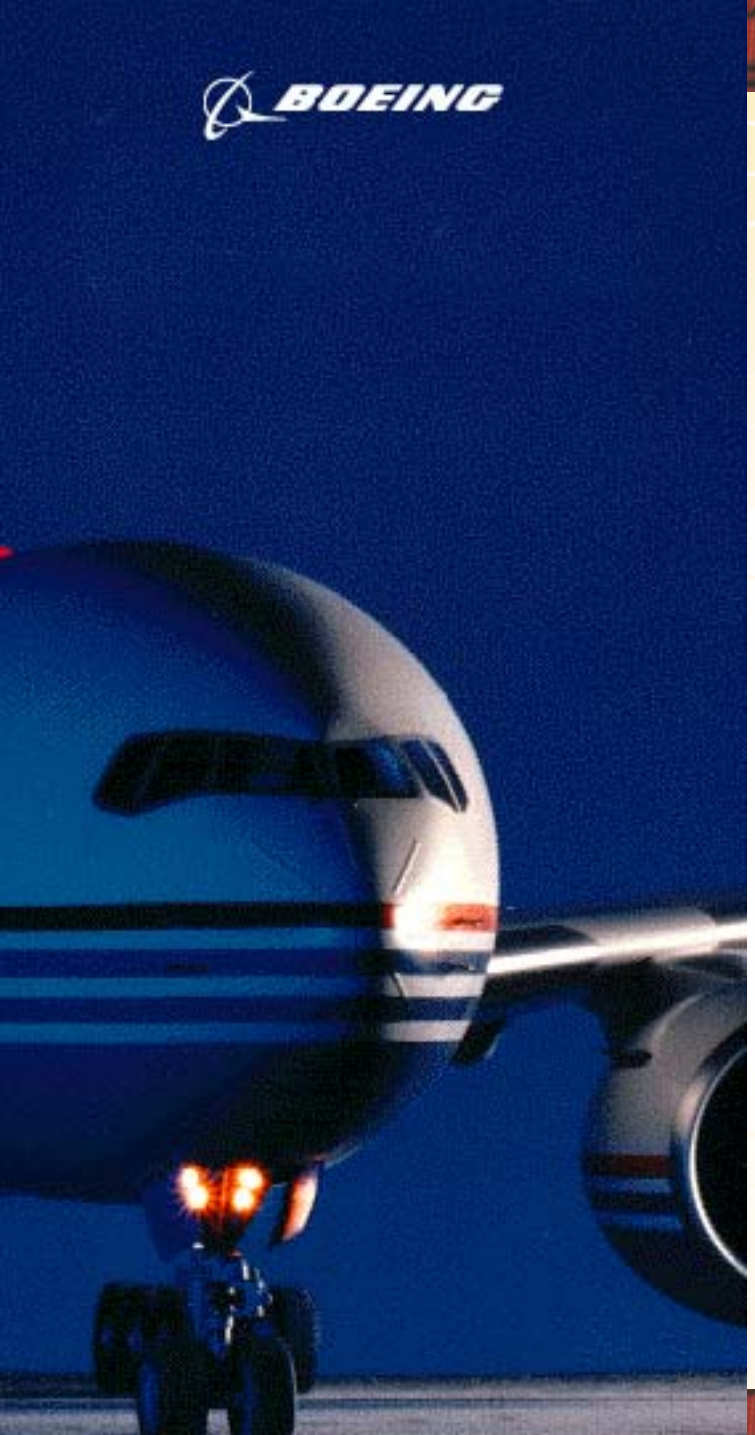


JCAA/JG-PP No-Lead Solder Project: Thermal Cycle Test Status

Tom Woodrow
Boeing Phantom Works
Seattle, WA

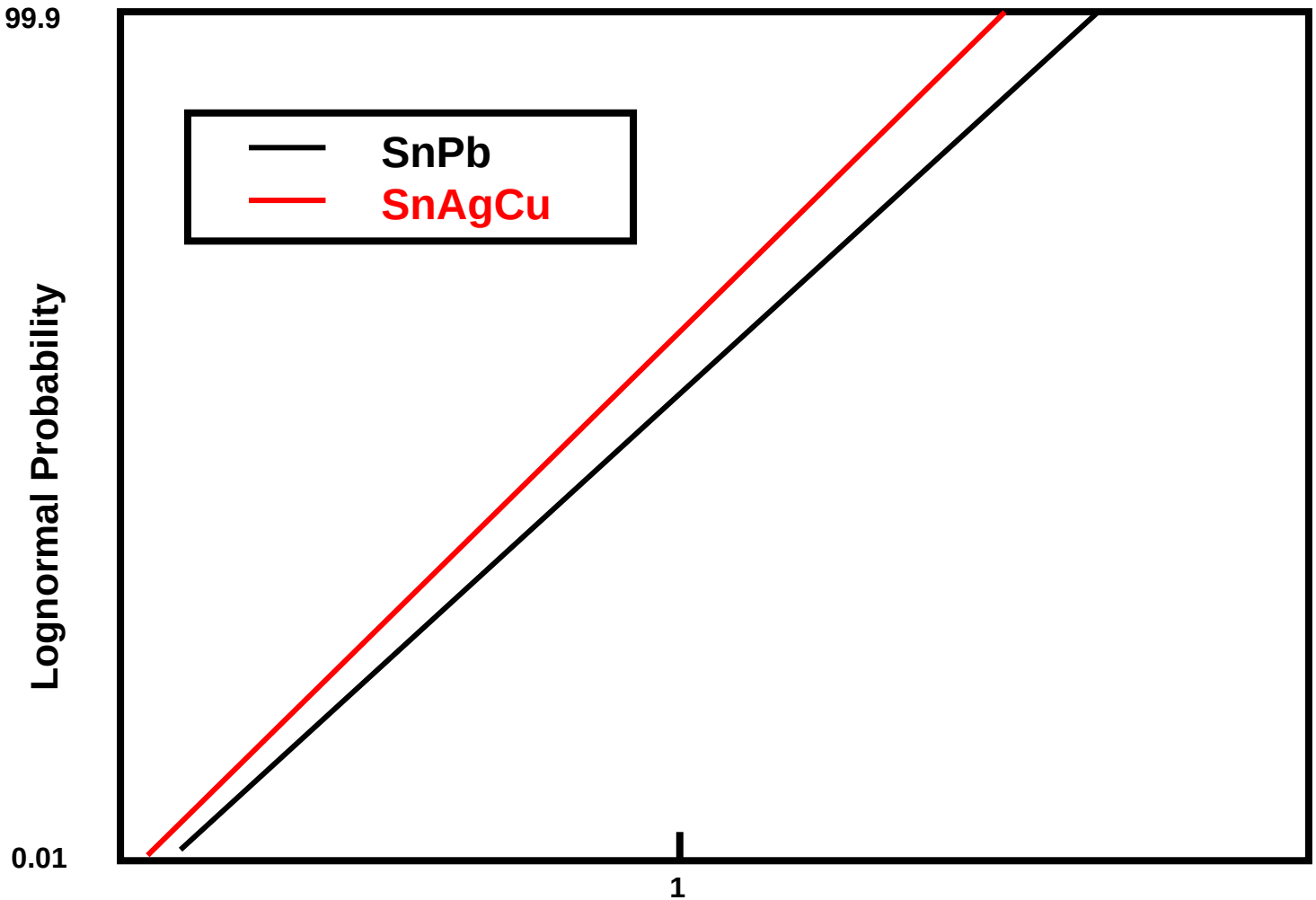
March 16, 2005

Thermal Cycling (-20°C to 80°C)

- Approx. 3000 cycles completed. 7000 cycles to go.

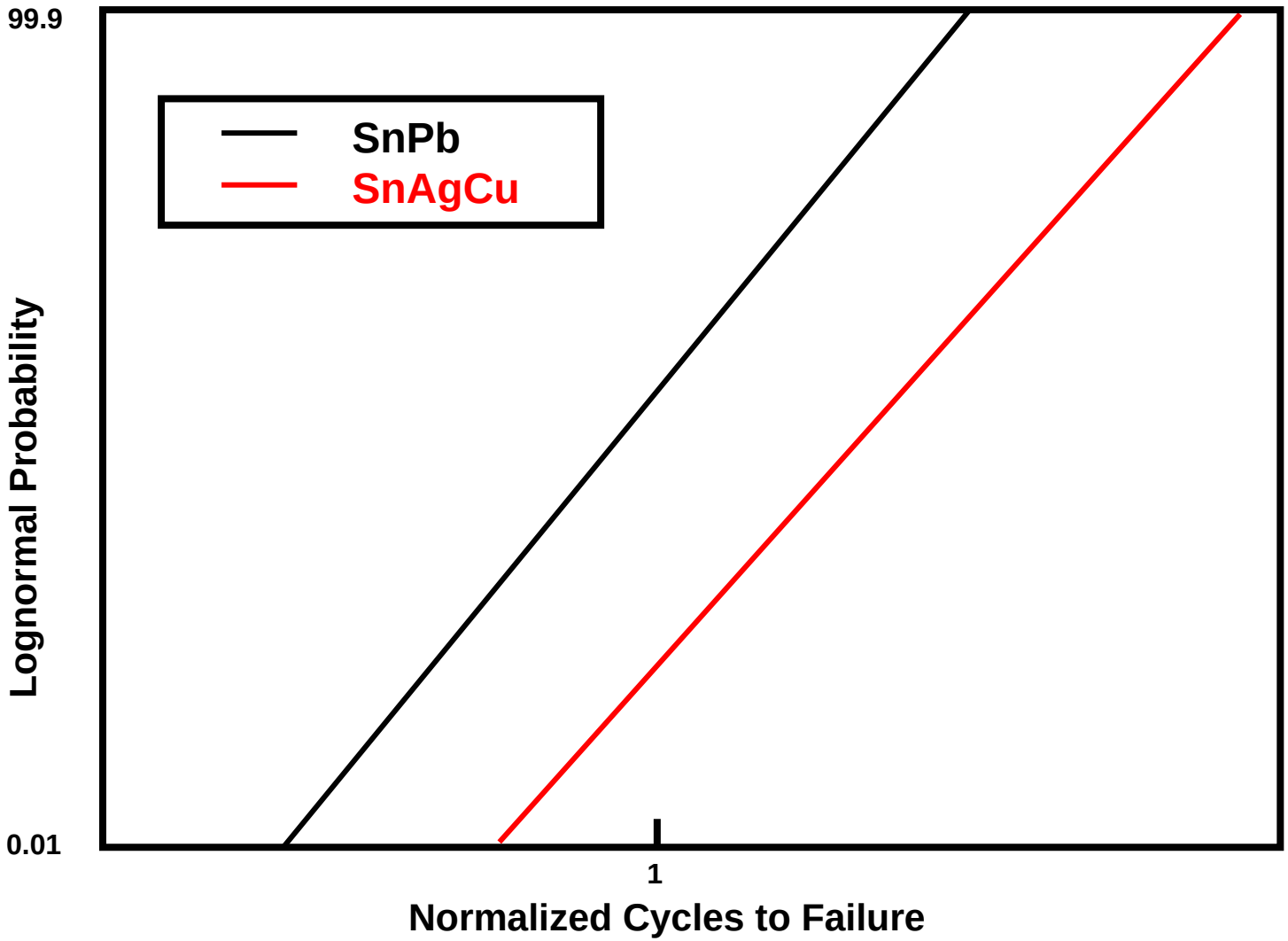
The Bartelo Study

625 I/O CBGA 32x32x0.8mm
-40° to 125°C; 42 min Cycle Results
8 min. Dwells



Bartelo, J., et. al., IPC/SMEMA Council APEX 2001

625 I/O CBGA 32x32x0.8mm
0 to 100°C; 30 min Cycle Results
7 Min. Dwells

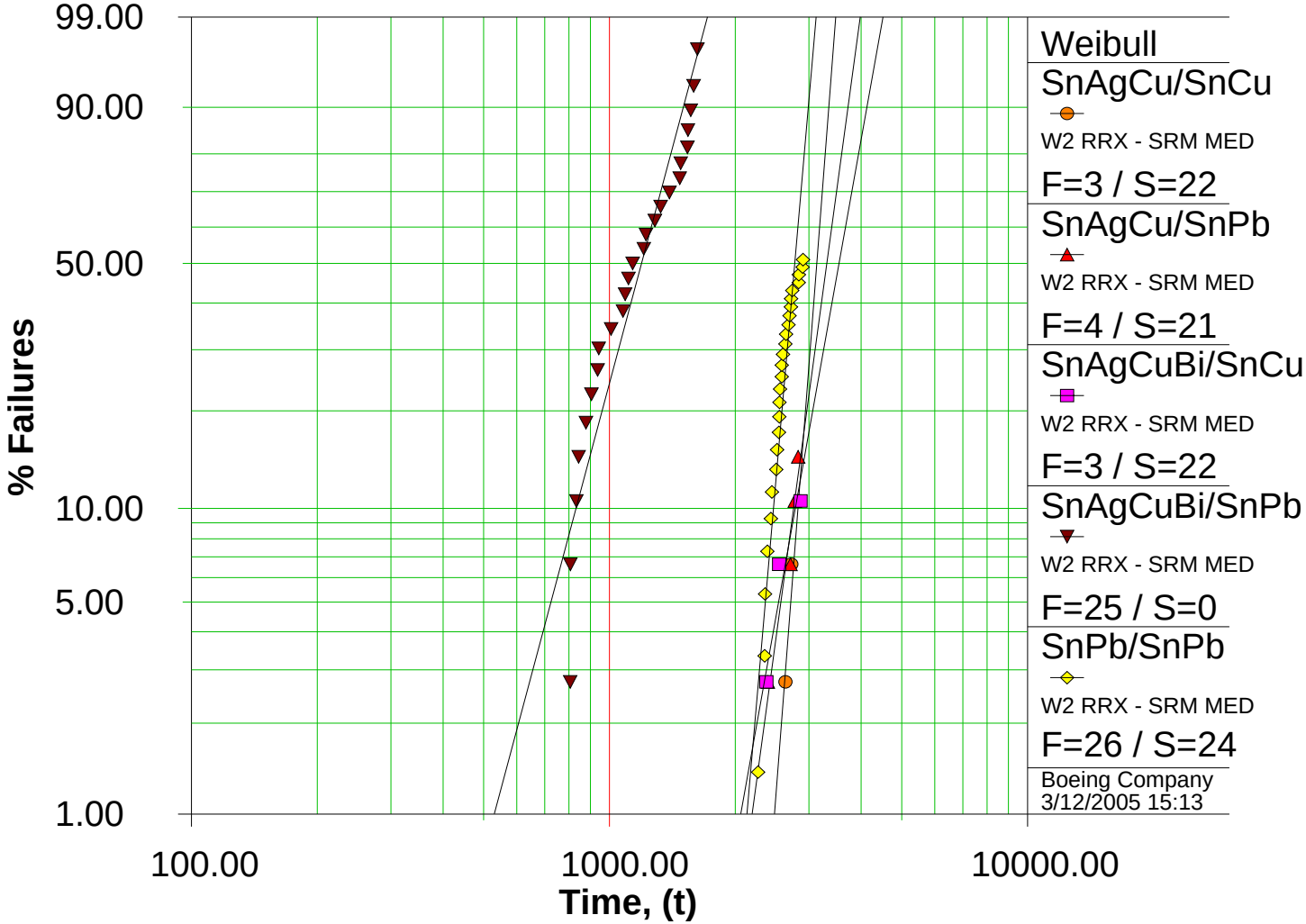


Bartelo, J., et. al., IPC/SMEMA Council APEX 2001

How to Make Sense Out of the Data?

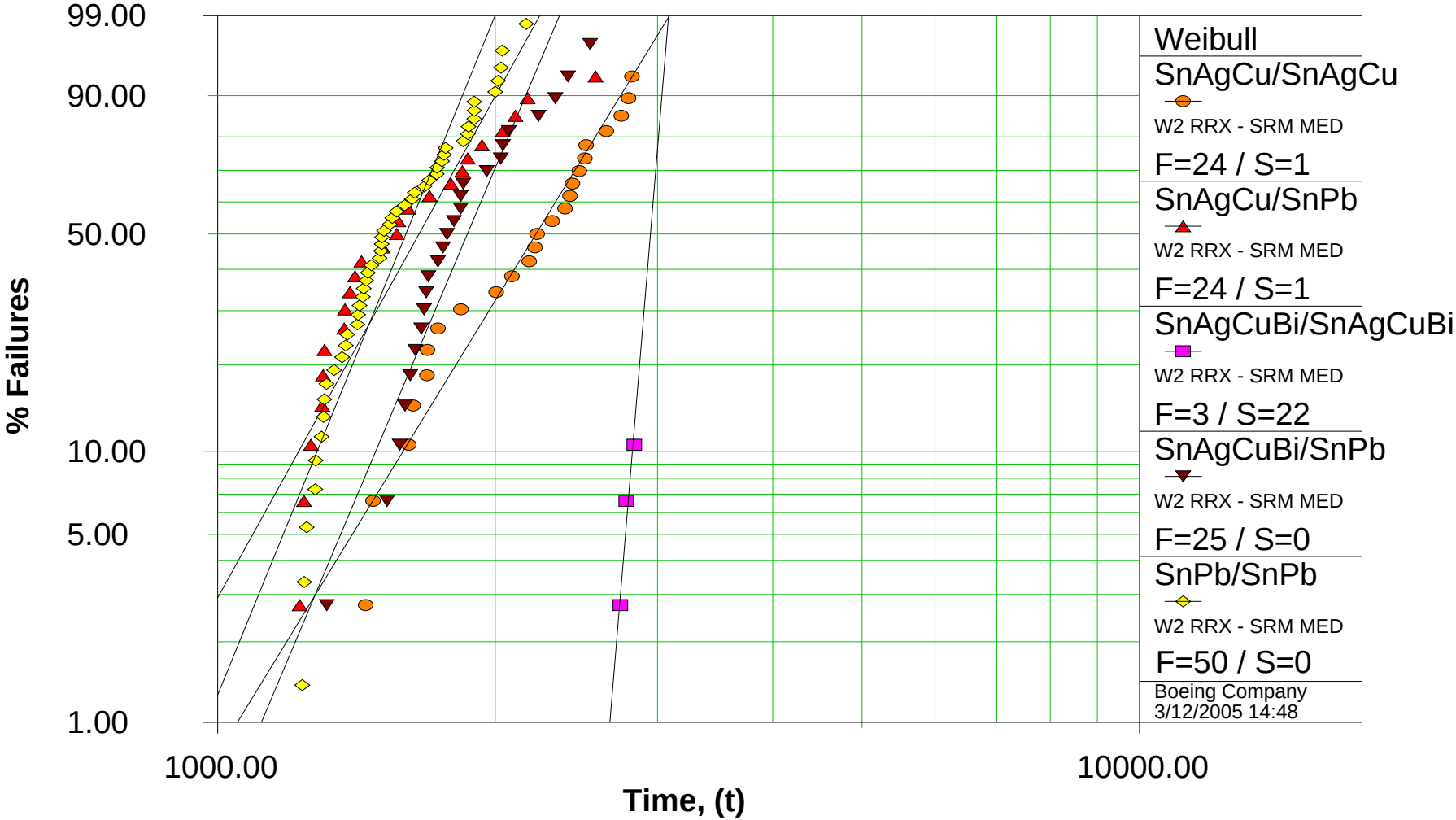
- Use thermal cycle test data to validate a model
- Then you can use the model to predict field lifetimes
- Problem: We don’t have a good model yet!!!

TSOP's (Manufactured Test Vehicles)



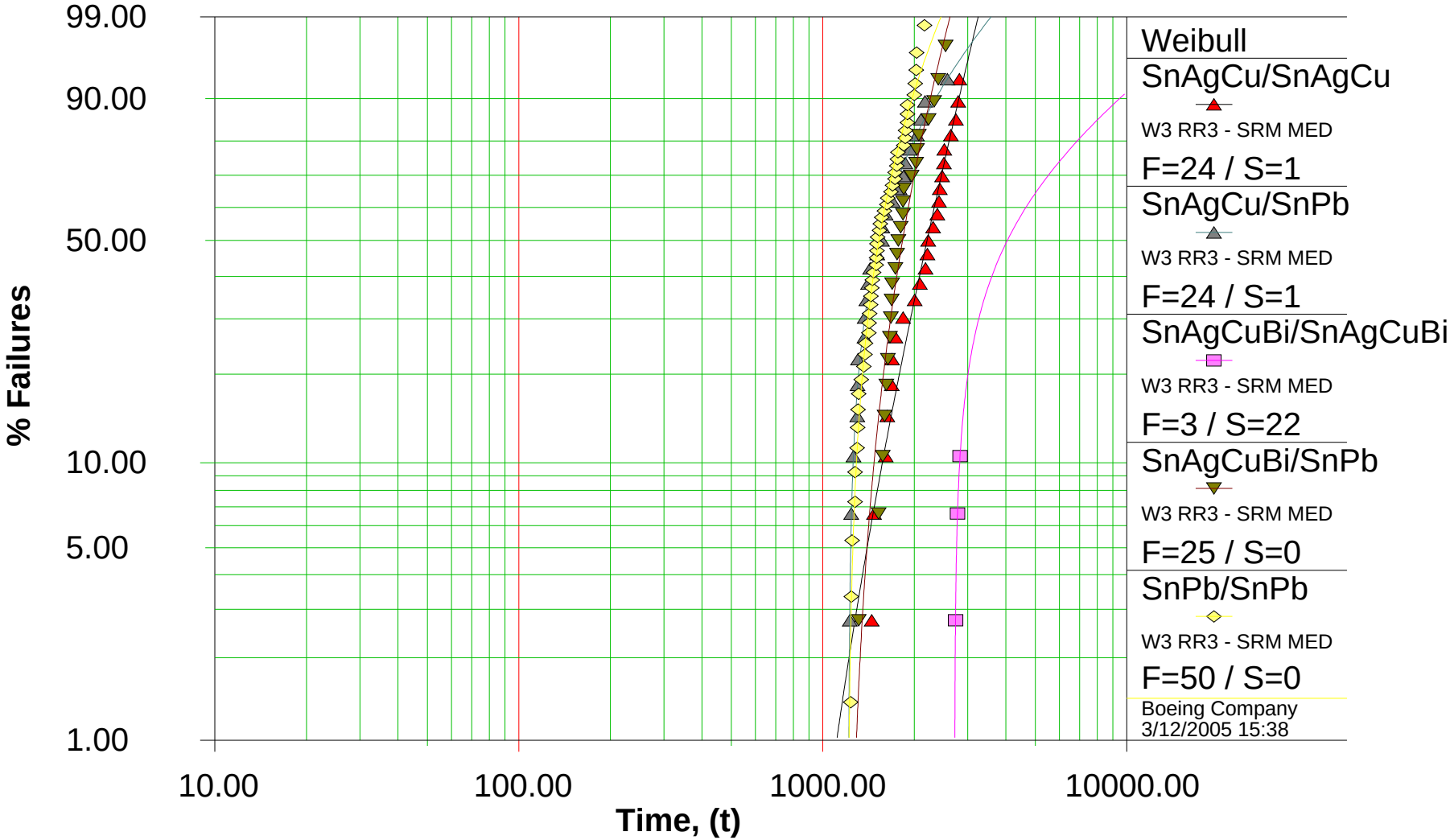
$\beta 1=18.1592$, $\eta 1=3196.9762$, $\rho=0.9603$
$\beta 2=10.2884$, $\eta 2=3431.3569$, $\rho=0.9720$
$\beta 3=7.8134$, $\eta 3=3711.9855$, $\rho=0.9495$
$\beta 4=5.2169$, $\eta 4=1280.7478$, $\rho=0.9520$
$\beta 5=16.0853$, $\eta 5=2837.6236$, $\rho=0.9459$

CLCC's (Manufactured Test Vehicles - 2P Plot)



$\beta 1=5.6800$, $\eta 1=2361.6716$, $\rho=0.9720$
$\beta 2=6.2716$, $\eta 2=1752.8913$, $\rho=0.8972$
$\beta 3=41.8204$, $\eta 3=2973.2488$, $\rho=0.9644$
$\beta 4=8.2285$, $\eta 4=1950.4921$, $\rho=0.9426$
$\beta 5=8.4987$, $\eta 5=1670.8514$, $\rho=0.9358$

CLCC's (Manufactured Test Vehicles - 3P Plot)



$\beta 1=3.8465$, $\eta 1=1801.4400$, $\gamma 1=567.0950$, $\rho=0.9753$
$\beta 2=0.9448$, $\eta 2=469.7697$, $\gamma 2=1215.5275$, $\rho=0.9965$
$\beta 3=0.7400$, $\eta 3=2188.2518$, $\gamma 3=2716.6600$, $\rho=0.9998$
$\beta 4=2.3691$, $\eta 4=756.9576$, $\gamma 4=1181.8525$, $\rho=0.9657$
$\beta 5=1.4113$, $\eta 5=421.7854$, $\gamma 5=1204.8625$, $\rho=0.9933$

3 parameter Weibull plots assume there is a failure free time (gamma)