Texas RRC 205 Regulatory Conference

Applying Real-Time Data to Address the Challenges of Hydrotesting

Application of real time data techniques

PipeGuard

Advanced pipeline leak detection

PipeTrack

Real-time pig tracking

PipeTest

Advanced hydrotest monitoring & leak location

PipeScan

Pre-existing leak location & blockages

History of O&G pipelines

Early 1800's - wooden pipelines

1865 – first commercial iron pipeline

1931 – first major US gas pipeline

1943 – Big / Little Inch pipelines WWII

1977 – Trans-Alaska pipeline

1990's / 2000's – Colonial pipeline expansion

2010 – Keystone pipeline

2020's - Hydrogen & CO2 pipeline transport

History of hydrotesting

1860's – first "hydrotests", visual for leaks

1915-20 first uses of chart recorders

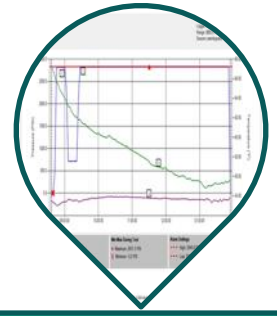
1935 – ASME B31, pressure and hold specs

1950's – more accurate calibrated gauges

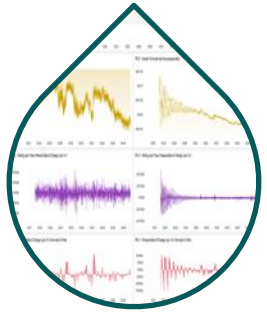
1980's – digital data loggers supplement charts

1990's - 2000's general refinement of techniques

2000 – 2020 – some use of digital solutions



2025 - AI driven real time monitoring and assessment



Test Range 1,171 psig to 1,239 psig	Circle Instrument Used Below: (Digital)	Circle: C = Chart or D = Digital				NOTES: List leak inspections, changes in weather, bleed downs, pump ups, pipe going into shade, chart bumps, pressure spikes, work activities or other problems that may influence the data recorded for this test.
Target: 1,215 PSI	Dead Weight	Ambient Temp	Buried Pipe Temp	Exposed Pipe Temp	Ground Temp	***Record Data Every 15 Minutes***
Date Time	Pressure					Ice Bath Readings
9-13-24 6:32	0	33.2	33.5		33.6	
9-13-24 6:34	0	58.6	71.7		66.5	START PRESSURIZATION TO FIRST HOLD
9-13-24 6:49	401	59.9	71.8		67.1	START 15 MIN HOLD @ 401 PSI
9-13-24 7:03	400	60.7	72.2		67.5	START PRESSURIZATION TO SECOND HOLD
9-13-24 7:35	800	61.5	72.3		67.6	START 15 MIN HOLD @ 800 PSI
9-13-24 7:40	800	61.6	72.3		67.5	LEAK CHECK NO LEAKS
9-13-24 7:57	799	62.2	72.5		67.6	START PRESSURIZATION TO TARGET PRESSURE
9-13-24 8:25	1210	63.0	72.3		67.5	AT TARGET PRESSURE 1210 PSI
9-13-24 8:30	1210	63.4	72.2		67.5	
9-13-24 8:45	1209	63.8	72.2		67.5	
9-13-24 9:00	1209	64.5	72.3		67.5	START TEST
9-13-24 9:15	1208	65.2	72.2		67.6	
9-13-24 9:30	1208	65.4	72.2		67.5	
9-13-24 9:45	1207	65.9	72.2		67.6	
9-13-24 10:00	1207	65.8	72.1		67.4	
9-13-24 10:15	1206	66.5	72.1		67.4	
9-13-24 10:30	1206	66.9	72.0		67.4	
9-13-24 10:45	1206	67.4	72.0		67.3	
9-13-24 11:00	1205	67.6	71.9		67.3	
9-13-24 11:15	1205	68.6	71.7		67.1	
9-13-24 11:30	1204	68.3	71.7		67.0	
9-13-24 11:45	1204	68.8	71.7		67.0	
9-13-24 12:00	1204	69.4	71.6		67.0	34% CLOUD COVER
9-13-24 12:15	1204	70.0	71.5		66.8	10 MPH EAST, SOUTHEAST WIND
9-13-24 12:30	1203	70.4	71.5		66.8	
9-13-24 12:45	1203	70.5	71.5		66.9	
9-13-24 13:00	1203	71.3	71.4		66.7	
9-13-24 13:15	1203	71.5	71.4		66.8	
9-13-24 13:30	1202	71.8	71.5		66.8	
9-13-24 13:45	1202	74.1	71.5		66.7	
9-13-24 14:00	1202	75.1	71.6		66.6	
9-13-24 14:15	1202	73.9	71.5		66.4	
9-13-24 14:30	1202	74.6	72.1		66.9	

BRANDON OLSON
HEATH CHURCH

NOTE: TEST APPROVED PER CHANNING MIGLIORE

Test Trailer

Typically holds main test chart recorder and deadweights

Pump Skid

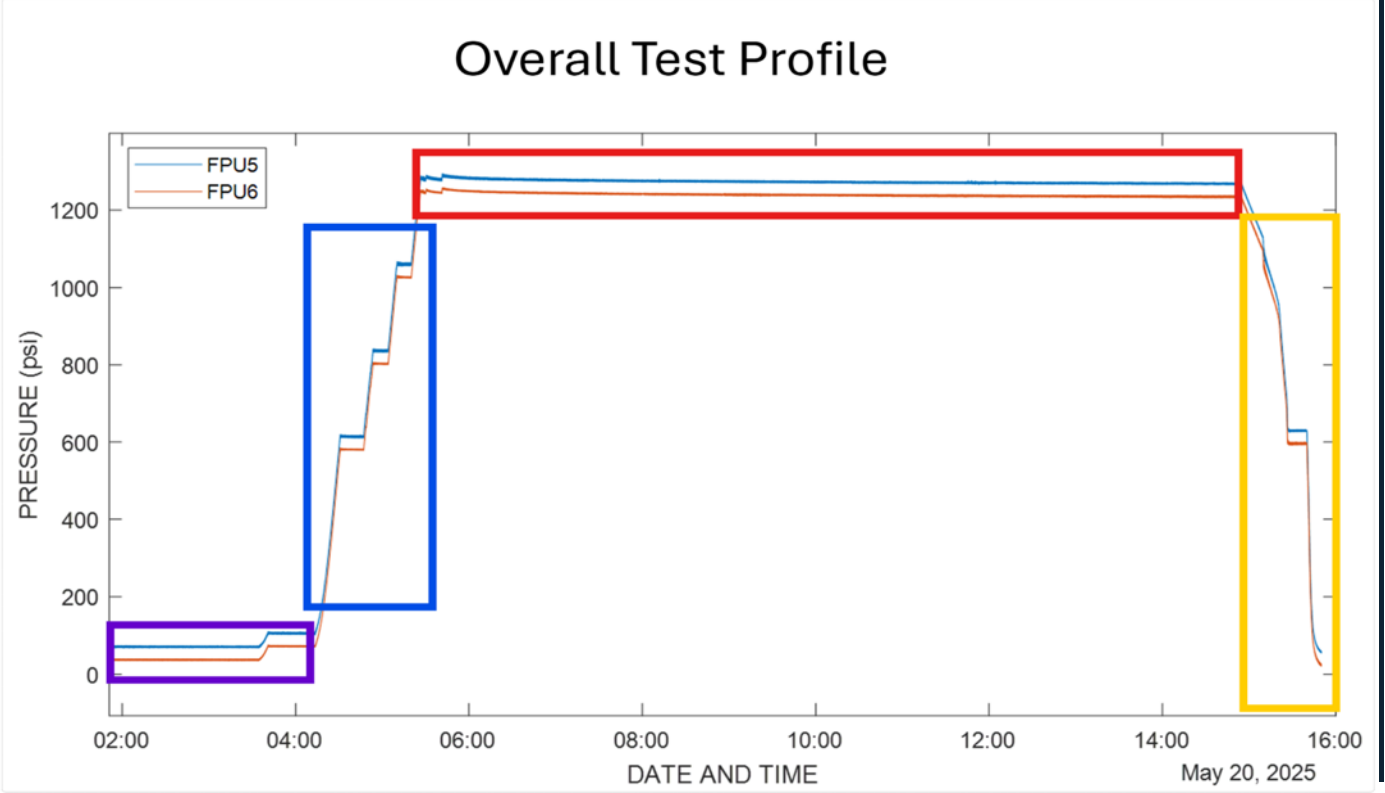
Pump for either filling or pressurizing the test section

Test Measurement

Typical use of crystal gauge(s) and dead weights to measure pressure

Test Recording

Chart recorder and transposed into a table



Typical hydrotest process

Fill → Stabilization → Build Up → Hold → Depressurize → Dewater →

Potential shortcomings of traditional hydrotesting

Paper charts and hand-written notes – poor communication of test progress

No real-time trending

Too short or too long stabilization

Pressure change uncertainty - small leak or temperature related?

No data-driven leak location

Time consuming and costly

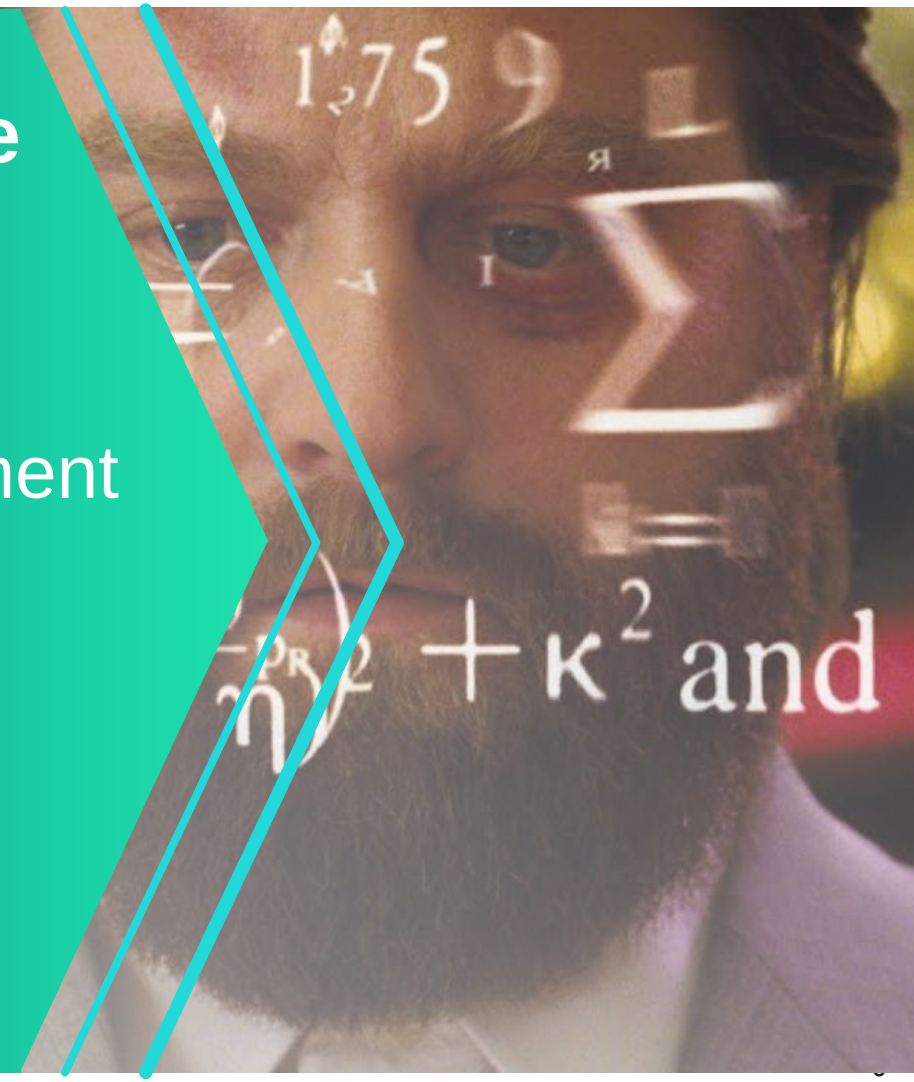
So how can real time data help?

Real-time data can help **identify and locate hydrotest leaks** whilst **improving test efficiency**

First, rugged, reliable data acquisition equipment

Second, we need to fix temperature measurement

Third, displaying meaningful real time data



Pipeline Sensors

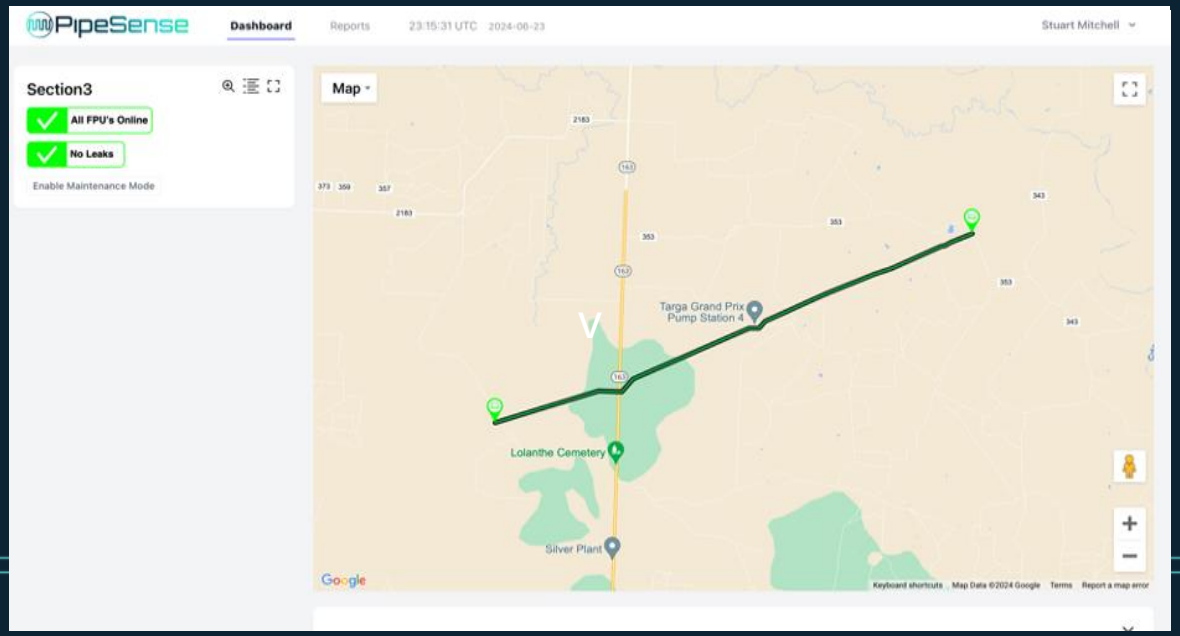
- Easy to attach to threaded connection on test header
- High speed data at 1 kHz allows for detailed view of pressure
- Easy to locate and install wireless ground temperature probes

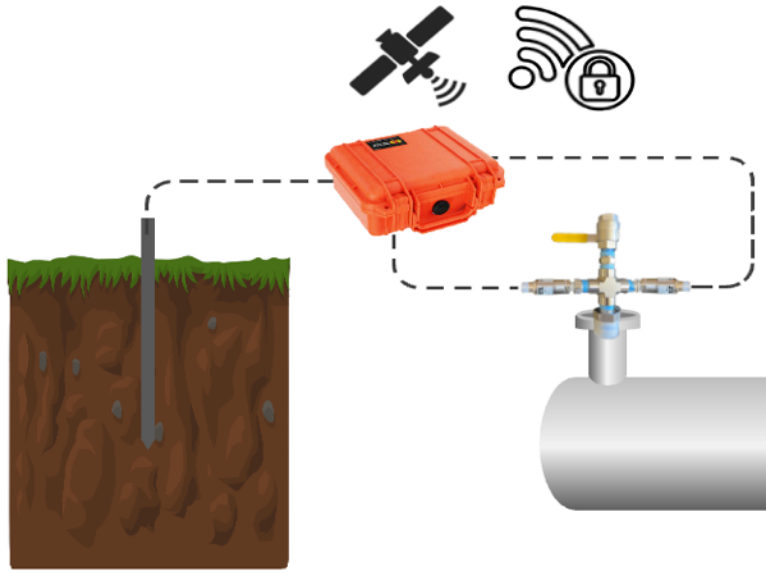
Processing Hardware

- Rugged field proven industrial hardware in a portable peli-case
- Low power requirement (around 100W)
- Built in Starlink ensures solid remote site communications

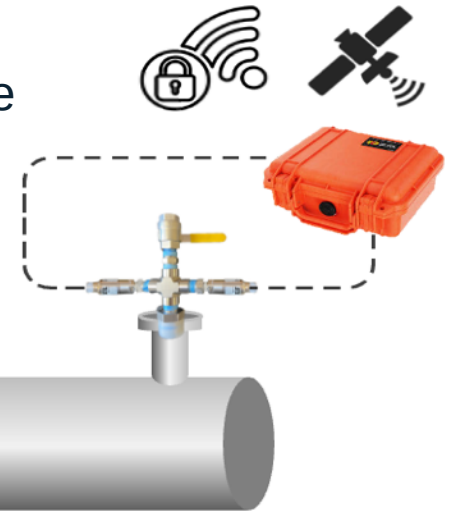
Leak Notification & Location

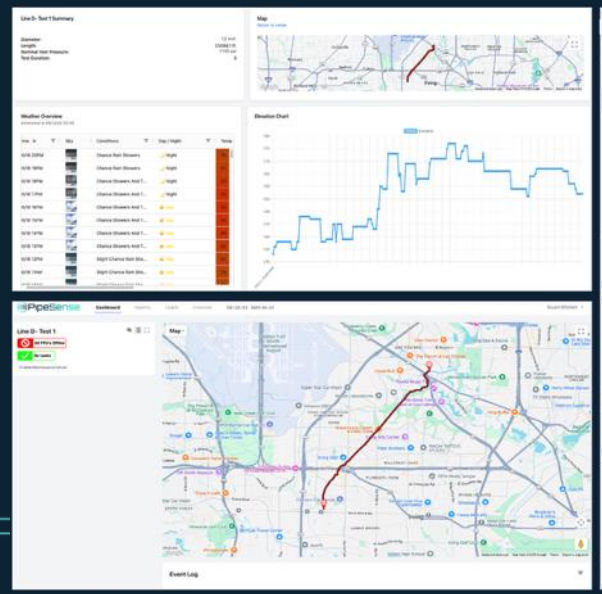
- Simple yet informative user interface
- Accurately confirms leak detection and calculates and displays leak location
- Site personnel notification via dashboard, text, or web app
- NEW LIVE DASHBOARD
- Real time pressure readout and trends
- Temperature corrected pressure
- Includes leak location

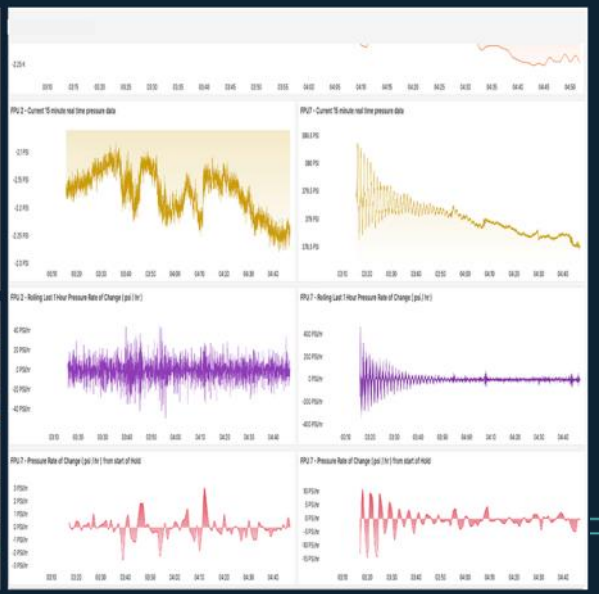




- 1 kHz pressure sampling both ends
- Water temperature sampling during fill and squeeze
- Fully wireless portable ground temperature probes
- Data acquisition, real-time processing & data streaming using Starlink







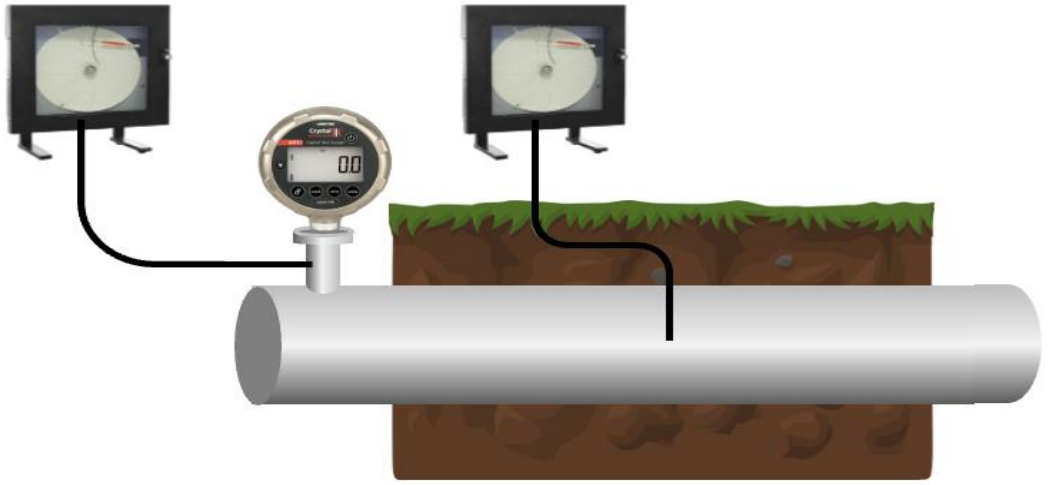
Temperature ..... traditional

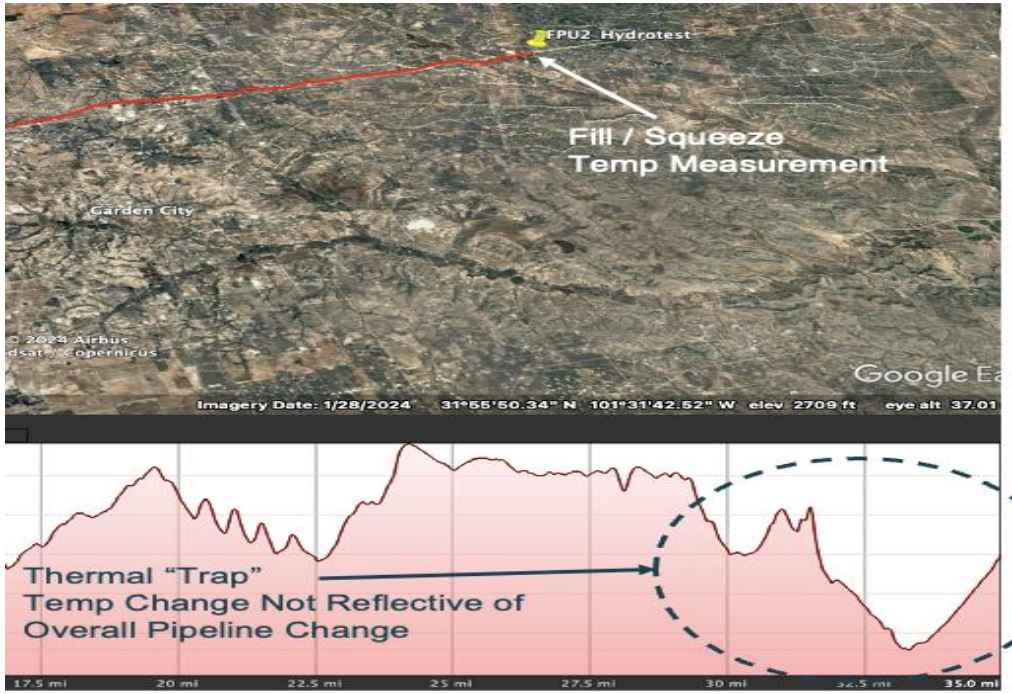
HOW

- Measures pipe skin temperature
- Can be misleading to measure local temperature
- Local measurement used to decide if a pipe is leaking or not
- Often by “feel” or by offline calculation

ISSUES

- Not representative of impact to overall pipeline pressure
- Impacted by fill / squeeze water temp, especially large volume with elevation change
- Not real-time





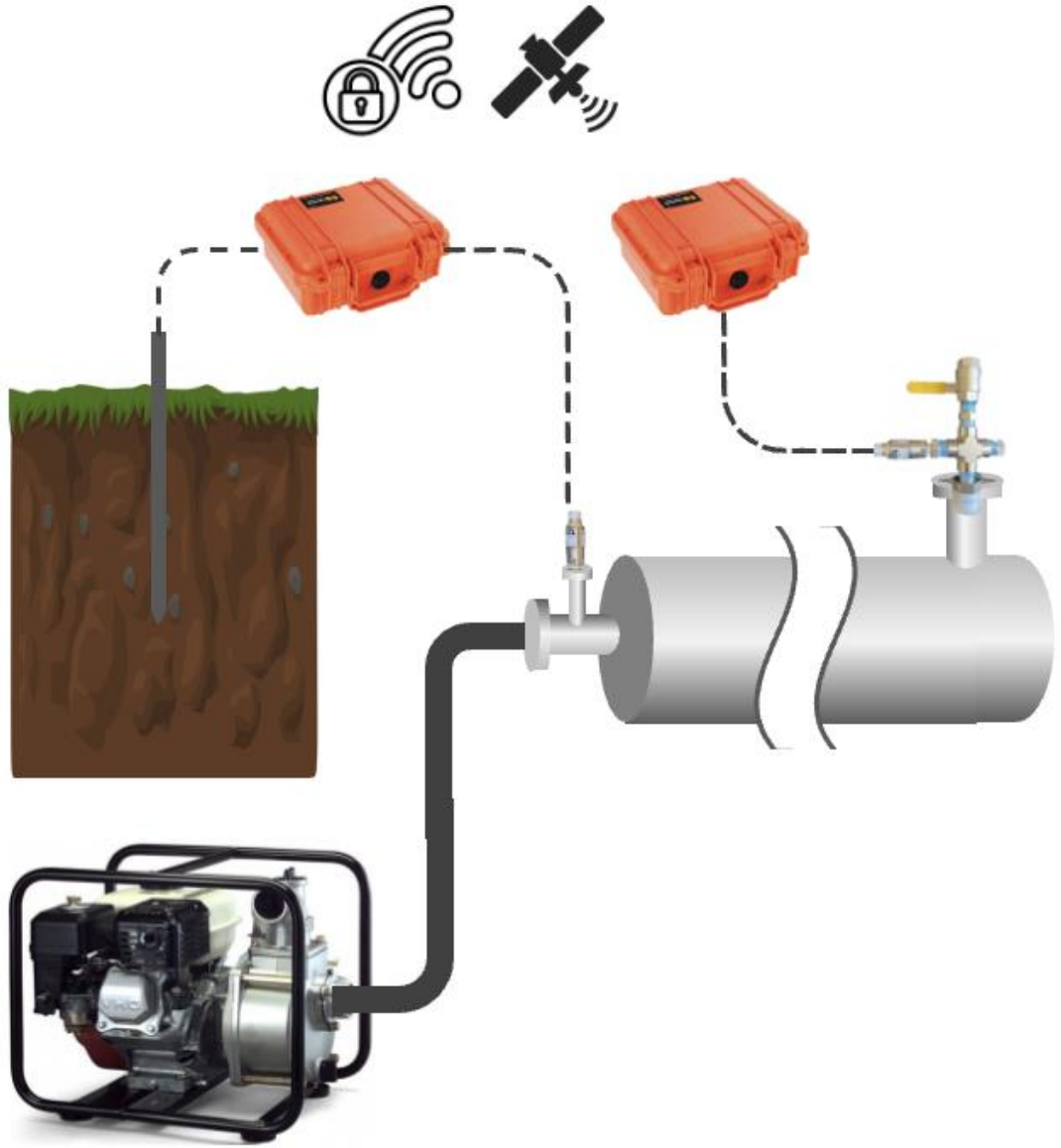
Temperature ..... new approach

HOW

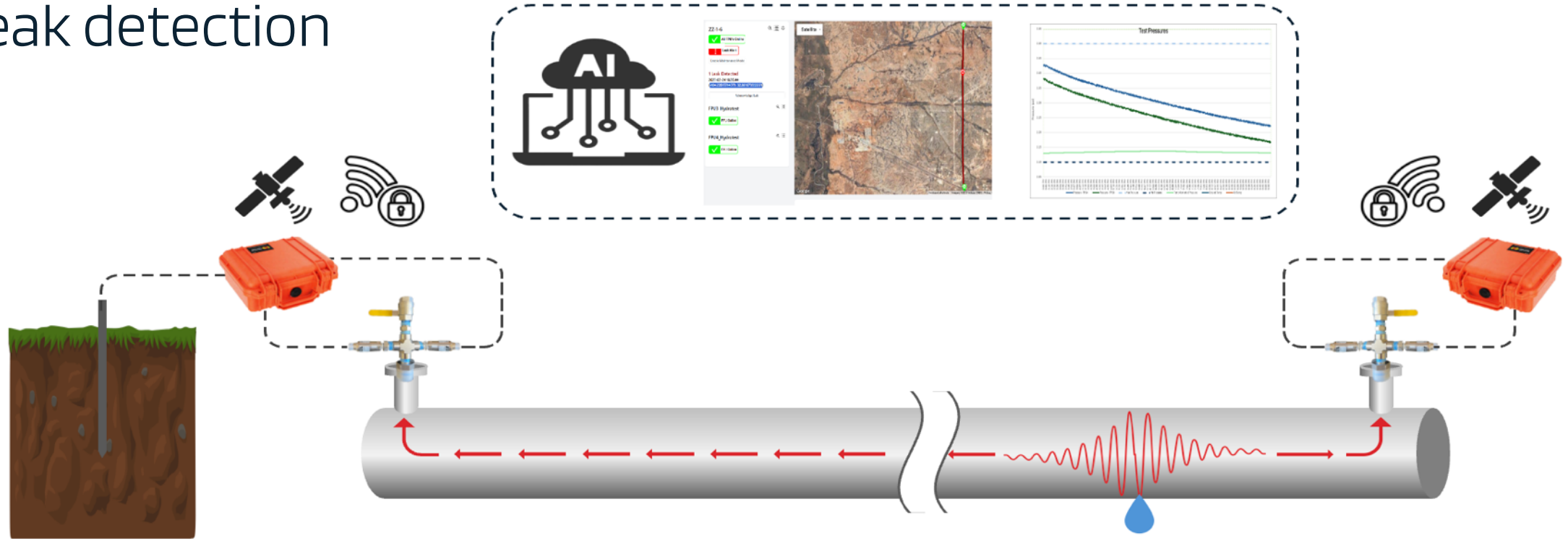
- Real-time samples volume and temperature of fill & squeeze water
- Easy measurement of soil temperature at pipeline depth
- Impact to pressure calculated from total thermal loss to surrounding soil

BENEFITS

- Not sensitive to local variations in pipeline temperature
- Especially effective for large volume pipelines with elevation change
- Enables data driven real-time temperature correct pressure to be provided during stabilization and test



Leak detection



Pressure Pulse

New leak creates pressure pulse

Transmission

Pulse travels in water to hit sensors

Detection

Real-time pulse detection and using AI to confirm leak

Location

Location is calculated based on timing difference

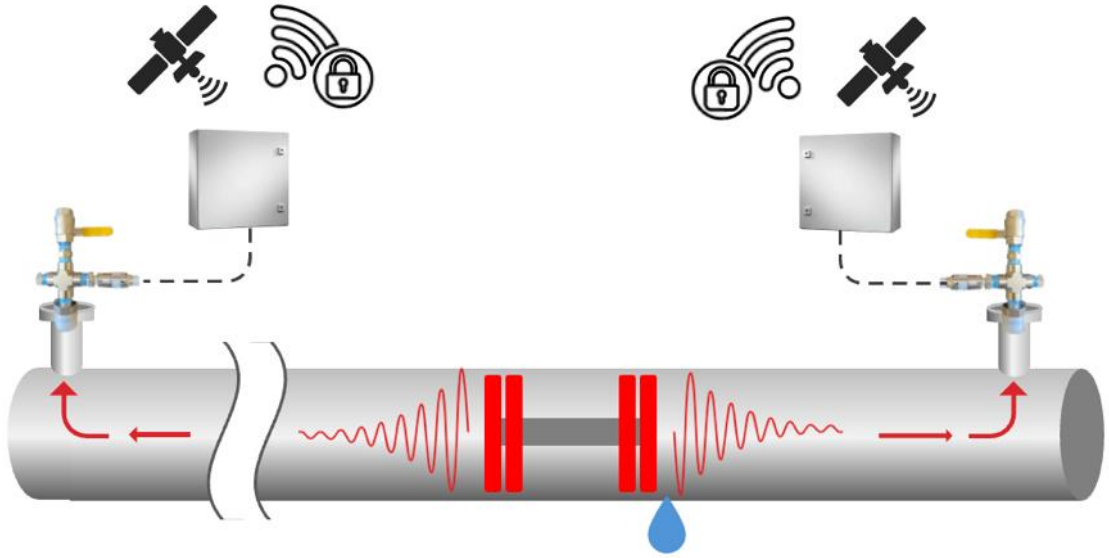
Fill – Pre-existing leaks

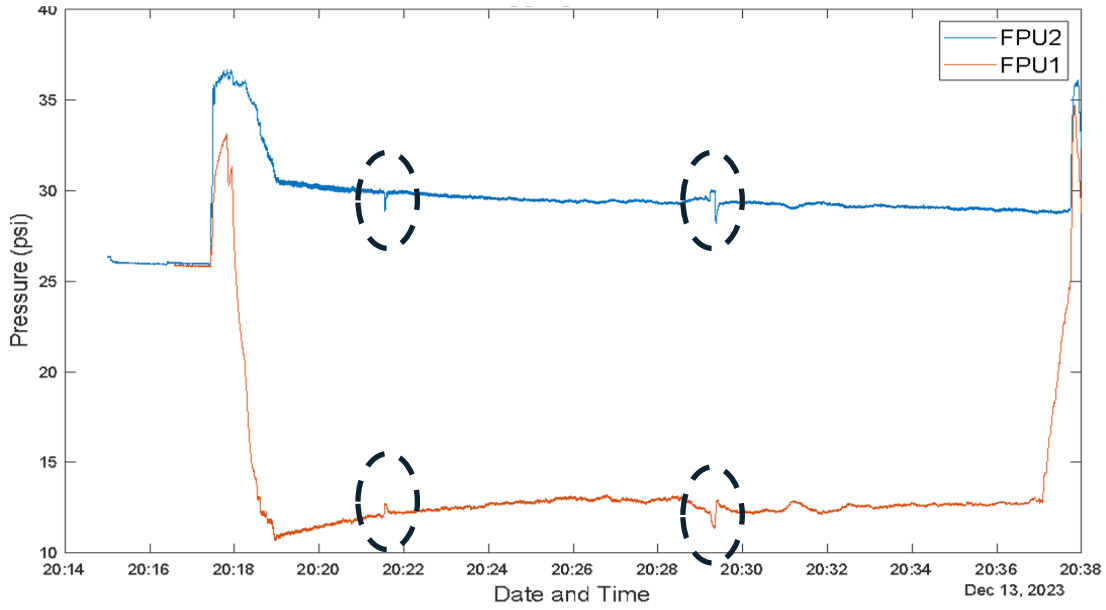
HOW

- Looks for unrepaired leaks during water fill
- Non disruptive – performed during normal pig fill run
- Checks for pressure pulse generated by pig passing over leak
- Leak must be open at pigging pressure
- The more pressure the better

BENEFITS

- Saves time by not carrying a small leak through stabilization and into test





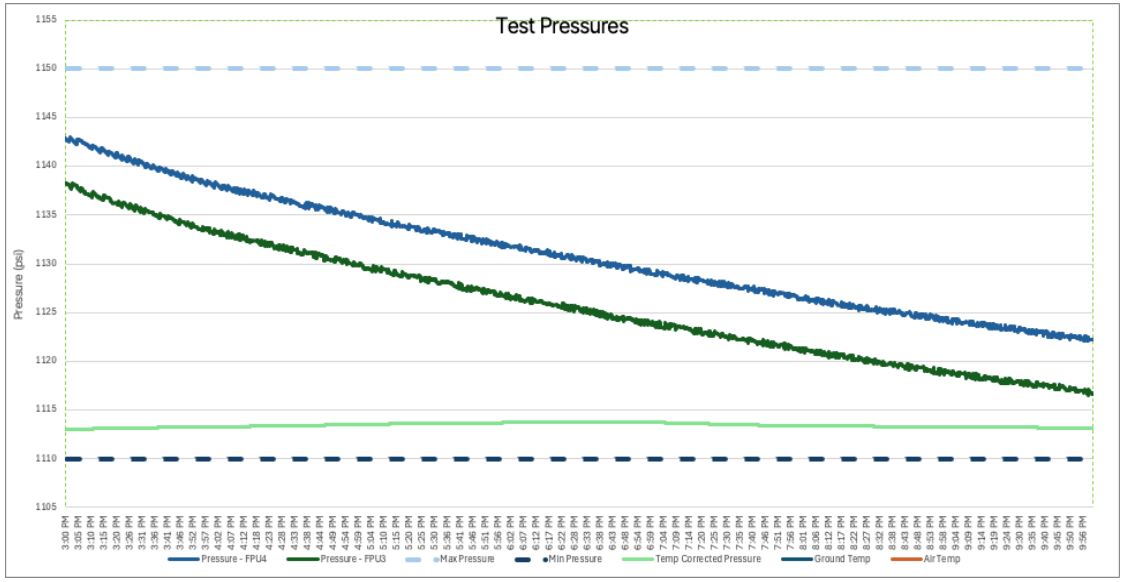
Stabilization – new leaks

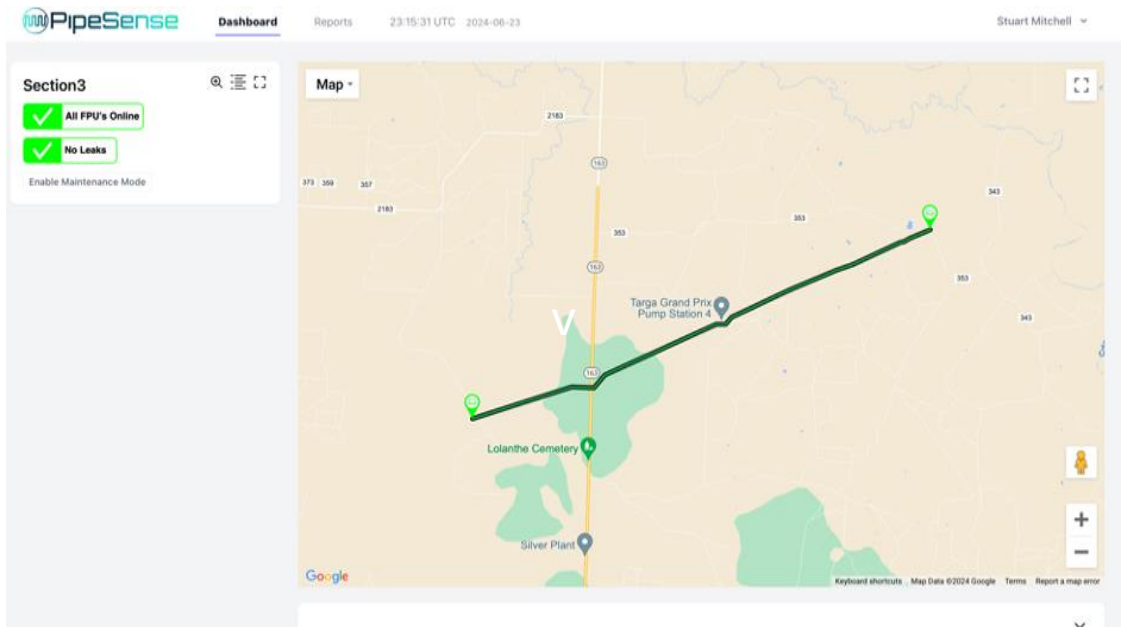
HOW

- Automated leak detection looks for new pressure pulses
- Accurately trend pressures from both ends
- Temperature corrected pressure provides true stabilized pressure floor

BENEFITS

- Accurately detects and locates new leaks
- Ensures pipe has truly stabilized
- Can shorten stabilization
- Ensures pressure drop is not carried through to main test





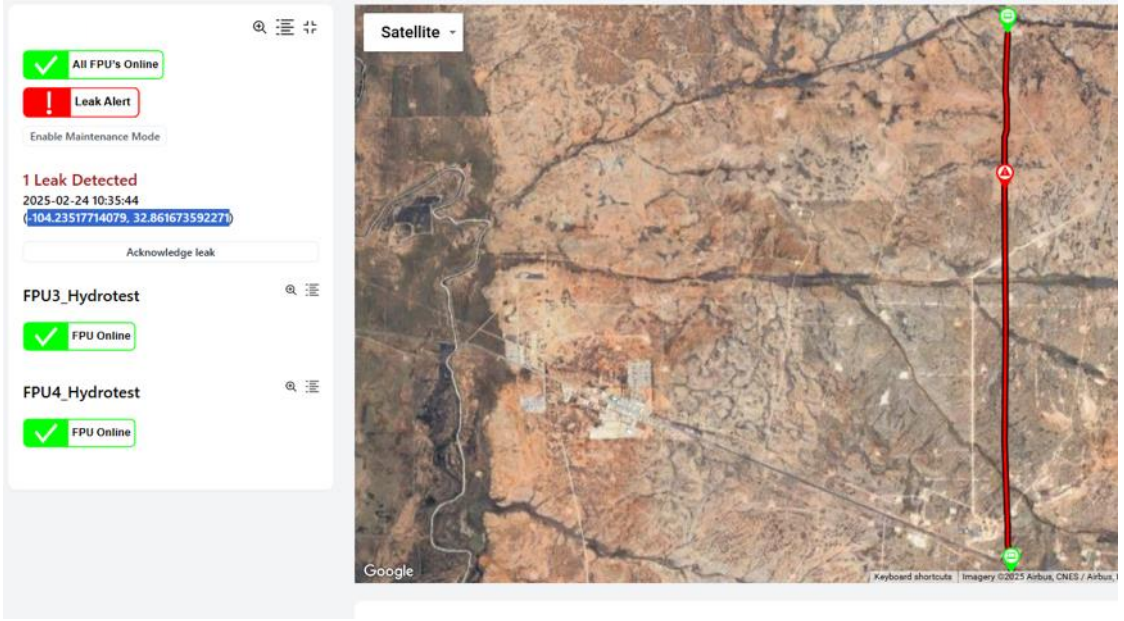
Pressurization / hold – new leaks

HOW

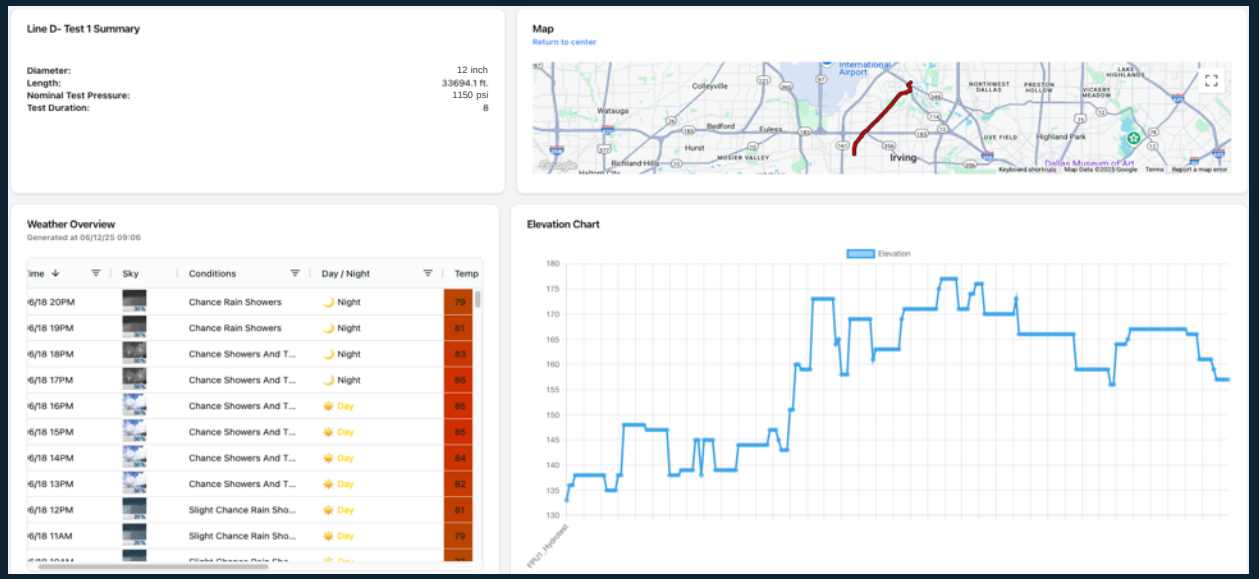
- Automated leak detection looks for new pressure pulses
- Accurately trend pressures from both ends
- Temperature corrected pressure provides true stabilized pressure floor

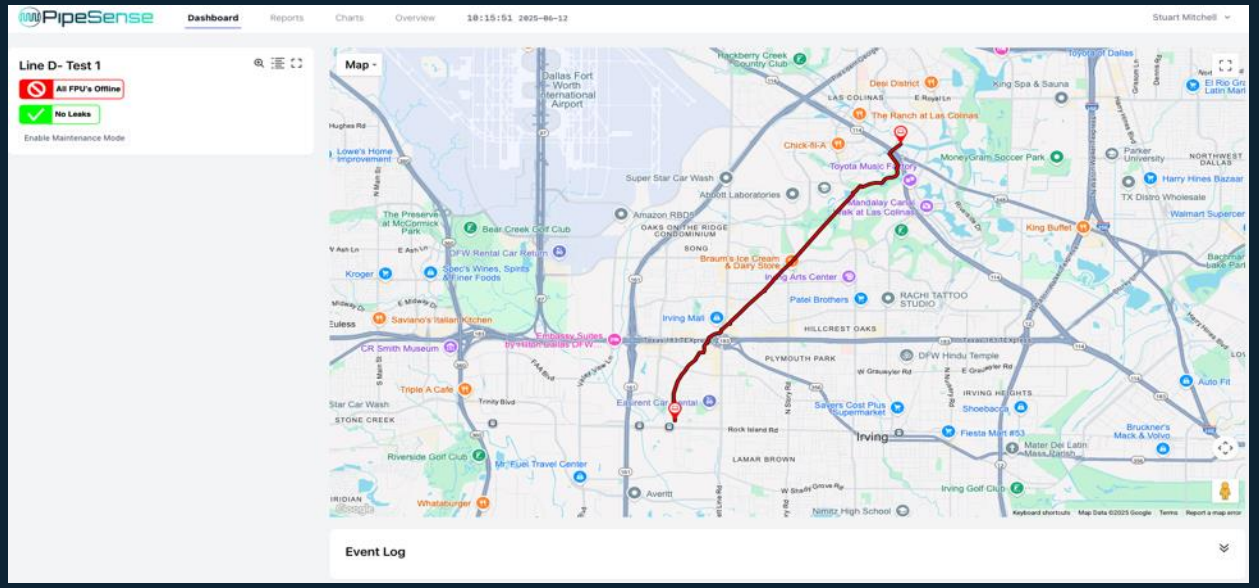
BENEFITS

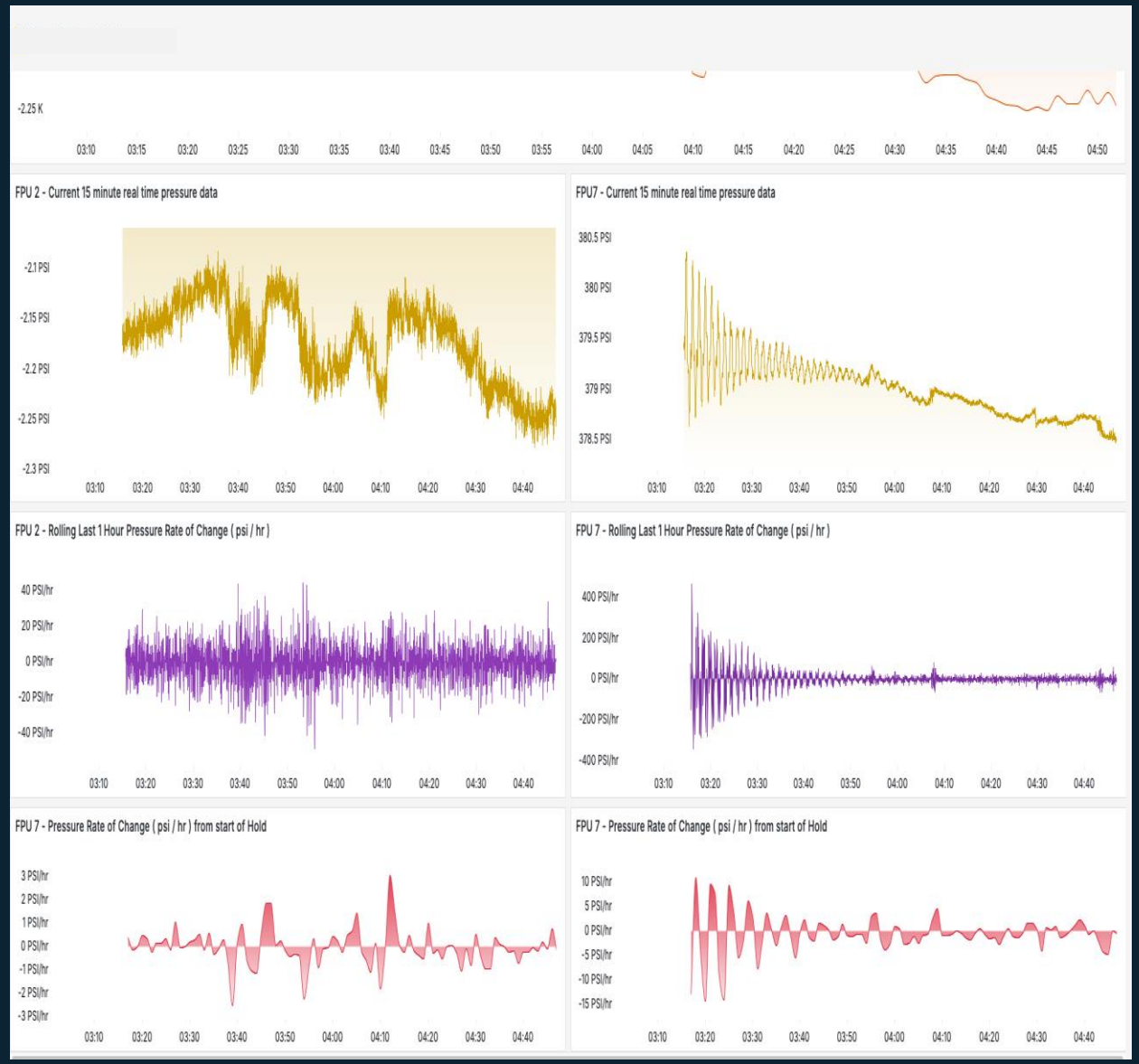
- Accurately detects and locates new leaks
- Separates temperature related pressure decline from very small leaks
- Prevents a bad test being incorrectly called
- Prevents chasing ghost “leaks” with temperature decline



Real-time hydrotest dashboard





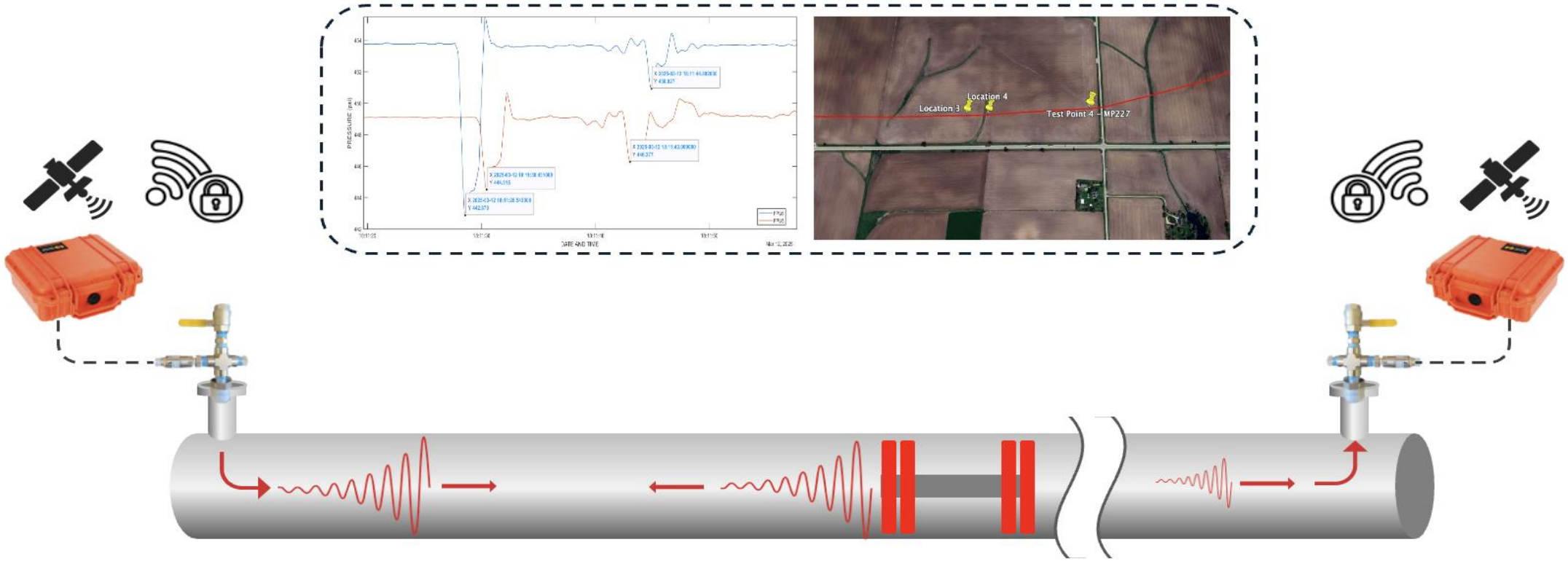


Main Test Benefits

Well designed data acquisition and processing

- Quick and easy to install
- 100% non-disruptive to the ongoing testing
- Real-time temperature corrected pressure data provides highly accurate view of “true pressure”
- Allows for accurate stabilization and identification of the smallest of leaks
- Identify newly formed leaks in real-time, with accurate leak location, typically around 100 ft
- Highly accurate digital record of pressure from both ends
- Detailed report which can supplement and re-enforce, even replace, your main hydrotest submission
- Added confidence for a 100% successful test with zero leaks

What happens if/when a pig goes missing?



Pressure Pulse

Short pressure release at sensor manifold

Transmission

Pulse travels in pipeline contents to hit blockage and reflect signal

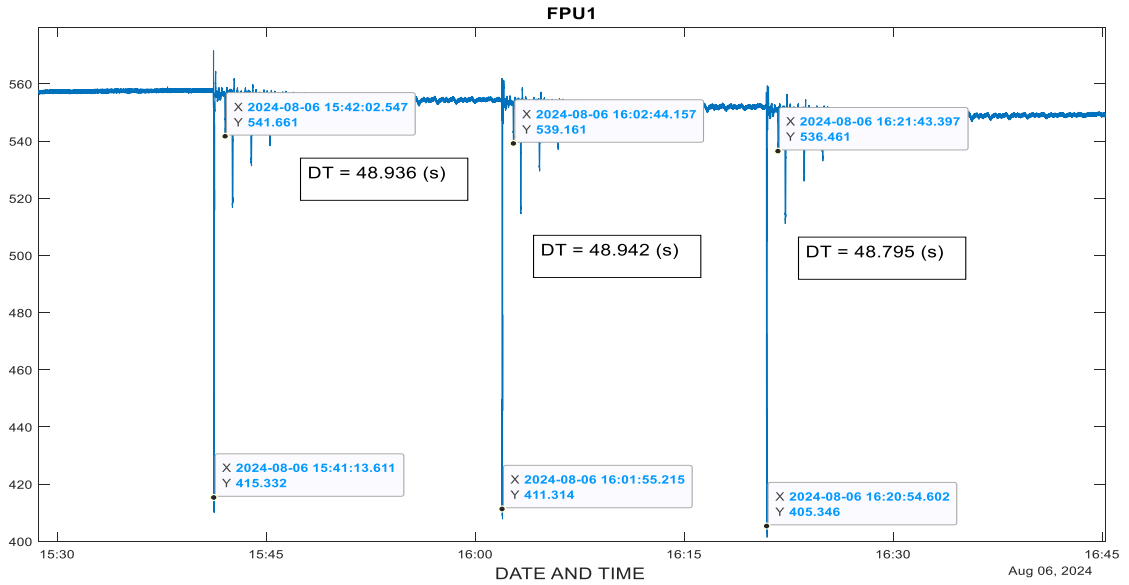
Detection

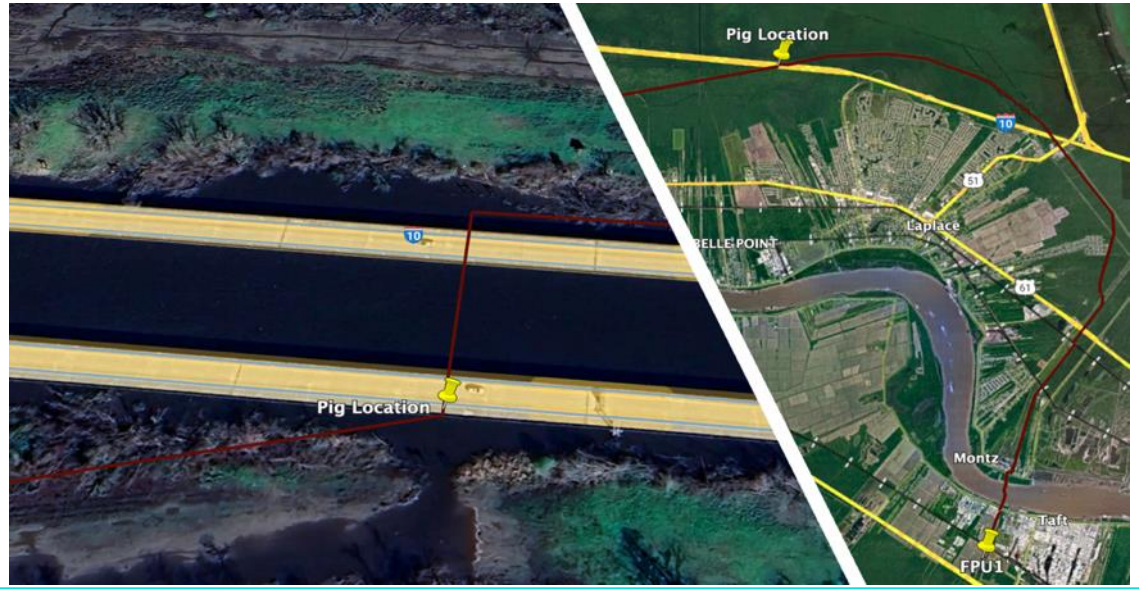
Signal is received back at release sensor and time of flight determined

Location

Location is calculated based on timing difference and speed of sound

Real life simple execution





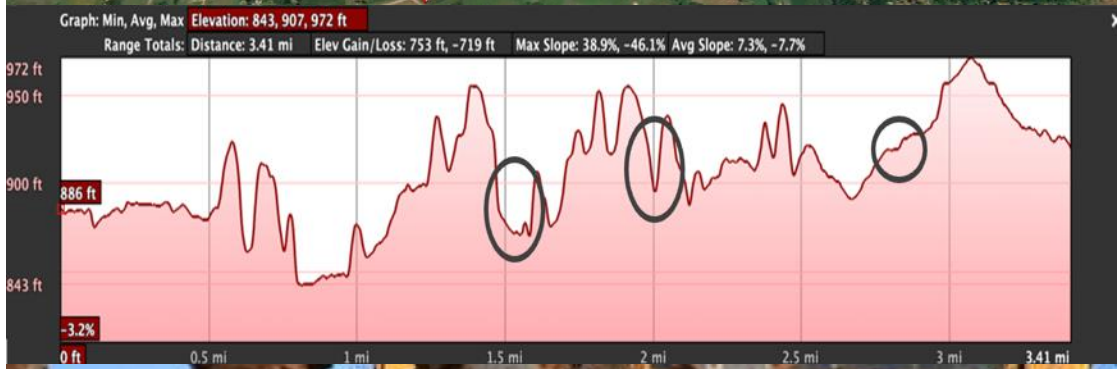
Execution

- Equipment installation
- Three (3) releases from each location
- Process data and map

Main Benefits

Can quickly and accurately find lost pigs (and other things)

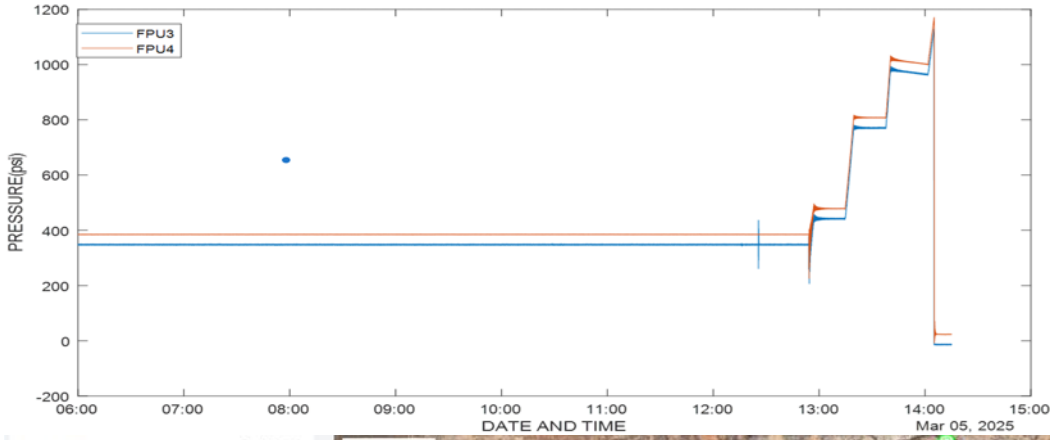
- Same equipment as for hydrotest monitoring
- Fully portable solution for even the most remote locations
- Quickly and accurately detect and locate pipeline blockages
  - Stuck pigs and pig remnants
  - Hydrate plugs
  - Faulty valves and closed check valves
- Preliminary location provided within 4-6 hours
- Can find multiple blockages or objects in same pipeline section
- Saves time and money compared to standard location techniques

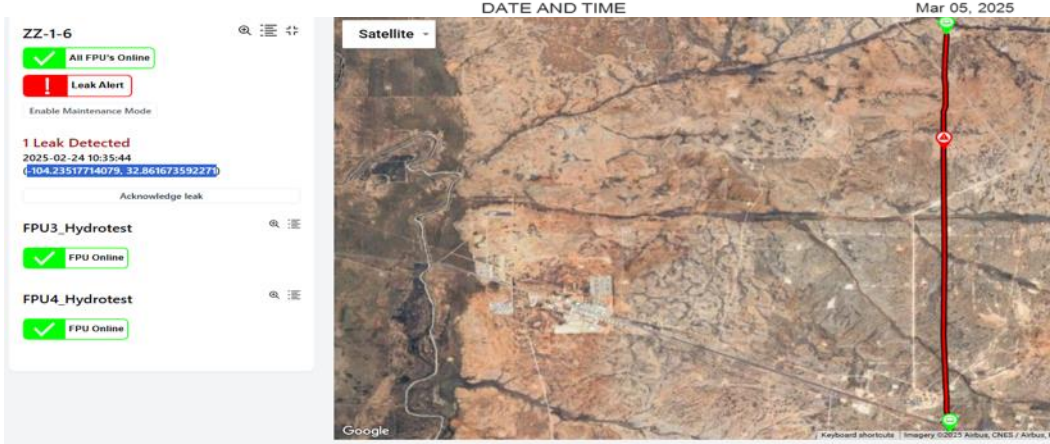


Case Studies

New Mexico PipeTest & PipeScan

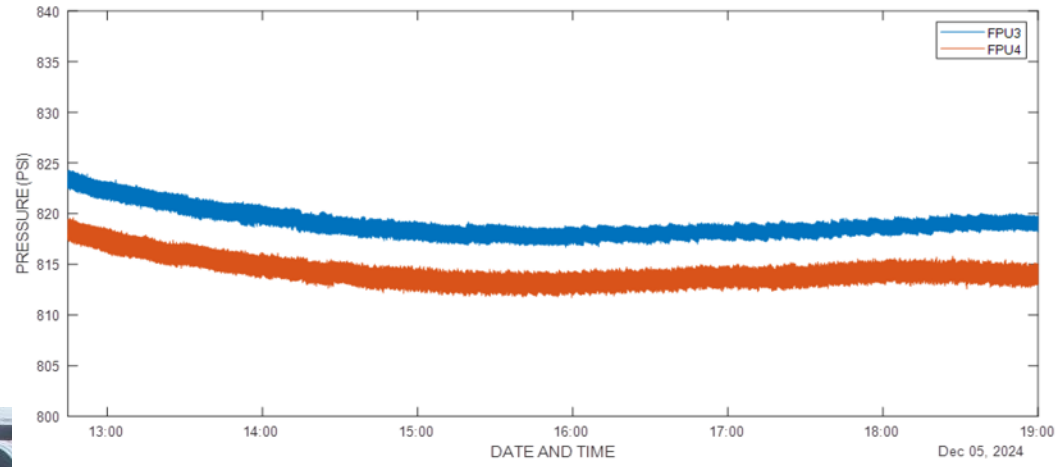
- 13.4-mile section of 8.625” pipeline
- Test pressures up to 1,180 psi
- Monitored fill, & pressure up
- Located stuck pig during fill – contractor was able to successfully remove
- Detected pipeline leak in real time
- Provided real time leak location
- Leak location accuracy within 111 ft
- Saved operator both pig location and leak location time

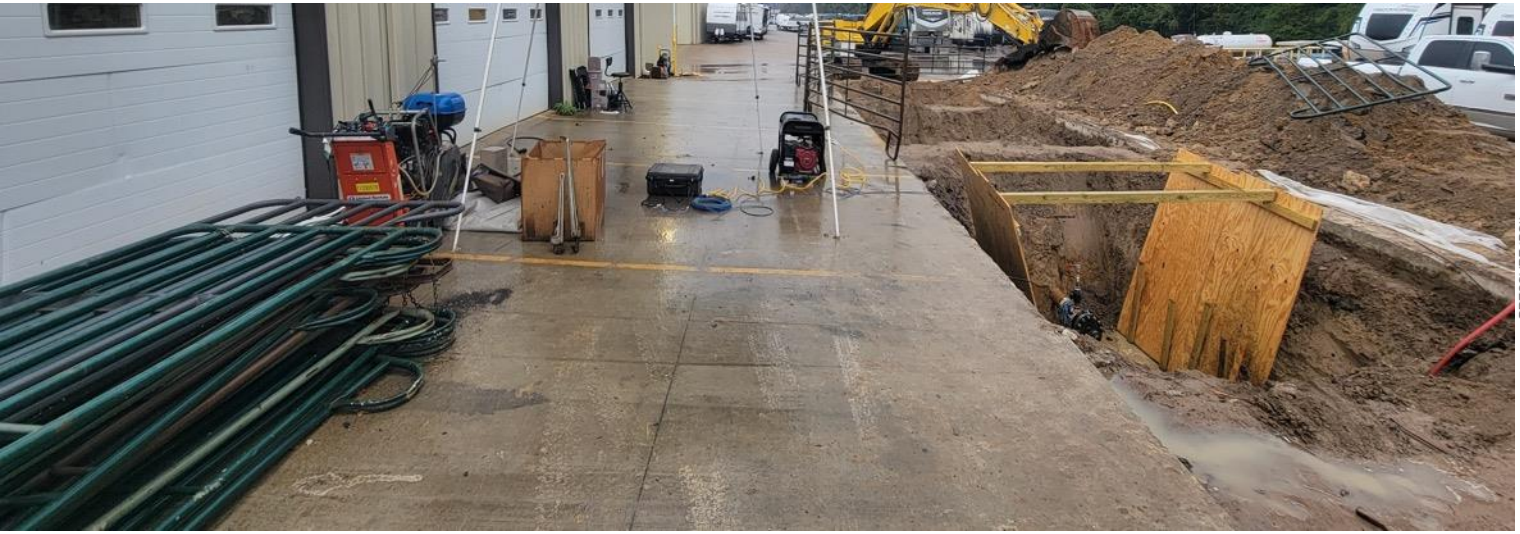


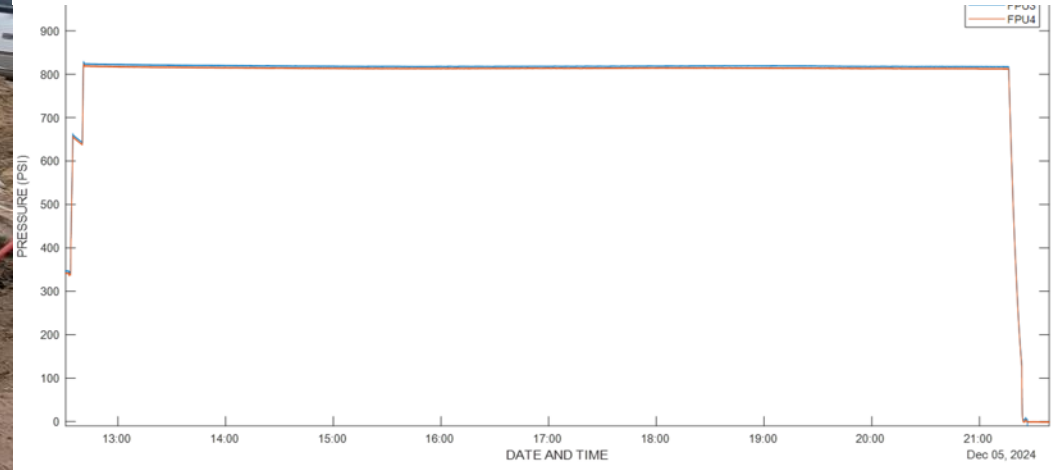


Texas PipeTest & PipeScan

- 957 ft section of 6” pipeline
- Test pressures up to 820 psi
- Used pig and temperature corrected pressure monitoring to look for suspected pre-existing leak
- Our monitoring and pig run showed no leak – client had been chasing for two (2) weeks!
- Following confirmation of zero leaks, successfully monitored hydrotest next day

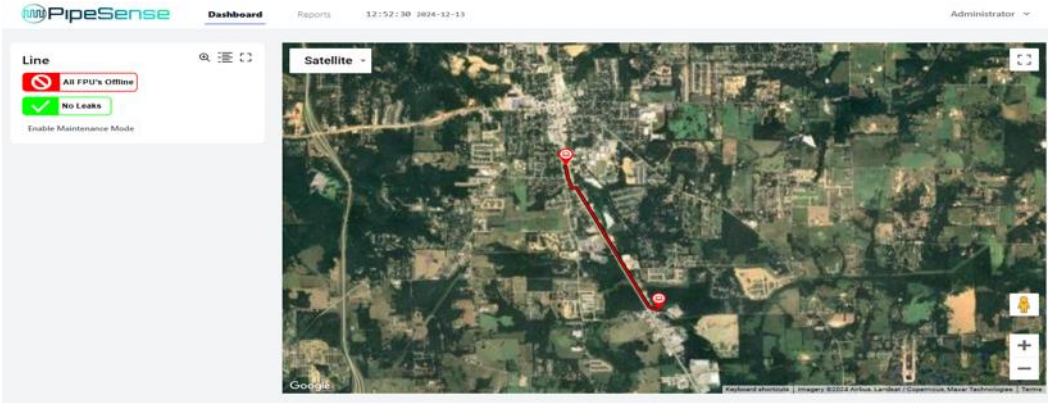


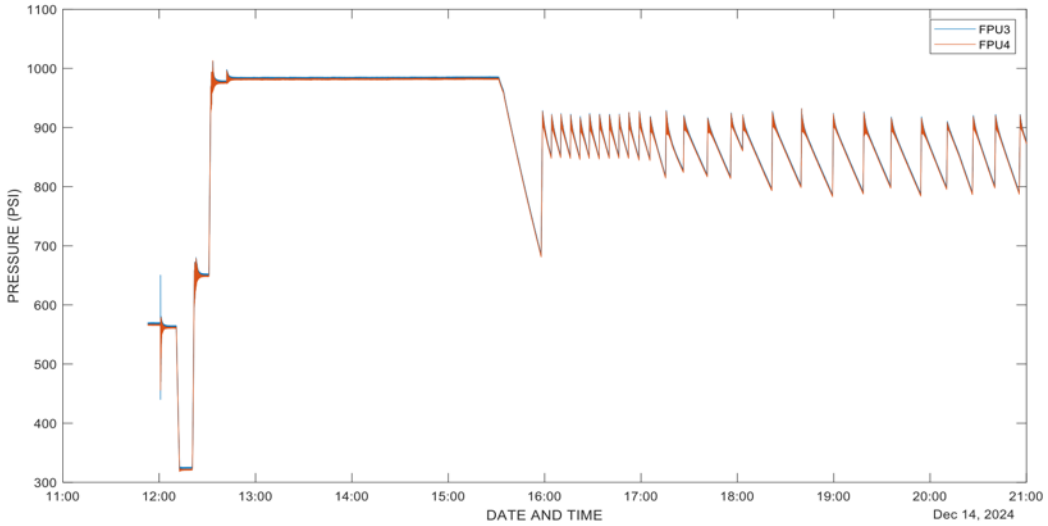


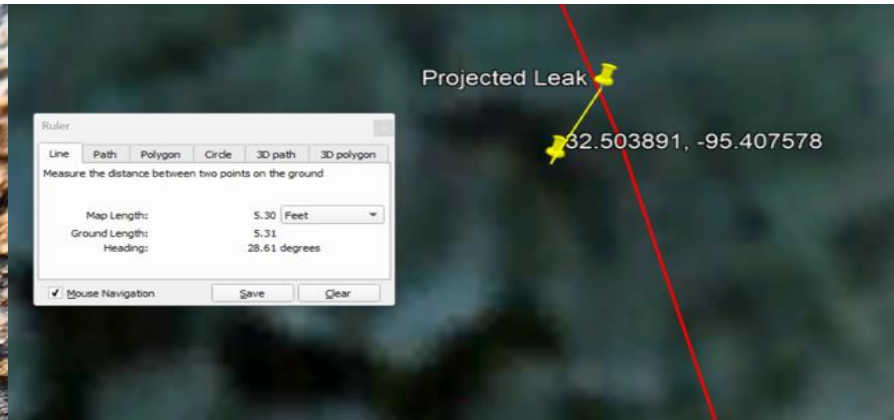


Texas PipeTest

- 9,116 ft section of 6” pipeline
- Test pressures up to 985 psi
- Monitored fill, pressure up, hold and dewater
- Leak detected three (3) hours into test
- Location provided to contractor and leak location confirmed
- Leak between 1/32” and 1/16’ at 6’o’clock on 6 ft deep buried pipeline
- Leak location also detected and confirmed on dewater
- Leak repaired at pipeline retested within 36 hours

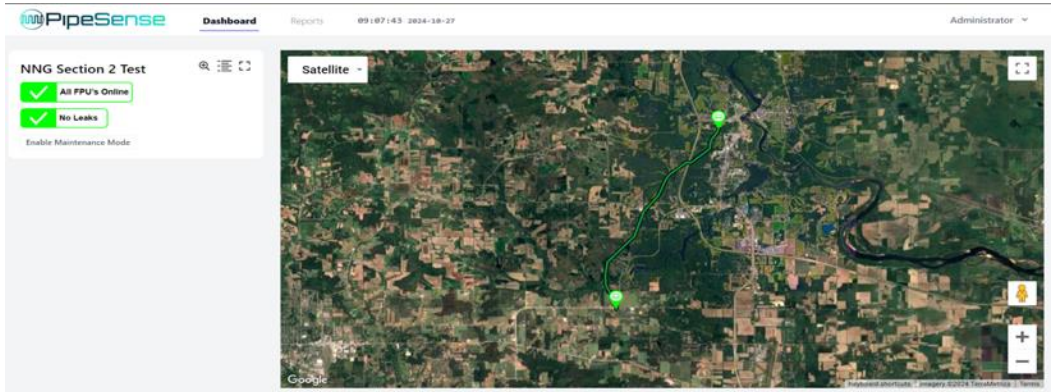


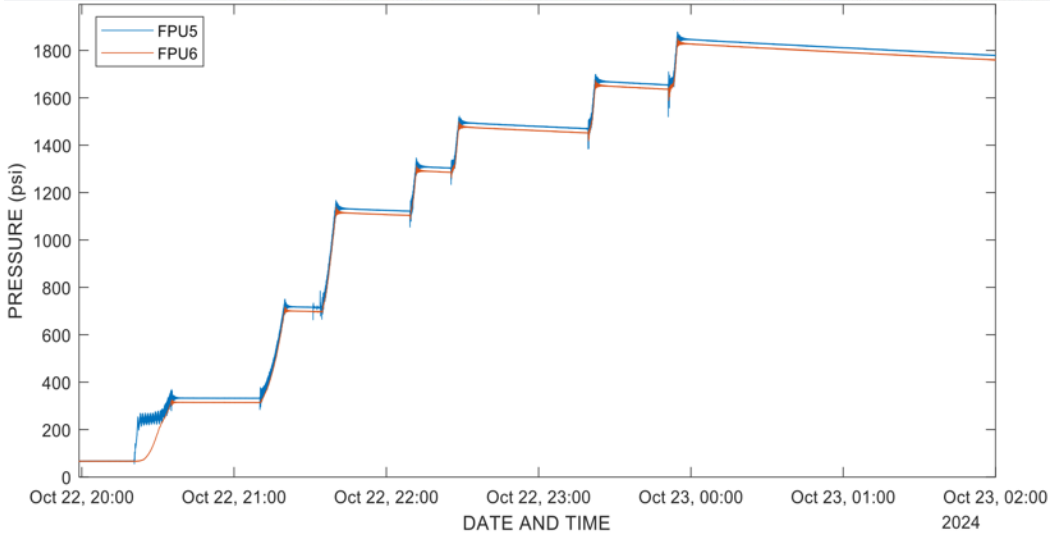


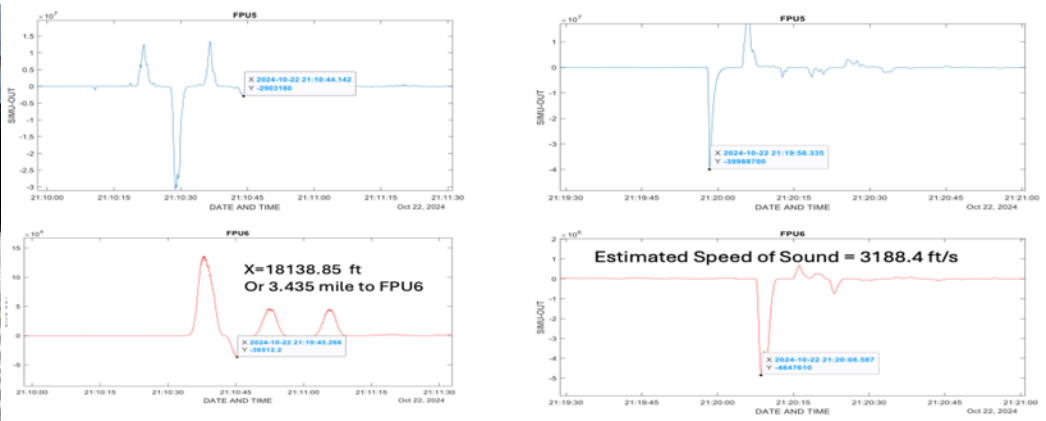


Wisconsin PipeTest

- 32,688 ft section of 4” pipeline
- Test pressures up to 1,840 psi
- Monitored fill, pressure up, hold of 1st and 2nd test
- Identified by drop off in pressure in pressure up and hold
- No pig used for fill process – lack of clear comms by PipeSense over need to use pigs to detect pre-existing leaks
- Leak identified as unidentified branch line leaking from test section into plant as pre-existing leak
- Despite being pre-existing PipeSense was still able to identify location of the leak from pressure data

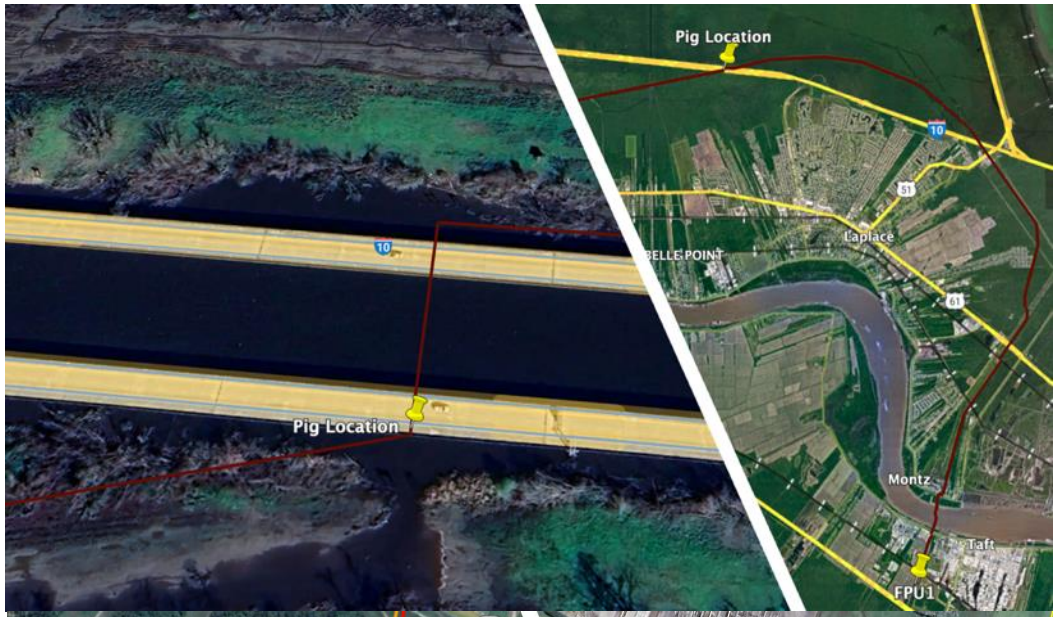


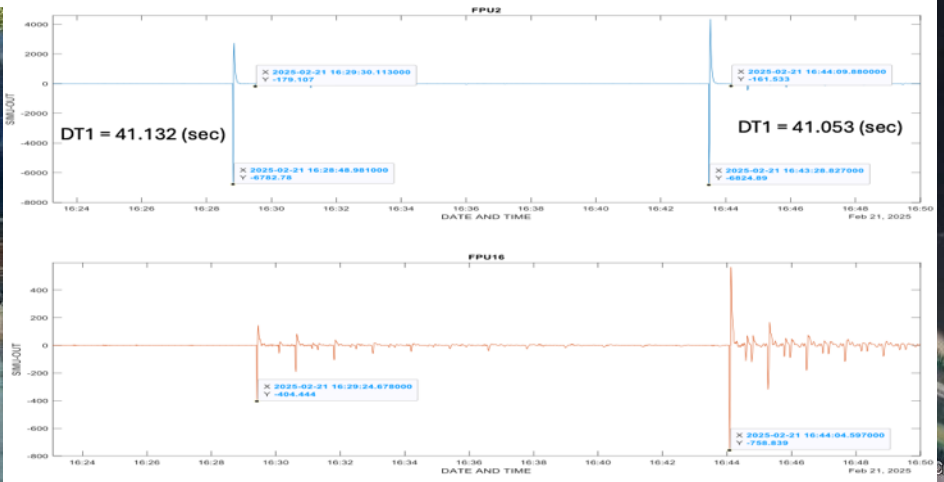




Louisiana PipeScan

- 22.53-mile section of 6” pipeline
- 550 – 600 psi of static liquid butane pipeline
- Broken off back section of ILI tool stuck in pipeline
- 90% flow still being achieved so only partial blockage
- Pig location originally identified as being south side of I-10
- Additional testing, analysis and most importantly new KMZ file and ILI data positioned pig just to north of I-10
- Linear distances were altered due to change in line length, therefore speed of sound and location





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Questions?

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