BINDT Aerospace Group

Objective 4 Working Document on new technologies

Objective 4 is: "To promote and enable the introduction of **new NDT technologies** by identifying and tackling barriers, and through scientific evaluation, validation and education of manufacturing and maintenance supply chains."

One of the first tasks is to identify the barriers to introduction of new NDT technologies into the aerospace industry. This document aims to capture those issues so that strategies can be established to tackle them.

	Manufacturing	**Maintenance**
Equipment	Generally well received if enhances throughput rate, reduces NDT time, cost, rejections, repairs or scrapping. Barriers are: • lack of an approved qualification process • absence of a legacy, accepted, min. detectable defect size • absence of, or inadequate scientific analysis of capabilities and limitations. • onerous POD methods that may not be appropriate anyway. • overhead in writing new procedures. Automated analysis and sentencing – how to qualify? Digital Certification?	May be badly received by MRO who are paid by the hour and need to purchase and train on new equipment. Need to find a recommended way of sharing the benefit (profit) of new technology between the OEM, operator and MRO. Barriers are: • lack of an approved qualification process • absence of a legacy, accepted, min. detectable defect size • absence of, or inadequate scientific analysis of capabilities and limitations. • onerous POD methods that may not be appropriate anyway. • overhead in writing new procedures. • lack of understanding of how measurements or hit/miss results feed into structural integrity
Personnel	Level III may be reluctant to put in the effort when (necessarily) outside the production process and not incentivised to find the optimum solution. Barriers are: • lack of knowledge of nominated Level III in new technology • lack of training courses for Nom. Level III to call up to meet EN4179 requirements • lack of knowledge of new materials and processes	NAS410 requirements Part 145 requirements Barriers are: • lack of knowledge in new NDT technology in user organisations and even in certifying authorities • Few experts in new NDT technology • lack of training courses to meet 145 requirements • lack of knowledge of new materials and processes

<table>
<tr><th></th><th>Process development and process control</th><th>Quality Control</th><th>Maintenance</th></tr>
<tr><td rowspan="2">Material or process</td><td rowspan="2">Particularly concerns ‘new’ materials and processes, eg. composites AM product, welding processes

Lack of understanding of flaw/defect types, morphologies and how these relate to mechanical performance.

Some NDT techniques are only valid for a specific process.

Often a need for non-contact inspection to avoid contamination or affecting the cooling process.</td><td colspan="2">Loop needs to be closed on design, stress analysis, effect of defects, inspection capability.
• Understanding of minimum required detectable defect size.
• Continual drive down on detectable defect size.

Design for NDT
• part shape
• access.
• need to prevent requirement for NDT going beyond practical capability.

Step-up in training for new materials.</td></tr>
<tr><td>Integrated processes – more of structure created in one shot.
• Reduced opportunities to inspect and increased complexity.</td><td>Different defect types to manufacturing defects.

Lack of historical data and experience to allow establishment of inspection intervals.
• Engineering judgement inadequate.
• Need for model-assisted qualification or a lot of experimental testing.</td></tr>
</table>

Strategies to tackle these barriers…

	Manufacturing	Maintenance
Equipment	ENIQ-like Technology/method validation of capabilities and limitations. Technique qualification using Model-assisted qualification	Continued interaction with SI community. Strategic leadership involving other institutes eg FESI and IMechE.

Personnel	Level 3 signs off a procedure and should be trained in how to do that and what the methodology is – eg technical justification or capability statement? What level of rigour/document would suit aerospace technologies or inspection procedures. Objective would be to have a short training course in how to do 'appropriate' validation.	Update existing materials and process courses and training materials to include new materials and processes. Introduction of new NDT technologies and new materials and processes in the PCN scheme. How NDT is affected by the material being inspected. For 3rd party, expanding within a method to novel technique eg FMC/TFM, nonlinear UT, etc. Could use appendices attached to a training course. Potentially 2nd party certification could cover this, as now, but PCN 2 may be able to cover this better.
Material or process	Establish Additive Manufacturing Working Group of the NDT TC • Mix of NDT and AM experts • MTC/AMRC/AFRC • TWI Courses for non-NDT designers to design for inspection. Part of NDT appreciation courses. Completing the loop – produce document about closing the loop on design etc. Capability matrices for different materials. Could produce a template for capability matrix for a particular NDT method on particular material. Influencing design standards and certification process in terms of whether NDT has been considered in the design (is this an EASA requirement?). Process control can be used to prove that no flaw is produced – NDT has a role in this and in process control.	Different defects in service compared with manufacture. Influencing design standards and certification process in terms of whether NDT has been considered in the design (is this an EASA requirement?). Currently reactive NDT provision whereas damage tolerance philosophy requires inspection from the start and at pre-set intervals Funding of the NDT development and writing of procedures by OEM and even hire out inspection equipment in non-standard technologies. Defect types not foreseen and may have access issues. Life extension requires new inspection methods. New technologies will probably need to be assessed and approved by OEMs like Boeing do. This reflects the complexity of the method. Needs control of what is being used.