

# European-American Workshops on Reliability of NDE

- A series of workshops, starting in 1997 in Berlin, has been improving understanding of the sources and effects of different factors influencing POD
- Aerospace, Nuclear, and Off-shore industries in each continent have developed distinct POD determination approaches consistent with their unique needs
  - Commonalities and differences influenced by the role that the resultant POD plays in life management
- 4<sup>th</sup> workshop held in Berlin on June 24-26
- Next workshop is being planned by SwRI
- Information from the 4<sup>th</sup> Workshop follows
  - Agenda
  - Area identified as needing further discussion



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## 4th European-American Workshop on Reliability of NDE

BAM – Berlin, Germany – June 24<sup>th</sup> – 26<sup>th</sup>, 2009

### Tuesday, June 23, 2009

- Tutorial: Design of Experiments (DoE)
- Tutorial: Probability of Detection (POD) Basics
- Tutorial: Probability of Detection (POD) Advanced

### Wednesday, June 24

- Keynote Presentations
- Statistical Tools for Inspection
- Applications in Industry I
- Applications in Industry II
- Break-out Session: Applications in Industry
- Break-out Session: Statistical Tools for Inspection
- Poster Evening



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**Thursday, June 25**

- Applications in Industry III
- Reliability of Structural Health Monitoring (SHM)
- Progress in Method for Reliability – Model-Assisted Probability of Detection (MAPOD) I
- Human Factor I
- Human Factor II
- Progress in Methods for Reliability – Model-Assisted Probability of Detection (MAPOD) II
- Progress in Methods for Reliability – Model-Assisted Probability of Detection (MAPOD) III



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**Thursday, June 25**

- **Break-out Session: Human Factor**
- **Break-out Session: Progress in Methods for Reliability and MAPOD**
- **Break-out Session: Reliability of Structural Health Monitoring (SHM)**
- **Integrated Solutions I**
- **Integrated Solutions II**
- **Break-out Session: Integrated Solutions**

# Areas Identified in Need of Further Discussion: Empirical (4<sup>th</sup> European-US Workshop)

- **Relative attributes**
  - 29 out of 29, DOEPOD (NASA). hitmiss, ahat vs a,
  - E.g., efficiency, assumptions...
- **Advanced statistical analysis techniques**
  - Right censoring, left censoring, truncation
- **Determining POD from finds**
- **Relationship of POR to POD**
- **Application to image-based data**
- **Interpreting repair and subsequent inspections**
  - Evolution of flaw population

# Areas Identified in Need of Further Discussion: MAPOD (4<sup>th</sup> European-us Workshop)

- Combining empirical and model-based information
- Accuracy of resulting POD predictions
- Assessing dependence on multiple parameters
  - Use of DOE to make practical
- Determining input distributions for stochastic calculations
- Role of coverage predictions
- Validation/calibration of MAPOD predictions
- Relative roles of model-assisted vs fully model-based POD determination
- Glossary of terms
- Description of use in training, certification, and testing of operators
- Relationship of accuracy of model and POD prediction
  - Validating models and metrics for model accuracy and POD uncertainty

# Areas Identified in Need of Further Discussion: Both (4<sup>th</sup> European-US Workshop)

- **Dealing with false calls**
- **Combining the results of independent inspections**
- **Assessing dependence on multiple parameters**
  - **Use of DOE to design practical tests**

# Some Future Directions

- New European Union research effort is being started to apply MAPOD ideas to aircraft engines
- A new study group is being initiated by IIW Commission V (NDT) on Reliability Including Simulation (Benoist). Possible activities include
  - **Simulation**
    - Guidelines for use and validation
    - International data bases in benchmarking
  - **Reliability**
    - Guidelines for determining POD
    - Guidelines for MAPOD approaches
    - Discussion of advanced concepts (mixing empirical and simulation data, multivariate effects, ...)