Session 5. SHM Panel session

What does SHM success look like? Meeting requirements.

- System view: Success is when a system is in place that gives information in-service to manage a platform and feedback information to designers about how it is used.
- Deterministic would be great, but need to understand uncertainty and probabilistic approach.
- How fast info is moved. SHM automation would have less onerous validation because fewer variables in the inspection. Less probabilistic.
- Choice of SHM has to last life of component.
- Lots of regulatory and functional requirements.
- Uncertainties should be smaller.
- Success is automation, lightweight sensors, more integration on surface or embedded, durability of whole system more than life of component.
- Memory is cheaper and bigger. Technology developments in systems and SHM will help success.
- Technology maturation. How to determine capability.
- Regulation. Visual vs NDT interchange curves will not change.
- A/c safety depends on lots of other sensors. How are they assessed? Can we learn how to assess reliability?
- In-built redundancy. Choice of sensor when differing readings – very difficult to get this right. Need avionics reliability on top.
- Determine accuracy and range of sensor/system. Sensor may compensate for variations to maintain accuracy.
- Variability – effect on reading - dealt with by tolerances
- Exercise variability.
- Need to reduce variables. Smaller spread of values. Determine sensor's uncertainty as usual if measurement. If hit/miss then need POD.
- Flight-safety critical with NDT/SHM.

- Debatable whether human factors are not relevant.
- In SHM sensor does not move and measurements could be continuous. Changes with time.
- In NDT sensor moves and measurement is occasional. NDDT looks for changes with position.
- How to overcome uncertainty depends on variables. Reduce variables, reduce uncertainty. Have to eliminate completely in order to make deterministic.
- SHM can have variability in time to deal with that NDT may not.
- Challenge to SHM could be 'what is the maximum size it could miss'.
- Regulation – should not design in a dependence on uncertainty in SHM measurements.
- Data storage now only a problem because there is too much data. What are we required to do with it.
- 'Acceptable level of safety' is the bottom line
- Only useful if can change decision making.
- Do not want to be the slave to data.
- Trade-off between data size and fidelity.
- FAA – metallic – cannot fly with known crack, although we do manage this!. On composites can fly with damage less than certain size. Hence SHM should identify damage which matters. (Ref. impact)
- Have allowable damage limits.
- Model is that substantiated damage limits are 'allowed', as at present.
- Submit proposal to regulator for system that can be run in parallel to build confidence.
- This establishes SHM as a viable technique. Eg Delta trial.
- How can this be migrated into more complex ones?
- Is there a requirements spec that could be posed to the SHM community? How accurately can it measure a defined damage level in composite? How well can it define when it is approached?

- Multiple failure modes need to be handled.
- Risk of undeclared large defect.
- Perceived implementation barriers: weight, power, cost, etc.
- Much work on simple structures. Not on complex structures. What is interaction of other components, sub-structure?
- SHM – sensors, wire etc on a/c.
- Major surprise will be that as soon as an airframe is in use people will want to modify it. Tricky with composites. This will be even harder with SHM.
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