Development of a Remote External Repair Tool for Damaged or Defective PE Pipe

National Energy Technology Laboratory
U. S. Department of Energy
Project Kickoff Presentation
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Timberline Tool

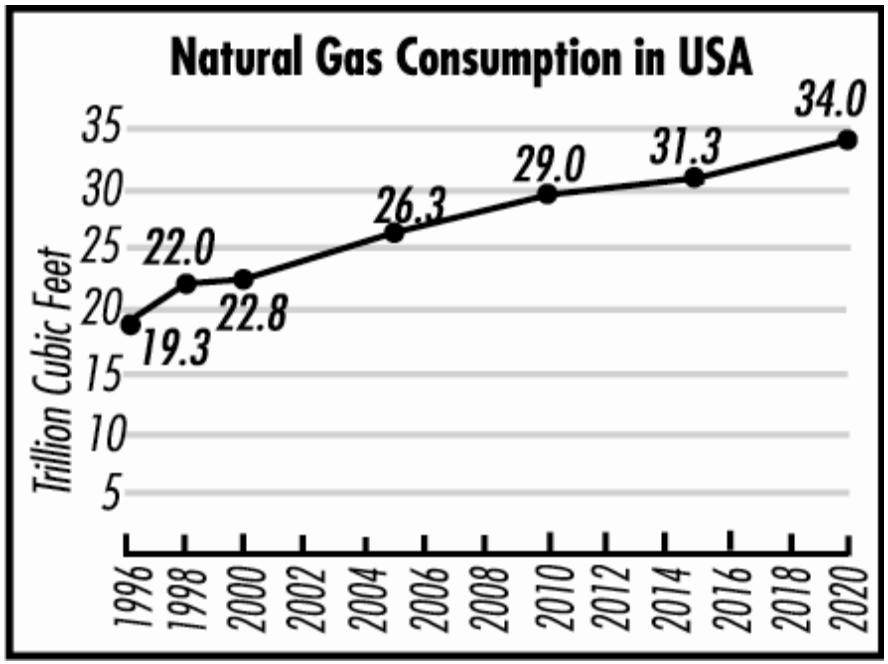
Executive Summary

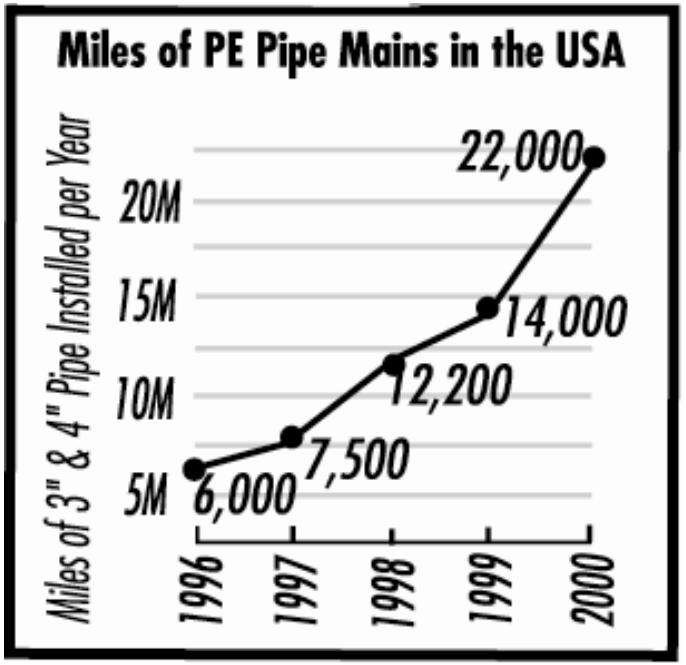
Remote External Repair Tool for PE Gas Pipe

- Project Objectives
  - Develop remote external repair tool for damaged or defective PE gas pipe (i.e. rupture, puncture, gouge)
  - Demonstrate functionality & test performance of engineered prototype
- Project Participants
  - DOE NETL
  - Timberline Tool
    - Oregon State University
    - KeySpan Energy
- Project Schedule
  - Phase 1: 18 months
  - Phase 2: 12 months

Background

Forecast





50% Increase in Demand = Increase in Miles of Pipe

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Background

Maintaining a Growing & Aging Infrastructure

- Increased demand for natural gas places increased demand on the existing pipeline system
- Need for improved tools for construction, maintenance and repair of damaged or defective plastic pipes
- Preference for cost effective and efficient tools to facilitate repair through “keyhole” excavation access

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Where Solutions Are Heading

Access and repair with minimal intrusion

“Keyhole” Access

Benefits:

1. Minimal excavation & surface disruptions
2. Less disruption to traffic & commerce.
3. Increased safety
4. Environmental savings

Remote External Repair Method

Operation of Remote Repair Tool

1. Use keyhole technology to excavate the damaged area
2. Encapsulate damaged pipe using remote repair tool
3. Apply chemical repair patch

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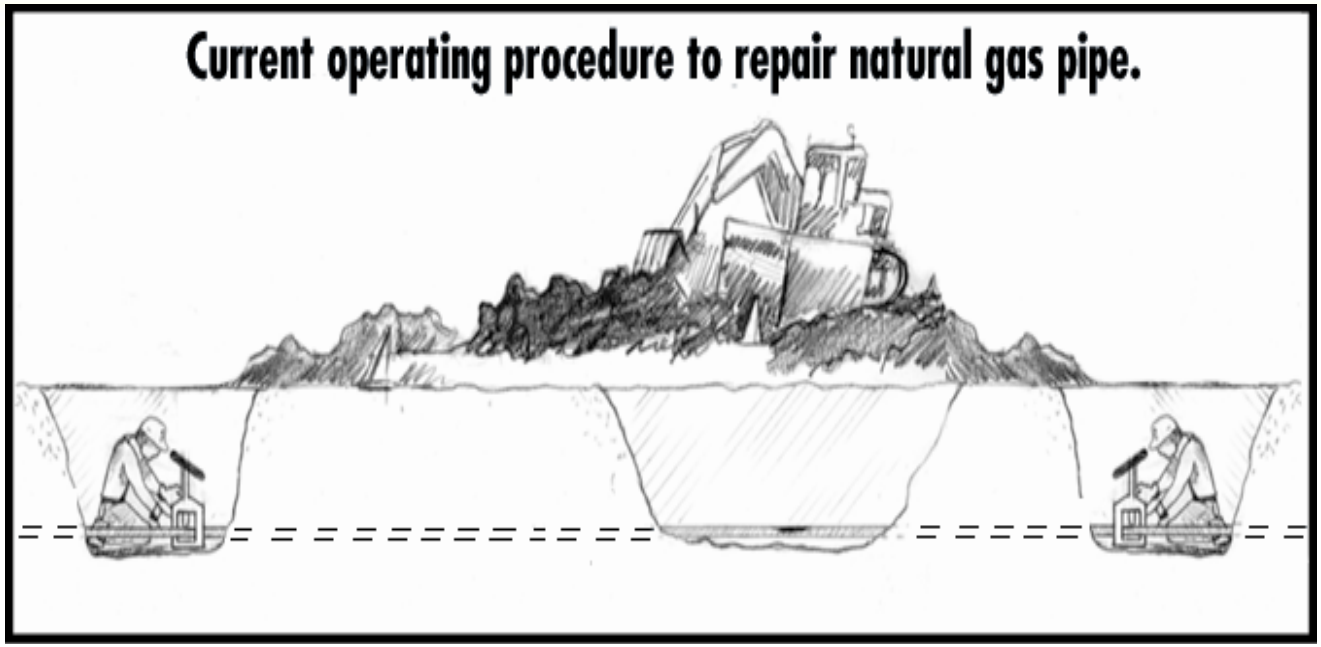
Standard Repair Method



1. Excavate upstream & downstream from the damaged area
2. Squeeze-off gas flow on both sides of damage
3. Excavate at site of damage & cut out damaged pipe section
4. Insert new section

Comparison of Repair Methods

Improvements over existing technology

Standard Method	**VS**	**Remote External Method**
Requires operators to work in the trench	→	Operators do not work in the trench
Multiple excavations/ Multiple operations	→	One excavation/ One operation
Not suitable for keyhole or confined space	→	Keyhole & Confined Space Accessible
Time consuming and expensive	→	Significant time & labor savings

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Benefits of Remote External Repair

- Safe for operator and environment
  - Operates remotely from ground surface
  - Keeps operator out of the trench
  - Operates in keyhole openings - minimal impact to environment & neighborhoods
- Cost effective
  - Faster repair time = substantial cost savings
  - Repair performed at site without additional excavation
  - Uninterrupted gas service

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Scope of Work

- Project Objectives
  - Develop remote external repair tool for damaged or defective PE gas pipe (rupture, puncture, gouge)
  - Demonstrate functionality & test performance of engineered prototype
- Design Goals
  - Lightweight construction
  - Top-down application
  - Manual operation from ground level
  - Operable in keyhole
  - Effective operation on 4-inch PE pipe

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Scope of Work

Phase 1: 18 months

- Design, fabricate one or more test tools
- Perform in-house & field tests
- Laboratory tests on repaired PE Pipe sections

Phase 2: 12 months

- Construct one or more engineered prototypes
- Perform in-house & field tests
- Laboratory tests on repaired PE Pipe sections

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Tasks to Be Performed

Phase 1 Test Tool

1. Research Management Plan
2. Technology Assessment
3. Development of Test Tool
   - 3.1 Safety Considerations for Repairing Pressurized Pipe
   - 3.2 Test Tool Conceptual Design & Development
   - 3.3. Detailed Test Tool Designs
   - 3.4 Test Tool Construction & In-House Testing

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Tasks to Be Performed

Phase 1 Test Tool

4. R&D of Chemical Bonding Process for Repair Patch
   - 4.1 Chemical Bonding Process
   - 4.2 Material & Thickness of Repair Patch
   - 4.3. Test Tool Performance Tests
5. Laboratory Testing on Repaired PE Pipe Sections
   - 5.1 Pressure Testing
   - 5.2 Accelerated Age Testing

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Tasks to Be Performed

Phase 1 Test Tool

6. Field Evaluation of Test Tool
   - Perform under simulated & actual field conditions

7. Technical Feasibility Assessment of Tool
   - Preparation for design & construction of engineered prototype

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Tasks to Be Performed

Phase 2 Engineered Prototype

8. Design & Construct Prototype
   - 8.1 Mechanical Design & Construction of Engineered Prototype
   - 8.2 R&D of Chemical Bonding Process for Repair Patch
9. Laboratory Testing on Repaired PE Pipe Sections
   - 9.1 Pressure Testing
   - 9.2 Accelerated Age Testing

Tasks to Be Performed

Phase 2 Engineered Prototype

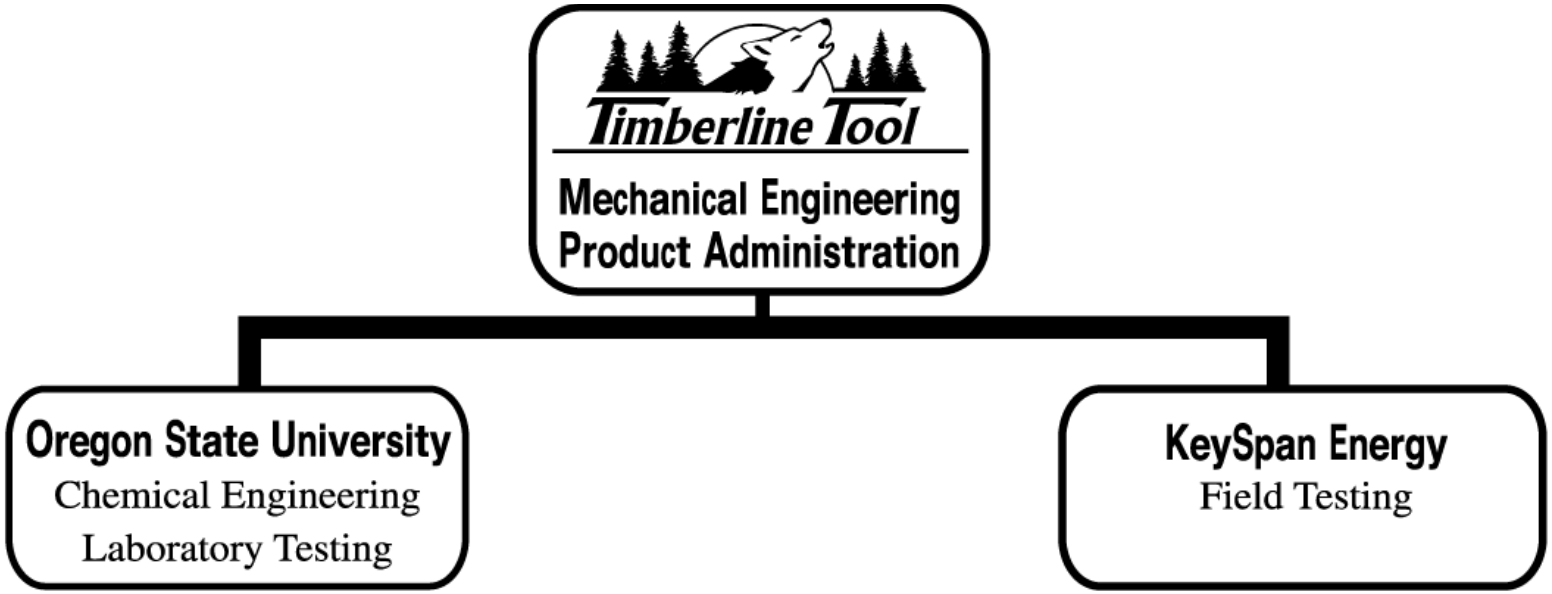
10. Field Evaluation of Engineered Prototype
    - Perform under simulated & actual field conditions

11. Performance and Design Assessment of the Engineered Prototype
    - In preparation for commercialization

Deliverables

- Research Management Plan
- Technology Status Assessment
- Periodic, Topical, and Final Reports
- Test Tools - Phase 1
- Engineered Prototypes - Phase 2

Project Team



Project Team

- Timberline Tool – Mr. Ken Green

  Integrated Manufacturing & Research Facility
  Columbia Falls, MT

- Oregon State University – Dr. Skip Rochefort

  Chemical Engineering - Polymer Laboratory
  Corvallis, OR

- KeySpan Energy – Mr. Joe Vitelli, Jr.

  Principal Engineer

  Hicksville, NY

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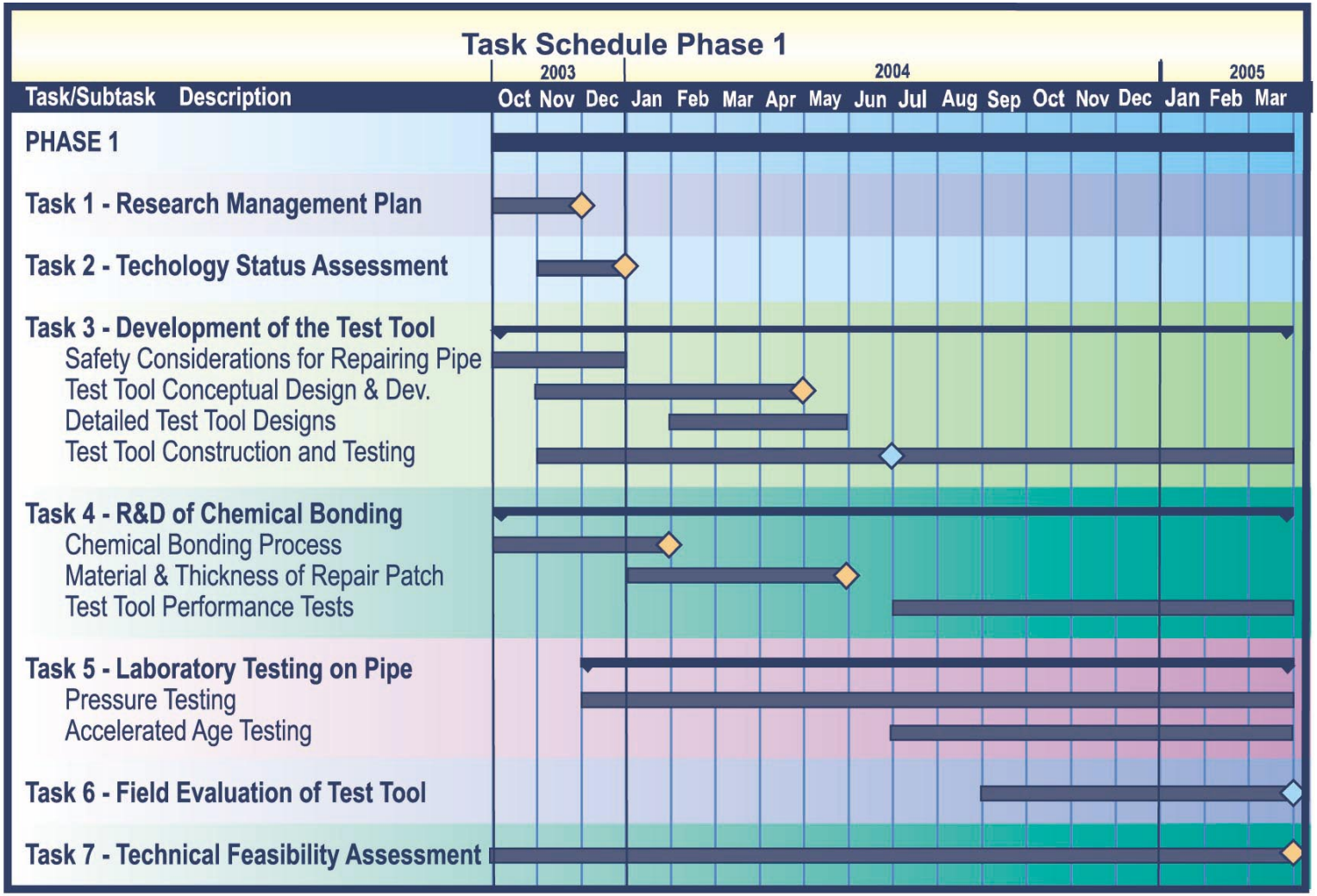
Project Schedule



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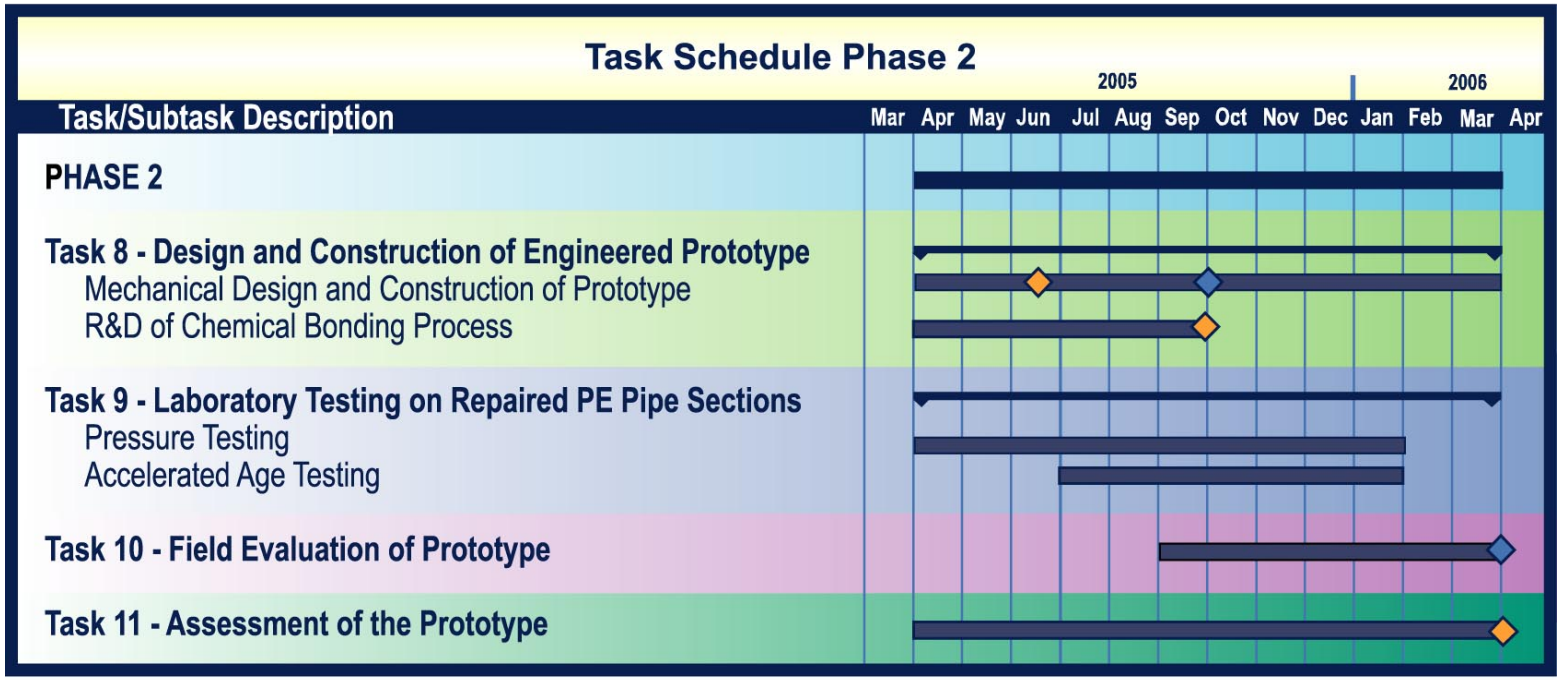
Project Schedule



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- KeySpan Energy

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