IMPLEMENTING RESEARCH TECHNOLOGIES IN THE FIELD

Mark Wright · PHMSA R&D Forum · October 2023

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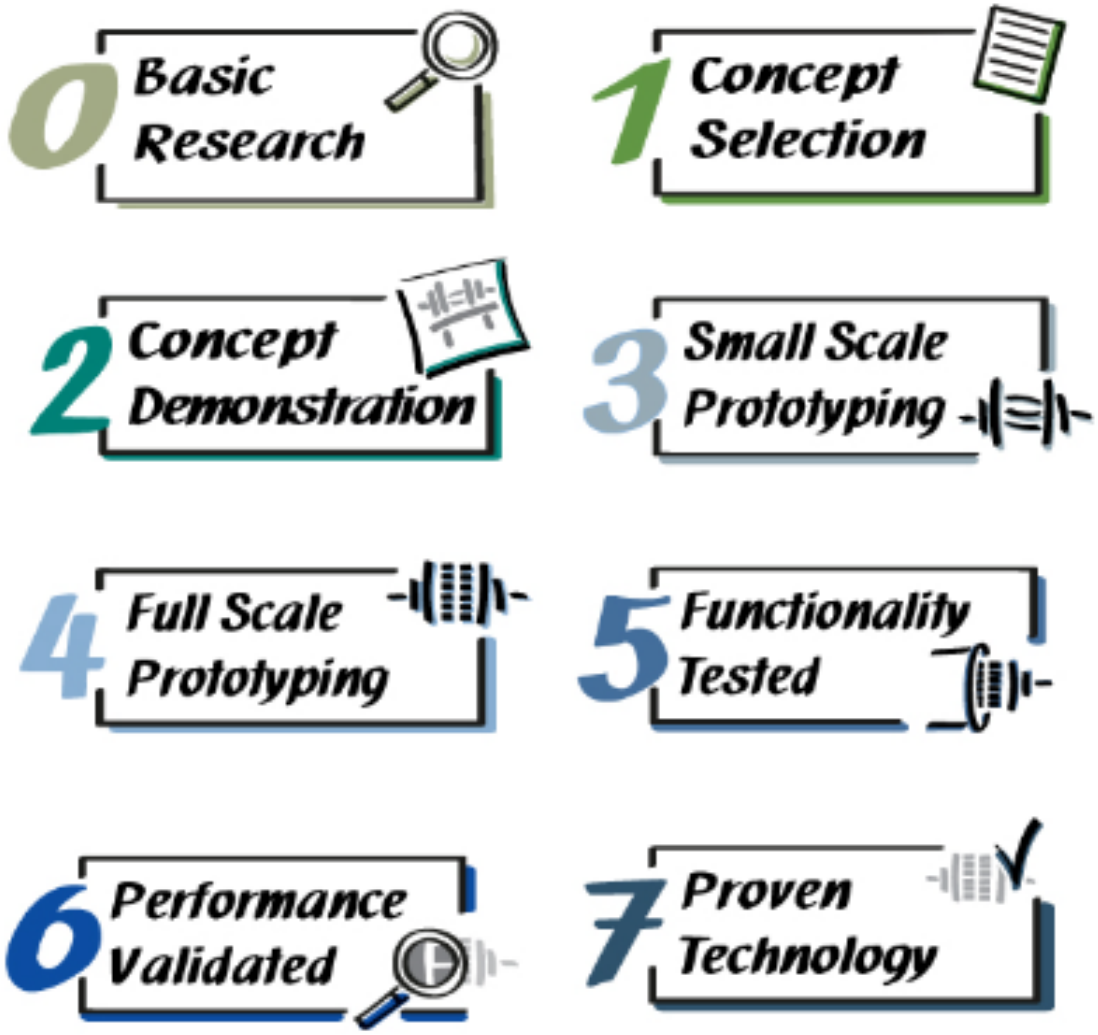
TECHNOLOGY READINESS LEVELS

- Method for assessing the state of development and reliability of new technologies
- Developed in 1988 by NASA for the evaluation of space technologies
- Now a standard in other areas for future technologies e.g. API RP 17N
- Process supports the full development cycle from initial idea through to tried and trusted



TECHNOLOGY DEVELOPMENT

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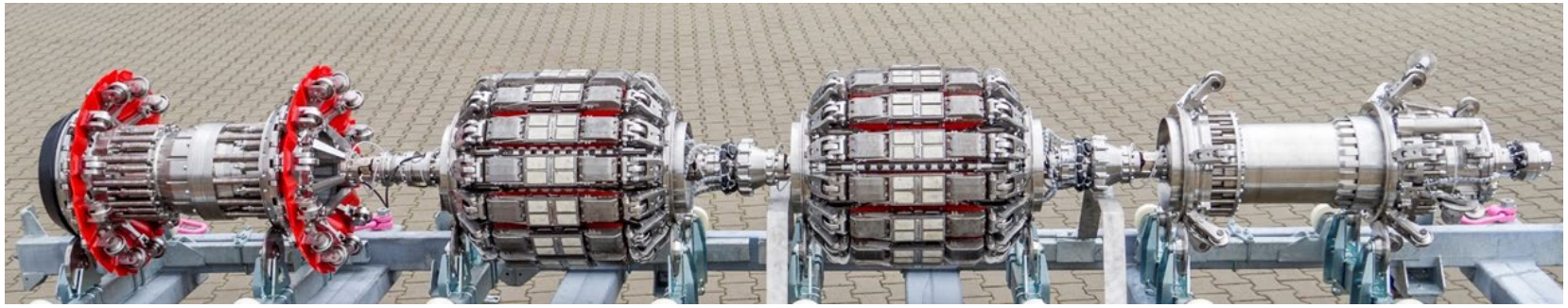
- Electro-Magnetic Acoustic Transducer (EMAT) technology, capable of detecting and sizing crack-like anomalies in pipelines without the need for a liquid couplant (TRL7)



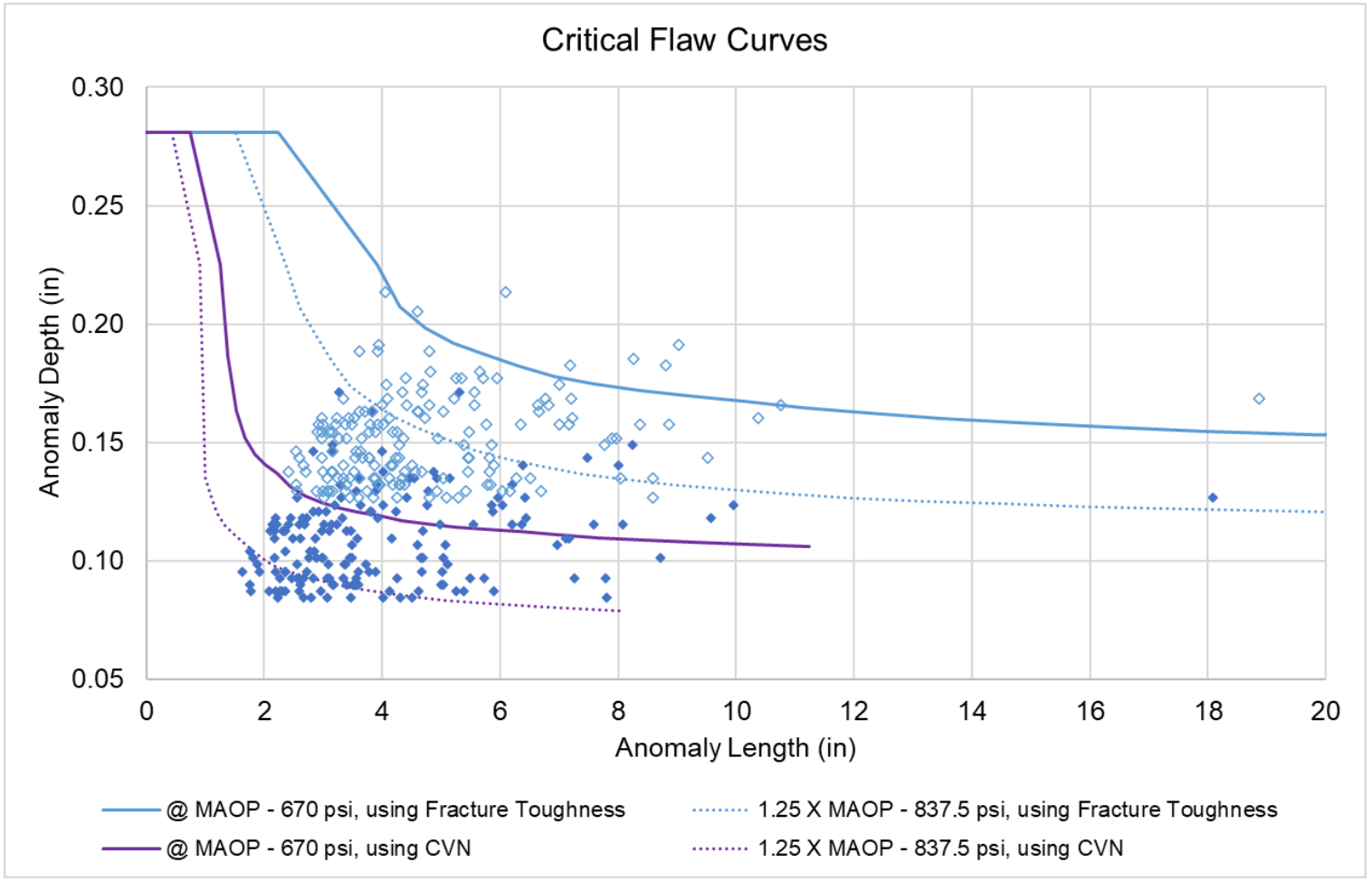
- EMAT Ultra – development of EMAT technology (TRL5) includes miniaturization of sensors, send/receive from both sides and 200% coverage

TECHNOLOGY IS NOT A PANACEA

- Technology is always evolving, and incremental improvements will occur over time
- Research into EMAT accuracy is an active subject via INGAA and PRCI projects
- Technology, and particularly inspection technology is generally a means to an end, and not the end itself
- Inspection technologies facilitate assessment, and assessment has many other variables

MATERIAL PROPERTIES

- Improving inspection accuracy is good, but remains a second order issue
- Good quality materials data are considerably more important
- Gathering toughness data requires destructive testing
- Work undertaken in response to §192.607 has revealed the scale of the issue



LOADING

- Effects of hoop stress from internal pressure well understood
- Additional stress fields from axial and flexural loads, as well as residual stresses are not
- Failures and identification of circumferential cracking on several pipelines are indicative of scale of the problem
- Commonly understood that SCC occurs only when the stress >60% SMYS, where hoop stress lower than this level there must be additional forces

%SMYS	In-service Failures		Hydrostatic Test Failures	
	<12" diam.	≥12" diam	<12" diam.	≥12" diam
<30	0	0	0	0
30-40	2	0	0	1
40-50	3	0	10	0
50-60	2	0	0	1
60-70	0	9	0	37
>70	4	33	0	250

From ASME STP PT 011, 2008

DISCUSSION POINTS
POTENTIAL RESEARCH AREAS

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- We need to stop thinking of pipelines as discrete assets and start thinking of them as groups of materials that share essential variables
- Opportunity to gather industry knowledge on fracture behavior of pipeline materials, and use that information in deterministic and probabilistic assessments
- Opportunity to define materials and location specific fracture mechanics models, rather than using lower bound generic models
- Opportunity to develop guidance for inclusion of additional stresses within assessments
- Differentiation between the behavior of a crack and a crack-like anomaly

THANK YOU FOR JOINING THIS PRESENTATION.

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