



the Energy to Lead

Enhancing Data-Driven, Risk-Based Decisions for Our Infrastructure

Eddie Johnston
Managing Director, Delivery Sector

MARC Annual Meeting
June 6th, 2011

GTI at a Glance...

- > Not-for-profit research, with 70 year history
- > Facilities
 - 18 acre campus near Chicago
 - 200,000 ft², 28 specialized labs
- > \$70 million in revenue
- > Staff of 250
- > A growing business
- > Commercial partners take our technologies to market



Offices
& Labs



Flex-Fuel
Test
Facility



Energy & Environmental Technology Center



Addressing Key Energy Industry Issues Across the Value Chain



Supply

Expanding the supply of affordable energy



Delivery

Ensuring a safe and reliable energy delivery infrastructure



End Use

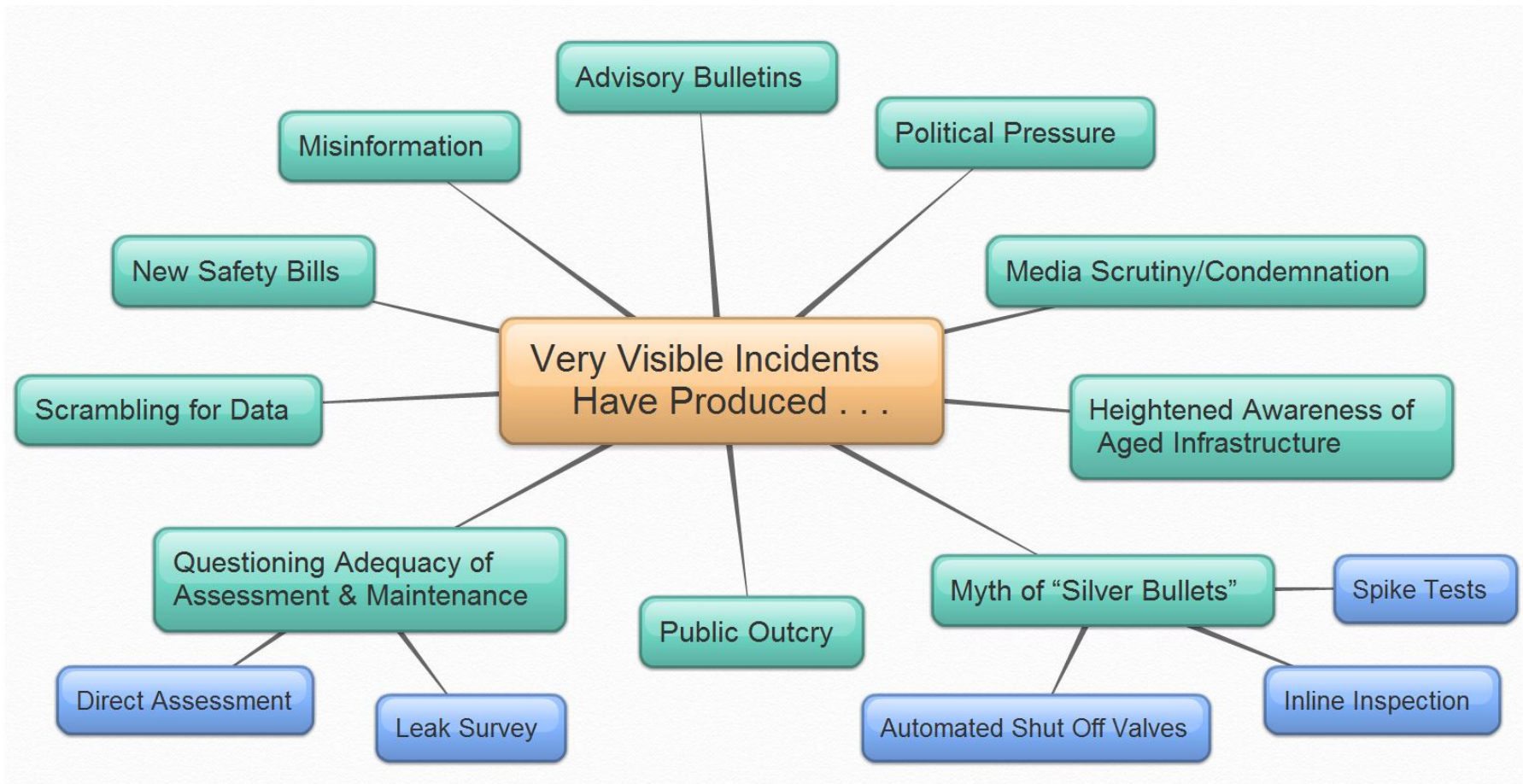
Promoting the efficient use of energy resources

Reducing carbon emissions to the environment

ONGOING BODY OF GTI PIPELINE INTEGRITY PROJECTS

Technology	Data
<ul style="list-style-type: none"> > Metallic Joint Locator (MJL) Development > BEM Technology - Sensor to Measure Wall Thickness and Cracks without Removing Coatings > Yield Strength Determination Without Line Shutdown > In-Field Corrosion Rate Measurement/Determination for Integrity Reassessment Intervals and Risk Prioritization 	<ul style="list-style-type: none"> > Leak-Rupture Boundary Determination > Flaw Acceptance of Mech. Damage-Low Stress Pipelines > Guided Wave Validation as Hydro Equivalent > North American Casing Program > Repair Techniques for Damaged Low Stress Nat. Gas Pipelines
<ul style="list-style-type: none"> > Mitigating Electrical Interferences on Cathodic Protection > Testing and Design of Casing End Seals > Cathodic Protection Monitoring Technology Deployment > MFL Inspection System for “Live” Steel Gas Lines – Coiled Tubing Platform 	<ul style="list-style-type: none"> > Major Corrosive Components in Biomethane: Affects on Internal Corrosion of Steel Piping > Composite Pipeline Repair Systems Analysis of Permanence of Repair
<ul style="list-style-type: none"> > Radiography by Selective Detection (RSD) > Right-of-Way Encroachment Detector > Metal Pipe Wall Loss Assessment from Aboveground 	<div style="background-color: #003366; color: white; text-align: center; padding: 5px;">Services</div> <ul style="list-style-type: none"> > Genetic (qPCR) Based Microbial Corrosion Testing > Root Cause Failure Analysis > Fitness-For-Service Assessments > Protective Coatings Testing and Evaluation > Pipeline Integrity Records Evaluation > Complete A2LA/ISO 17025 Lab Services

Current Landscape



GTI's Call to Action

- > Immediately following recent integrity incidents, GTI's services have been in high demand and sought by:
 - NTSB
 - Gas utilities and pipeline operators
 - State agencies and utility commissions
 - Excess line insurance companies
 - Multiple media organizations
 - Advocacy groups

Moving forward - what research and services are necessary to fill critical gaps?

New GTI Initiatives are Underway

> Immediate

- Pipeline integrity records evaluation
- Understanding threat interactions*
- Internal inspection optimization – Phase I: Current state and gap analysis*

> Midterm

- Internal inspection optimization – Phase II: Technology development*
- System modeling for rupture response – systematically evaluate the benefit of valve modifications and/or additions
- Historic pipe property validation – dynamic sampling and causal analysis

> Strategic

- Pipeline assessment technology study and pilot implementation
- Composite Pipe – develop an integrated approach to balance cost and risk benefits associated with introducing composite piping system

* *Descriptions included*

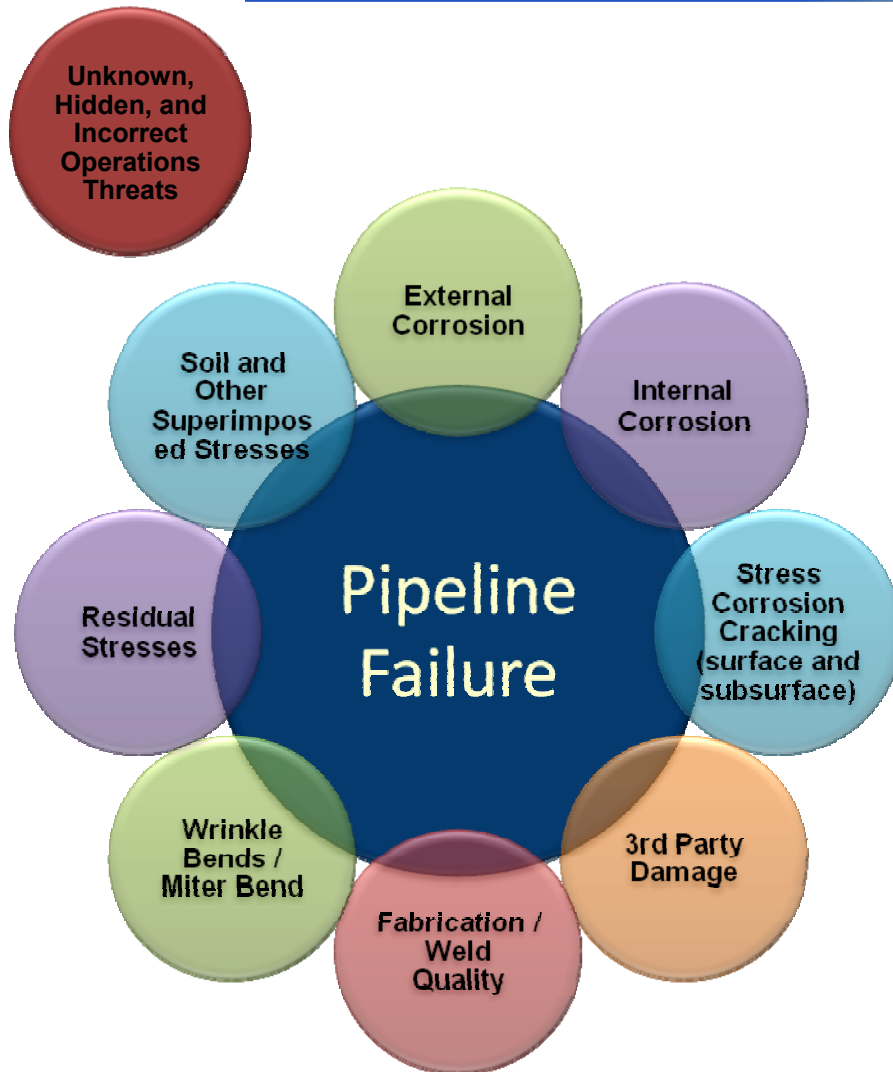
Program: Internal Inspection Optimization

Threats	Parameters of Interest	Sensor Technology	Platforms	Overarching Influencers / Other Considerations
<ul style="list-style-type: none"> External Corrosion Internal Corrosion Stress Corrosion Cracking (surface and subsurface) 3rd Party Damage Fabrication / Weld Quality Wrinkle Bends / Miter Bend Residual Stresses Soil and Other Superimposed Stresses 	<ul style="list-style-type: none"> Wall Thickness and Loss Cracking Residual Stress Levels Hardness and Ultimate Strength Yield Strength Toughness Physical Dimensions (ID) Internal Defects (Porosity, Laminations, etc.) Physical Contact to Other Structures 	<ul style="list-style-type: none"> Ultrasonic/microwave Eddy Current/RFEC Guided Wave UT X-Rays Magnetic Flux Leakage Magnetic Field Strength Electromagnetic Optical/IR/UV Video/Stills Caliper Hardness Modulus Stress-Strain Probe 	<ul style="list-style-type: none"> Tethered (e.g., mechanical cable or coiled tube pulled) Push Rod (e.g., coiled tube pushed) Robotic Tethered (e.g., self-driven brush drive but with trailing power cord) Robotic Autonomous (no tether for power, etc.) Flowable Sensors (e.g., Fluidized Sensors, Smart Balls, etc.) 	<ul style="list-style-type: none"> Existing and Impending Regulations (i.e., Post San Bruno) Market Size (diameters, distances, obstructions) Cost (development and per inspection unit) Time to market Sponsors Repeatability of Inspections Commercializers

FACETS OF THE PROGRAM

- PHASE - 1 {
1. **Perform overlap analysis** of sensors and platform capabilities.
 2. **Determine current state** of sensor and platform development.
 3. **Perform gap analysis:** Threats and Parameters of Interest ↔ Sensor and Platforms in existence.
- PHASE - 2 {
4. **Identify off-the-shelf manufacturers and commercializers** (short and long-term view).
 5. **Fund technical development** in critical gap areas.
 6. **Work with regulators and SDOs** on acceptable internal inspection technologies.

Project: Understanding Threat Interactions



> Background

- Many pipeline incidents are the result of multiple, interacting causes, not a single threat.
- Individual threats can each be at “acceptable” levels but when overlaid may result in a more significant threat to the pipeline.

> Approach

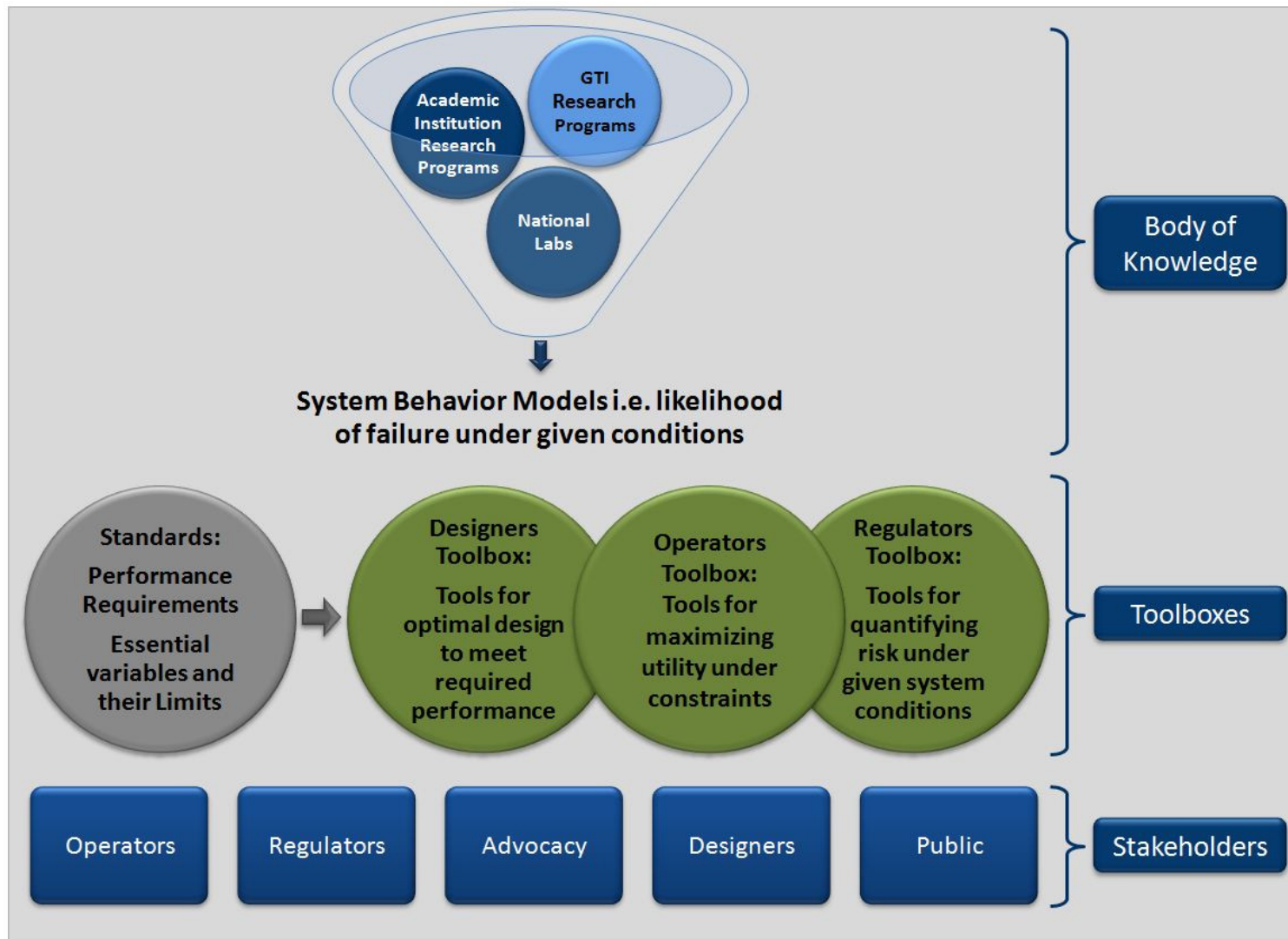
- Identify threat combinations to address and control,
- Develop a method to calculate threat interaction levels and severity, and
- Provide a method to continuously monitor threat interactions and flag concerns at trigger points.

> Benefits

- Operators will be able to adequately identify combinations of threats and their associated risk.
- Reduction of an operator’s risk and enhancement of compliance with regulations.

What We're After...

Sound Science → Applied Models → Good Decisions



What Will It Take?

- > Research results **targeted** to industry needs
- > **Dedicated team** to build, organize, and provide a suite of solutions
- > **Alignment** with stakeholders to ensure **critical** needs are met
- > **Funding** and **in-kind** support

