MAPOD Working Group Meeting - Minutes

October 27, 2012

Palm Springs, California

Attendees:

A list of attendees may be found in File 1.

Introduction - Eric reviewed the MAPOD philosophy.

Status updates:

AFRL – reviewed by J. Aldrin (File 2)

- The discussion began with a review of the MAPOD flowchart created by Thompson and Annis. Broz pointed out that options other than MilHnbk 1823 which would be in effect if we were looking at an all-encompassing view rather than focusing on the Appendix of the 1823. John reported on the AF effort to use Bayesian methods to arrive at a MAPOD calculation. The need to understand the controlling factors, sort between those that can be modeled and which need to be measured was emphasized.
- Number of samples to arrive at relevant POD was discussed. The difference between confidence bounds and uncertainty was discussed as was the difference between hit/miss studies and "ahat vs. a" studies. The needs of the customer will drive to what extent POD feeds into life management, safe life vs. damage tolerance.
- Crack morphology effects were highlighted in UT inspection for cracks in Ti64. The current comparison pointed to the need for further validation and understanding when we get to "real cracks".
- John reviewed a POD study applied to SHM studies. John emphasized the need to make sure you are sensing what you think you are. (Example given of a change due to two week gap rather than a structural change.) The relationship of sensor location, sensor mortality, role of reference sensors was reviewed. Understanding the role of location in the POD was recommended as an alternative parameter for consideration. The difference between localized inspection and the associated POD compared to global, SHM sensing and their ability to really manage the health of the fleet was pointed out. ASIP requires that a POD curve, false call rate, and durability be provided before an SHM system can be installed on a platform. Recommendation to look at Fitzwater presentation at ASIP to see recent effort on cost/benefit analysis. The role of global/local and the appropriate mix was discussed and the role POD will play in what will and can be implemented was pointed out. Education of SHM community regarding the role of rigorous POD is still needed and has been a focus of recent AF efforts.

CEA – Nicolas Dominguez – new CIVA manager, from EDS (File 3)

- PICASSO project –includes 14 partners as listed in the presentation. Focus is on more cost effective provision of POD curves and improving accuracy thru model-based approach. Using uncertainty propagation approach using CIVA, Vic3D. Use CIVA GUI to define input parameters and estimate uncertainty.
    - Validation case 1 – HF EC of fatigue cracks in Titanium, flat configuration using pencil probe, 2MHz. Gathered input from industrial community regarding the influential parameters and used to build simulation using Monte Carlo sampling strategy. Parameters considered were crack depth, angle of the probe, scan increment, crack closure (electrical contacts). Probability density functions were estimated for each of the factors. Reasonable bounds were placed on the distributions based on experience and allowables in the procedures. Also had experimental data for 69 cracks, 5 inspectors, compared to 600 simulated points. The question was asked regarding what statistical models can be used when data is censored but log/log model does not fit the data? Prior work by Spencer and Meeker should be reviewed.
    - Validation case 2 – PAUT in manufacturing
- IIW activity in relation with simulation and POD
    - EB weld inspection of steel component, locally flat are with void detection, 32 element linear array, 10 MHz. part rotates, probe stationary. Used Ying and Truell to account from creeping waves around the void; Validation was within 1.5 dB, experimental variation was within 1 dB. Looked at defect radial position, defect angular position, and water path as variables.
- Application of simulation-based transfer function used by Hugo and Harding
- Picasso ends in 2012. Two cases relevant thus far, one UT and one EC. Automated inspection is easier to manage than manual. Nine test cases being run by industry partners. Statistical library is more expansive. POD when results are images is an area of work that is needed.
- IIW - V-1480-10 – recommendations for the use and validation of NDT simulations – generated document; submitted to panel of experts in April 2011. An outline was shared. The full document will be distributed to the MAPOD WG for their comment.

Sandia – Bode – MAPOD for WFD Detection (File 4)

- Mike reviewed transfer function study where samples were available for all four quadrants. The decision of "what is an opportunity" to establish false call rates was discussed. In weld inspection, it was pointed out that a gradient is defined which is often related to the UT beam width and that becomes –one opportunity. The total number of opportunities is arrived at by dividing the weld length by the gradient.
- The work reported looked at statistical models to use data from 4 inspectors to "generate more data" and establish correlations to move to the quad 4. Suggestion to look at data using the Harding approach.

Jennifer Brown – ASTM Standard (File 5) – reported on progress of ASTM document that is being reviewed within the ASTM main committee. American Society for Testing and Materials (ASTM) "Standard Practice for Probability of Detection Analysis for Hit/Miss Data" (Work Item 29631) was recommend for E07 NDT Main Committee ballot at the ASTM E07.10 Specialized Nondestructive Testing Methods Sub-committee meeting that was held in June in Anaheim, CA. The one negative comment that was received during Sub-committee ballot was successfully resolved. The Standard is currently in Main Committee ballot, which will remain open through mid-November. Based on feedback from the attendees of the MAPOD WG meeting at the 2010 Fall ASNT Conference, a section on False Call Analysis was included in the Standard. (Pratt & Whitney Rocketdyne - Jennifer Brown, Steve James). The document benefitted from input from MAPOD last fall and a review by Bill Meeker. Issues associated with use of statistical tools to validate the applicability of the models to the data were discussed, i.e., are appropriate tools being used?

TRI/Austin – MAPOD Protocol Document – use wiki to get the information out. Forsyth and Brasche to work to get it started.

CNDE – Several CNDE reports of POD studies, funded by FAA, have been released.

EWI - Todorov reported that EWI has recently completed a POD for girth welds in pipelines which will be available on the DOT website. The link to be added to MAPOD site.

Discussion and future results:

Thoughts on where we are today and still want to go to be a focus of our next discussion. The next meeting will be held in conjunction with the AAS conference in Baltimore in April. We will take advantage of rooms assigned for AF use. Exact time will be decided once the agenda for the AAS Conference is published.