

# **Nondestructive Inspection Reliability and Risk in the Field and Depot**

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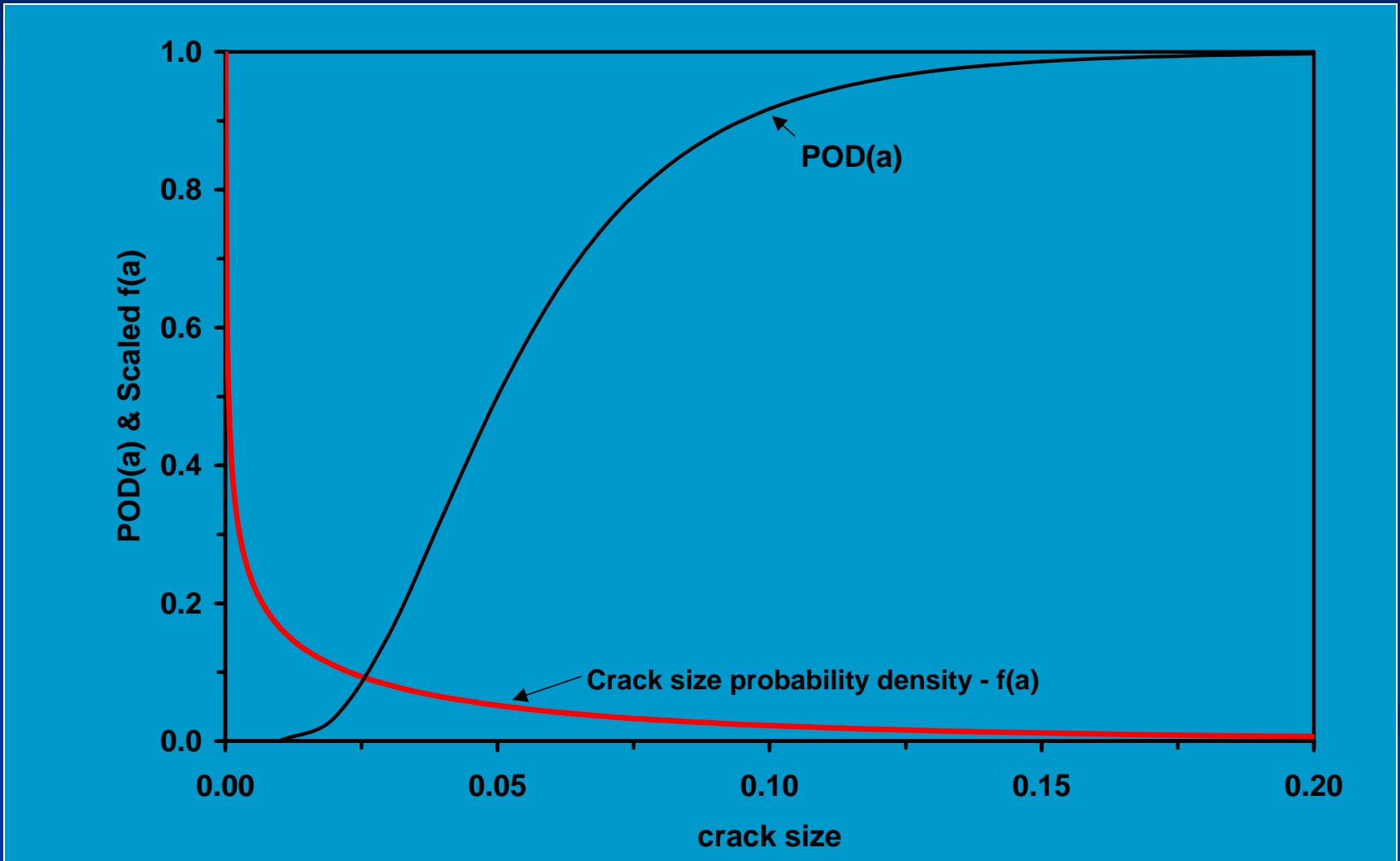
Texas Research Institute, Austin

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D&W Enterprises, Ltd.

**ASIP 2006, 28 - 30 November 2006, San Antonio TX**

# What is found at inspection?



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**Proportion < a detected**  $= P_D(a) = \int_0^a f(x)POD(x)dx$

**Distribution of detections**  $= D(a) = P_D(a) / P_D(\infty)$

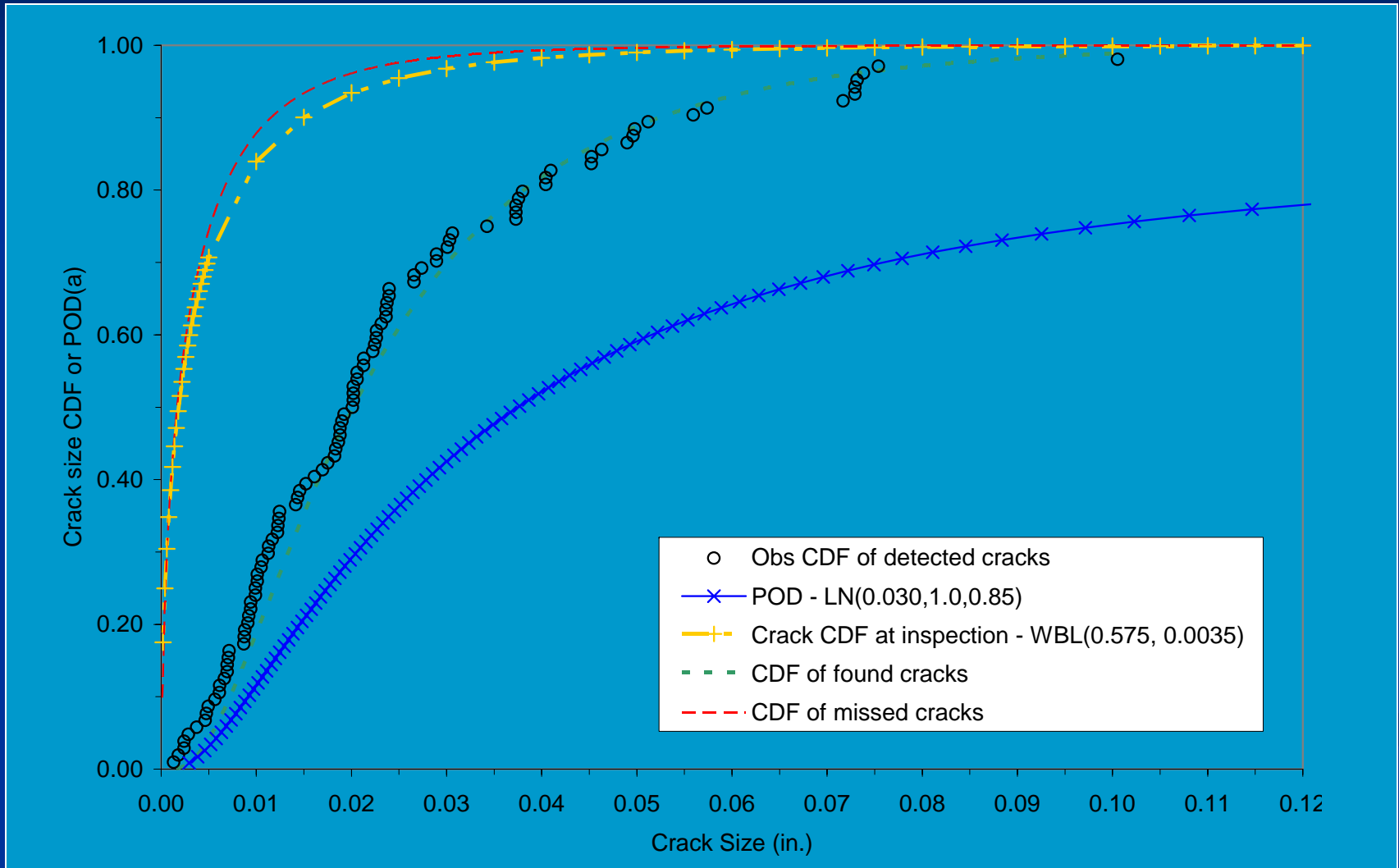
**Proportion < a missed**  $= P_M(a) = \int_0^a f(x)[1 - POD(x)]dx$

**Distribution of misses**  $= M(a) = P_M(a) / P_M(\infty)$

# Crack findings

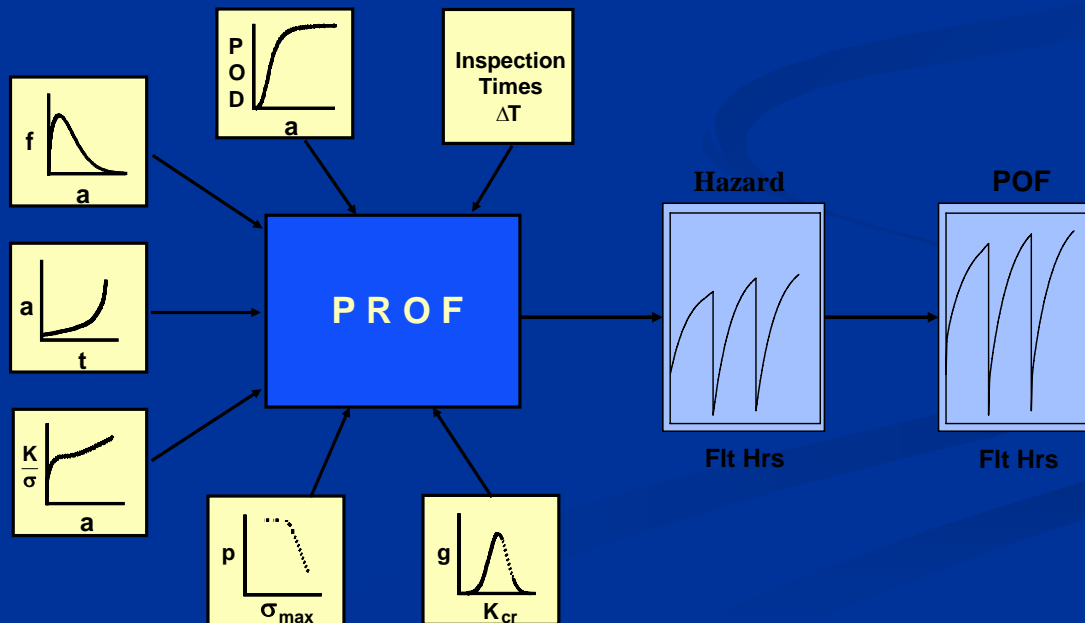
- Inspection finds are the integration of the actual crack population and the POD
- Using the crack finds population to estimate the actual population yields a biased result
  - there are many small cracks you have not found
  - YOU ONLY FOUND MOST OF THE BIG ONES
  - this biased result was used in multiple presentations at ASIP 2005, ICAF 2005 as an estimate of actual crack population

# Distribution of cracks at inspection



# Risk Analysis - PROF

- Mil-Std-882D requirements
  - Hazard rates and/or failure probability
- Expected number of missed cracks
- Expected number of fatigue failures



# Recommended Short Term Actions:

- Do no more POD's until "calibration" and equipment issues have been resolved.
- Institute a multiple point "calibration" and master gauge program.
- Validate all fracture critical NDI procedures.
- Initiate a data base of all fleet findings for critical inspections (key input to PROF and audits).
- Develop and demonstrate methods for implementing risk analysis in fleet management

# Recommended Long Term Actions:

- (Re)validate fracture critical inspections and periodically audit
  - by reference to master gauge responses
  - by duplicate inspections and review of recorded data
  - by periodic teardown of removed hardware components.
- Record information from found cracks for use in fleet management and risk assessment.
- Review and validate requirements and inspection thresholds. This may result in changing inspection intervals.