

▶ Measurement Research Update

Program Presentation

Government-Industry R & D Forum

March 23, 2005

Houston, TX

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What a Measurement Program does for the Industry

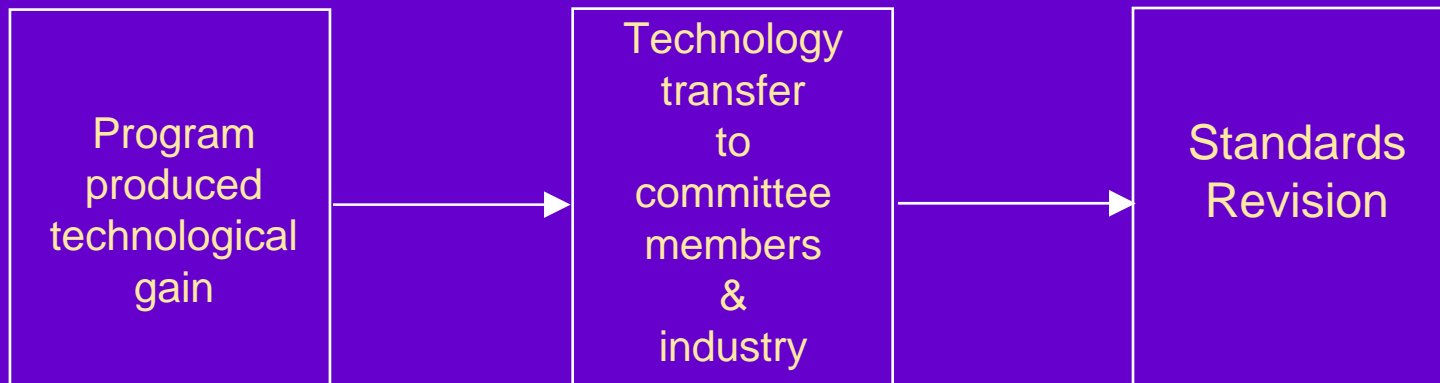
1. Provides an industry forum for recognition of measurement problems and opportunities
2. Enables the industry to find practical solutions to recognized operating problems
3. Provides an efficient means to introducing new technologies to each of our operations
4. Provides a professional, unbiased research & test facility for error recognition and resolution

What a Measurement Program does for the Industry (continued)

5. Provides professional training opportunities for industry technical staff to efficiently transfer technology from the research lab to our operations
6. Provides a stepping stone to review problems in other areas which are related to Measurement
7. Stimulates and expedites change

Producing Change

Metering standards can be a barrier to change, or can enable change



Program Cost Versus Benefit

One study has shown that for every dollar spent on this program
nine dollars were returned

How?

1. Through capital cost savings on new facilities (55% of ROI)
2. Through improving pipeline balance (45% of ROI)

Recent Successes – Ultrasonic Meters

- **Completed Programs Items:**
 - Ultrasonic Meter Performance Characterization as impacted by Application Features
- **Technology Transfer:**
 - AGA Report 9 / ISO TC30/SC5/WG1 WD17089
- **Deliverable Date:**
 - Completed, Standards publication 2005
- **Expected Benefit:**
 - Capital cost reductions of 50% for meter installations & replacements, lower O & M costs, & reduced pressure drop; High financial value

Recent Successes – Gas Sampling & Quality Assurance

- **Completed Programs Items:**
 - Gas Sampling Quality Assurance
- **Technology Transfer:**
 - API Report 14.1
- **Deliverable Date:**
 - Year 2004 completion, Standard Revision Year 2005
- **Expected Benefit:**
 - Operations quality control and cost reduction,
 - Aid to pipeline FERC tariff filings
 - High financial value

Recent Successes – Orifice Meters

- **Completed Programs Items:**
 - Orifice Meter expansion factor calculation changes
- **Technology Transfer:**
 - AGA Report 3 / API Report 14.3
- **Deliverable Date:**
 - Year 2004 completion, Standard Revision Year 2005
- **Expected Benefit:**
 - Avoidance of changing flow computers, operations guidance;
 - High financial value

Recent Successes – Turbine Meters

- **Completed Programs Items:**
 - Turbine Meters O&M Practices
- **Technology Transfer:**
 - AGA Report 7
- **Deliverable Date:**
 - Year 2004 completion, Standard Revision Year 2004
- **Expected Benefit:**
 - Reduced O&M costs, operations guidance;
 - Moderate financial value

Recent Successes – Coriolis Meters

- **Completed Programs Items:**
 - Coriolis Meter Performance Evaluations
- **Technology Transfer:**
 - AGA Report 11
- **Deliverable Date:**
 - Completed, 2003
- **Expected Benefit:**
 - Capital cost reductions of 30% on low flow meter installations, e.g.: power plants & industrial sites;
Moderate financial value

Industry Drivers for Future Measurement Projects

- **Efficiency Improvement opportunities:**

- High financial returns
 - 21 TCF market approximately with 30 TCF future forecast
 - 0.35% imbalance typical
 - Financial opportunity assuming 0.1% improvement:

Current Annual U. S. Natural Gas Market

	<u>\$4 gas</u>	<u>\$6 gas</u>	<u>\$8 gas</u>
Imbalance	\$300 M/yr	\$450 M/yr	\$600 M/yr
Opportunity	\$85.7 M/yr	\$128.5 M/yr	\$171.4 M/yr

Industry Drivers for Future Measurement Projects

- **Discussions before FERC concerning:**
 - Hydrocarbon dew point tariff filings – gas quality enforcement
 - Gas Interchangeability
 - Involved organizations:
 - FERC
 - INGAA
 - NGC
 - AGA, & others

Industry Drivers for Future Measurement Projects

- **Need for O & M Reductions:**
 - Operating practices are being scrutinized for cost efficiencies
 - Risk based service basis as an industry standard is desired

2005 Program

- **Direct Energy Meter Joint Industry Project**
 - Eight member companies
 - SWRI/GTI – I.P. holders
 - YZ Industries – Commercialization Partner
 - Target commercial product in Q1 of 2006
- Test results are good BTU calculation within 1 – 2 BTU/CF
- Opportunity for industry participation

2005 Program

- **Hydrocarbon Dew point Prediction**
 - Follow up on 2004 project results
 - Provide suggestions for modifications of P. R. and S. R. K. equations of state

2005 Program

- **Water vapor detection in Natural Gas**
 - Determine appropriate sample system design requirements for installation of on-line analyzers

2005 Program

- **Evaluate hydrocarbon dew point detection devices**
 - Project RFP to be developed
 - Two new device proposals – SwRI & GTI
 - Consumer reports type testing - CEESI

2005 Program

- **Evaluate high speed heating value measurement devices**
 - Project RFP to be developed
 - Results will be valuable to LNG terminal operators for blending and gas engine manufacturers as a fuel quality monitor

2005 Program JIP Opportunities

- Orifice Plate Compliance
- In situ meter transfer proving
- Ultrasonic noise effect on USMs
- Baseline Ultrasonic meter Performance

Measurement Issues & 2006 Research

Measurement Reliability

1. Making practical use of existing performance indicators in ultrasonic meters to develop real time “smart” meters that prompt service needs.
2. Employ clamp-on (portable) ultrasonic meters as in field proving standard.
3. Close orifice meter operational uncertainty gaps.
4. Produce a recommendation for ultrasonic meter recalibration intervals.

Gas Quality Assurance

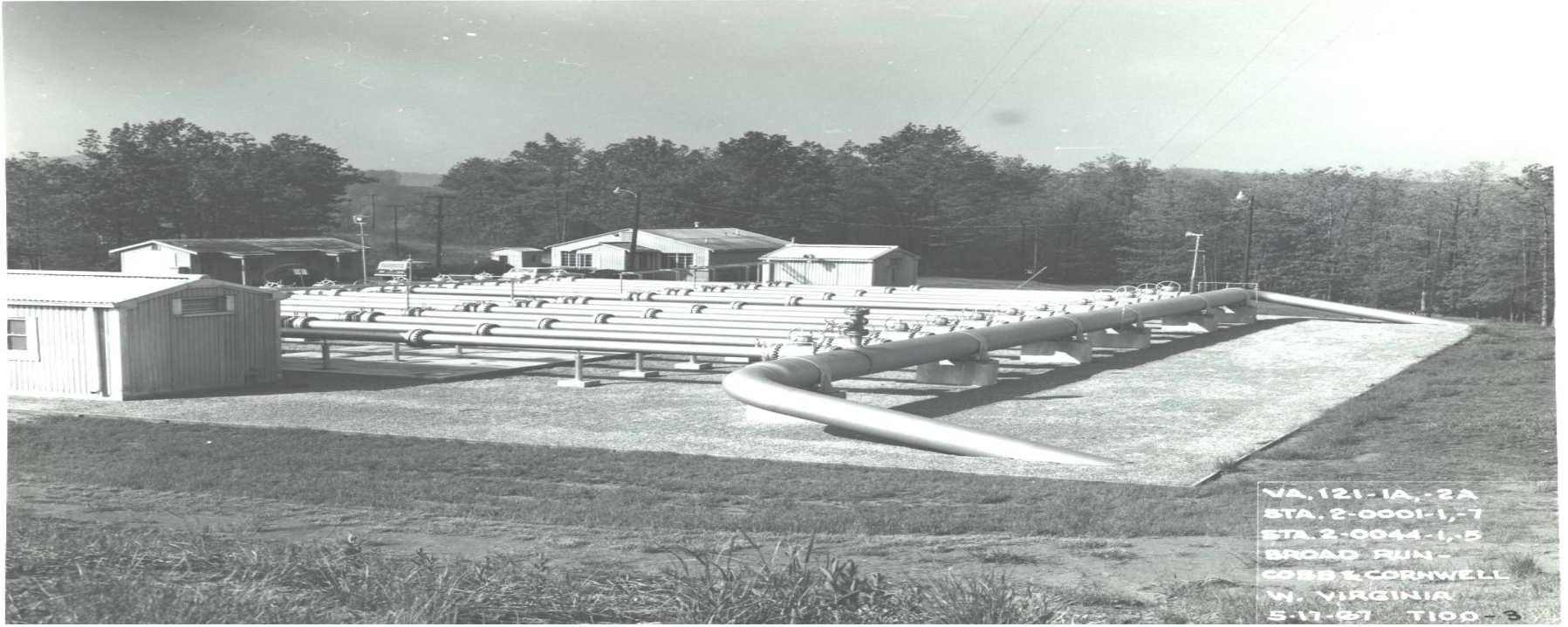
1. Sampling of natural gas in two-phase or condensing flow streams.
2. Evaluate existing technologies for diluent and corrosive gas contaminant on-line monitoring.

Measurement Issues & 2006 Research

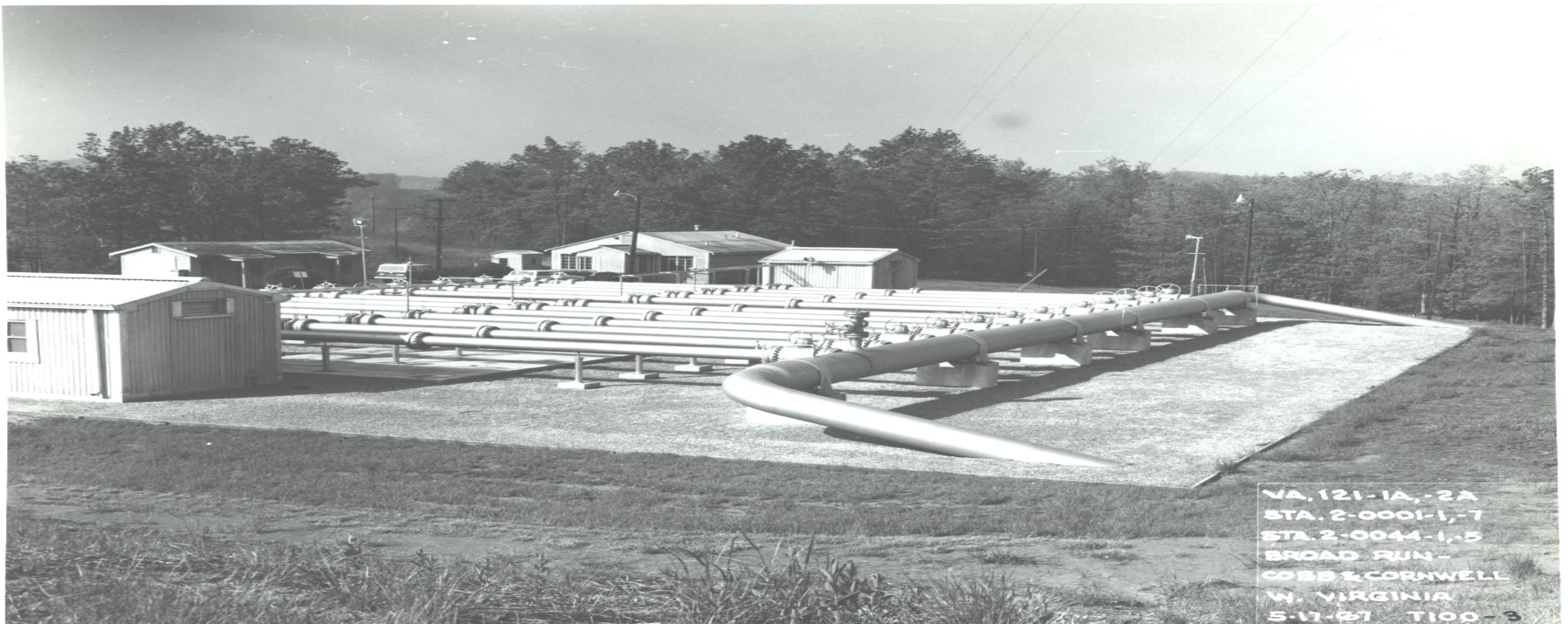
System Balancing and Measurement Uncertainty

1. Apply measurement uncertainty criteria to system efficiency management.
2. Assess velocity effects (both high and low velocity) on meter performance.
3. Determine appropriate meter test intervals as an industry recommendation to optimize technician activities and tools.

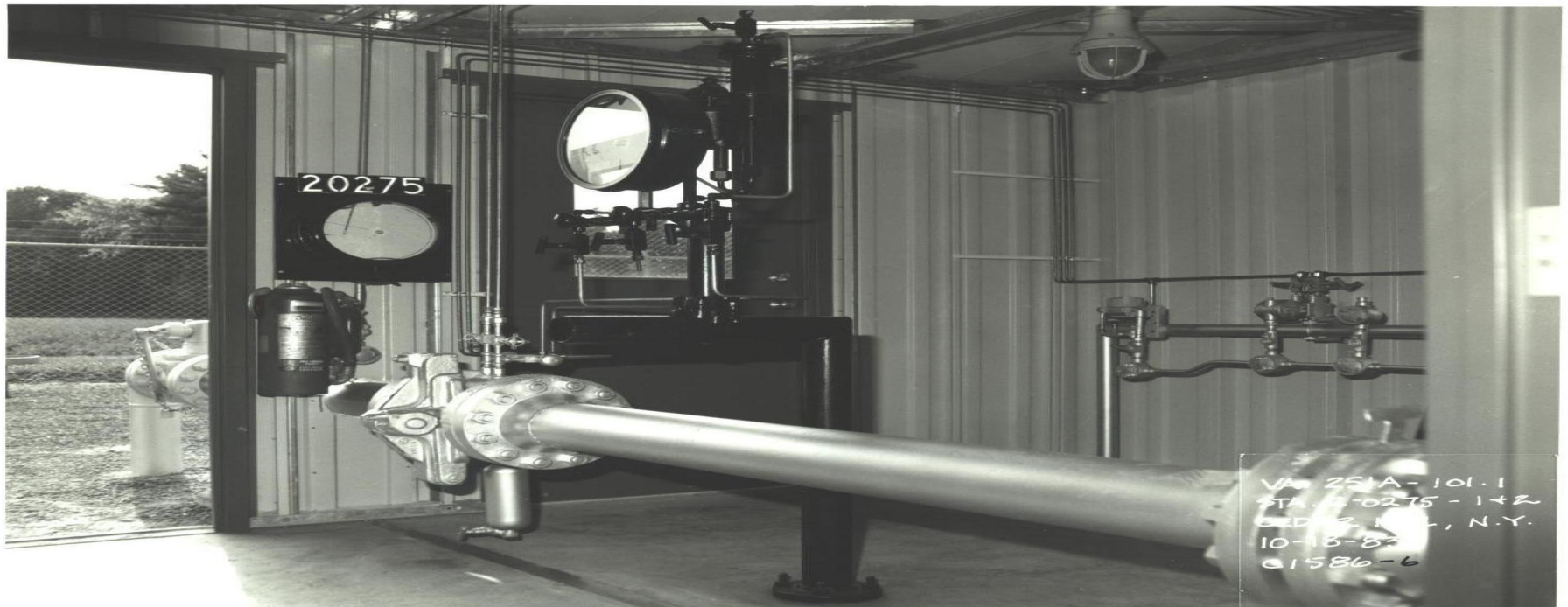
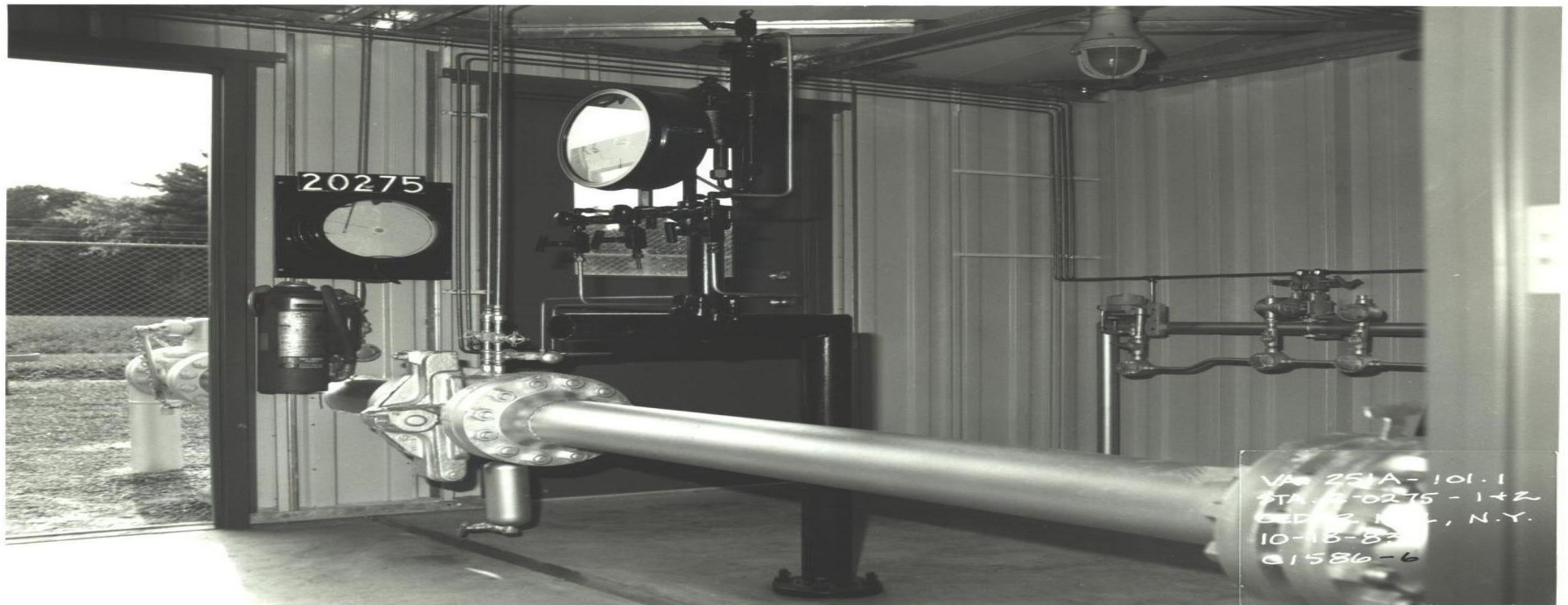
Multi-phase/Wet Gas Metering



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STA. 2-0044-1,-5
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Not So Famous Quotation

“There are a million ways to get measurement wrong and only one way to get it right, consensus & technical knowledge collectively understood and supported are the solution.”

(Research Committee Member View)