

# A NOVEL APPROACH FOR DETERMINATION OF LIQUIDS IN PIPELINES



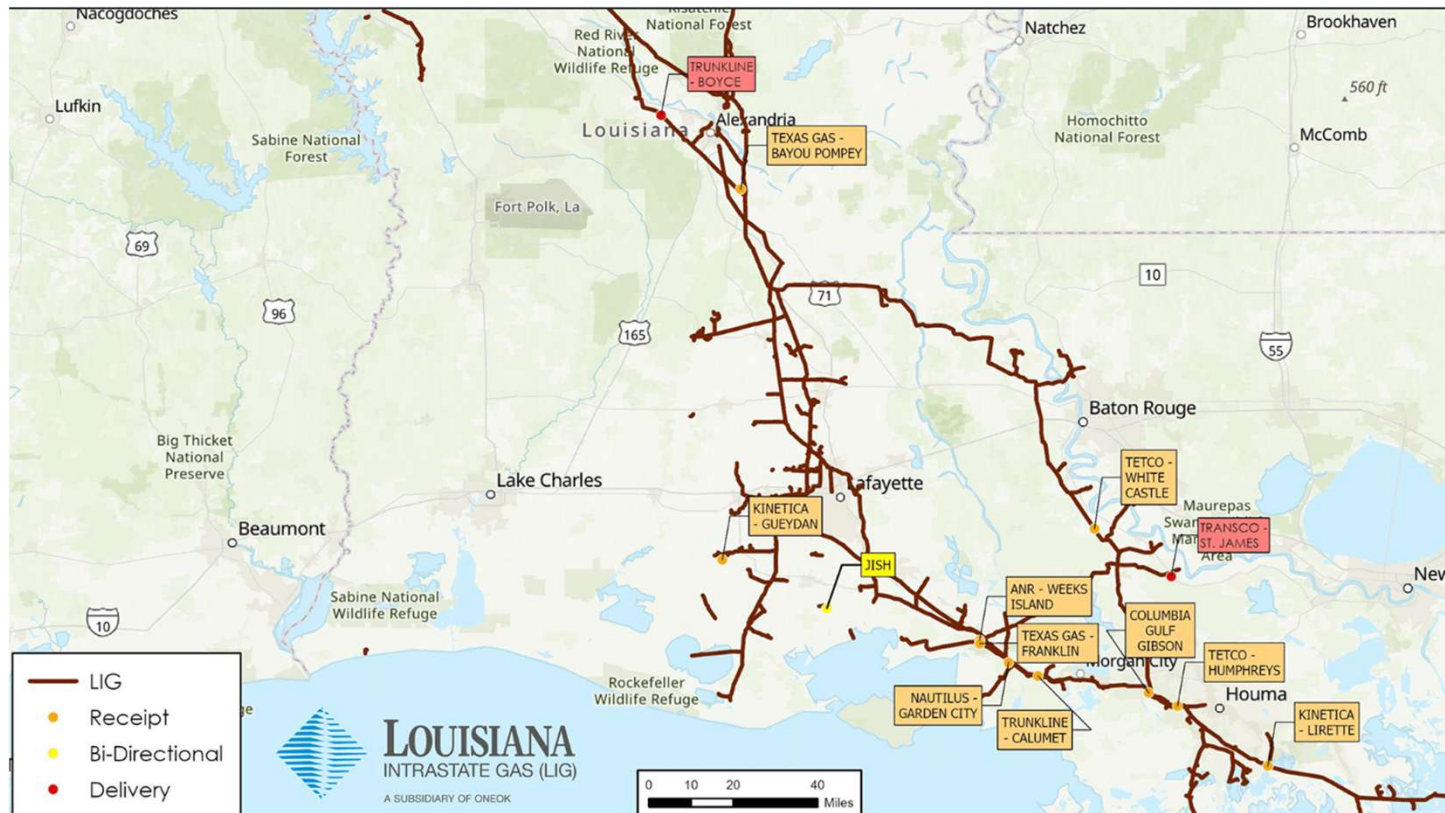
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# The First Use of Ultrasonic Diagnostics



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## Diagnostic Lessons from 90's

- Meter Comparisons (Different Technologies)
  - Turbine Meter vs Ultrasonic Meter
  - Orifice Meter vs Ultrasonic Meter
- Speed of Sound as Diagnostic Tool
  - Helped to differentiate meter problems from
  - Not sensitive enough absolute errors
  - Was impetus for AGA-9 / AGA-10 evolution
- Gas Chromatograph / Ultrasonic Meter Combination
  - Speed of Sound comparisons

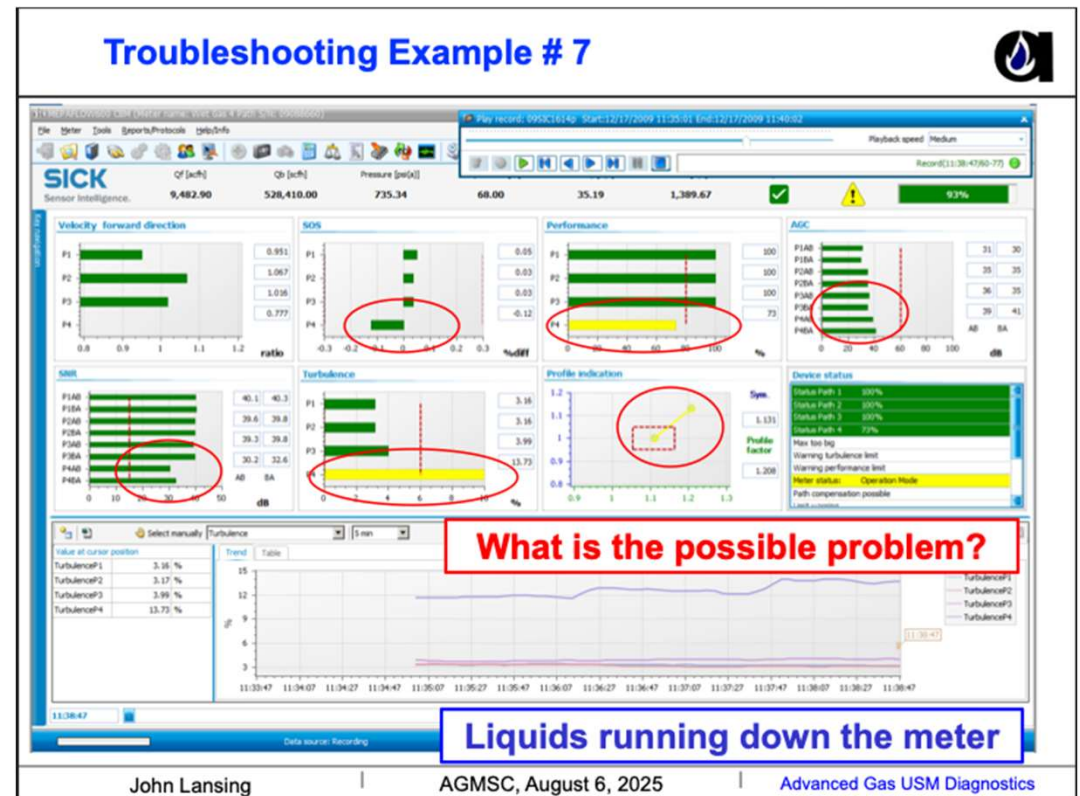


# Growth of Ultrasonic Meter Diagnostics



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- Internal meter issues
  - Gas properties
  - Flow dynamics
    - Crossflow
    - Swirl
    - Assymetry
- Abnormal pipeline conditions
  - Blockages
  - Liquids



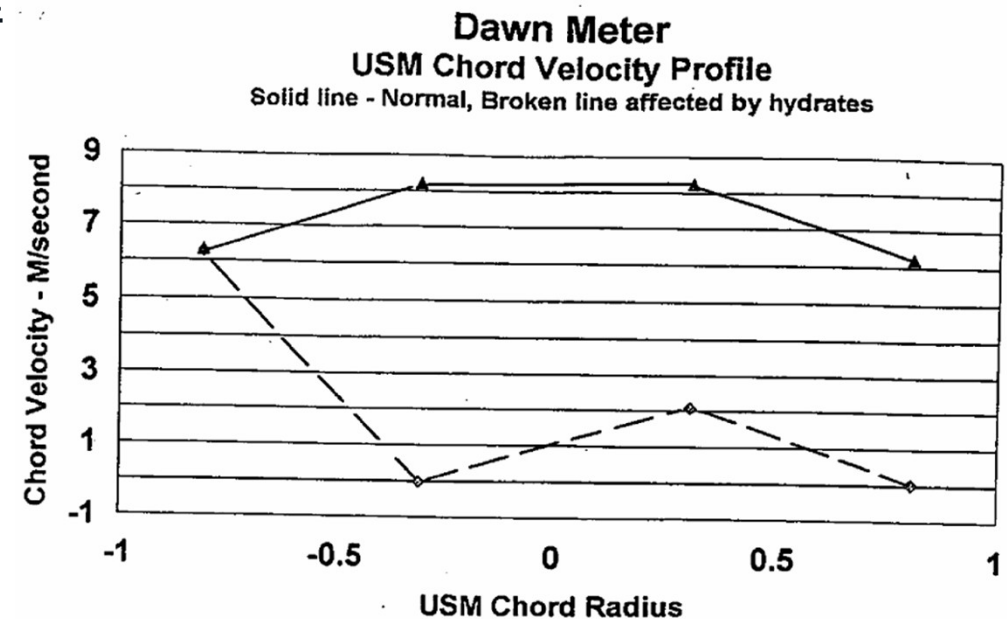


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## Area of Special Concern - Liquids

### Ultrasonic Wet Gas Measurement in Late 90's

- Klaus Zanker / Gordon Stobie
- Wet Gas Studies at NEL / CEESI
- Hydrocarbon Dewpoint
  - Chromatography
  - HCDP / DP Detectors





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## Unresolved Issues with Fluids

- Most USM diagnostic methods are inferential
  - Speed of Sound
  - Velocity Profiles
  - Direct Path Measurements
- Chromatography methods have inherent flaws
  - Samples are not representative of total contents (fluid / gas)
  - Fluids variations are vast (velocities / types / profiles)
  - Calculated HCDP values are highly sensitive to heavier components
- Direct HCDP methods are difficult at line conditions

# What is the Novel Approach?



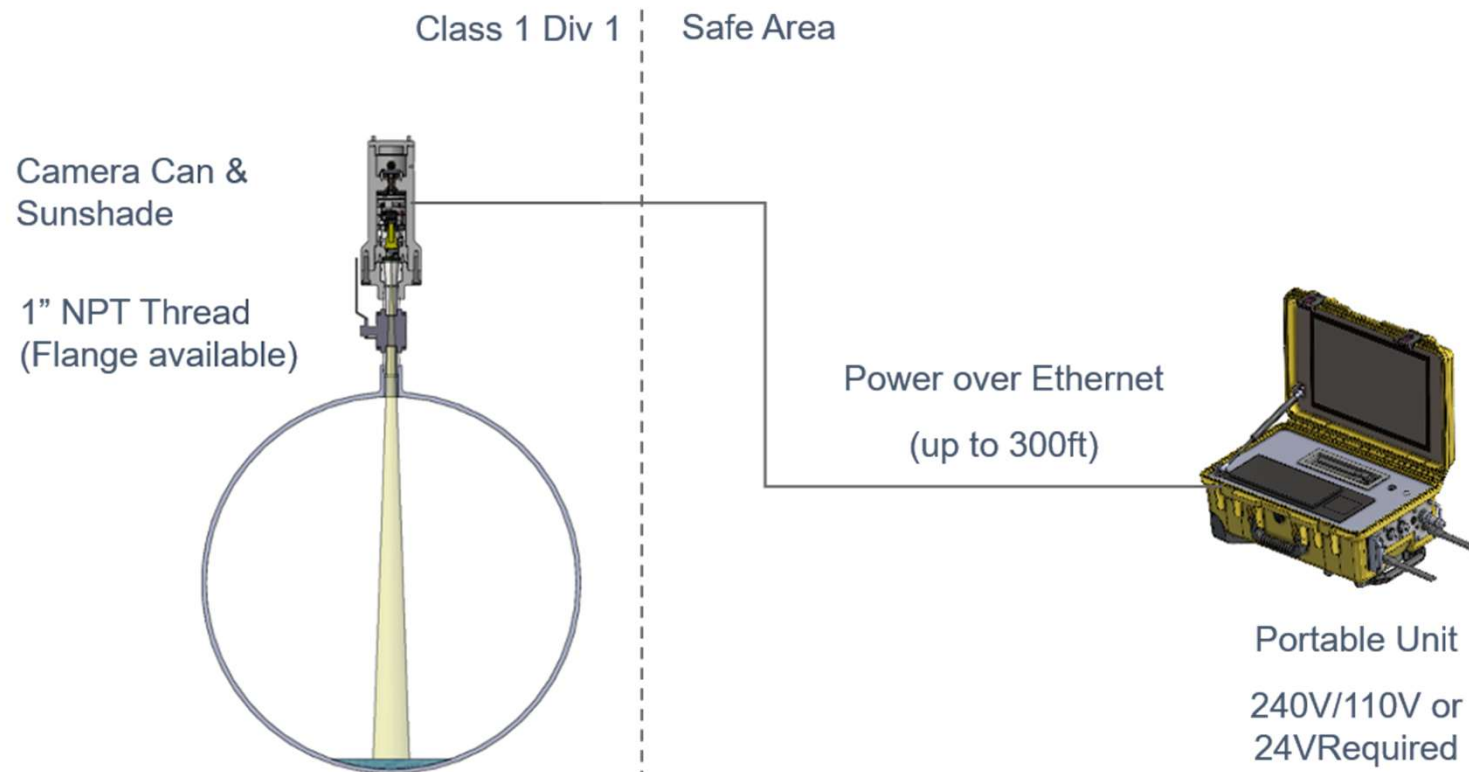
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Insert a camera directly into the pipeline to determine if fluids are present and if so, what are they and how are they moving

# LineVu Camera System



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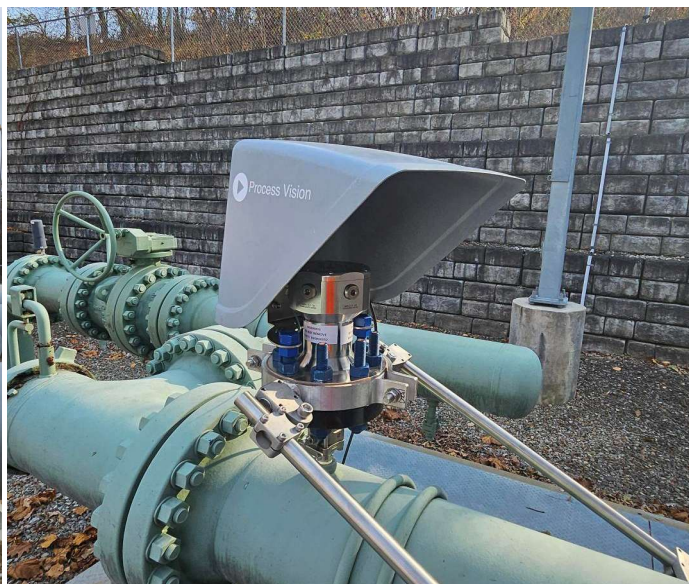




# LineVu Installation Examples



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LINEVU CAMERA  
1" NPT

SUNSHADE KIT

TAPPING HEIGHT

SPACER PLATE,  
CPA & (3) GASKETS

1" TOL NIPPLE VALVE

ULTRASONIC METER

1" TOL NIPPLE, VALVE, PLUG

Dimensions (inches):

- Top section: 5" (width), 2 3/4" (height), 1" (height), 1" (height)
- Horizontal dimensions: 1' - 1 1/4" (total), 6" (segment), 8" (segment), 9 3/8" (segment), 10 3/4" (segment), 1' - 5" (segment), 1" (segment), 1' (segment), 1" (segment), 6" (segment), 6" (segment), 6" (segment), 6" (segment), 8" (segment), 10 7/16" (segment)
- Bottom section: 2' - 5 5/8" (total), 1" (segment), 1" (segment), 1" (segment), 1" (segment), 4' - 0 5/8" (total), 9' - 0 9/16" (total)

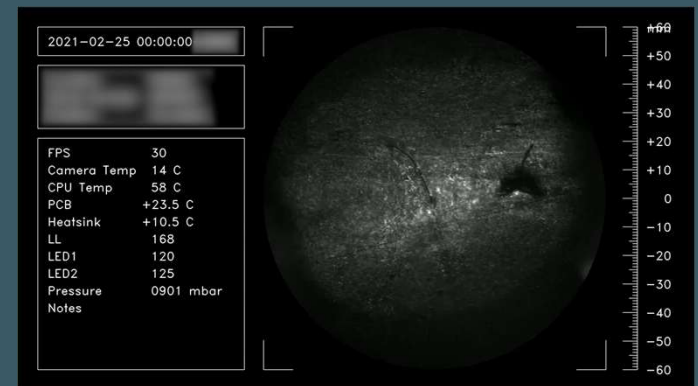
# Liquid Flow Onset – Time Lapse

Gas flow at entry to a gas network.

Time Lapse Video at 1500x speed.

24 hours in 57 seconds.

Gas flow from left to right.



**Thank you – More to Come...**



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