Current Events with Plastic and related subjects

API 15S
Spoolable Composite Pipeline Systems

Overview

- Why Use Spoolable Pipe
- Spoolable Composite Pipeline Types
- Manufacture
- Transportation
- Installation Methods
- Connection Systems
- Applicable Standards and Codes
- Spoolable Pipe in Jurisdictional Applications
- API SC15 Working Group Activities to Revise API 15S

Why Use Spoolable Pipe?

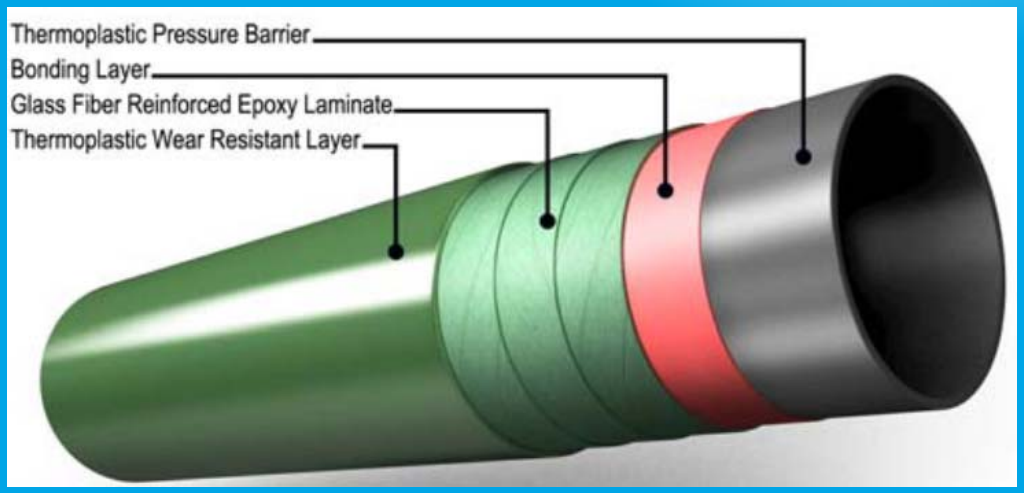
Advantages

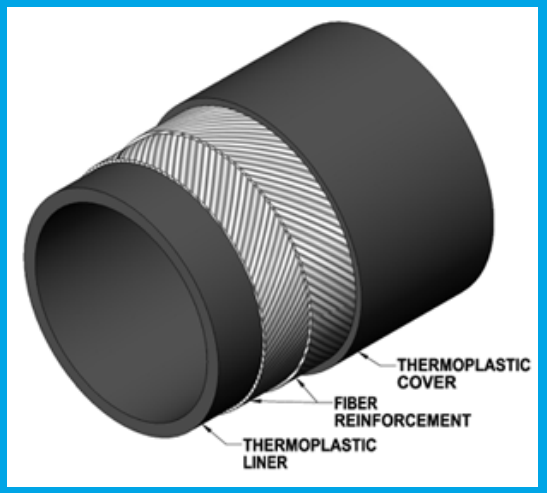
- Economic:
  - Install in 40-80% of the time
  - 35-65% lower installed cost than welded steel line pipe
  - Minimal manpower and equipment requirement
  - No welding, field bending, coating or X-ray costs
- Technical
  - Increased Reliability
  - Improved Safety/Environment
  - Corrosion resistance
  - Smaller right of way

Challenges

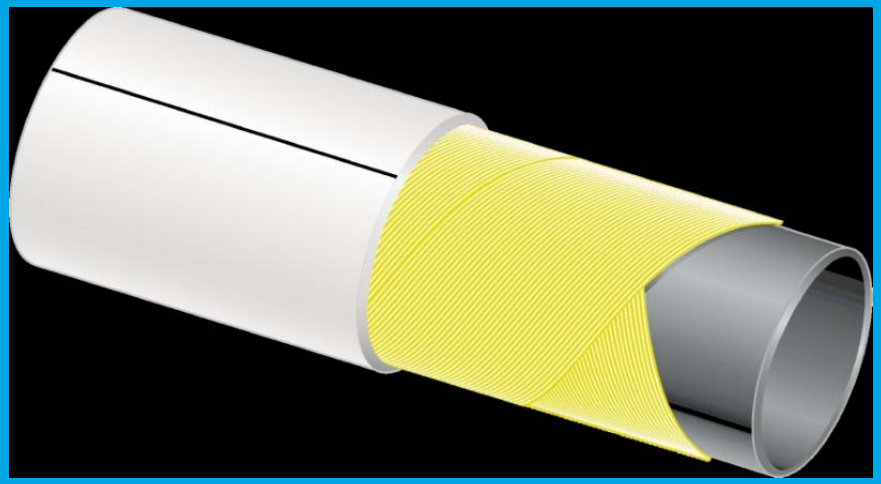
- Technical
  - Reliability data base & Design methodology
  - In-service monitoring
- Financial
  - Focus on system & life cycle costs rather than $/foot
- Emotional
  - Change of culture & Lack of standards
  - Minimal tolerance to failure of new technology

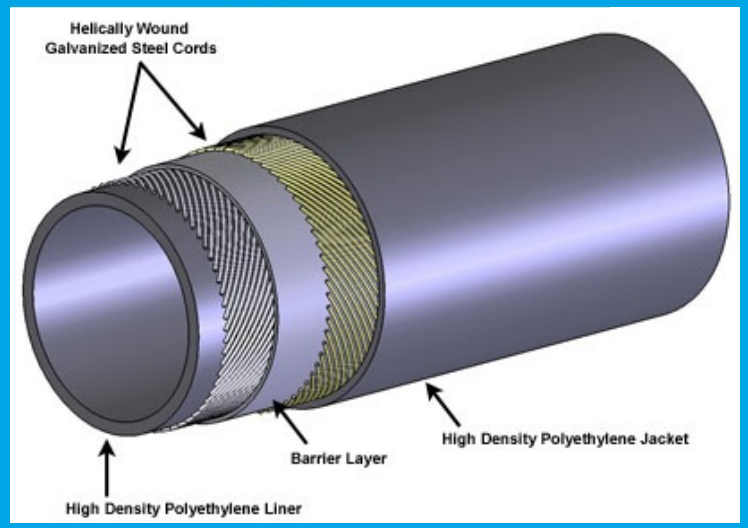
Spoolable Pipe Structures – Fiber Reinforcement





Spoolable Pipe Structures – Metallic Reinforcement

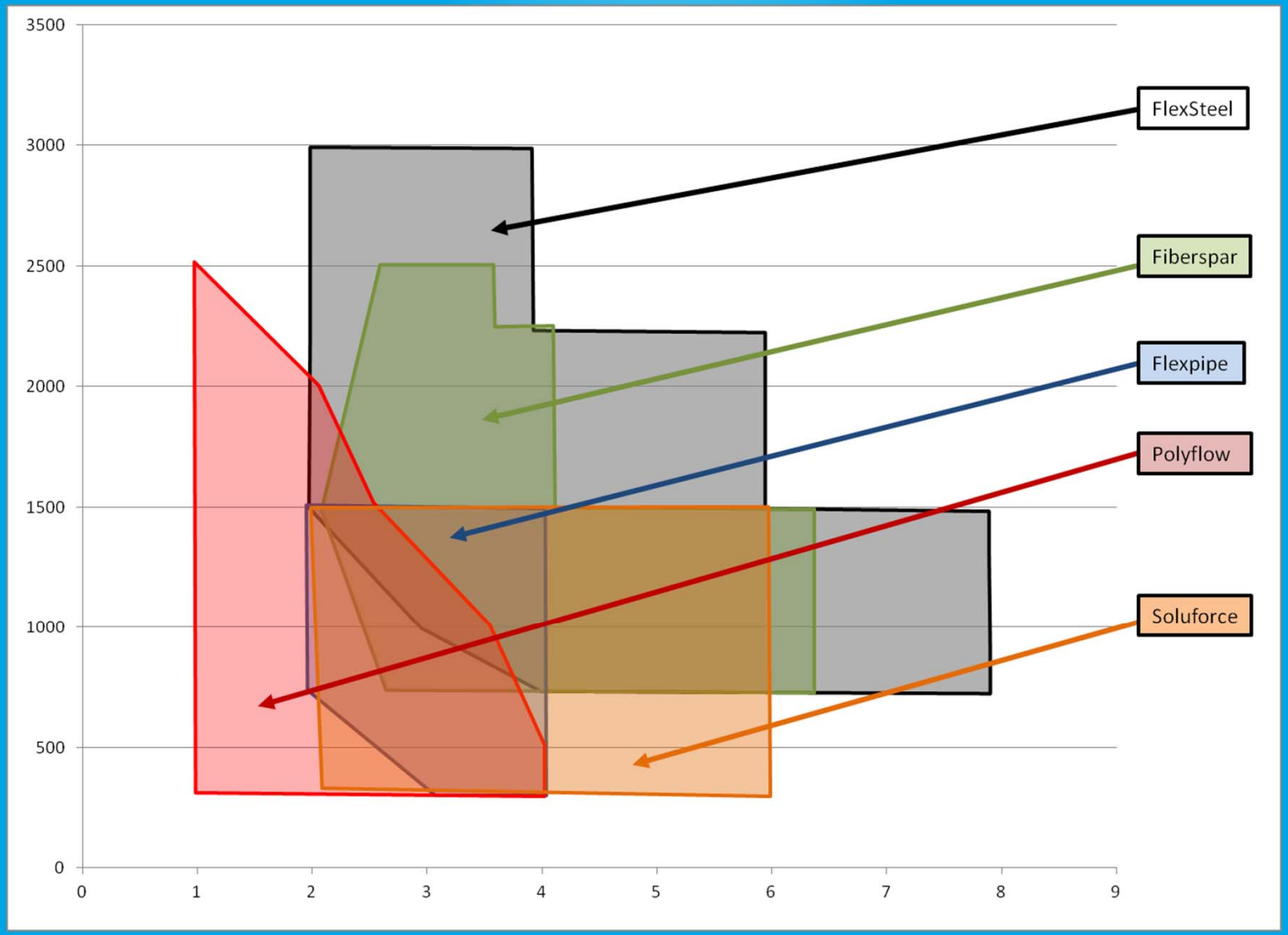




Common Sizes and Operating Pressures

- Diameters from 2 inch to 8 inch
- Pressures 300 PSI to 3,000 PSI

Operating Envelope Comparison



Pipe Manufacture

Transportation

Deployment Equipment

Installation - Trenching

- Minimal equipment and crew
- Reduced R.O.W.
- Rapid deployment

Installation - Plowing

- Minimal ground disturbance
- Up to 4 miles/day

Installation – Pipeline Rehabilitation

- Obtain maximum operating pressure
- Fraction of cost vs. new pipeline construction
- No de-rating
- Pulls in excess of 10,000 ft

Installation – Horizontal Directional Drilling

- Overcome surface challenges
- Minimizes environmental impact
- Bores in excess of 3,000 ft
- Tough outer shield eliminates need for special coatings

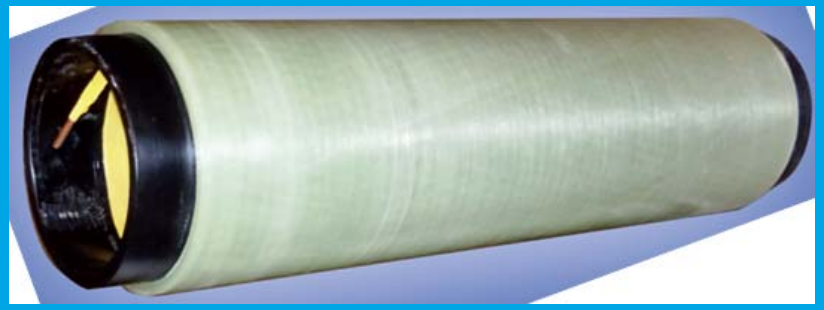
Pipe Locating Technologies

- Similar to HDPE pipe, non-metallic reinforced pipes require tracer wire
- Steel reinforced pipes are typically electrically continuous and do not require tracer wire

Riser Termination

Pipeline Connection Systems

Swage, Crimp, Mechanical, Fusion



Applicable Standards and Codes

Metallic reinforced thermoplastic pipe

- API 17J / 17K / 15S
- ASTM F2805
- CSA Z662
- ISO 18226

Non-metallic reinforced thermoplastic pipe

- API 15HR / 15S
- ASTM F2686
- CSA Z662
- ISO 18226

Spoolable Pipe in Jurisdictional Systems

Vast majority of spoolable pipelines are used in upstream applications outside the scope of existing regulations.

Several States are considering or have passed legislation that would result in the regulation of thousands of miles of these upstream flowlines.

- All pipelines, whether spoolable, plastic, or steel would be affected by these laws
- Ohio has passed legislation
- New York, Pennsylvania, and Texas among states considering proposals

192.14, Conversion of Service, format used to make formerly non-jurisdictional lines fall within regulations

Spoolable Pipe in Jurisdictional Systems

Ohio Revised Code 4905.90

- (D)"Gas gathering pipeline" means a gathering line that is not regulated under the Natural Gas Pipeline Safety Act and the rules adopted by the United States Department of Transportation pursuant to the Natural Gas Pipeline Safety Act, including 49 C.F.R. part 192, as amended. "Gas gathering pipeline" includes a pipeline used to collect and transport raw natural gas or transmission quality gas to the inlet of a gas processing plant, the inlet of a distribution system, or to a transmission line.
  - More stringent than Federal definition thus regulating production flowlines

Ohio Revised Code 4905.911 Compliance:

- "(A) (1) …pipelines that was completely constructed on or after the effective date of this section and that transports gas produced by a **horizontal well** to comply with the applicable pipe design requirements of 49 C.F.R. 192 subpart C:
  - (a) A gas gathering pipeline;
  - (b) A processing plant gas stub pipeline.
  - Targets horizontal wells for no specified reason

Spoolable Pipe in Jurisdictional Systems

Ohio Revised Code 4905.911 Compliance, cont'd:

- (2) …require the operator to do all of the following regarding that pipeline:
  - a) Design, install, construct, initially inspect, and initially test the pipeline in accordance with the requirements of 49 C.F.R. 192 if the pipeline is new, replaced, relocated, or otherwise changed;
  - (b) Control corrosion according to requirements of 49 C.F.R. 192 subpart I if the pipeline is metallic;
  - (c) Establish and carry out a damage prevention program under 49 C.F.R. 192.614;
  - (d) Establish and carry out a public education program under 49 C.F.R. 192.616;
  - (e) Establish the MAOP of the pipeline under 49 C.F.R. 192.619;
  - (f) Install and maintain pipeline markers according to the requirements for transmission lines under 49 C.F.R. 192.707;
  - (g) Perform leakage surveys according to requirements in 49 C.F.R. 192.706;
  - (h) Retain a record of each required leakage survey conducted under division (A)(2)(g) of this section and 49 C.F.R. 192.706 for five years or until the next leakage survey is completed, whichever time period is longer

Spoolable Pipe in Jurisdictional Systems

All Spoolable Composite Pipelines would require a special permit

Special Permit Advantages

- Enables PHMSA/State Agencies to monitor new technologies over time

Special Permit Disadvantages

- ***No formal application or guidelines for submission (ASTM standard needed or PHMSA prepare regulation covering process to qualify new materials.***
- 180+ days approval cycle is typical and most oil and gas producers cannot accommodate the delay
- PHMSA proposing operators to pay for PHMSA expenses related to special permit? Will kill development of new materials unless clear process is developed and adhered to.

Spoolable Pipe in Jurisdictional Systems

Known Special Permits for Spoolable Pipelines

- FlexSteel special permits:
  - TXRRC Gas Services Docket 09813 for use of 25,000 feet 6” FlexSteel to rehabilitate 12” flowline in Texas
  - TXRRC Gas Services Docket 09903 for use of 3” FlexSteel to rehabilitate 6” flowline in Texas
- Fiberspar special permits:
  - Docket RSPA–04–18757 for use of 4,200 feet of 4” Fiberspar in New York
  - Docket PHMSA-2010-0063 for use of 8 miles of 4.5” Fiberspar in Alaska
  - Docket PHMSA-2012-0112 for use of 3 miles of 6” Fiberspar in Alaska (in process)

API SC15 WG02 Spoolable Plastic Line Pipe

SC15 WG02 is tasked with re-writing API RP 15S as a single performance based standard for composite pipelines:

- Metal reinforced
- Fiber reinforced with or without matrix material
- Fabric reinforced
- Other materials

The objective is to have a document for spoolable composite pipeline systems that can be incorporated by reference into Part 192 and Part 195

TG02/WG02: Spoolable Plastic Line Pipe Members

Approximately 30 Members:

- **Manufacturers:**
  FIBERSPAR, FLEXPIPE SYSTEMS (A ShawCor Company), FLEXSTEEL, FPI FUTURE PIPE INDUSTRIES, POLYFLOW, SoluForce
- **End Users:**
  ExxonMobil, OXY, Shell, ConocoPhillips, PETRONAS
- **Suppliers/Labs:**
  JANA, merl complete engineering solutions, REHAU Unlimited Polymer Solutions, SOLVAY, Microbac, Ticona ENGINEERING POLYMERS
- **Trade Associations:**
  PLASTICS PIPE INSTITUTE
- **Regulatory:**
  PHMSA
- **Independent Consultants**

History of API 15S Document

1999-2002:

Joint Industry Project (JIP) on "Implementation of Reinforced Thermoplastic Pipes in the Oil and Gas Industries"

Professor Geoff Gibson, Centre for Composite Materials Engineering, University of Newcastle upon Tyne

2002- 2004:

ISO Working Group, ISO/TC138/SC4/WG8 produced ISO TS 18226 (2004), Reinforced Thermoplastic Piping Systems for Gaseous Fuels

2006:

API RP 15S 1st Edition, Qualification of Spoolable Reinforced Plastic Line Pipe

2011:

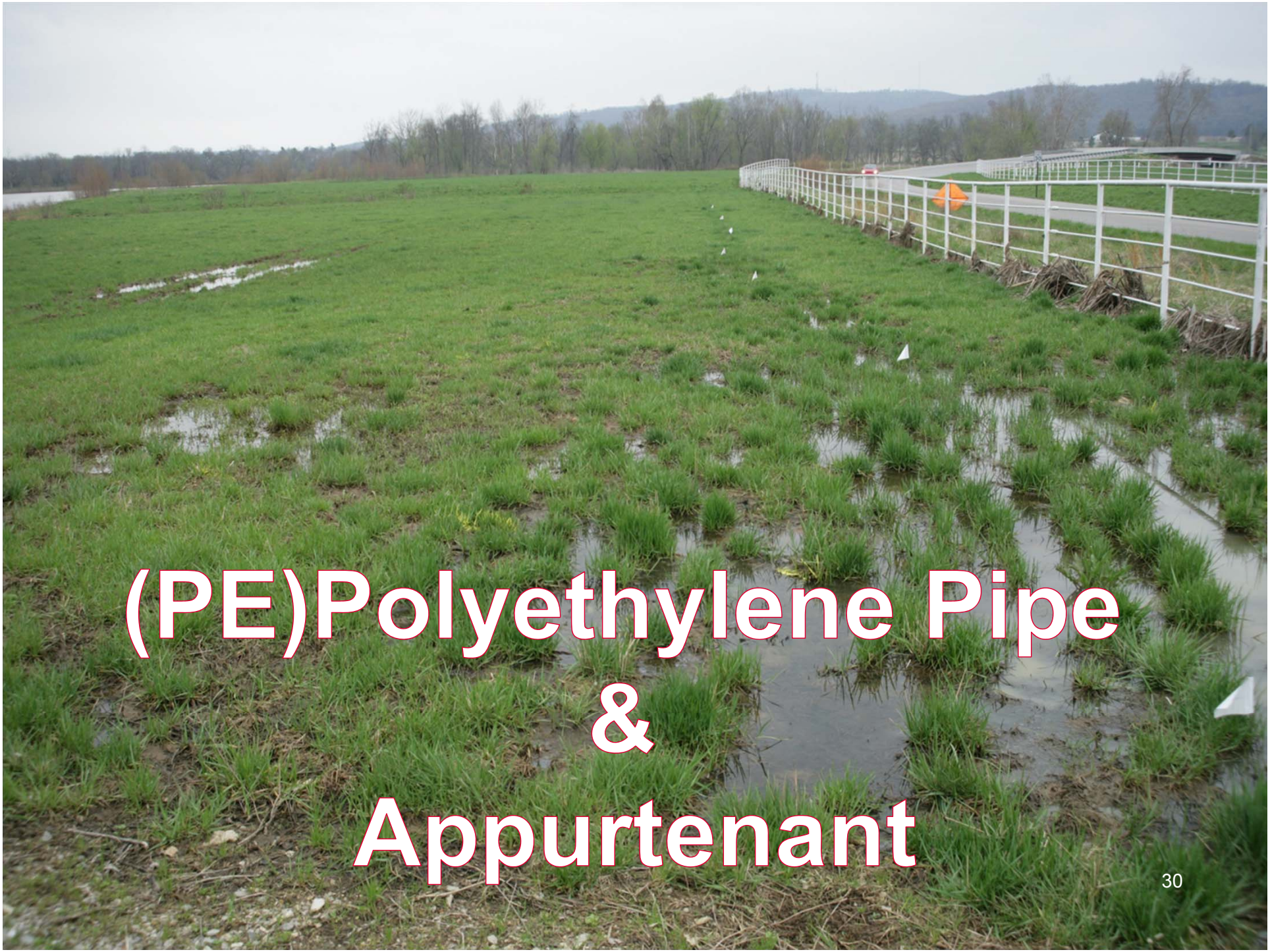
Working Group initiated to rewrite 15S as an API Specification

Current Status and Remaining Work API 15S

Document Outline	Status
1. Scope	▪ Complete
2. References	▪ Complete during final editing
3. Definitions	▪ Complete during final editing
4. Product Description / Material Requirements	▪ Complete
5. Qualification Program	▪ ~90% Complete
6. Process and Quality Assurance Requirements	▪ ~90% Complete
7. Dimensions, Tolerances and Marking	▪ Complete
8. Documentation	▪ ~90% Complete ▪ ~90% Complete
9. Handling, Storage and Transportation	▪ ~10% Complete
Appendices	

Timeline for Remaining Activities

- Next meeting scheduled for May to finalize drafting document
- SC 15 Ballot in the Third Quarter of 2013
- Anticipated Publication in the Fourth Quarter of 2013



(PE)Polyethylene Pipe & Appurtenant

PE (Polyethylene)

- **Unimodal vs. Bimodal**
- New systems and replacement systems
  - DIMP – Raising the Bar
  - 2708 MDPE vs. 2406 MDPE
  - 4710 HDPE vs. 3408 HDPE

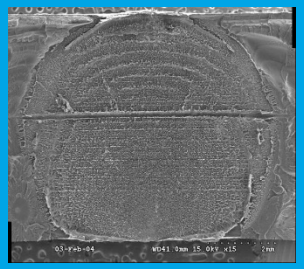
Quality Assurance

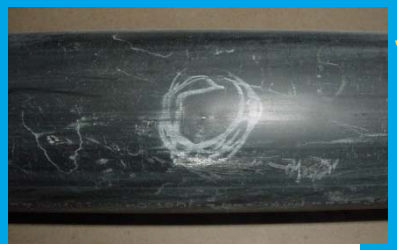
Materials Selection

- Highest quality materials available
- Resins – Bimodal & Unimodal
- Rework Free

PolyPipe® Pressure Pipe by Dura-Line

dura·line





(SCG)
Slow Crack Growth

Slow Crack Growth (SCG) is a slow growing failure

- **Initiated by impingement or external event**
- **Initiates on ID of pipe and permeates through exterior wall over time creating a pinhole failure.**

PolyTough 1™ A BIMODAL MDPE PRODUCT FROM DURA-LINE

dura·line

(RCP)
Rapid Crack Propagation

- Rapid Crack Propagation is a fast fracture 200m/sec
- Un-arrested sinusoidal crack path
- Only a few incidents in gas applications
- Rare but catastrophic in nature.

PolyPipe® Pressure Pipe by Dura-Line dura·line

PE Gas Pipe History (US) (HDPE)

Today HDPE *bimodal* resins are available from most resin manufacturers.

Since the bimodal resins are so resistant to the main failure modes of PE pipe (SCG, RCP)…*and* since HDPE bimodal resins are commonly available…

almost all HDPE gas distribution pipe today is manufactured with BIMODAL resins.

In the past few years, some gas companies have switched back to HDPE because of the superior properties of <u>bimodal</u> PE 100 / 4710

PE (Polyethylene)

- Update standards ASTM D 2513 2009a
- Change design factor from .32 to .40
- Other discussion on Class 1 & 2 for design factor (.50 or .67)
  - 10 series to 20 series for LTHS

Polyamide (Nylon) Plastic PA-11 & PA-12

Polyamide (Nylon) Plastic

Pipe and Appurtenances

- ANSI standards PA-11 & PA12
- PA-11_ASTM F-2945
- PA-12_ASTM F-2785
- ***NEED COMPATABILITY TEST***
- ***NEED TO ALLOW :*** Pipe sizes ½" to 8"and SDR = to PE.

PLEASE - Participate at ANSI standards meetings PLEASE!

- (ASTM, API, ASME, etc.)
- Get new technology to the Operator – DIMP & TIMP

RISK MODELING

FOR

THE FUTURE

Threat Assessment Question

- NAPSR participation with GTI on benchmarking TIMP & DIMP
- Include material with questionnaire, spreadsheet to date, with no names

  (Demo answers to questionnaire,)
- Path forward and request that others take the material and answer the questions and submit to ***me*** for processing

JANA & GTI

Engineering solution to promote proactive approaches to dealing with system failure or projected failures

(who, what, where, why and HOW?)

Risk Modeling

"... worse than useless and even worse than random."

- Dr. Tony Cox

Consensus among Risk Management Experts

That Index / Scoring Methods of modeling are inadequate

- Kent Muhlbauer

  Pipeline Risk Management Manual
- Dr. Ken Oliphant

  Advanced Pipeline Risk Modeling
- Douglas Hubbard

  The Failure of Risk Management: Why It's Broken and How to Fix It
- Nassim Taleb

  Fooled by Randomness, The Black Swan
- Nate Silver

  The Signal and The Noise
- Dr. Tony Cox

  Improving Risk Analysis
- Dr. Sam Savage

  The Flaw of Averages: Why We Underestimate Risk in the Face of Uncertainty

State-of-the-Art, as practiced by these experts, is

Probabilistic Modeling

Within Probabilistic Modeling, there are different hierarchies of approaches

Data-tuned Mechanistic Probabilistic Models

- Ability to forecast over long periods
- Tuned to reflect actual operating conditions
- Most robust

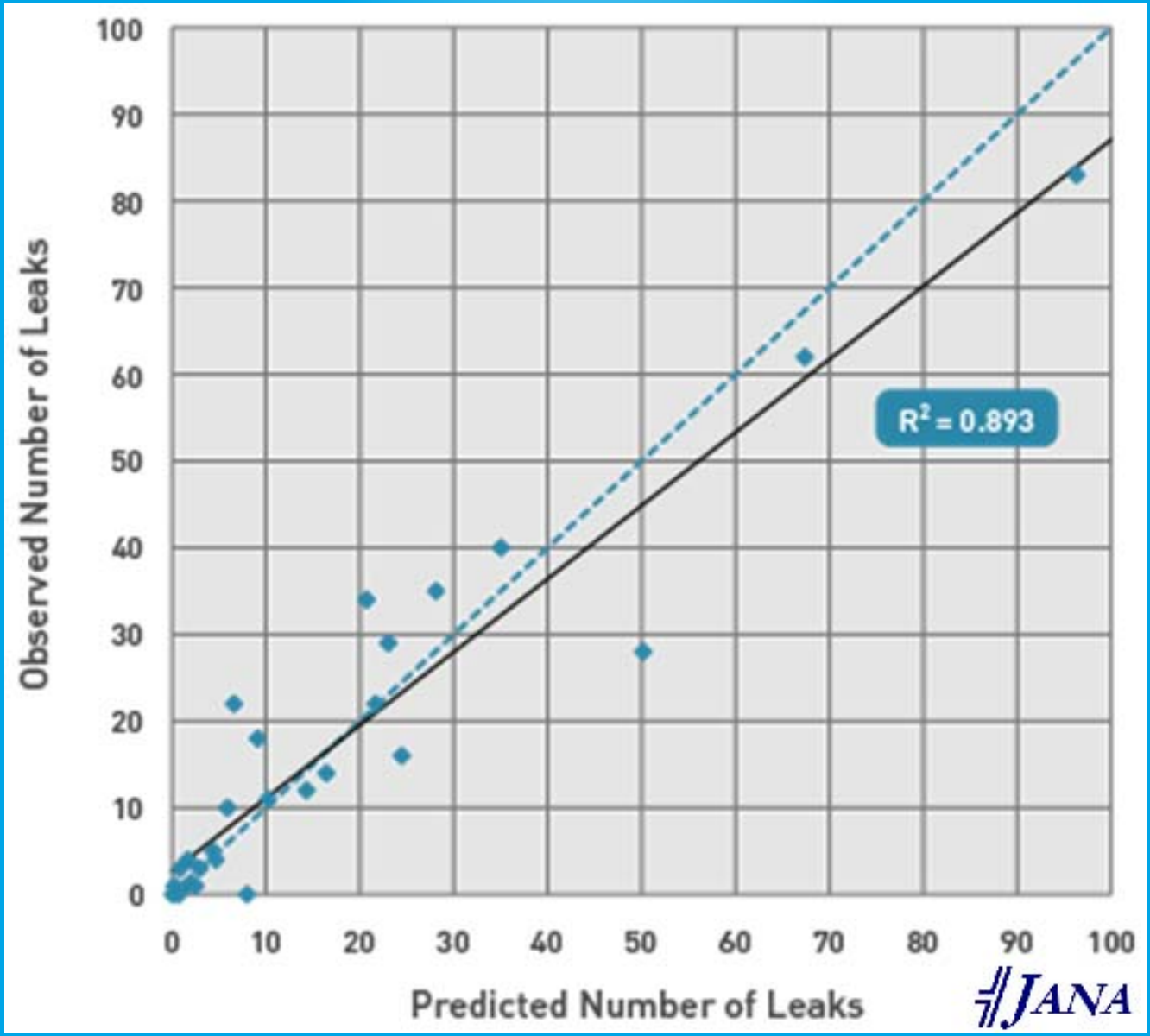
Mechanistic Probabilistic Models

- Ability to forecast over long periods
- Missing idiosyncrasies of specific operation

Data-based Probabilistic Models

- Short-term forecasting
- Need a failure history

Data-tuned Mechanistic Probabilistic Models



Better modeling is Imperative

- For pipelines, **Data-tuned Mechanistic Probabilistic Models - -** talk to JANA

- JANA is collaboration with ***Kent Muhlbauer***, who is an expert in the industry on risk modeling, and will be involved in develop state-of-the-art model/s

Asset Lifecycle Tracking and Marking of Materials

Asset Lifecycle Tracking Marking of Materials

- ASTM F 2897-11a (Needs to be Adopted into Code)
- Purchasing Specification Guidelines (GTI)
- Field Data Collection Technology
- ASTM F 2897-11a *Standard Specification for Tracking and Traceability Encoding System of Natural Gas Distribution Components (Pipe, Tubing, Fittings, Valves & Appurtenances)*
  - 16 digit alpha-numeric code
  - Standardizes – Manufacturer, lot number, date, material, size, type

astm standards info

Homepage ASTM Book of standards Contact

ASTM F2897 - 11a

Standard Specification for Tracking and Traceability Encoding System of Natural Gas Distribution Components (Pipe, Tubing, Fittings, Valves, and Appurtenances)

This standard is a part of ASTM Book of Standards Volume 08.04

Click to order this standard

Annotation and contents

ASTM Standards Search

Enter document number or name of standard

Go

Asset Lifecycle Tracking

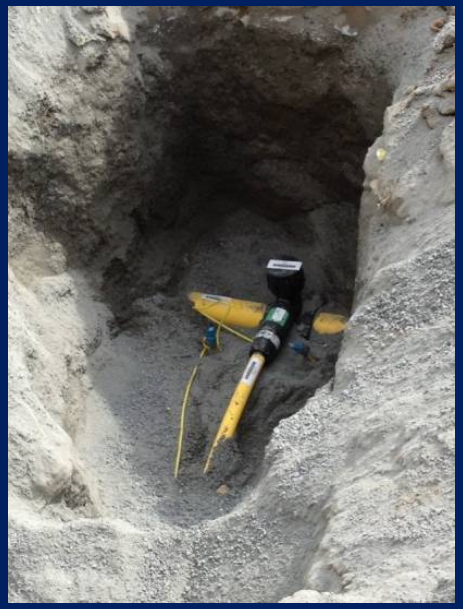
- **Tracking and Traceability issues, ways to standardize, assure all industry has a path to comply, 16 digit number, bar coding, time for materials to be marked, are there alternatives to marking, ASTM F-2897**

Asset Lifecycle Tracking

- Manufacturers are beginning to label pipe/fittings via 1D and 2D barcodes
- Working group with operators and manufacturers
- Develop a Consensus on Barcodes
  - ✓ Structure and format
  - ✓ Durability
  - ✓ Placement, spacing and orientation
- Available Upon Request

Asset Lifecycle Tracking

- **GTI's technology solution to complete asset lifecycle tracking**
  - ✓ Barcode scanner
  - ✓ High accuracy GPS receiver
  - ✓ Tablet device with GIS-based data collection software
  - ✓ Application to convert barcode into asset attributes to auto populate the GIS
- **Creates GIS features in the field**
- **Populates GIS with asset tracking and traceability information**

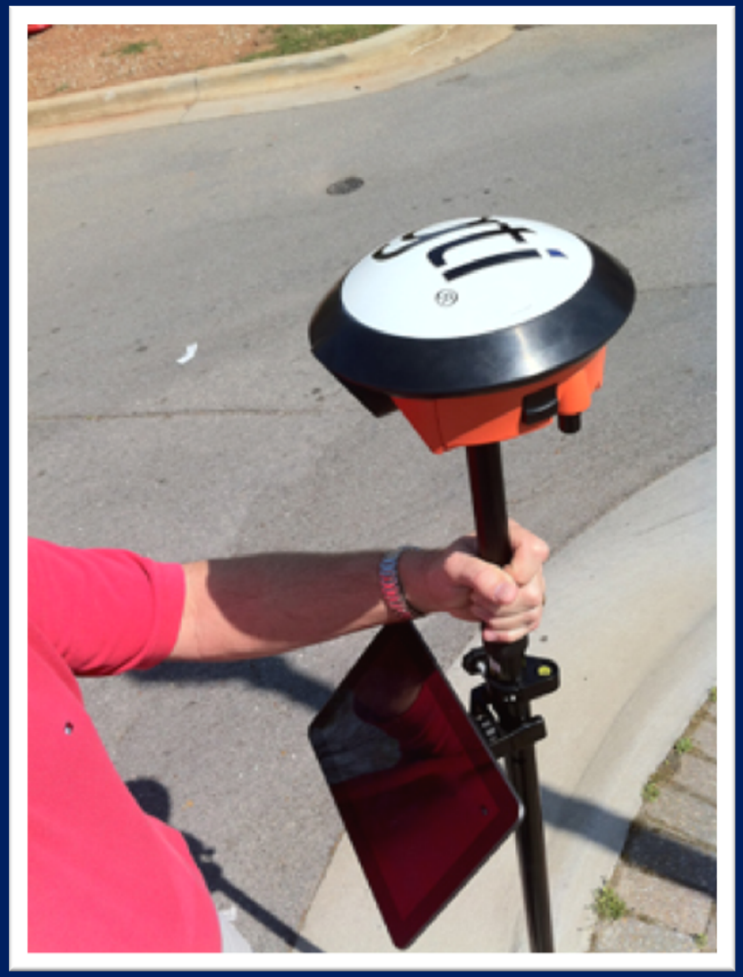


Asset Lifecycle Tracking

- **Automates the entire data collection process for documenting new installations**
- **In less than one minute . . .**
  - ✓ The barcode scanner captures asset attribute information and causes a new feature to be created in the GIS
  - ✓ GIS fields are automatically populated with asset attribute information (material type, batch number, etc.)
  - ✓ The location of the new asset is positioned with the sub-foot accurate GPS in real time
  - ✓ Data is available in the back office immediately

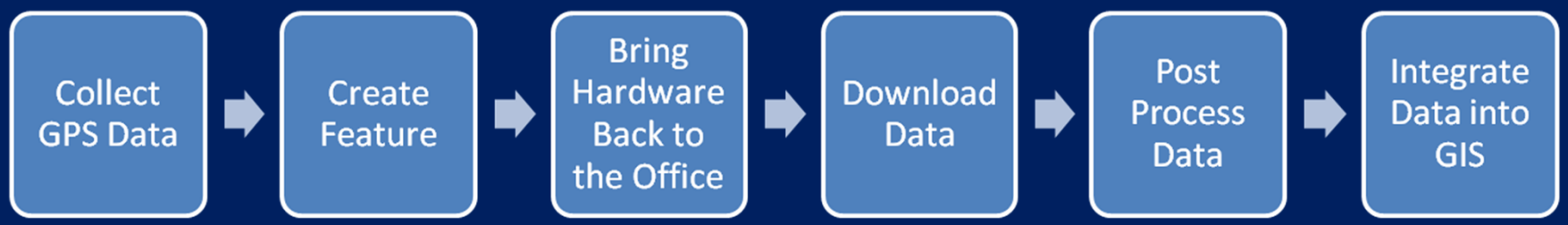
High Accuracy GPS

- **High accuracy GPS receivers integrated with tablet computers**
  - ✓ Sub-foot quality data in real time
  - ✓ No need for post processing or a base station
  - ✓ Field data directly inserted into the GIS (with controls)
  - ✓ NAVCOM, GENEQ, TRIMBLE



Data Collection Workflow

> Existing



> New

Pilot Projects

- Ongoing pilot projects
- Several other pilot projects planned for Q2 and Q3 2013

QUESTIONS

?

Thank You