Session 4: 3D characterisation and materials modelling

Full 3D mapping of material properties
As-manufactured components or test coupons
NDT-based performance modelling to determine residual strength
Use of FE models to determine the important metrics for NDT to measure

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4a NDT Requirements, or what is needed to define them? – **Prof Robert Smith**
4b Current status of modelling of defects and failure in composites. – **Prof Stephen Hallett**
4c Current 3D characterisation and importance of metrics. - **Prof Robert Smith**
4d Breakout groups – What are the requirements for NDT measurements?
4e De-brief from breakouts
4f Panel discussion

Session 4e: Breakout de-brief

- Resolution.
  - 1 ply in depth desirable. But speed of inspection may be more important than resolution – trade off.
  - Definition of acceptance criteria.
  - OEMs to sub-contractors.
  - How to reconcile 2% criterion. Need evolution of system to account fr fidelity.
- Wrinkles
  - % wrinkled plies in a stack or multiple wrinkles?
- FE – links to concessions
  - Part value vs cost/value of NDT. Small value high vol parts – good database information. Can test lots of defects.
  - High value parts, low vol so more benefit in FE. Smaller database of defect characterisation. Not seen many or tested many. Can stand longer timescale doing concession.
  - FE can build database or on part by part basis.
  - What level of fidelity required to resolve concession?

- 3D models. Model ultrasound to better understand inspection. Validation through models.
- Sensitivity – 3Dneeds understanding of use of data.
- What do you need to do to understand o/p of NDT.
- Improve availability. Measure damage and schedule corrective action later – better fleet management.
- Training of NDT inspectors important when moving to a measurement.
- Future high-rate single aisle a/c. Rapid decisions for concessions.
- But need it on the shop floor.
- Non-expert decision makers. Framework.
- Reduce number of repairs pending.
- Systems engineering – production process working with NDT. Get functional requirements in process first – leads to NDT requirements.
- Could end up with more realistic NDT requirement.
- Impossible to give generic requirements for NDT at this stage.
- Underpins automation if information is more relevant
- 'Adequately accurate'
- Practical NDT
- Current requirements for 3D analysis. Currently some systems incapable of 3D. Cost of updating hardware. Still needs to do routine NDT.
- FMC/TFM may help fulfil requirements.
- S/ware easier investment – engage with manufacturers to release data (formats)
- Others – TT not 3D. Shearography – may measure parameters more directly related to models.
- Physical data required for validating models and NDT o/p.
- Thermoplastic 3D props. 3D useful at start of process of using new material.
- Optical fibres in composites – structural effects.

- Military
- Can 3D be done in all environments? In theatre?
- Speed – sometimes slow is OK – on production. In theatre - fast.
- Can data capture be fast enough? Interpretation on site or remotely?
- FE model for entire a/c – currently coarse. Take BC and have finer models. Multi-scale. Embed failure modes being developed.
- Automation – inspect to generate information data set for FE
- Realistic parts – side of a/c. Hand held. Upside down. Complex shapes.
- Accuracy – maybe not sub-ply in near future?