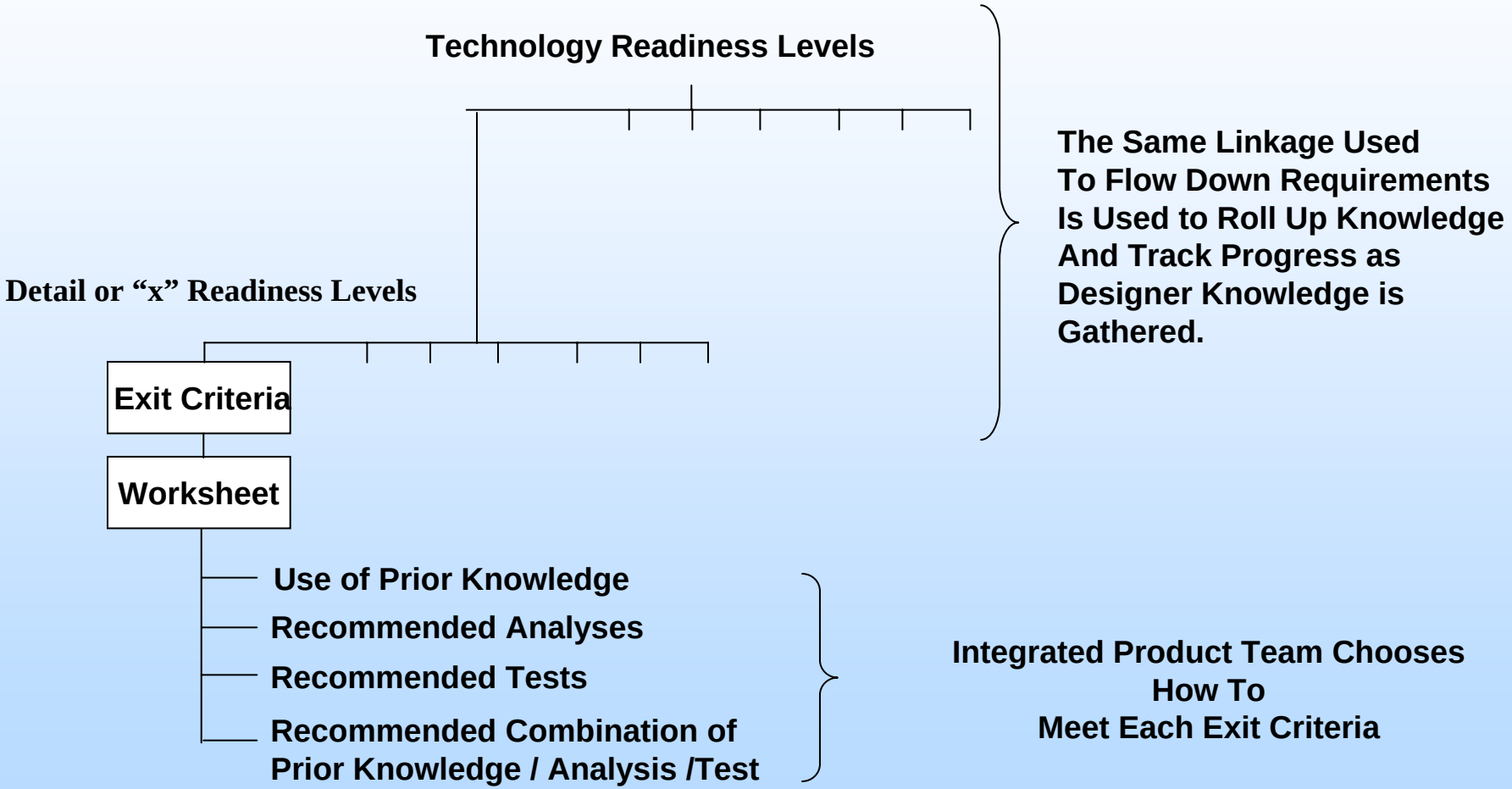
Knowledge Gathering

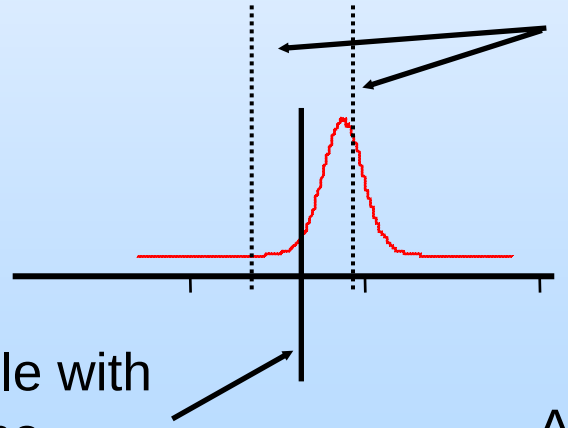


Conformance Assessment Data from Knowledge, Analysis, and Test – Design Values with Uncertainty

•Existing Data with replicates => can estimate design values (quantities and confidence bands)

•RDCS allows simulation of physical data with sources of randomness including batch effects (aleatory or random uncertainty) => can simulate design values.

•Combined data: design values with uncertainty bands



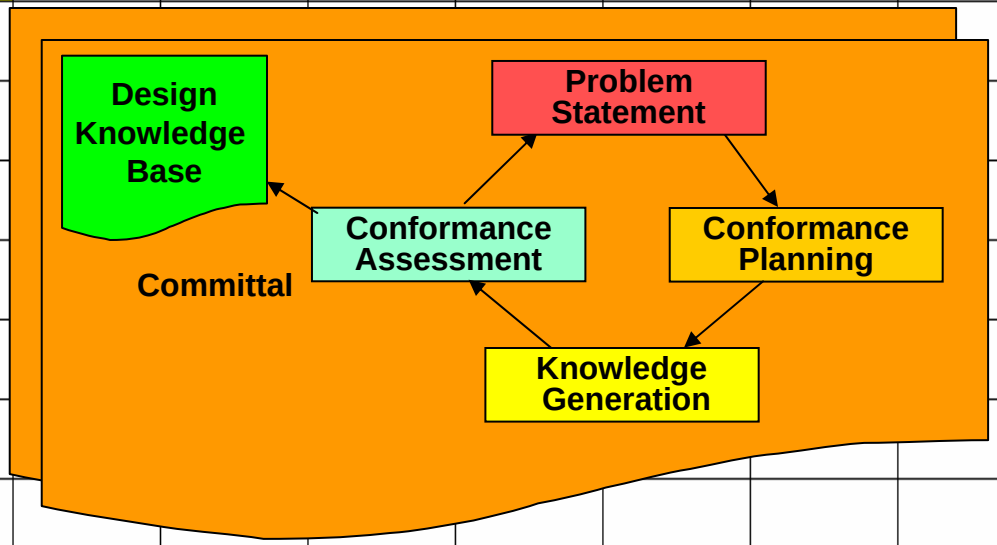
Bayesian uncertainty band on analysis based properties

Property estimate = quantile with confidence band. This is the "aleatory"/measured content

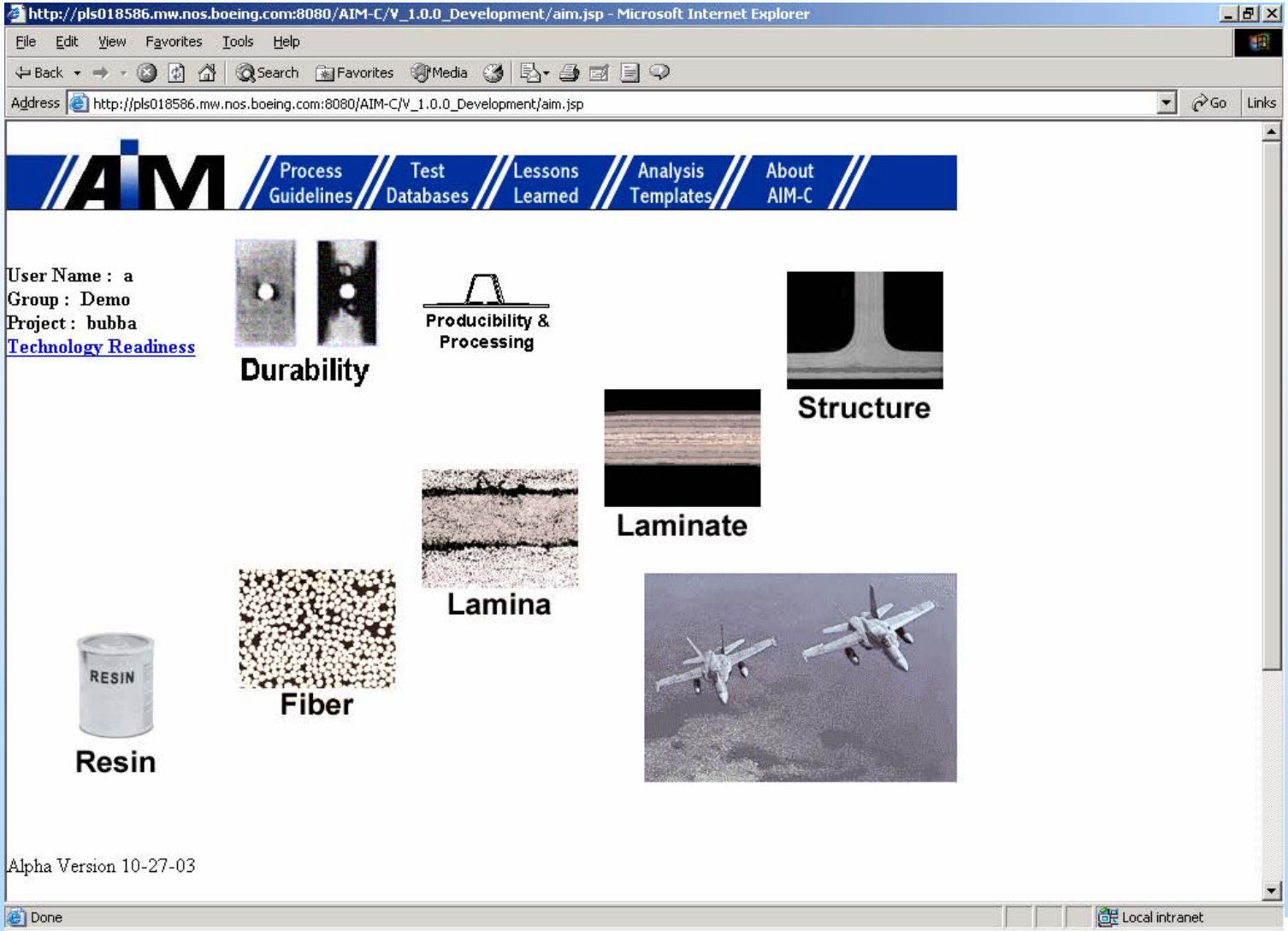
Aleatory and Bayesian are kept separate

AIM Allows the IPT to Track Progress

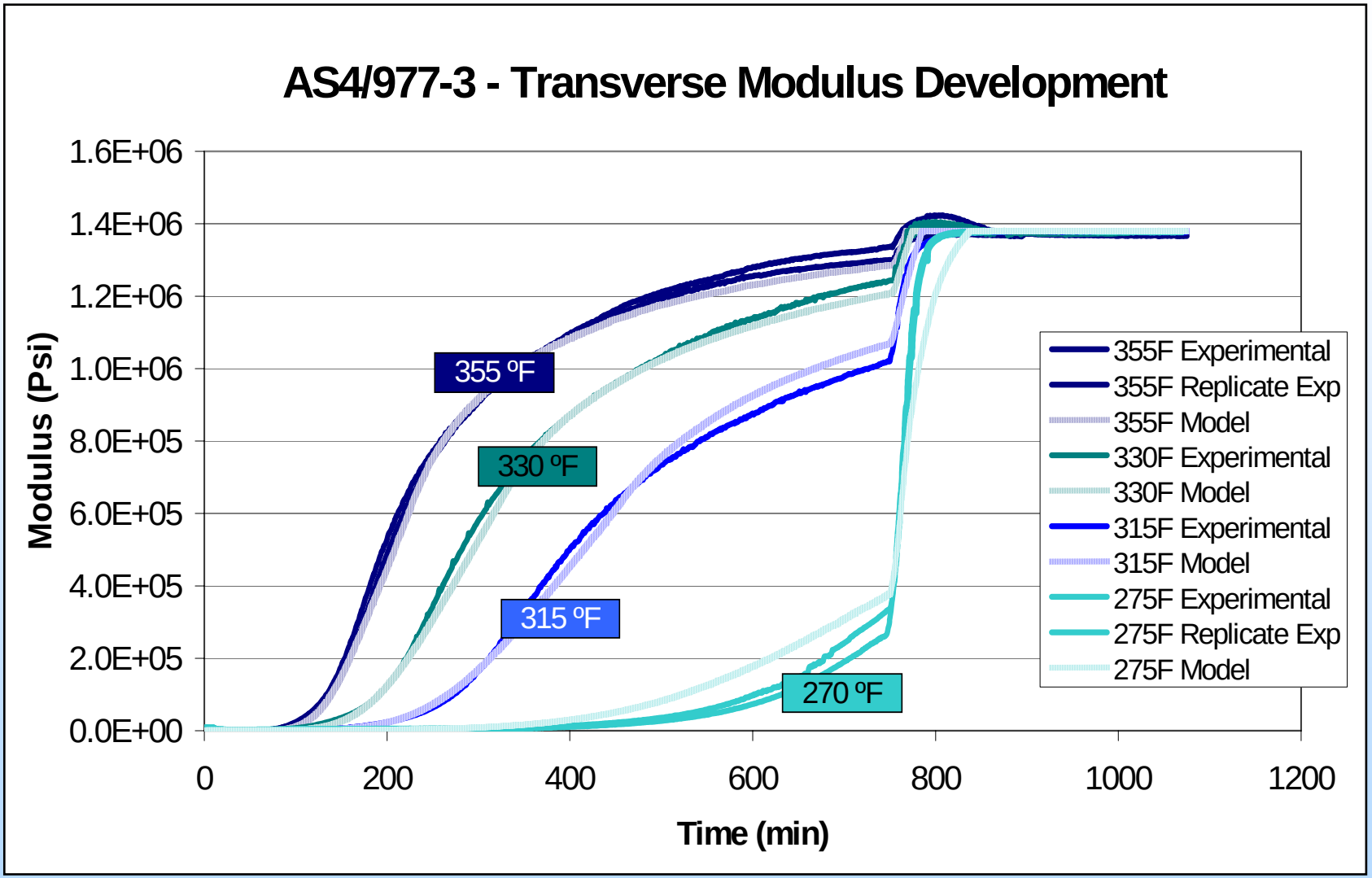
TRL	0	1	2	3	4	5	6	7	8	9	10
IPT Reviews	Technology Insertion Readiness	System Requirements Review	Material and Process Readiness	Key Features Design and Fabrication	Key Features Test / Conformance	Preliminary Design	Critical Design / Ground Test Readiness	Flight Test Readiness	Production Readiness	Operatioinal Readiness	Technology Insertion Readiness
Application / Design											
Certification											
Assembly											
Structures / Durability											
Fabrication / Quality											
Materials & Processes											
Supportability											
Survivability											
Cost / Schedule											
Intellectual Property											



AIM Has Assembled a Web-Based System to Help the IPT Apply the Process

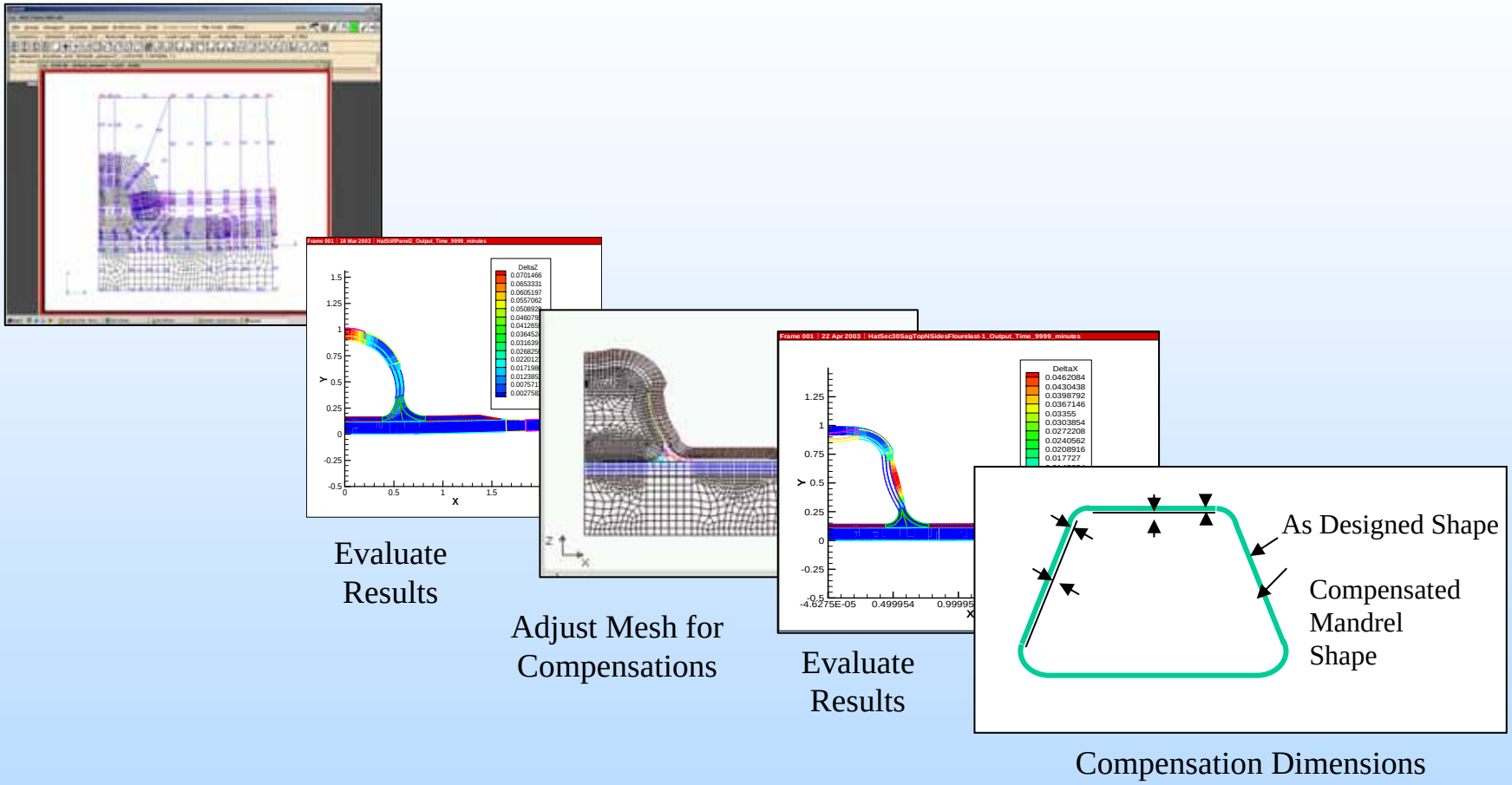


How Do Materials Engineers Use AIM-C?



AIM-C Helps Monitor Conformance to Requirements

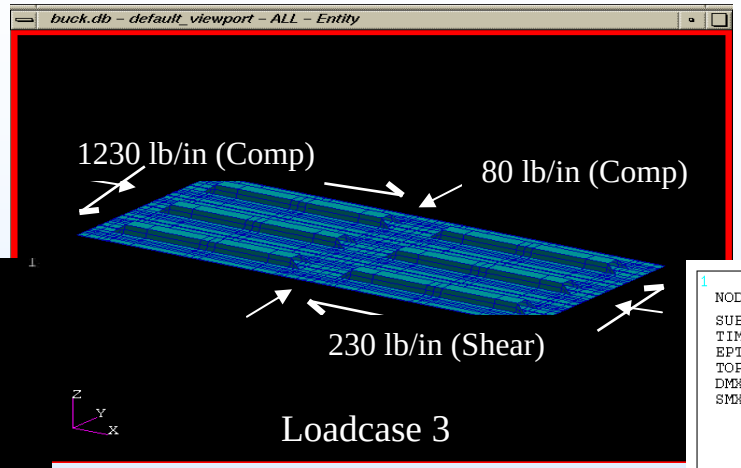
How Does Manufacturing Use AIM-C?



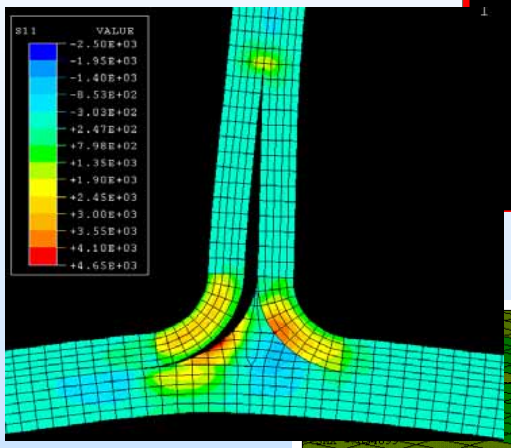
AIM-C Helps Identify Analysis Tools to Guide Fabrication

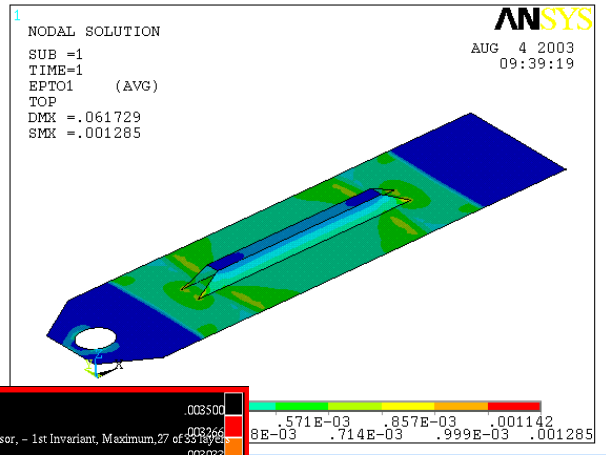
How Do Structures Engineers Use AIM-C?

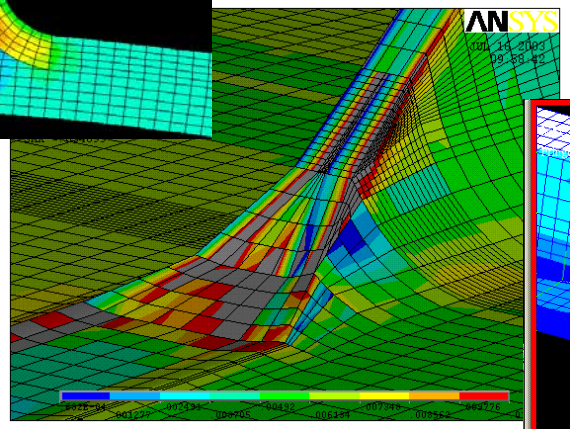
Fed Back to FEM
For Verify Satisfaction
Of Requirements

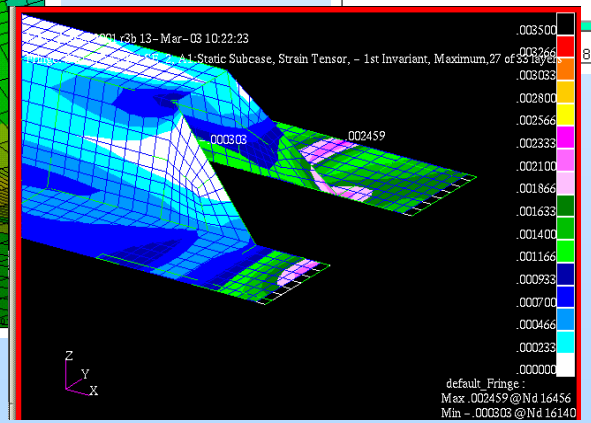


From Full FEM
to Segments









Details to
Effects of
Defects

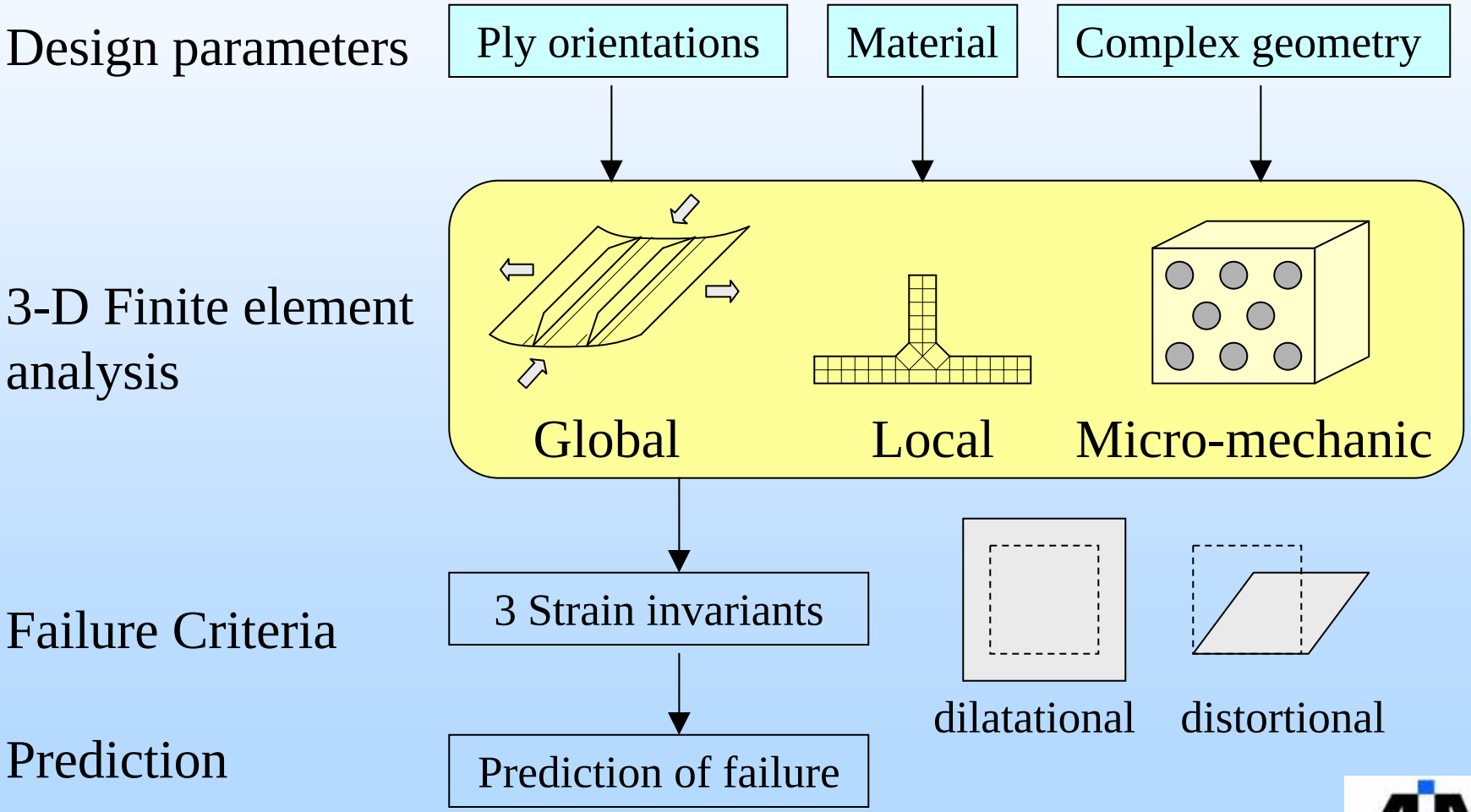
Segments to
Elements

Elements to
Details

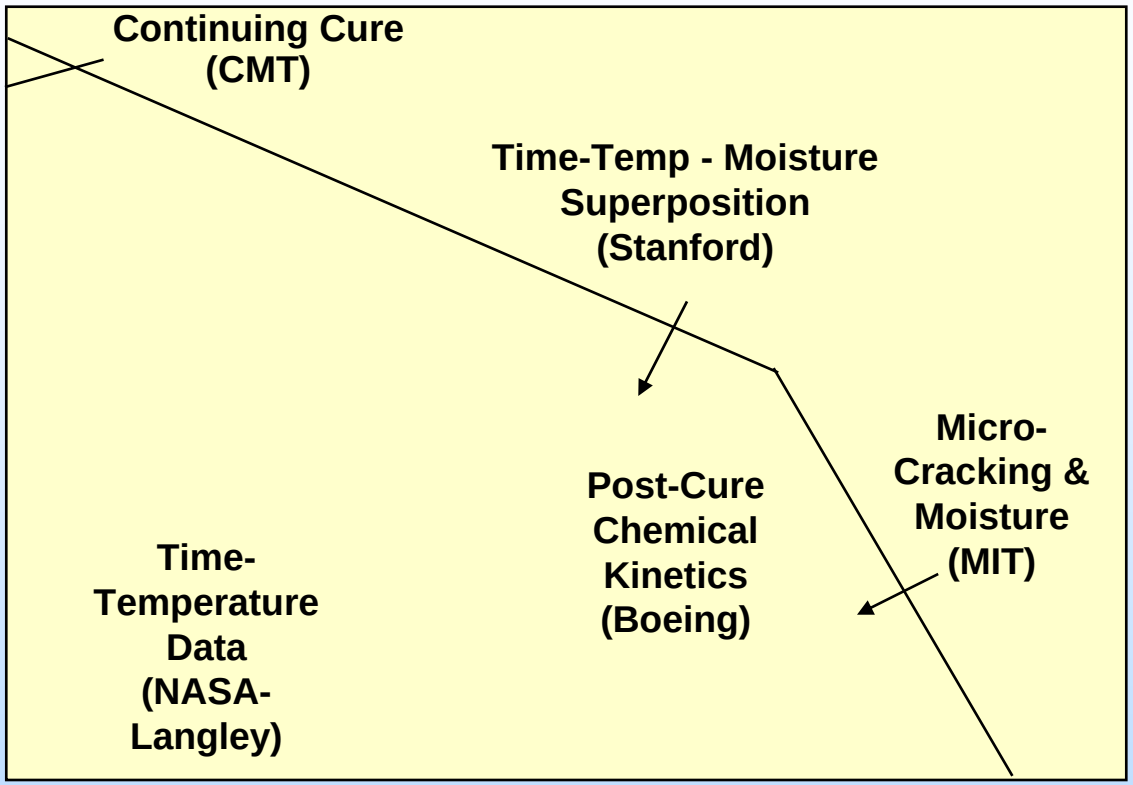
AIM-C Helps Plan the Maturation Process

How Does AIM-C Assess Strength?

Detailed 3D FEA of complex structures
combined with simple strain-based failure criterion
(SIFT)

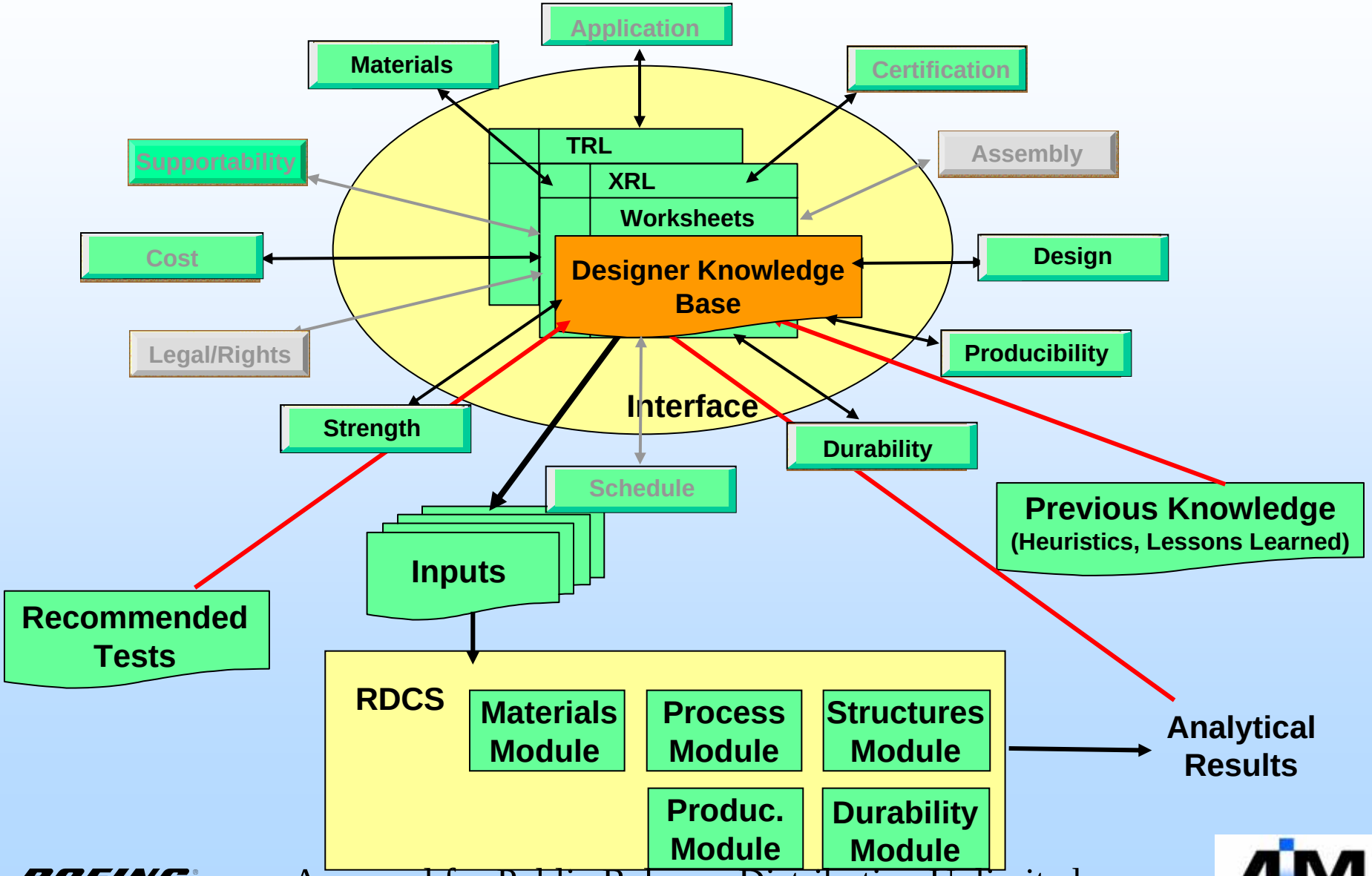


How Does AIM-C Assess Durability?



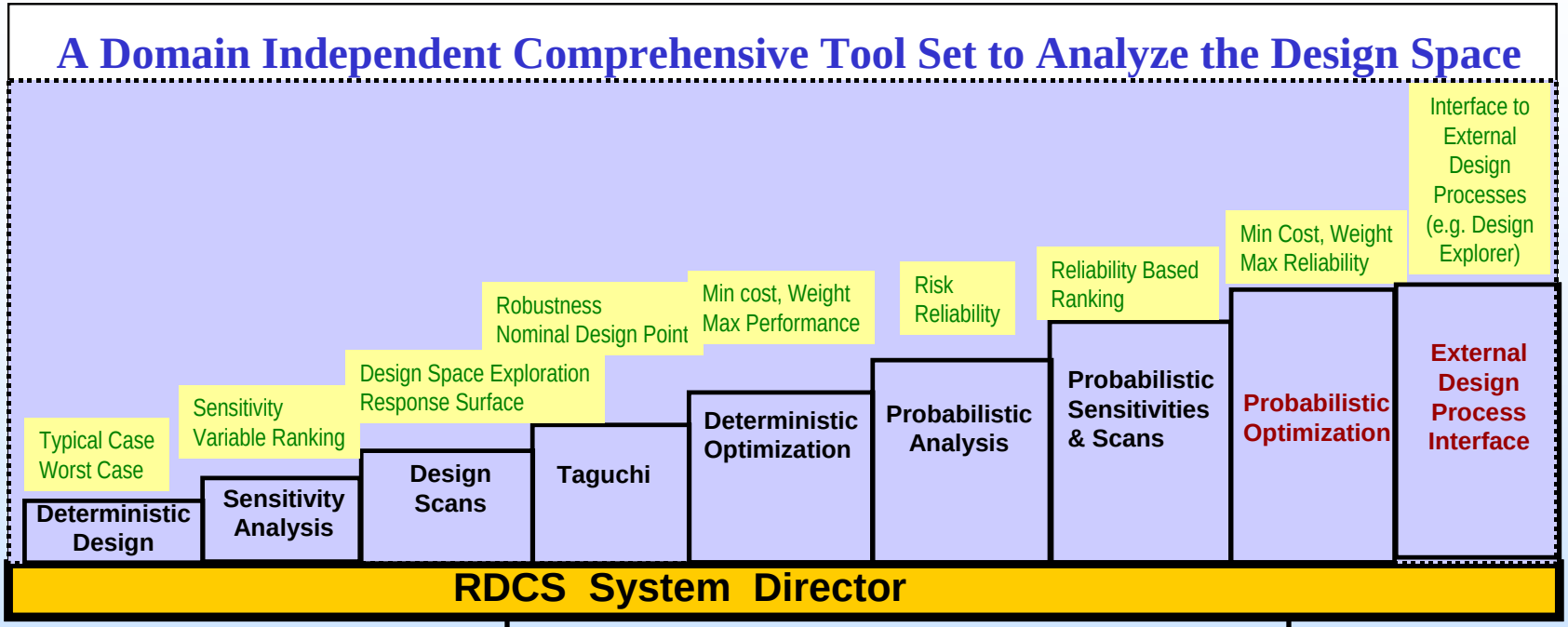
This Module Predicts the Effects of Four Competing Failure Modes – Time, Temperature, Environment and Chemical Degradation

The AIM-C System Uses These Tools to Produce a DKB That Meets Certification Requirements



Robust Design Computational System

Wide Variety of Error Propagation and Uncertainty Analysis Tools



AIM-C Three Step Validation Approach

Step 1

Individual Module and System Validation

Existing Data

Step 2

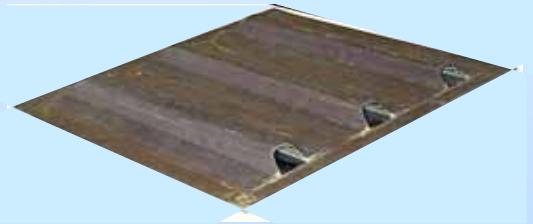
Demonstrations and System Validation of Improvements

System Demonstration and Tests of Compelling Demo Validate Projected Means and Scatter

Step 3

Blind Validation

Known Design Requirements

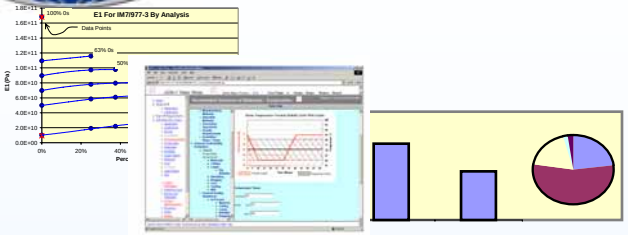


NGC IPT Uses AIM-C

Validates Technical Results, Time Reductions, Cost Reductions

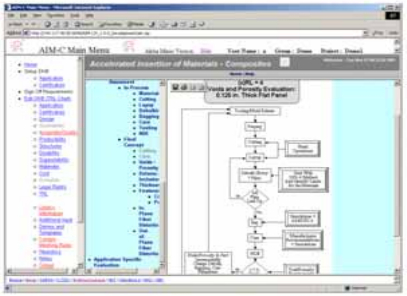
DARPA

NAVAIR

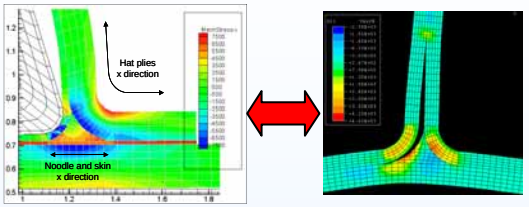


DKB Re-creation

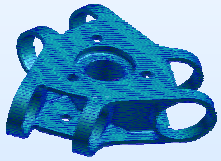
Encoded Heuristics

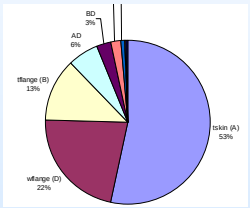


Producibility



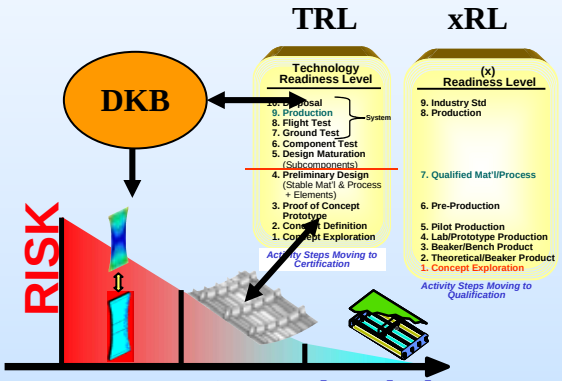
Processing data passed to Structural Analyses





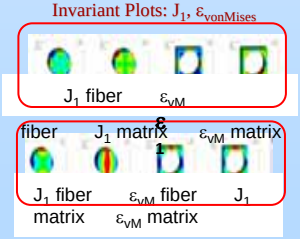
Design, ANOVA, Design Explorer, & Probabilistic Optimization RDCS Links

AIM-C Significant Accomplishments

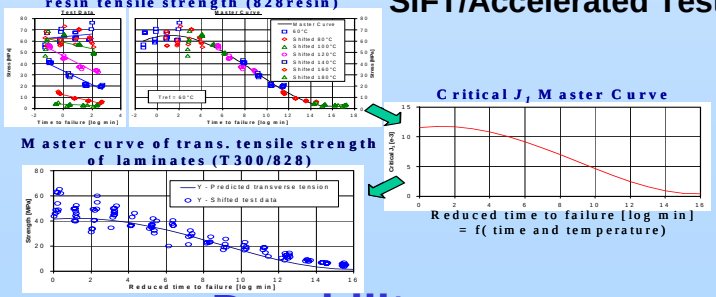


AIM-C Methodology Links Readiness Levels

Physics Based 3D SIFT & Fracture Failure Theories

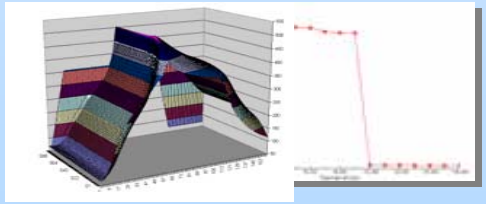


Structures



SIFT/Accelerated Testing

Durability



Materials & Processing

BOEING

AIM Accelerated Insertion of Materials

Where is AIM Being Used?

Materials Selection for X-45

Composite Flap for F/A-18 E/F

Transparencies for 7E7