Evaluation of Intensive CIPS / DCVG Survey Methods

6/6/2022

Headline: Purpose

Why ?

- Operator Requirements to Evaluate:
  - CP Performance against Relevant Criteria
  - Pipeline Coating Condition

What?

Stand-Alone Surveys v's Intensive Methods

- Reliability / Repeatability ?
  - Efficiency ?
- Cost Effectiveness ?
  - Accuracy ?

How !

- Traditional Overriding Survey Techniques
  - CIPS
  - DCVG / ACVG / Current Attenuation / Pearson's
- Emergence of Intensive / Combined Methods

PROCESS

Evaluation of Intensive Survey Methods

How ?

- Review of Industry Standards / Papers / Technical Guidance
- Identification of Above Ground Survey Techniques / Methodologies
- Discussions / Interviews with Relevant Parties
  - Survey Providers
  - Technology Providers
  - Pipeline Operators
- Review of Operator Experiences

Study Process

- Overview of Techniques
- Distribution of Use
  - Questionnaire
- Operator Experiences
- Reliability Review
  - Pros and Cons
  - Where and When
- Future Developments
- Recommendations for Development / Further Clarifications

Overview Of Techniques

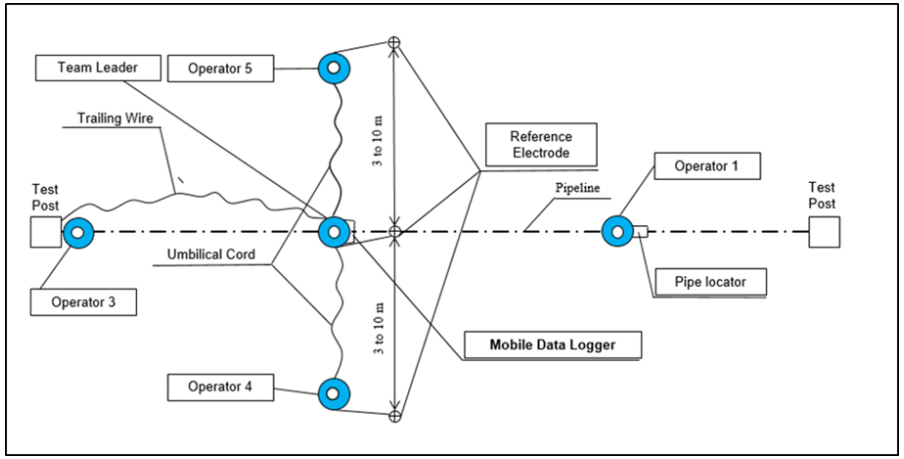
Study Process Identified the Following Survey Methods

Stand Alone Methods:

1. Stand-Alone CIPS
2. Stand Alone DCVG

Intensive Methods:

1. Simultaneous CIPS / DCVG
2. Lateral CIPS / DCVG
   a) 4 Person Technique
   b) 5 Person Techniques
3. Trailing CIPS / DCVG
4. Additional 'Hybrid' Surveys
   a) Side Drain Cell to Cell
   b) Hot Spot Cell to Cell



Considerations

- Overview of Techniques
- Methodologies
- Data Analysis
- Criteria
- Personnel Requirements
- Reference within International Standards


INTERNATIONAL STANDARD ISO 15589-1

Petroleum, petrochemical and natural gas industries — Cathodic protection of pipeline systems —
Part 1:
On-land pipelines

Reliability Review

Development of Comparative Scoring Matrix

1. Operational Aspects
2. Personnel Aspects
3. Industry Guidance
4. Data Analysis / Management

	Operational Aspects				Personnel		Industry Guidance / Documentation		Data Analysis		
Weighting Scale	CP Current Interruption	Survey Efficiency	Right Of Way Access	Execution Complexity	Personnel Requirements	Personnel Competency	Established Methodology	Defined Criteria	Data Accuracy	Data Alignment	Data Interpretation
1	Just one	>6Km/Day	min. 2m	Easy	1	1	Comprehensively Documented	Comprehensively Documented	Good	<6m	Easy
2					2						
3	Some	4-5 m/Day	min. 4m	Moderate	3	3	Recognised in Standards	Recognised in Standards	Moderate	6m	Moderate
4					4						
5	All	<4Km/Day	min. 10m	Difficult	5	5	Reliant on local interpretations	Reliant on local interpretations	Poor	>6m	Difficult

Reliability Matrix		Stand Alone		Intensive Methods			
		1	2	3	4a	4b	5
		CIPS	DCVG	Simultaneous CIPS&DCVG	Lateral 4 person	Lateral 5 person	Trailing
Operational Aspects	CP Current Interruption	5	1	5	5	5	5
	Survey Efficiency	1	2	4	4	5	3
	Right Of Way Access	1	2	2	3	5	1
	Execution Complexity	2	1	5	4	5	4
Personnel Aspects	Personnel Requirements	3	2	4	4	5	4
	Personnel Competency	2	3	5	3	3	3
Industry Guidance	Established Methodology	1	1	3	5	5	5
	Defined Criteria	1	1	2	5	5	5
Data Analysis / Management	Data Accuracy	2	1	3	3	4	3
	Data Alignment	3	3	3	2	2	2
	Coating Defect Assessments	1	1	1	3	3	4
	Data Interpretation	2	1	3	4	5	4
Comparative Index per Technique:		24	19	40	45	52	43
Stand Alone CIPS&DCVG combined:		43					

Reliability Review

- **1 – Interruption of Current Sources**
- Required for all CP assessments
- Most efficient survey techniques would advantageous
- DCVG requires only local interruption

2 – Survey Efficiencies

- Stand-alone methods advantageous due to;
  - Personnel / operational aspects / two data sets

Survey Type	Achievable Dist. Per / Day (km)
Stand-Alone CIPS	6
Stand-Alone DCVG	5
Simultaneous CIPS / DCVG	3.5
Lateral CIPS / DCVG 4 Person	4.5
Lateral CIPS / DCVG 5 Person	3
Trailing CIPS / DCVG	4.5

3 – RoW / Access Requirements

- Significant Issues with Lateral Survey Technique (3-20m)
  - Permissible route
  - Changes in ground resistivity
  - Consider the route in question

4 – Execution Complexity

- Stand-alone methods - Considered straightforward
- Intensive methods - Separation distances may be difficult
- Additional personnel
- Emphasis on the survey lead

5 – Personnel Requirements

Survey Type	Personnel Required
Stand-Alone CIPS	3
Stand-Alone DCVG	2
Simultaneous CIPS / DCVG	4
Lateral CIPS / DCVG 4 Person	4
Lateral CIPS / DCVG 5 Person	5
Trailing CIPS / DCVG	4

6 – Competency

- CP Survey Competency is ‘Grey Area’
- Simultaneous CIPS / DCVG requires two competent survey leads
- Available training course manufacturer specific

Reliability Review

7 – Established Methodology

- Comprehensive methodologies for CIPS / DCVG in Int Standards
- Lack of defined methodology for intensive methods in Int Standards
  - Significant discrepancies relating to separation distances

9 – Data Accuracy

- All data relies on competent survey process
- Intensive survey issues;
  - Separation distance issue
  - Voltage gradient signal strength
  - 'Live View' Issues
  - Establishing Remote Earth

11 – Coating Defect Assessments

Aspects to Consider

- Pin Points
- Sizes (Benchmarking required)
- Corrosion Status
- Assessing multiple / complex defects

8 – Defined Criteria

- CIPS Criteria documented in all Int standards
- DCVG Criteria – small variations relating to Categorisation
- Sim CIPS / DCVG as above
- Intensive Methods – Often criteria is depicted by the survey operator

10 – Data Alignment

- Benefits with Intensive methods due to single point GPS entry
- GPS Accuracies within the specific regions to be considered

12 – Data Interpretation

- Significant increase in data to manage / analyse when considering intensive methods
- DCVG Data does require some manual translation (equipment dependable)
- Data Interpretation / Analysis International Standards.

Questions Remain?

- **Equipment / Survey Improvements**
- Numerous Manufactures for all CP / Coating Survey Methods
- Multi Chanel Data Loggers for Intensive Methods
- Certain Manufacturers claim to have ability to perform add on surveys (ACVG / CA / SR Etc.)
- Comprehensive Data Management Software Packages

Question marks relating to Intensive Methods ???

- Consistent Methodology ?
- Access Restrictions ?
- Coating Defect Assessment Accuracy ?
- Coating Defect Criteria ?
- Data Accuracy ?

Clear Advantages

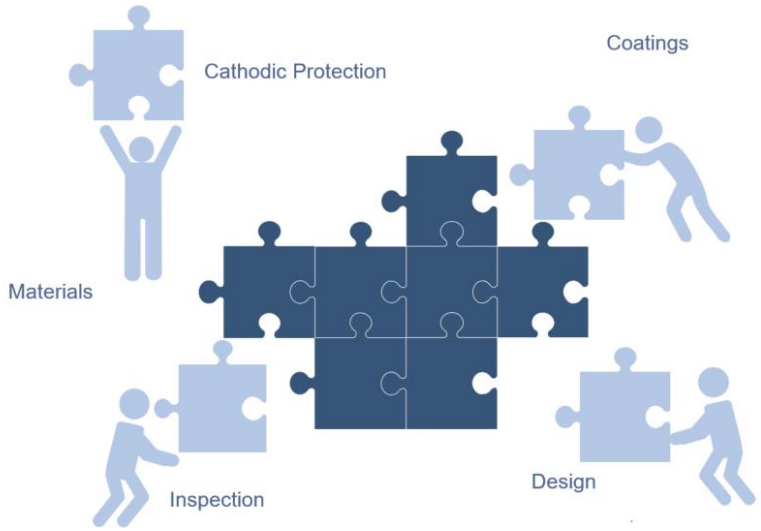
- Two surveys in one pass
  - Limiting change in environment
  - Improved data alignment

'Know your Pipeline Understand the Challenges'

Going Forward

Field Trials

- Requirement to Understand Limitations / Gaps in Intensive Methods
- Comparable Field Trials of Intensive Vs Stand Alone Methods
- Findings to be shared with all parties



Onus on Operators

- Development of Pipeline Specific Survey Strategies to Include:
  - Comprehensive knowledge of Survey Route
  - Understanding Equipment / Survey technologies
  - Defined / Agreed Criteria for Survey Data Interpretation
  - Operational Communications with Survey providers / Information sharing etc.
  - Realistic Expectations
- Data Management Strategy
- Additional Data Sets

'Avoid reviewing survey / inspection data in isolation'

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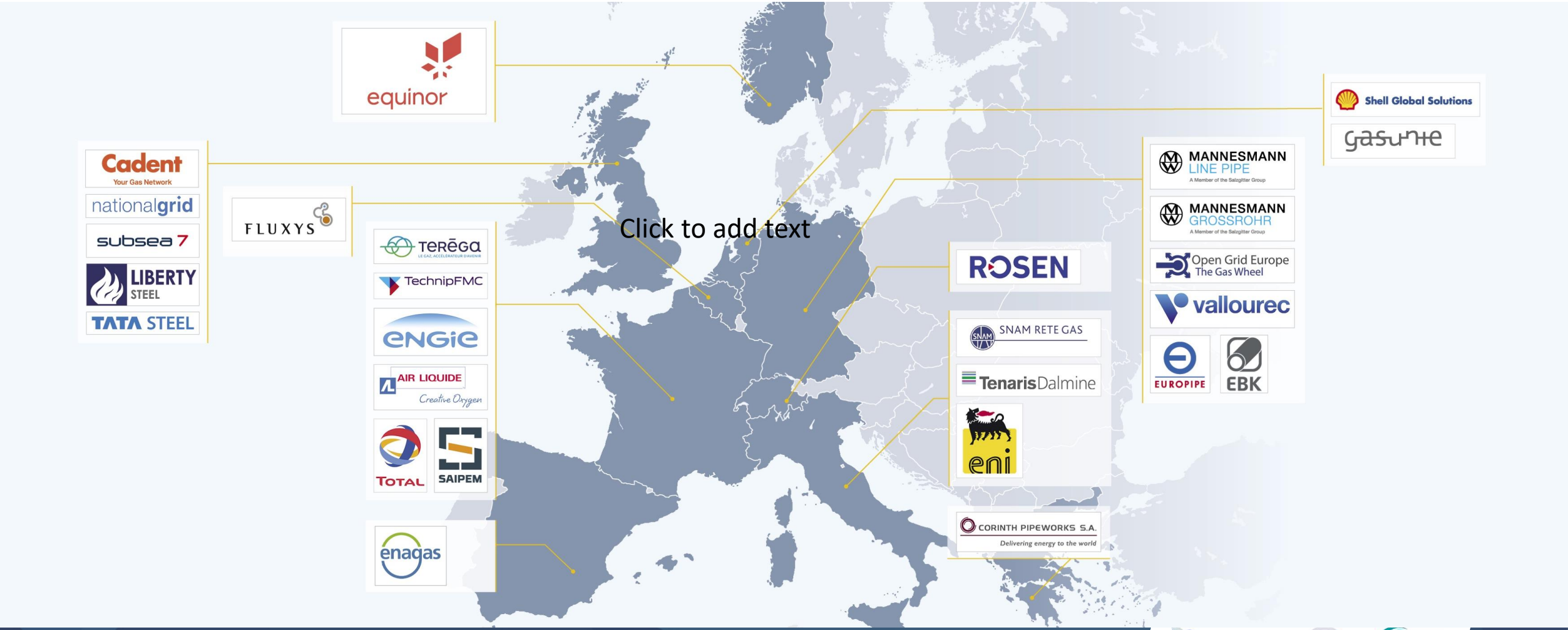

Thank you for your attention.