MINUTES
MODEL-ASSISTED POD WORKING GROUP MEETING
FEBRUARY 4, 2005
PALM SPRINGS, CALIFORNIA

Attendees:

A list of attendees may be found in file 1.

Agenda:

The meeting agenda may be found in file 2.

Minutes:

This one day meeting consisted primarily of a report on the outcome of action items. Brief abstracts of the presentations follow, with links to the slides presented. Those slides presentations will be added to the web site at a rate determined by their release by the presenters, who in a number of cases must obtain approval from their organizations.

Review of Current Status/Action Items: Thompson reviewed the steps leading up to this meeting, including a summary of the status of action items (many of which were addressed by the following talks) and the agenda of this meeting. His slides may be found in file 3.

Charge to the Group: Malas provided a charge to the group to move as rapidly as possible to wrap up protocols and establish the feasibility of this approach so that its potential cost/time benefits can be realized as soon as possible. He emphasized the desire for an inclusive process that would air all concerns. His slide may be found in file 4.

Elements to be Included in MAPOD Protocol: Spencer presented a set of thought related to protocol development based on experiences of other technical communities. He felt that the primary issue is validation, defined by the DoD to be "the process of determining the degree to which a model or simulation is an accurate representation of the real-world from the perspective of the intended uses of the model or simulation". The talk included an extensive background on this subject, including a characterization of the various types of nondeterministic features that might have to be considered in different ways. The talk concluded with a discussion of the features which need to be included in a validation study. His slides may be found in file 5.

Status of List of Empirical POD Studies: Irving Gray discussed progress on his action to provide a list of empirical POD studies and sought input from the group on a number of issues. It was agreed that some degree of annotation/summary of the references would be more helpful to the group than a simple listing of references

Status of List of Model-Based POD Studies: Aldrin discussed progress on his action to provide a list of Model-Based POD studies. Included was a discussion of the criteria that he had used. A good bit of progress had been made and his slides may be found in file 6.

Update on the Repository of POD Protocols and Review of ASNT Sub-Group Meeting: Knopp summarized discussions that had taken place at AFRL regarding the ultimate repository of Model-Assisted POD Protocols. It had been decided that this would occur within the organization of Joe Gallagher, with Vincent Spanel (ASC/ENFS) as the point of contact. He also noted that there appears to be a number of potential opportunities for the Model-Assisted POD approach within the aging aircraft area. Needed are ideas of particular approaches and the basis for a business case. In order to be considered for FY'06 funding, examples need to be identified in the very near future. The "holy grail" would be a problem that would be cross-cutting, affecting several weapons systems. Knopp also summarized the sub-group meeting that occurred at the fall ASNT meeting and led to the remaining presentations on the morning agenda. His slides may be found in file 7.

Outline of General Steps of MAPOD Approach and Example of Application to Engines: Smith presented a discussion of the transfer function (XFN) approach and gave an example of its application to engines. His slides may be found in file 8. Considerable interest was expressed in the data since it represented a well documented quantification of the relative responses of cracks and notches for a particular case. In the approach presented, a transfer function was defined as the ratio of the mean responses of the cracks and notches. The variation that controlled the steepness of the POD curve was associated with the field inspection of notches, a manual operation. Spencer suggested a generalization of this approach in which the variation of the crack and notch response would also be taken into account. Smith accepted an action item to draft a protocol based on his experience. Goldfine expressed the feeling that it is important to include consideration of false calls as a part of the procedures that are produced by the MAPOD Working Group.

Updated Statement of Steps for FMA Approach: Thompson presented an update of the steps for the full model-assisted approach (FMA). This was basically an elaboration of what had been presented at the previous MAPOD meeting, with changes being made in response to the discussions which occurred at that meeting. His slides may be found in file 9. In the ensuing discussion, several suggestions for further elaboration were made. Included were the following:

- A branch needs to be added to treat sources of variability that are not statistically independent (Reference step 7).
- This also needs to be reflected in the final step.
- Additional steps need to be added to allow prediction of noise, false call rates, and hence ROC curves

Discussion of Lap Splice Data Available at AANC: Swindell presented a summary of the lap splice data that is available at AANC (Sandia), motivated by the idea that it could become a basis of a demonstration of the MAPOD approach. His slides may be found in

file 10. At the conclusion of the presentation, he asked whether this data was of a form that could be used by the group in further studies. The general feeling was negative, with the reasons being (a) the probes are no longer available and they were not characterized at the time and (b) the data was hit/miss only, with no records of flaw response. Although these comments might be interpreted as deficiencies in the study, it should be recognized that the primary focus of that work was the study of human factors. It was also noted that there would be significant confidentially issues associated with any uses of that data, since there were a number of conditions put in place to protect the participants of the original studies. Moreover, there is no desire to reveal what is in the test panels since this would reduce their effectiveness in future tests. However, in the succeeding discussion, it was noted that, although there were limitations to the usefulness of the full POD study data and panels, there\is an alternate approach. As a part of the program, there were two "practice panels" that had been prepared to allow groups to evaluate how they are doing prior to a blind test. It was agreed that these might be used in future studies. Bode and Spencer accepted an action item to provide a report describing those two panels. Buynack commented that there were also some Air Force panels that might be used to the same end and accepted an action item to provide further detail.

TESI POD Approach: Annis described the TESI approach. He emphasized the difference between fitting a waveform and a peak amplitude and noted that one needed to select a model "appropriate" to the need. He felt that physical theory can suggest the form of a model, but that the model can be empirically derived from experimental data. He described how this will be done on a sample containing a large number of spherical inclusions of different diameters and properties. His slides may be found in file 11.

Comparison of Crack/EDM Notch POD Results for B1-B: Lindgren discussed ultrasonic POD studies that had been done on lap joints on the B1-B using a prototype rotary scanner. It was found that the responses of cracks were similar to those of notches in these studies. His slides may be found in file 12.

Discussion of Cracks Versus Notches: Thompson presented some thoughts on the relative responses of crack versus those of notches. His central theme was that the relative response will depend on the specifics of the measurement situation. In some situations there will be little difference while in others there could be a significant difference. The answer will depend on the details of the inspection. He presented some ideas, based on theory, regarding the situations in which there would and would not be a difference. His slides may be found in file13. In the ensuing discussion, it was suggested by Goldfine that we should also consider the effects of "cracks not being where we expect" on POD. Thompson remarked that this had been considered for the ultrasonic case by the ETC.

Future Directions: Thompson summarized action items that had been identified during the meeting. Marshall presented a slide, prepared by Malas, indicating some possible future directions, as documented in file 14. There was considerable overlap between these two views, and the group defined a composite set of action items, as defined below.

The names given are those who were identified by participants at the meeting. However, it was emphasized that this is an open process and others are welcomed to join. Please contact Thompson or the parties identified below if you wish to contribute to the action item.

Action Items: At the conclusion of the meeting, a number of action items were adopted to guide future activities of the MAPOD WG. There were the following.

- Complete first draft of a list of empirical POD studies that have been conducted: I. Gray
- Complete first draft of a list of model-based POD studies that have been conducted (NTIAC report provides a good start): Aldrin
- Develop a list of items that should be included in the "Toolbox": Rummel
- Develop protocols for the XFN and FMA approaches: Smith, Thompson, Spencer, Meeker
- Complete determination of ultimate repository for MAPOD protocol: Malas, Knopp, Washbaugh
- Complete listing of available POD data and samples: Swindell, Annis, Lindgren
- Develop plan for establishing technical feasibility of MAPOD approach and posture for Aging Aircraft FY06 POD Optimization Program: Thompson, Malas, Knopp
- Email group when new material added to web site: Thompson
- Add discussion forums to web site: Thompson
- Provide description of Sandia lap splice panels: Bode, Spencer
- Provide descriptions of Air Force samples: Buynak
- Seek opportunity to brief MATEC on MAPOD activities: Thompson to contact Matzkanin
- Seek opportunity for broader publicity of the MAPOD activities (e.g. NTIAC or JNDE): Thompson
- Validate that Navy is still on the distribution list: Thompson
- Contact Perez regarding possible Navy interest: Marshall
- Determine time for next meeting: Marshall-see below

Next Meeting: Discussions were held about the best time/site for the next meeting. It was agreed that AeroMat provides a good opportunity in about the correct time frame. This meeting will be held in Orlando on June 7-9. However there was no consensus about the specific time window during this period in which MAPOD would meet. Marshall (AFRL) will look into this and suggest a plan