



## NONDESTRUCTIVE EVALUATION SYSTEM RELIABILITY ASSESSMENT MIL-HDBK 1823

Vincent S. Spanel Flight Technologies Branch ASC/ENFT WPAFB OH







- Introduction
- MIL-HDBK 1823
- Use of POD in ENSIP & ASIP
- Update process
- "Validation"
- Conclusions







- MIL-HDBK 1823 Responsible Engineering Organization (REO) is ASC/ENFT (Flight Technology Branch)
  - Airframe Structures Group\*
  - Propulsion Group\*
  - Internal and External Aero
  - Flight Controls
- ASC/ENOI, Engineering Standards Office is managing organization
  - Tech Writers
  - Official review and coordination cycles
  - Publishing



## MIL-HDBK 1823



- MIL-HDBK 1823 published in 1999
  - Handbook is used for guidance
  - Recommended practice, not a requirement
- Assessment of capability of an NDE system
  - Probability of detection as a function of flaw size
- Addresses responsibilities for planning, conducting, analyzing, and reporting NDE reliability evaluations
- Specific requirements for particular systems
  - Eddy Current
  - Fluorescent penetrant
  - Ultrasonic
  - Magnetic Particle



## Use of PODs



- ENSIP
  - Probability of detection sets assumed initial flaw size in deterministic fracture mechanics analyses
  - POD curve an input variable for probabilistic analyses
    impacts inherent flaw distribution
- ASIP
  - Aircraft structure design target is to require no inservice inspections
  - Probability of detection sets flaw size for recurring inspection interval (when required due to mission changes)
    - Subsequent to initial interval







## Damage Tolerance Approach









- Technical community (combined gov't/industry) develops proposed content
- Draft document distributed for "informal" review and comment cycle
  - Affected/interested contributors
- Comments adjudicated by REO
- Draft document finalized and released for official comment/coordination by ASC/ENOI
  - Adjudication cycle
- Publish

1-2 year cycle – paced by document development







- Validation "to confirm or establish the truthfulness or soundness of something"
- Technical demonstration of model accuracy & robustness compared to actual results
  - Experimental data
  - Historical service data







- PODs are "statistical" in nature
  - Dependance on a number of influence variables
- Analytical tools must account for all <u>significant</u> variables
- Experimental validation of tool over full range of influence variables
- Test case for representative part/geometry
  - Combination/interaction of influence variables
  - Identify any unaccounted for variables
- Success criteria
- Uncertainties input variables, measurements







- PODs critical to safe management of airframe and engine structural components
- MIL-HDBK 1823 is current "Best Practice" for NDE reliability assessments
- MIL-STDs and Handbooks must keep up with emerging technologies to remain relevant as design documents
- ASC/EN committed to maintaining design standards
- Close coordination with technology teams and industry users to ensure proper maturity and confidence for incorporation