Consolidated Edison Company of New York

SMART Robot

Presented by:

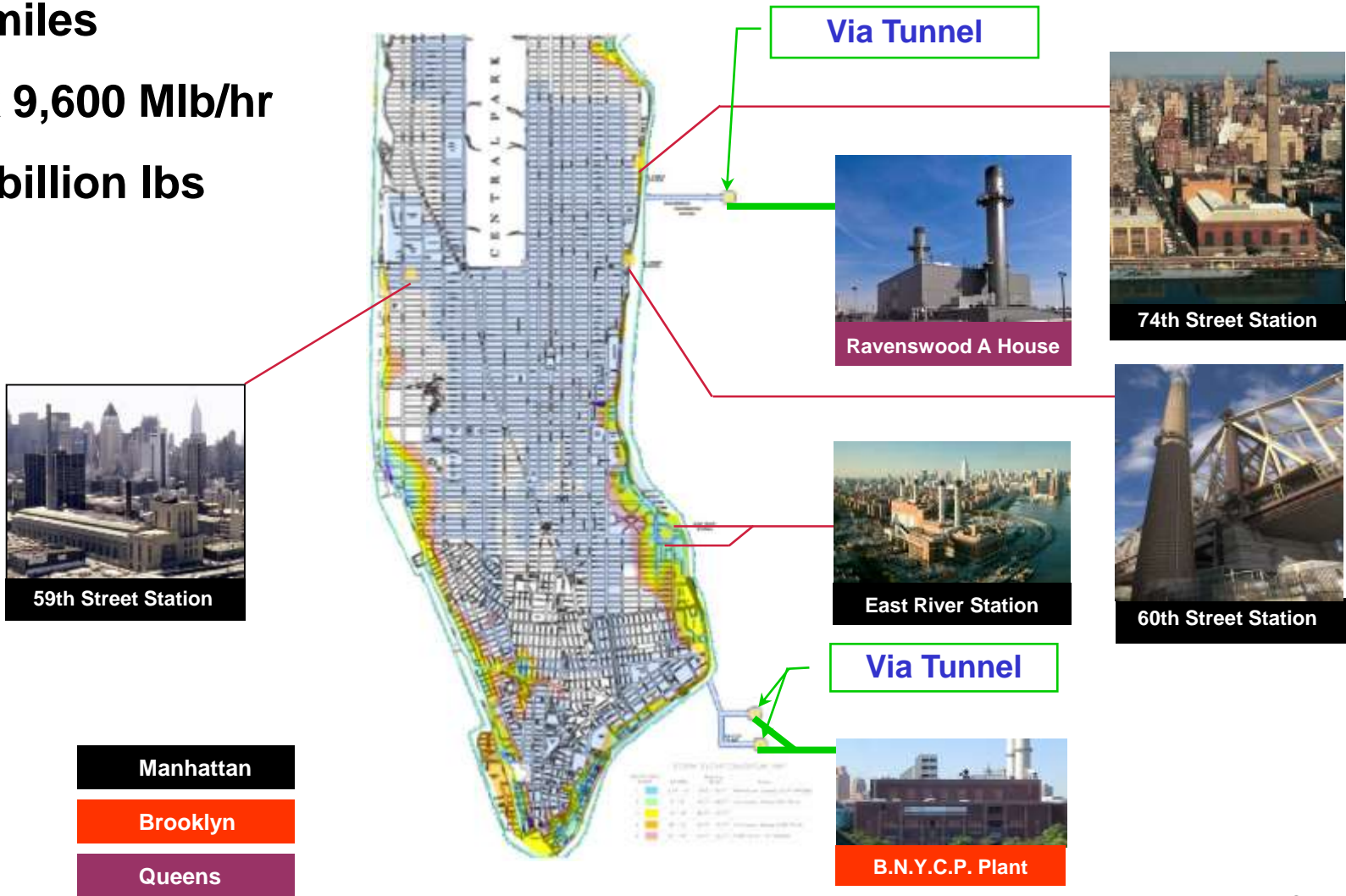Dowlatram Somrah, ME, PE

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Agenda

- **Con Edison Steam System Overview**

- **Design and Integrity of System**

- **Steam Leaks and Repairs**

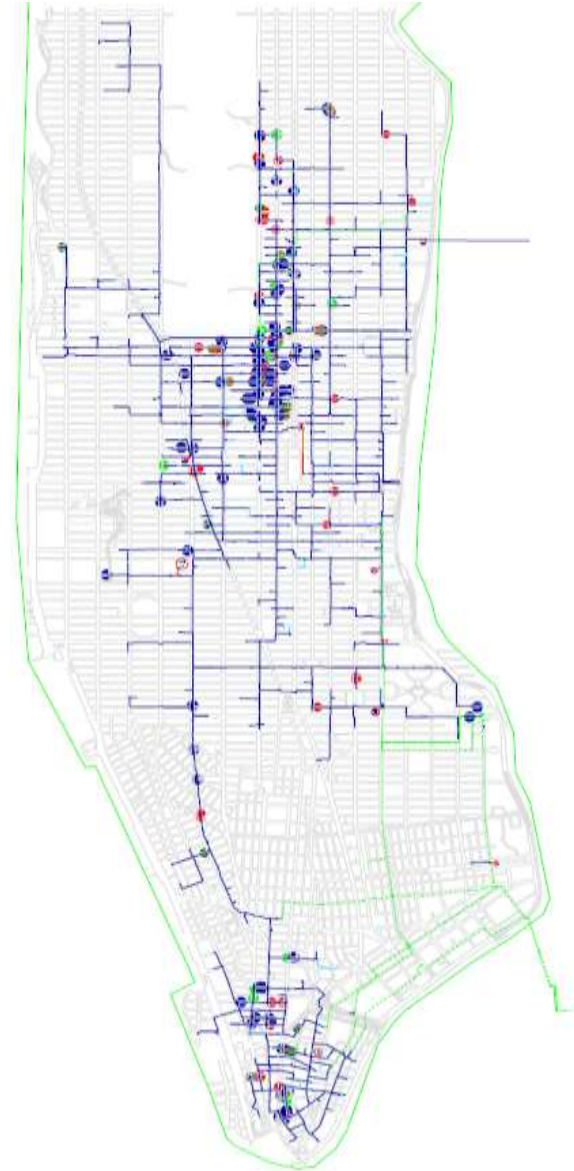- **SMART Robot Design**

- **Field Application**

- **Benefits**

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Con Edison Steam System Overview

- **106 miles**

- **Peak 9,600 Mlb/hr**

- **23.2 billion lbs**

Via Tunnel

Via Tunnel

74th Street Station

Ravenswood A House

60th Street Station

East River Station

59th Street Station

B.N.Y.C.P. Plant

Manhattan

Brooklyn

Queens

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Design and Integrity of System

- Design basis
  - Pressures: 200 psig, 400 psig
  - 1" – 36" diameter pipes
  - 0.179 inch to 0.675 inch wall thickness

- In-service conditions
  - No external corrosion
  - Flange Leaks
  - Flow accelerated corrosion

- Leaks impact reliability
  - Repair within 6 months
  - Main isolation
  - Safety concerns, loss of product

Finding and Repairing Leaks

- Challenges finding leaks
  - Subsurface, conduits
- Finding steam leaks
  - History/design/pinpointing leaks
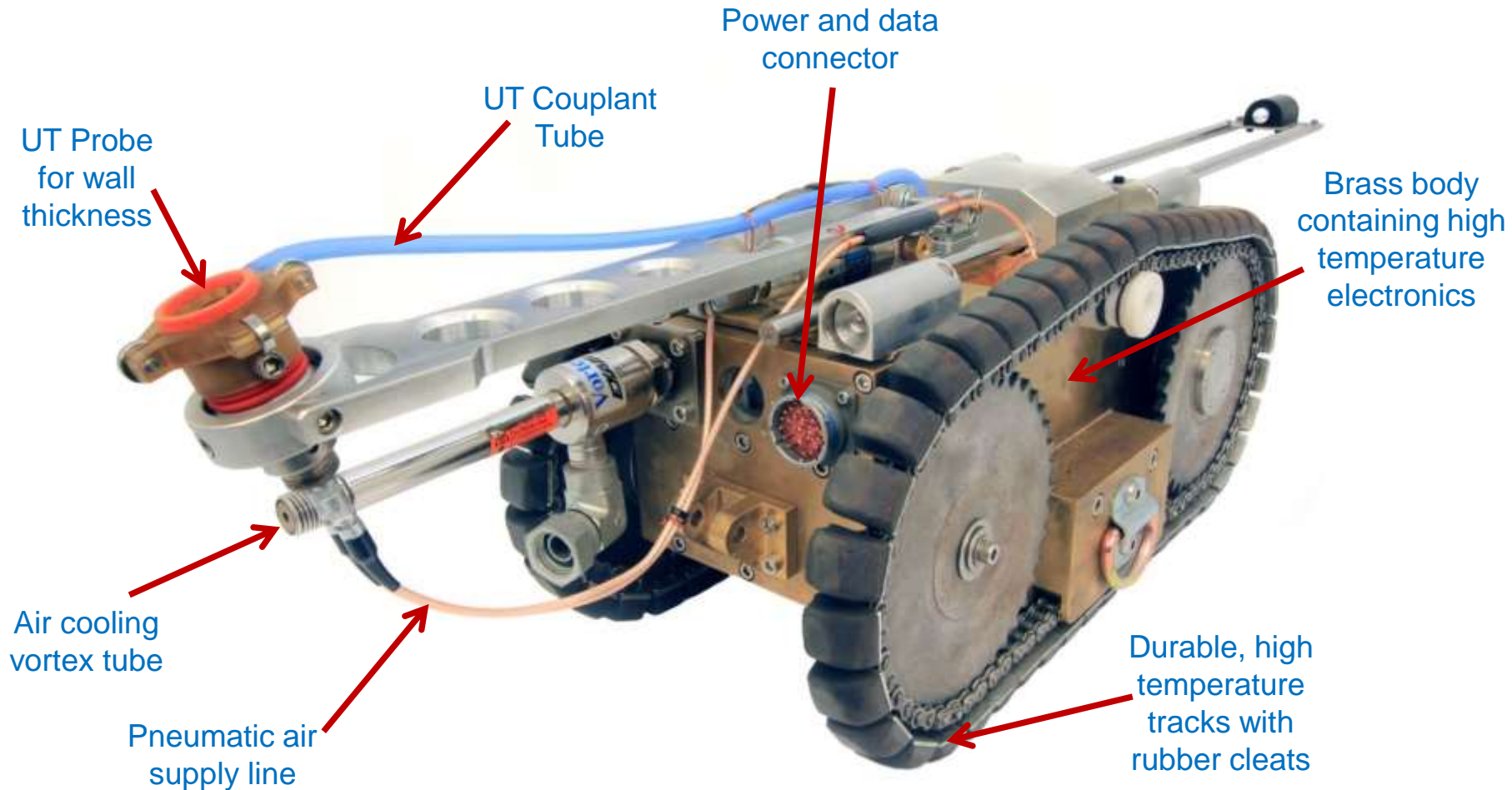- 65 leaks require an excavation

SMART Robot – Smart Maintenance

- Assess 8"- 24" diameter pipes

- Maneuver up to 30° bends

- Withstand 350° F, 100% humidity

- Inspect 500 feet length in 4 hrs

- Record distance and elevation

- Measure wall thickness & ovality

- Quantify internal corrosion
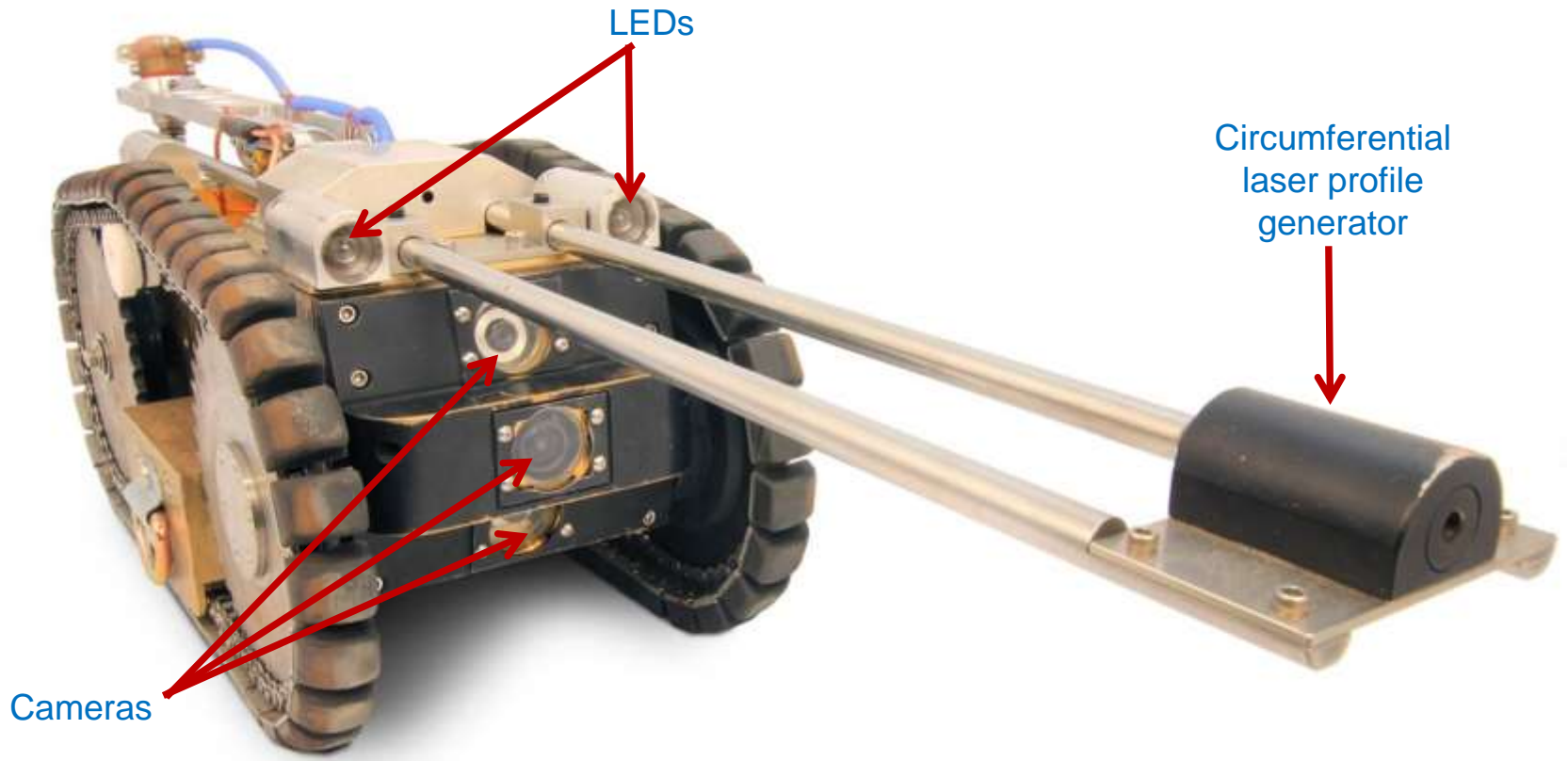
- Record video of inspection

SMART Robot Design
Rear View

Power and data connector

UT Couplant Tube

UT Probe for wall thickness

Brass body containing high temperature electronics

Air cooling vortex tube

Pneumatic air supply line

Durable, high temperature tracks with rubber cleats

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SMART Robot Design
Front View

LEDs

Circumferential laser profile generator

Cameras

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Field Application

- 16" diameter main
  - Installed 1924

- Inspected 250 feet
  - 150 feet east
  - 100 feet west

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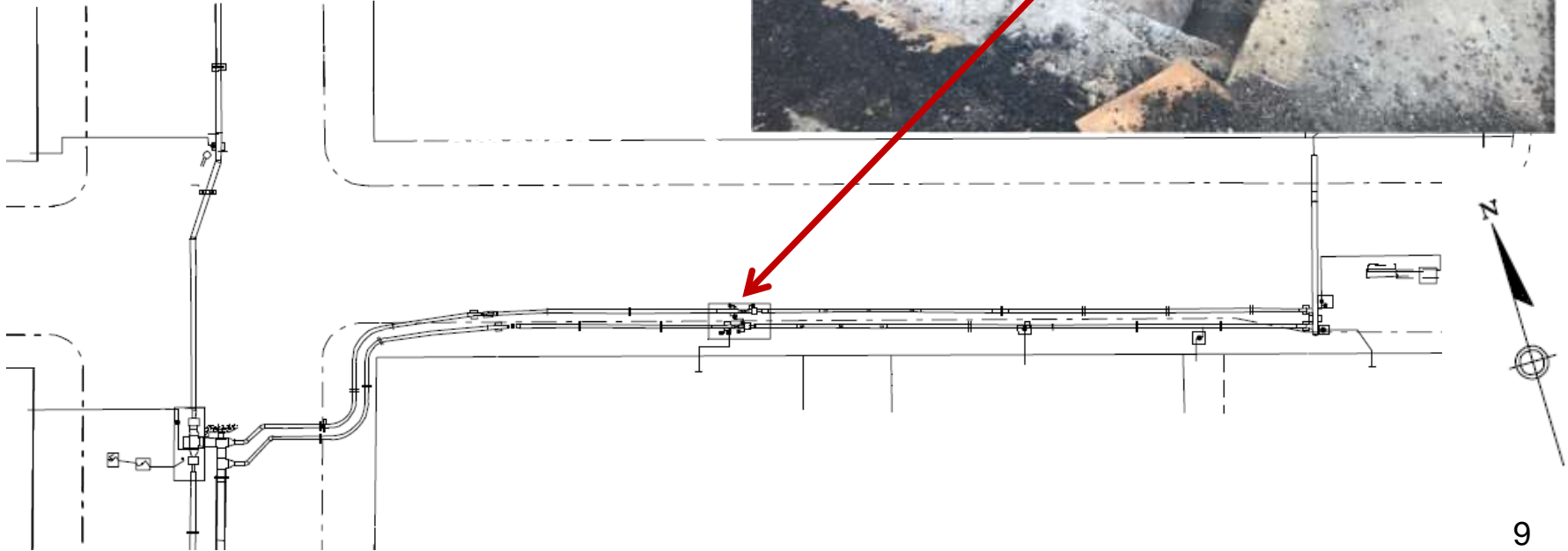
Deploying The SMART Robot
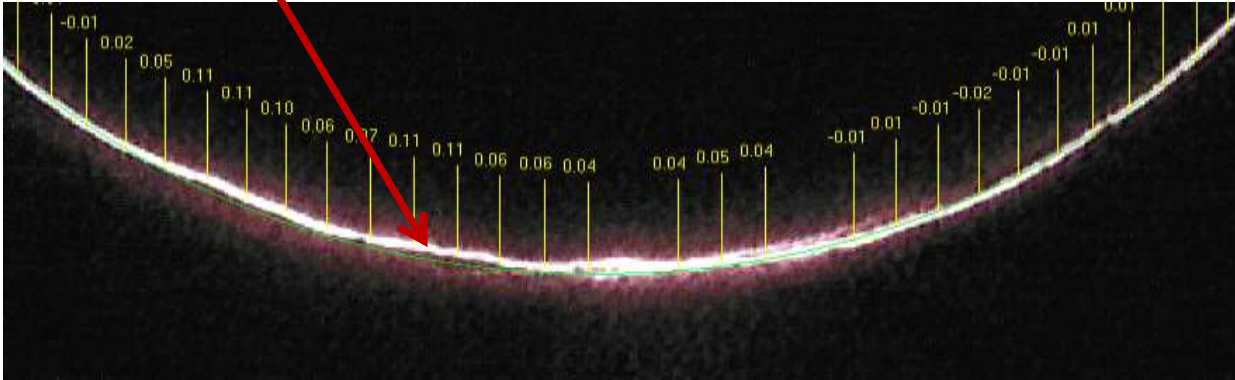
Wall Thickness Measurement
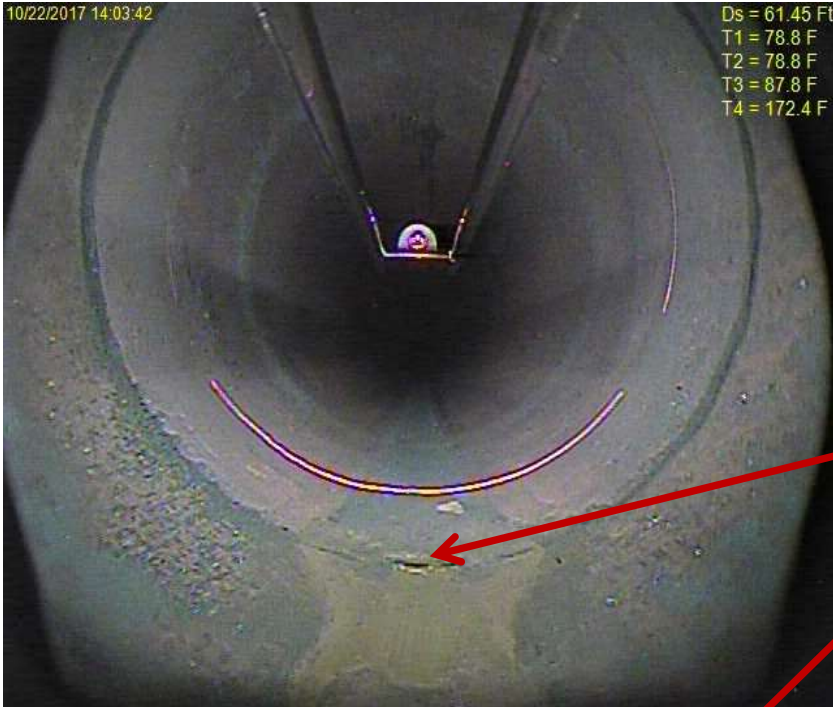
UT Probe
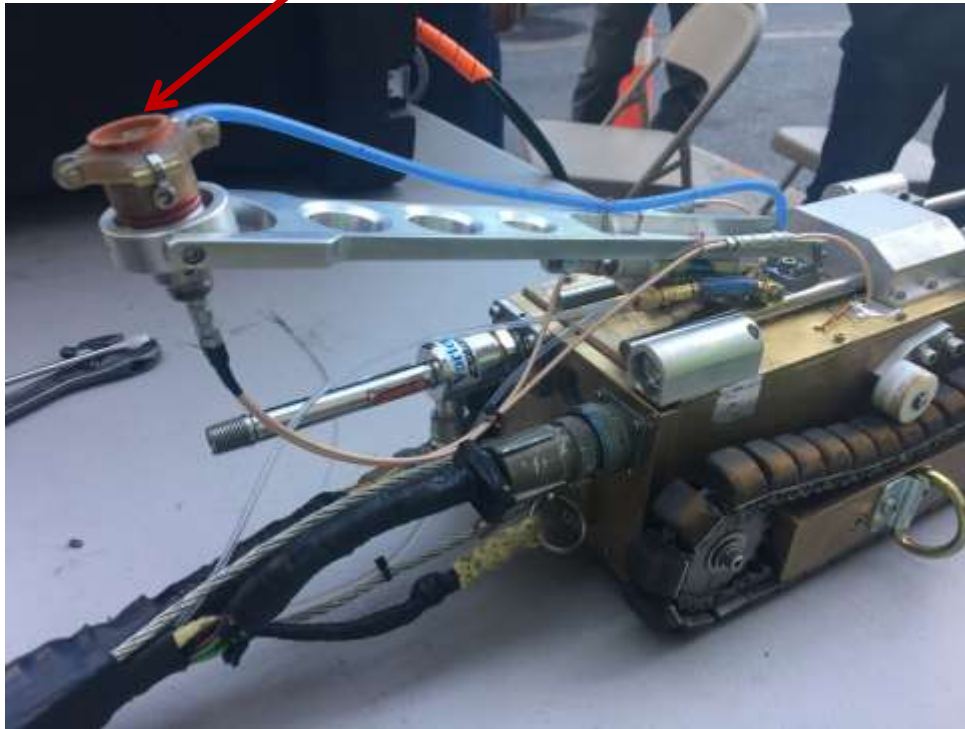
Field Application - Video

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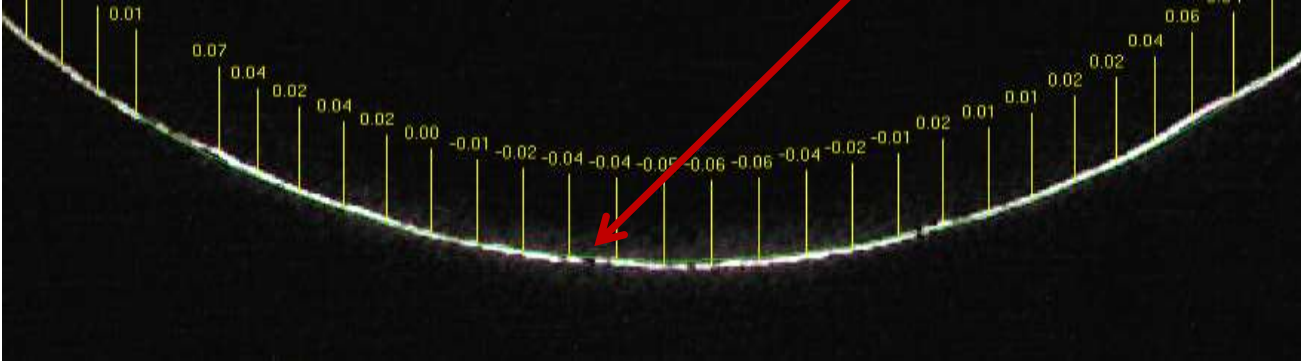# Field Application – Findings
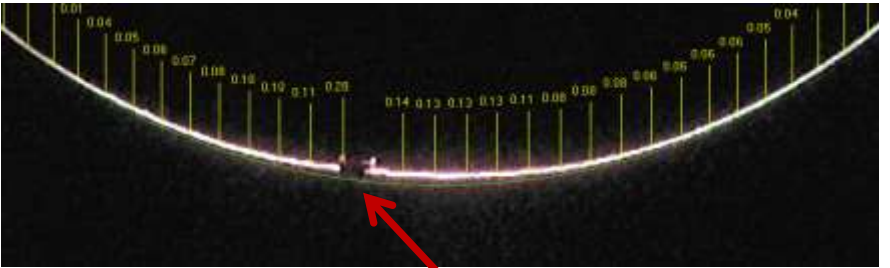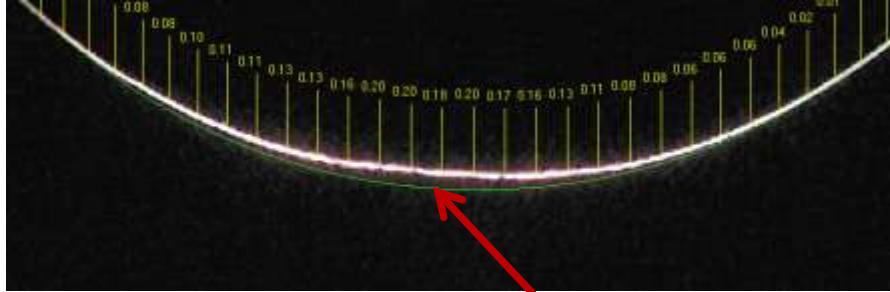

Circumferential Weld
- Fully Penetrated

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Field Application - Findings

Circumferential Weld – Lack of Penetration

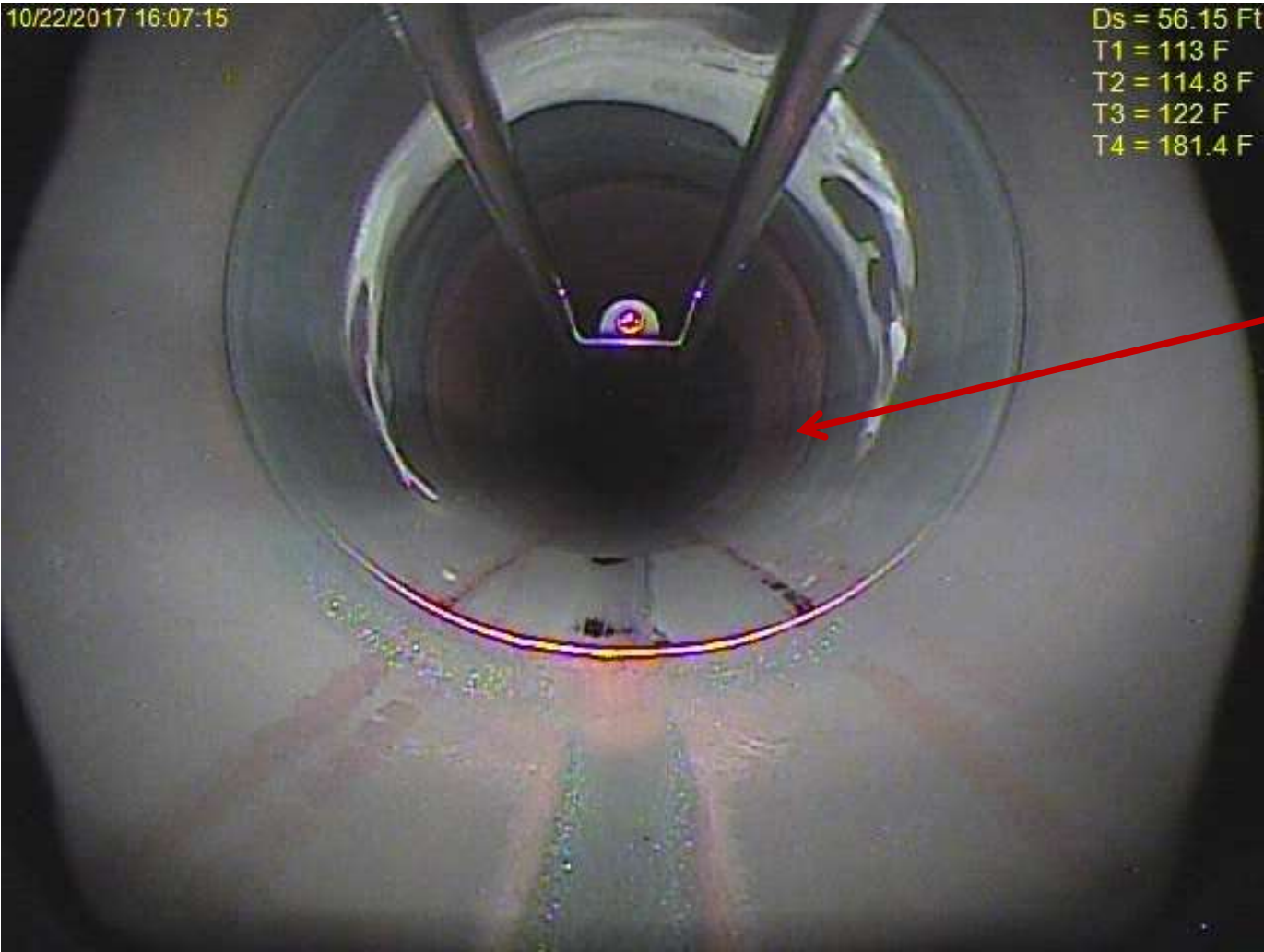conEdison

# Field Application - Findings

Field Application - Findings

10/22/2017 14:25:31
Ds = 153.79 F
T1 = 109.4 F
T2 = 111.2 F
T3 = 116.6 F
T4 = 134.6 F

Cap – End of Pipe

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Field Application - Findings

10/22/2017 16:07:15

Ds = 56.15 Ft
T1 = 113 F
T2 = 114.8 F
T3 = 122 F
T4 = 181.4 F

Expansion Joint

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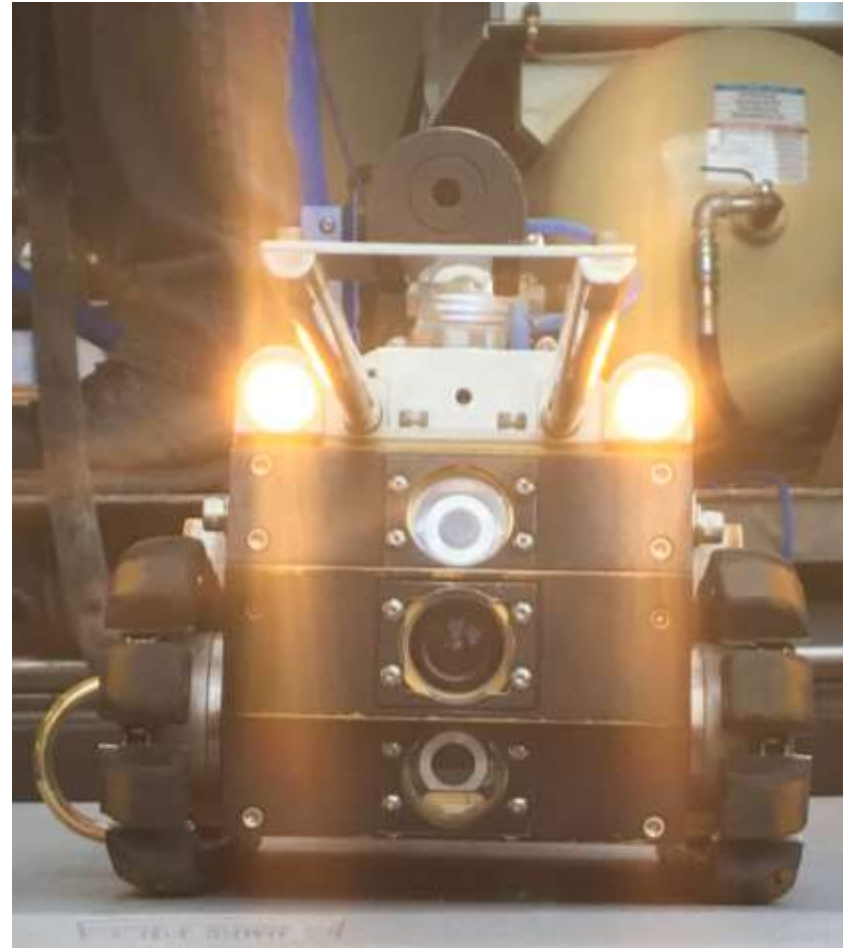
Field Application – Navigating Capability

Pipe Diameter	Max Sweep Angle
8"	Straight Pipe
10"	7°
12"	15°
16"	20°
20"	25°
24"	30°

90° Elbow
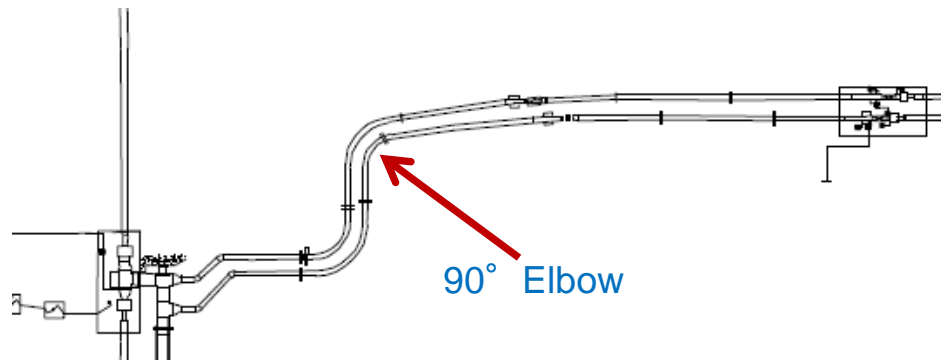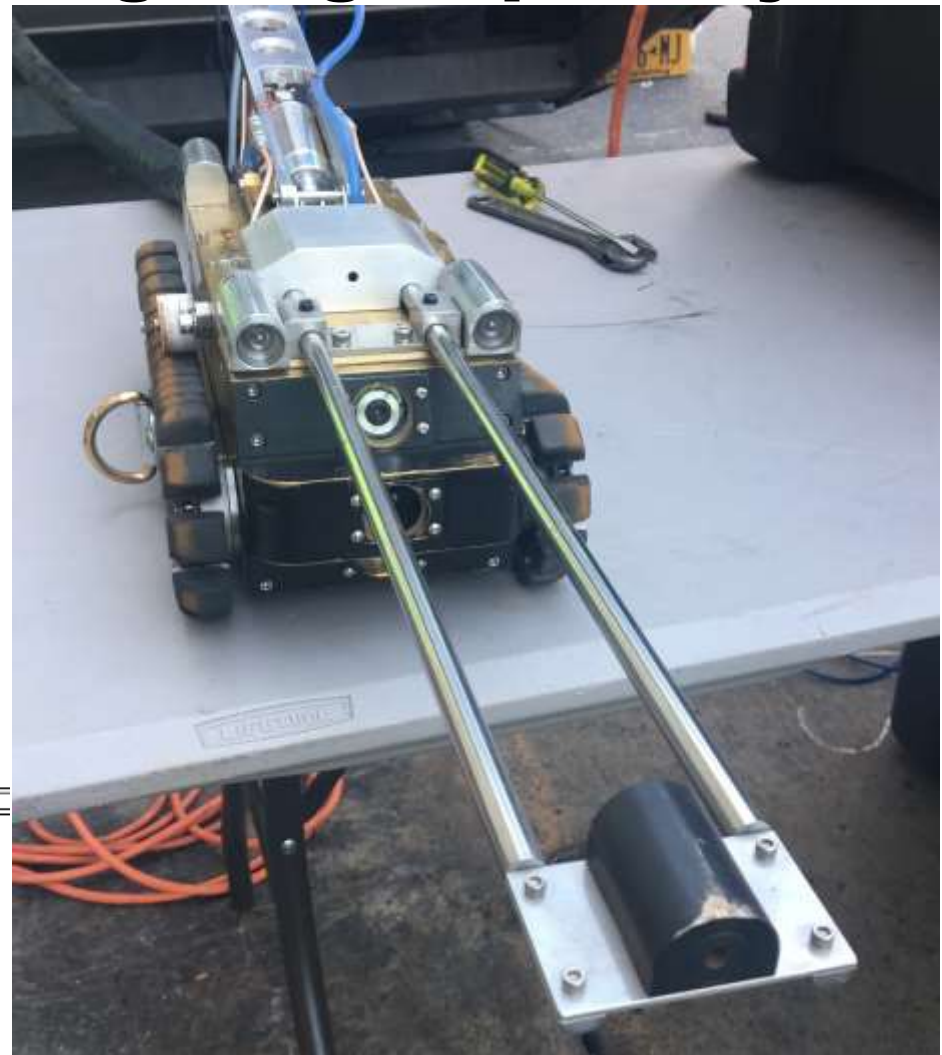
Benefits of Using SMART Robot

- Automated reporting

- Mapping of pipe features

- Pipe integrity assessments

- Real recorded pipe data

  - Input into failure models

  - Post failure analysis

- Improved safety, efficiency and reliability

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