

Canadian Forces GBHEC PoD Presentation to the Model Assisted PoD Working Group

Atlanta, GA 10 Mar 2006

Captain DJ Butcher

NDT Development Officer

Aerospace and Telecommunications
Engineering Support Squadron (ATESS)

(613) 392-2811 ext 3186



**ATESS
ESTIMA**

*Enhanced Operational
Readiness Through
Excellent Support*

*Amélioration de l'état
de préparation
opérationnelle grâce à
l'excellence du soutien*





**ACCESS
ESTIMA**

*Enhanced Operational
Readiness Through
Excellent Support
Amélioration de l'état
de préparation
opérationnelle grâce à
l'excellence du soutien*



Outline

- Introduction to Canadian PoD Team
- Project Objective
- SLAP PoD Results
- Update on DOE
- Update on Modelling
- Current/Remaining Work
- Timelines
- Conclusion



**ATESS
ESTIMA**

*Enhanced Operational
Readiness Through
Excellent Support*

*Amélioration de l'état
de préparation
opérationnelle grâce à
l'excellence du soutien*

Canadian GBHEC PoD Team

- Project Sponsor – Maj Brosseau
DGAEPM/DAES
- Project OPI – Capt DJ Butcher, ATESS
- Project Lead Tech – Sgt Mike Bunn, ATESS
- EC Modelling – Dr. Catalin Madache, NRC
- PoD DOE – Dr. Zheng Liu, NRC
- Crack Manufacture – Mr. Marko Yanishevsky,
NRC





**ACCESS
ESTIMA**

*Enhanced Operational
Readiness Through
Excellent Support
Amélioration de l'état
de préparation
opérationnelle grâce à
l'excellence du soutien*

Project Objectives (2)

- To validate the current minimal detectable crack size (a_{NDT}) in fastener holes representative of a box wing structure using Rotating Bolt Hole Eddy Current (RBHEC)*
- To verify a PoD model so that the PoD of defects in similar structures can be interpolated

*Also known as ABHEC



**ACCESS
ESTIMA**

*Enhanced Operational
Readiness Through
Excellent Support
Amélioration de l'état
de préparation
opérationnelle grâce à
l'excellence du soutien*

Project Objective (Cont'd)

- As much as possible the intent of this project is to have a generic PoD study
- Conventional PoD studies are limited to the exact structure inspected
- This project will use a combination of actual test data and models
- By use of the models the real PoD results can be applied to similar structure (generic)
- This approach will be more cost effective than conducting many specific PoD studies

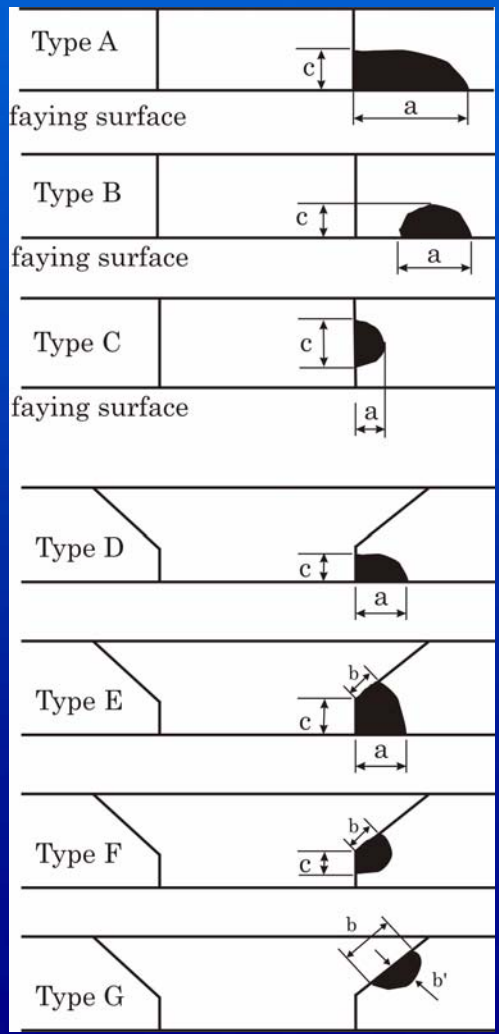




**ACCESS
ESTIMA**

*Enhanced Operational
Readiness Through
Excellent Support
Amélioration de l'état
de préparation
opérationnelle grâce à
l'excellence du soutien*

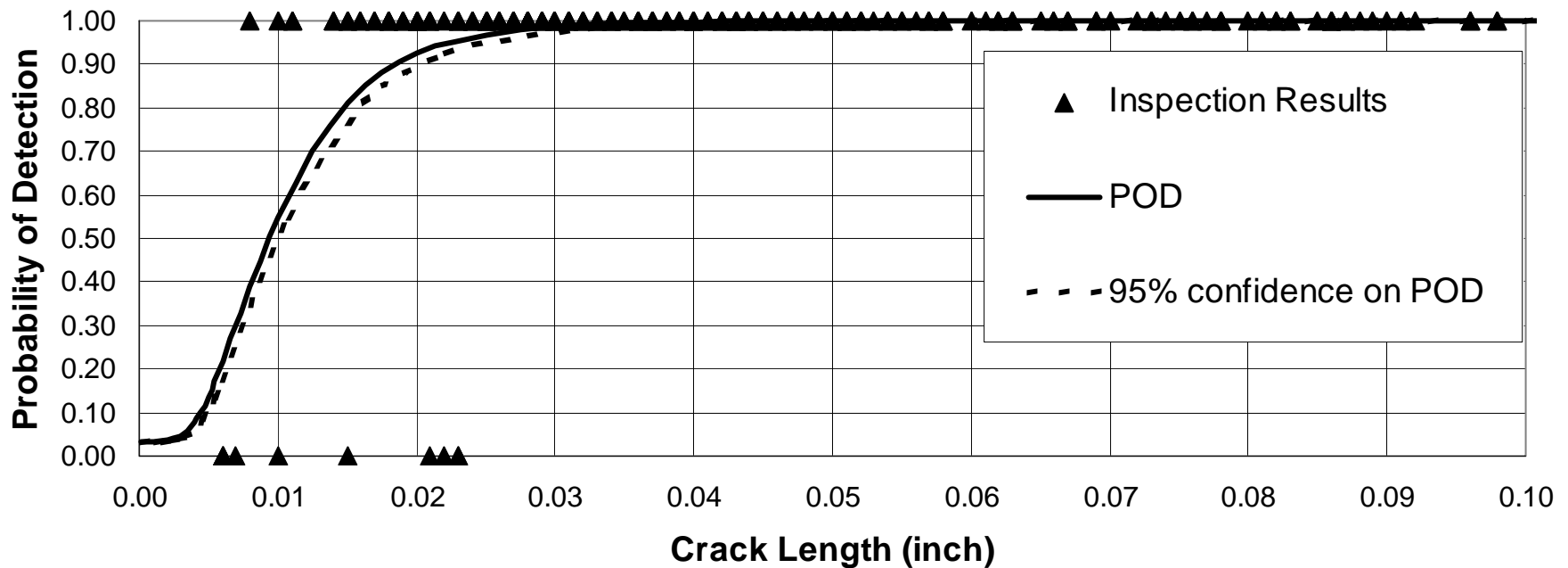
SLAP PoD Study on BHEC as Confirmed by Fractography



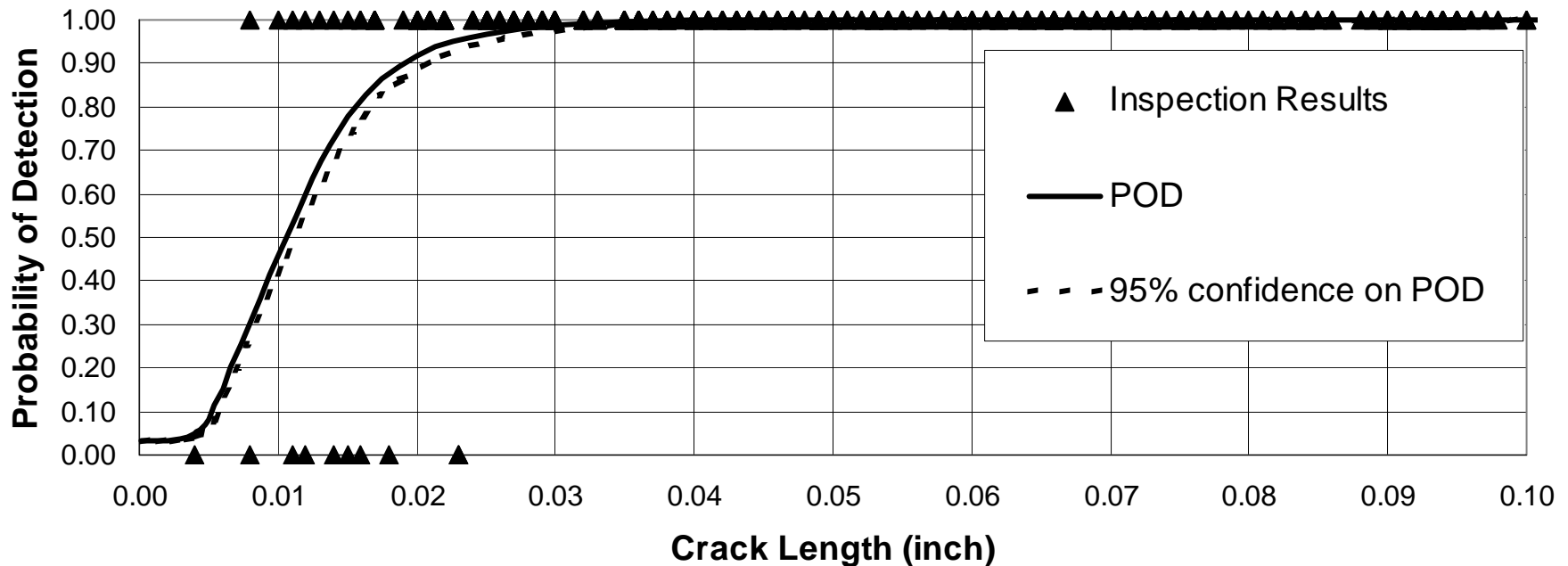
SLAP PoD Study
based upon Type
A and Type C
defects found in
the 2nd layer of
the P3 wing
splices



SLAP PoD Study on BHEC as Confirmed by Fractography PoD $f(a)$



SLAP PoD Study on BHEC as Confirmed by Fractography PoD $f(c)$



Bolt Hole PoD Specimens



**ACCESS
ESTIMA**

*Enhanced Operational
Readiness Through
Excellent Support
Amélioration de l'état
de préparation
opérationnelle grâce à
l'excellence du soutien*

- Four sources:
 - Lab Grown cracks (Zheng presentation)
 - EDM Notches in Test Coupons (same coupons as lab grown cracks)
 - EDM Notches in Real Structure
 - Real Cracks in Real Structure (left over SLAP pieces and other USN P3 wings)





**ACCESS
ESTIMA**

*Enhanced Operational
Readiness Through
Excellent Support*

*Amélioration de l'état
de préparation
opérationnelle grâce à
l'excellence du soutien*



GBHEC PoD

Design of Experiments

- [DOE Link](#)

Fatigue Process

No-crack



38 thou crack hole



15 thou crack hole



Endoscopy





**ACCESS
ESTIMA**

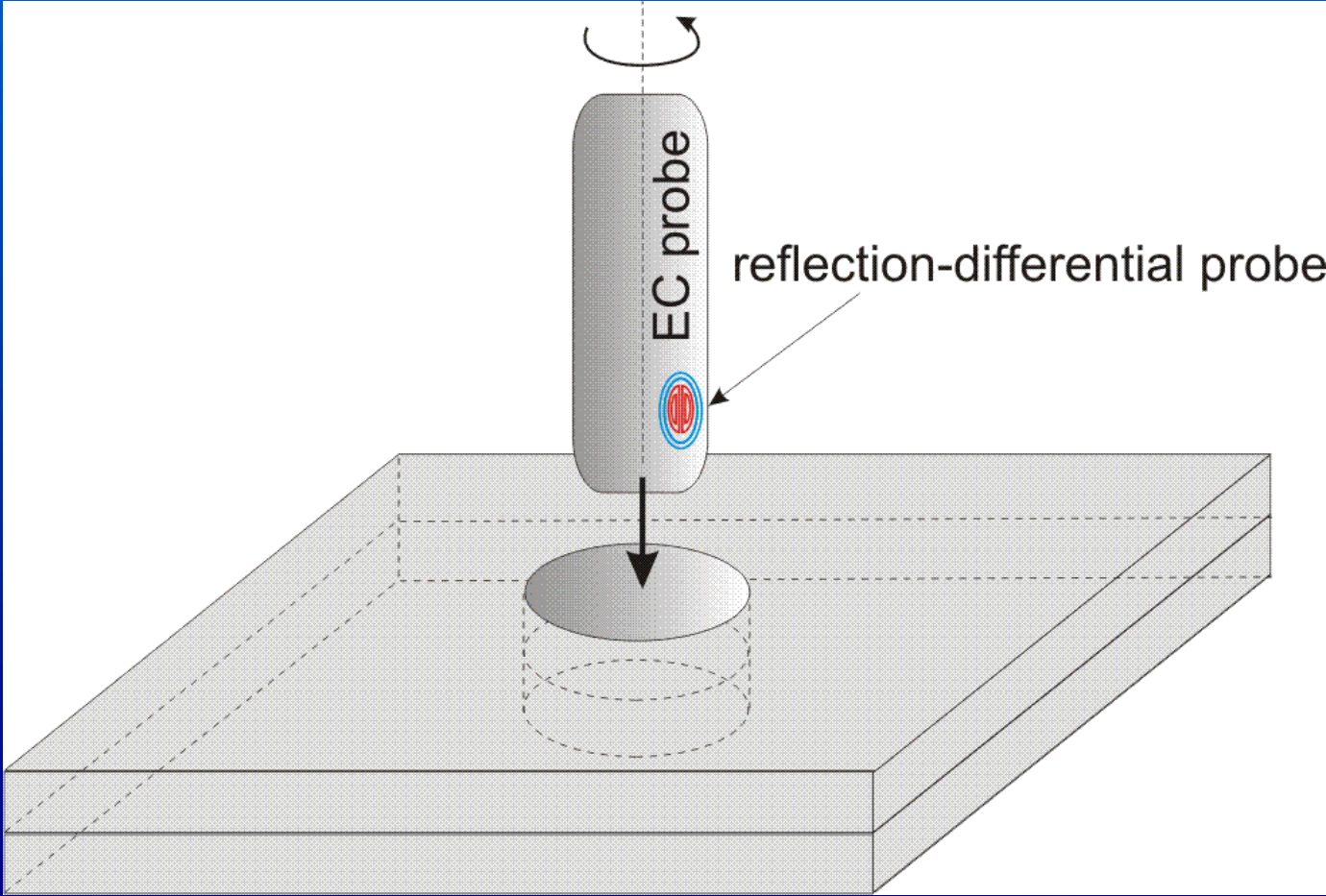
*Enhanced Operational
Readiness Through
Excellent Support*

*Amélioration de l'état
de préparation
opérationnelle grâce à
l'excellence du soutien*



GBHEC PoD EC Modelling

- Modelling Link



Current Work at ATESS



ATESS
ESTIMA

*Enhanced Operational
Readiness Through
Excellent Support
Amélioration de l'état
de préparation
opérationnelle grâce à
l'excellence du soutien*

- Continue crack harvesting of real cracks in real structure from SLAP leftovers and old P3 skins from the USN (fracto after tech inspections)
- EDM notches in real structure (40 notches in range of 0.05” to 0.080”) in web and web stiffener structure of USN P3 (each layer approx 0.090”)





**ACCESS
ESTIMA**

*Enhanced Operational
Readiness Through
Excellent Support
Amélioration de l'état
de préparation
opérationnelle grâce à
l'excellence du soutien*



Current State

- The crack manufacture methodology has been validated (NRC)
- Cracks are being grown at this time (NRC)
- Modelling efforts well underway (Catalin Presentation)
- Design of Experiments near completion (Zheng Presentation)
- Crack harvesting ongoing



**ACCESS
ESTIMA**

*Enhanced Operational
Readiness Through
Excellent Support
Amélioration de l'état
de préparation
opérationnelle grâce à
l'excellence du soutien*



Remaining Work

- Grow (NRC) and harvest (ATESS) cracks
- Measure (Visual, CT, some Fracto) and catalogue cracks
- Manufacture carrying cases (big tissue box?)
- Assemble coupons in the carrying case
- Develop Briefing Package, Work Instruction, Data Registry, etc..
- Fracto
- Data Analysis
- Final Project Report
- Generic PoD Handbook

Timelines



**ACCESS
ESTIMA**

*Enhanced Operational
Readiness Through
Excellent Support
Amélioration de l'état
de préparation
opérationnelle grâce à
l'excellence du soutien*

- If current schedule is followed then should be ready to conduct the technician inspections early this summer (Have Cracks Will Travel – Canadian Edition)
- The project is scheduled to be completed by March 2007





**ATESS
ESTIMA**

*Enhanced Operational
Readiness Through
Excellent Support
Amélioration de l'état
de préparation
opérationnelle grâce à
l'excellence du soutien*



Conclusion

- At the completion of the PoD study the minimal detectable crack size (a_{NDT}) in fastener holes representative of a box wing structure using RBHEC will be determined
- Interpolation to other similar structures will be done by applying eddy current and PoD models to the PoD results
- This effort will be coordinated by ATESS and involves other CF NDT facilities, NRC, QETE and possible others