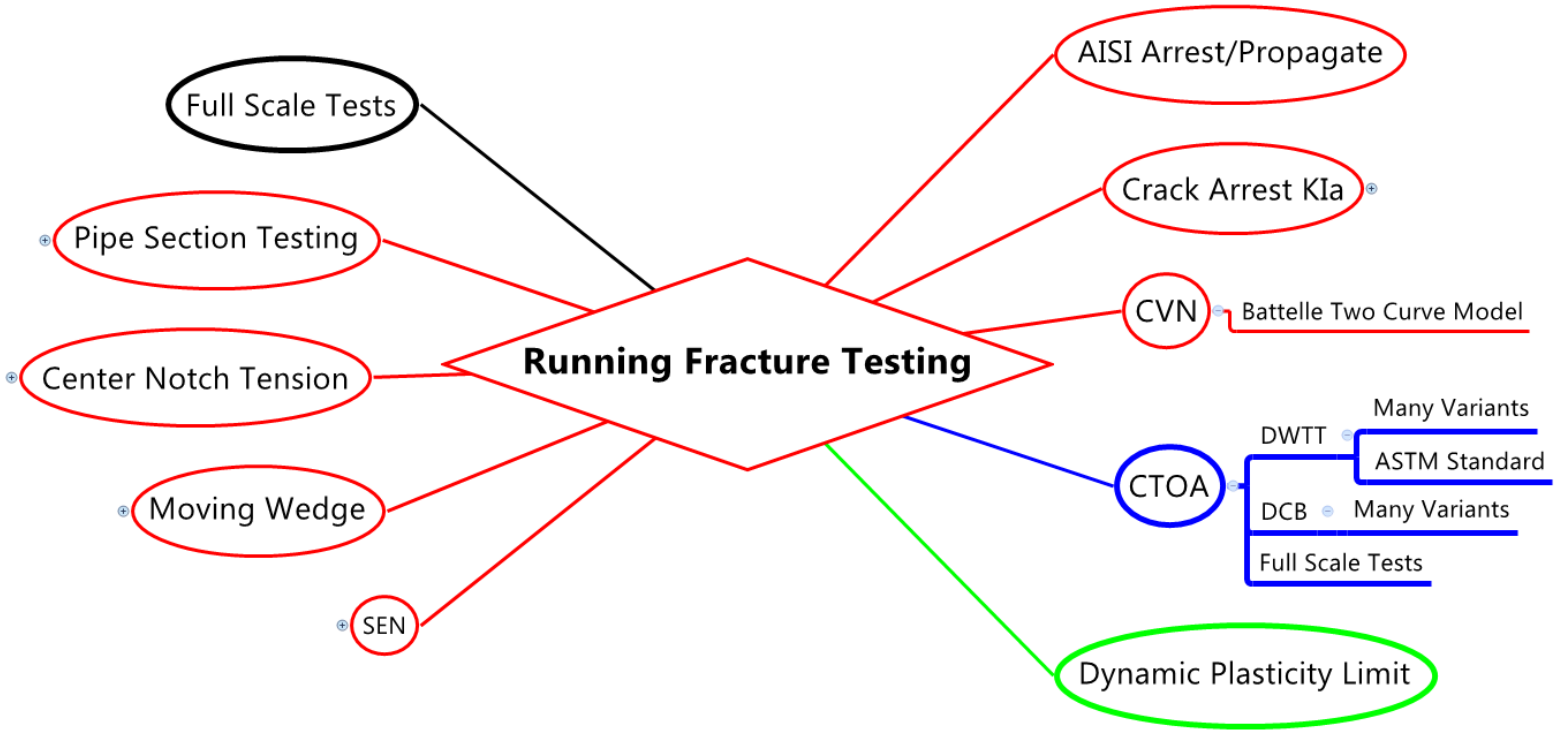

Project Overview - Modeling

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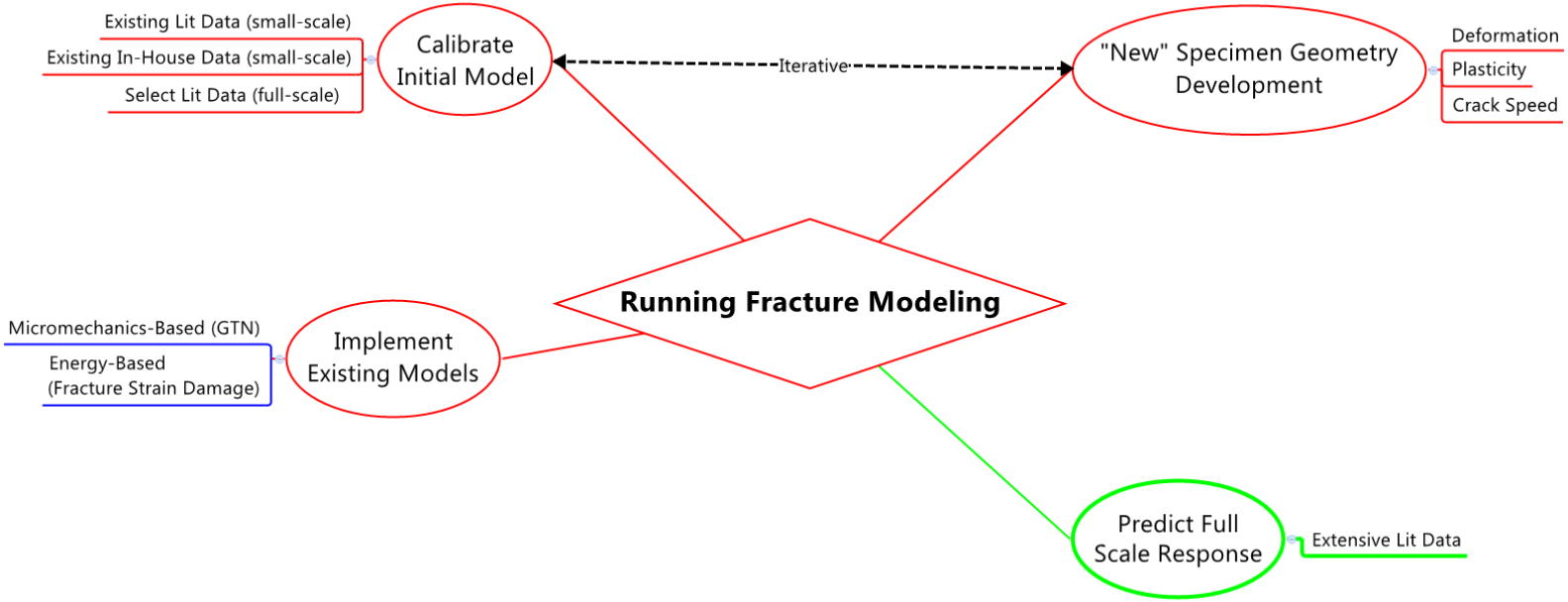

Medium-Scale Test Development

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- Specimen reflects reality
  - Pipe or Plate section
  - Wall thickness
- Mechanics reflect reality
  - Opening Modes
  - Driving Force
  - Stress/Strain distribution
  - Failure Velocity
- Measurements
  - Possible physics/mechanics measurements
  - Boundary condition validation

Medium-Scale Test Development

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- Environmental conditions
  - Temperature
- Boundary conditions
  - Clear enough that modelling is possible
  - Validated for use in models
- Iteration with modelling
  - Parametric significance
  - Measurement data requirements

Medium-Scale Test Development

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- Shortcomings of current test methods
  - Driving Force
  - Opening Mode
  - Morphology
  - Relevance or Conservatism
  - Transferability with scale

- End Game
  - Repeatable/Reproducible
  - Test Method Draft

Medium-Scale Model Development

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- Currently implementing micromechanics-based (GTN) model
  - Has shown promise in literature
  - Relatively simple to calibrate
  - Energy-based damage model to be implemented if necessary
- Model to be used for medium-scale specimen development
  - Deformation mode, plasticity, and crack velocity to ensure appropriate conditions

Medium-Scale Model Development

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- Ongoing work to focus on smaller length scales
  - Effects of near-field vs. far-field plasticity
  - Opening modes (tensile, shear, and combination of the two)
  - Iterative test specimen design based upon the above
- Final product to be valid for both medium scale tests and full scale results

Possible Future Work

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- Full Scale Tests
  - Measurement enhancements
  - Model validation
  - Scale transferability of test results
- Full Scale Test Modelling
  - Model the Full Scale Test
  - Package the model parameters for design

Next Steps

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- Iterate with Steering Committee
  - Email Correspondence
  - Next meeting (~ 2 weeks)

- Continue Lit Reviews
- From Steering Committee

- Work through the full scale mechanics and determine a way to scale them down.

Adjourn

- Thank You for your time!
- Propose next meeting
  - April 11th 10:00 – 11:30 AM MDT

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