

Advanced Welding and Joining Technical Workshop

Boulder, Colorado, January 25-26, 2006

Working Group #3

Weld Inspection and Assessment

Methods

Working Group co-Chair – Mark Lozev
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Facilitator – Mark Lozev/David Horsley
Scribe – Angelique Lasseigne

WG #3 - Inspection and Assessment

Attendance Breakdown

Approximate total attendance	13 persons
Federal Regulators	3 persons
State Regulators	0 persons
International Regulators	1 persons
Pipeline Industry	3 persons
Standard Organizations	1 persons
Researchers	3 persons
Academics	1 persons

WG #3 – Inspection and Assessment

Top 3 Identified Goals (Inspection)

Goal #1 - Develop, validate and implement a set of methodologies and standards to quantify the reliability of automated ultrasonic testing (AUT) systems, procedures and operators for critical pipeline weld inspection applications

Goal #2 - Investigate, develop and quantify 3-D digital image capture radiography

Goal #3 - Investigate the practical applicability of AUT matrix phased array probes and 3-D imaging

WG #3 – Inspection and Assessment

Top 3 Identified Goals (Assessment)

Goal #1 - Implement a Reliability Based Design and Assessment (RBDA) standard

Goal #2 - Calibrate reliability targets with respect to current practice

Goal #3 - Guidance document to define “essential variables” , tailored to the level of assessment (including how to measure them)

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Associated Actions (Inspection)

(Goal #1)

Develop, validate and implement a set of methodologies and standards to quantify the reliability of AUT systems, procedures and operators

Regulatory

Awareness, acceptance and incorporation by reference (1-3 years after availability)

Technology

1. Quantify the reliability of AUT systems, procedures and operators in terms of measurement and model errors [with respect to flaw height, depth, length, and probability of detection (POD)], compatible with a limit-states/reliability design approach for flaw assessment. (1-3 years)
2. Quantify reliability of AUT zonal and non-zonal techniques input for determination of acceptance criteria, interaction rules and high/low effect for typical carbon and high strength steel welds, ECA and strain-based design applications. (1-3 years)
3. Develop methodologies for:
 - Design, assembly and qualification of AUT systems,
 - AUT operator performance demonstration and certification. (1-3 years)

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Associated Actions (Inspection)

(Goal #1)(cont.)

Develop, validate and implement a set of methodologies and standards to quantify the reliability of AUT systems, procedures and operators

Consensus Standards

1. Incorporate the results and methodologies into RBDA standards and/or recommended practices (1-3 years)
2. Incorporate AUT POD and sizing curves, non-zonal techniques, systems and operators performance qualification. (1-3 years)

General Knowledge

1. Develop a database of reference AUT/macro images of flaws. (1-3 years)
2. Training and education to address lack of qualified designers and operators, and general lack of understanding within the industry of AUT systems. (1-3 years)

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Associated Actions (Inspection) (Goal #2)

Digital Radiography

Regulatory

1. Awareness, acceptance and incorporation by reference (1-3 years after availability)

Technology

1. Investigate practical application of 3-D digital radiography (1 year)
2. Develop and quantify capabilities of digital image radiography (1-3 years)

Consensus Standards

1. Update recommended practices/codes (1-3 years)

General Knowledge

1. Educate the industry (1-3 years)

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Associated Actions (Inspection) (Goal #3)

AUT matrix phased array probes and 3-D imaging

Regulatory

1. Awareness, acceptance and incorporation by reference (1-3 years after availability)

Technology

1. Optimize AUT matrix phased array probes design (1 year)
2. Validate and quantify AUT matrix phased array probes capabilities (1-3 years)
3. Develop, validate and quantify 3-D imaging (1-3 years)

Consensus Standards

1. Update ASTM recommended practices/ API codes to address AUT matrix phased array probes and 3-D imaging capabilities (1-3 years)

General Knowledge

1. Develop AUT matrix phased array probes and 3-D imaging database (1-3 years)

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Associated Actions (Assessment) (Goal #1)

Implement a Reliability Based Design and Assessment standard

Regulatory

Awareness, acceptance and incorporation by reference (1-3 years after availability)

Technology

1. To enable implementation of an RBDA standard:
 - Refine limit states functions (stress and strain based) and required inputs
 - Quantify high/low effect
 - Quantify flaw interaction(1-3 years)
2. Develop and standardize procedures for measuring weld and HAZ properties
 - Procedures and specification for specimen type, size, location
 - Procedures to define variation of properties with respect to welding procedure variations (1-3 years)

Consensus Standards

1. Develop standards and /or recommended practices that incorporate refined limit states functions. (1-3 years after technologies are available)

General Knowledge

1. Develop a database of high/low effect and flaw interaction curves. (1-3 years)
2. Inform and educate industry on RBDA methods. (1-3 years)

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Associated Actions (Assessment) (Goal #2)

Calibrate reliability targets with respect to current practice

Regulatory

1. Awareness, acceptance and incorporation by reference (1-3 years after availability)

Technology

1. Develop and calibrate reliability of inspection process with respect to current practice (1-3 years)

Consensus Standards

1. Develop recommended practices (1-3 years)

General Knowledge

1. Educate industry (1-3 years)

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Associated Actions (Assessment) (Goal #3)

“Essential variables” guidance document

Regulatory

1. Awareness, acceptance and incorporation by reference (1 year after availability)

Technology

1. Define “essential variables” (1 year)
2. Tailor “essential variables” to the level of assessment (including how to measure them) (1-3 years)

Consensus Standards

1. Develop guidance document (1-3 years)

General Knowledge

1. Educate industry (1-3 years)

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Additional Identified Goals

- Goal - State of the art report on UT and AUT systems (education and awareness).
- Goal - Standards Implementation