IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Center for Nondestructive Evaluation
115 Applied Sciences Complex II
1915 Scholl Road
Ames, Iowa 50011
515-294-5227/4999

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To: MAPOD Working Group

From: Lisa Brasche
CNDE Associate Director

RE: POD Working Group Meeting, Fort Worth, TX, October 19, 2006

Attendees: John Lively, Kevin Smith, Dave Gallela, Paul Swindell, Al Broz, Dave Morgan, Brian Bauer, Chris Brown, Pamela Herzog, Leo Post, Danny Crab, Bill Miller, Sharon Vukelich, Lisa Brasche

A short, informal meeting in support of the Model Assisted POD working group initiative was held in conjunction with the Air Transport Association NDT Forum in Fort Worth, TX. The meeting focused on:

1. Current uses of POD data and tools
2. How POD needs and usage might be changing.
3. What tools are needed to facilitate those changes?

Presentations were provided by Dave Piotrowski of Delta and Kevin Smith of Pratt & Whitney which addressed item 1. Copies are provided as Attachment 1 and 2 respectively.

- Delta: POD sample sets have been generated for use in FPI, MPI, and LFEC testing which incorporate some aspects of typical geometries into the samples. POD data were generated to establish a baseline for new systems, i.e., installation of FPI and MPI lines. Recurrent POD data is generated to monitor inspection processes. The samples conform to 1823 definitions with data analysis being performed using software provided by Rummel and/or USAF (Behrens). Delta views POD as increasingly important for engineering analysis in meeting continued airworthiness requirements.

- Pratt: In the past five years, PW has increasingly used POD as part of the qualification for field inspection procedures. Depending on the application, POD baselines may be generated for incorporation into the risk analysis and only inspectors that meet or exceed the baseline POD performance will be qualified to perform the inspection. PW continues to generate POD in response to ENSIP requirements for military engines. POD data is generated using the full spectrum of POD tools ranging from FMA techniques to purely empirical 1823 type analysis. It was pointed out that FMA and XFN are really just shades of gray depending on the proportion of empirical data used to arrive at the POD. In both cases, a physical understanding (model) of the inspection process is crucial to arriving at the final answer. It was also pointed out that depending on the use of the POD results, understanding the 90/95 point and/or the full POD curve may be important.

Discussion by the group indicated that the use of POD is increasing. In many cases, factors other than crack length are becoming increasingly important. Understanding aspects of the flaw

morphology and/or the signal response that affect the detectability were viewed as increasingly more important. It was pointed out that different aspects of the POD calculations may be used to make engineering decisions. For example, if 90/50 or 90/75 data is more readily available than 90/95 data, then more frequent inspections may be performed in lieu of tightening up the confidence level.

A phenomenon that is increasing the use of POD is safe life parts which aren't making life and therefore require a post-design damage tolerance analysis. POD data will be generated to define the inspection requirements and inspection frequency. This is particularly true of some components in commercial aviation applications such as landing gear.

Structural health monitoring was a topic presented at the ATA NDT Forum. It was pointed out that there are implications for POD as this new philosophy moves into the mainstream. Issues identified included the reliability of the sensor (not necessarily a POD issue), decisions regarding data mining (continuous data, periodic data, sampling frequencies), use of data to manage an individual aircraft vs use of data in fleet management. It was pointed out that SHM approaches will have to meet the reliability numbers of other flight critical systems (10^{-7} to 10^{-9}) in order to be certificated by the FAA, EASA, etc.

Tools used by the audience include the NTIAC Databook (need for update identified), other FAA and NASA (NASGRO) data.

The need for "rule of thumb" tables was identified and the use of models to generate or flesh out these tables was pointed out. A caution that the models can only be as accurate as the input data was provided. Even with the current limitations, MAPOD tools may be better than the ad hoc assumptions currently being made.

MAPOD tools for other techniques (thermal, sonic IR, other modes of UT and EC, image-based methods like x-ray and thermal) were identified as a need.

The usefulness of a protocol for MAPOD approaches was emphasized. It was the view of the group that incorporating this protocol into 1823 and/or other industry specifications would be extremely beneficial and a key deliverable of the MAPOD working group.

A concern was expressed regarding the standardization of POD sample sets used in empirical studies. It was pointed out that two different POD sets could be run through an FPI process and arrive at different answers even though all other variables are the same. How does the engineer know the true "POD answer"? Is there guidance that can be provided to arrive at a standard set?

Training and communication tools were identified as a high impact item. Confusion over "common definitions" continues to be an issue, particularly when communicating with management that is unfamiliar with the rigors required to generate and utilize POD data appropriately. Included in outreach efforts should be the structural engineers that are requesting and using POD information.

In summary, the discussion was useful in pointing out the current uses and limitations of POD tools and approaches. Many of the points reaffirmed previous discussions and directions of MAPOD and the importance of this initiative to commercial aviation community members.