Accelerated Insertion of Materials - Composites

A New Way to Design Composite Structures

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What is AIM-C?

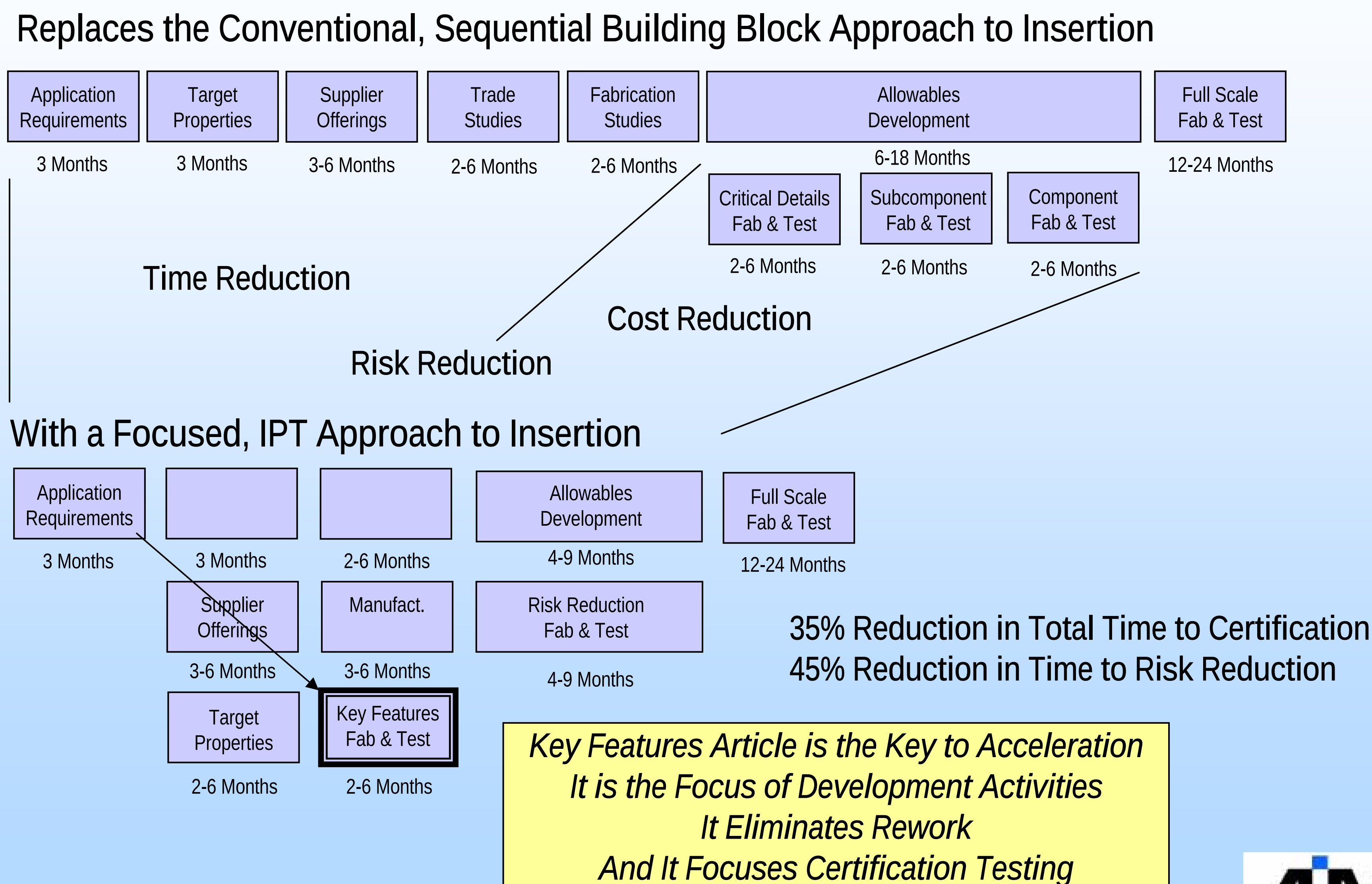
AIM-C is a methodology for accelerated insertion of materials into defense structures at reduced costs.

This methodology develops a design knowledge database that links what is known about a material system to what is needed in order to qualify its application to an application that meets certification requirements

It allows rapid identification of which applications are too risky and which are not.

It uses verified analysis methods, existing test data, and lessons learned from previous experience to minimize the amount of data required to insert new materials into a system with confidence

What Does AIM-C Do?

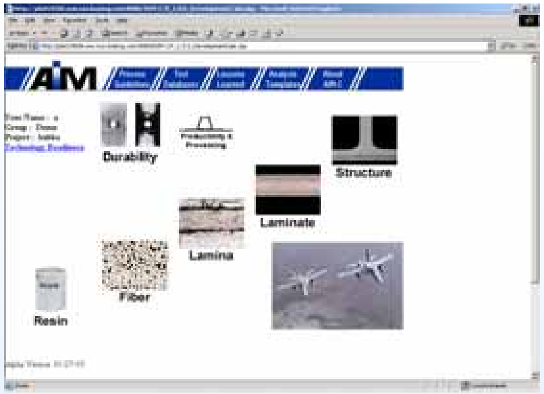


How Does AIM-C Accelerate Insertion?

- Focuses on Real Insertion Needs (Designer Knowledge Base)
- Identifies the Necessary IPT and provides IPT with Readiness Level Status
- Coordinates Use of
  - Existing **K**nowledge
  - Validated **A**nalysis tools
  - Focused **T**esting
- Provides Access to the Latest Physics Based Material & Structural Analysis Methods
- Uses Integrated Engineering Processes & Simulations
- Uses Uncertainty Analysis and Management
  - Focuses on Early Feature Based Readiness Demonstration
  - Tracks of Variability and Error Propagation During Scale Up

Provides Orchestrated Knowledge Management to efficiently tie these elements to the Design Knowledge Base

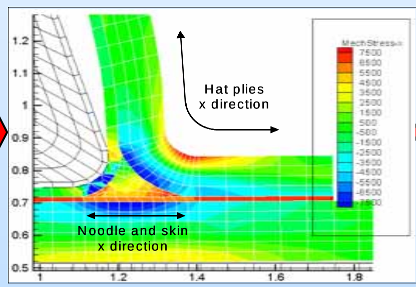
How Do I Use AIM-C?



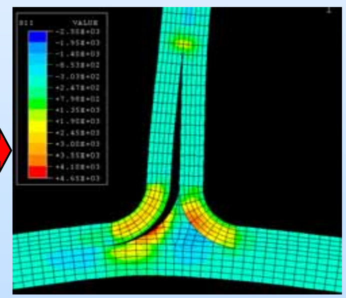
Web-Based System Delivery

Process Guidance and Risk Reduction Status

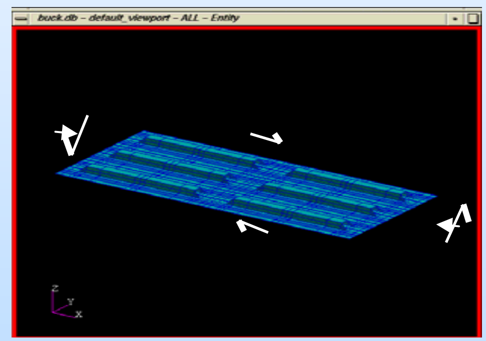
AIM-C Contains Analytical Models From Constituents



To Processing



To Effects of Defects

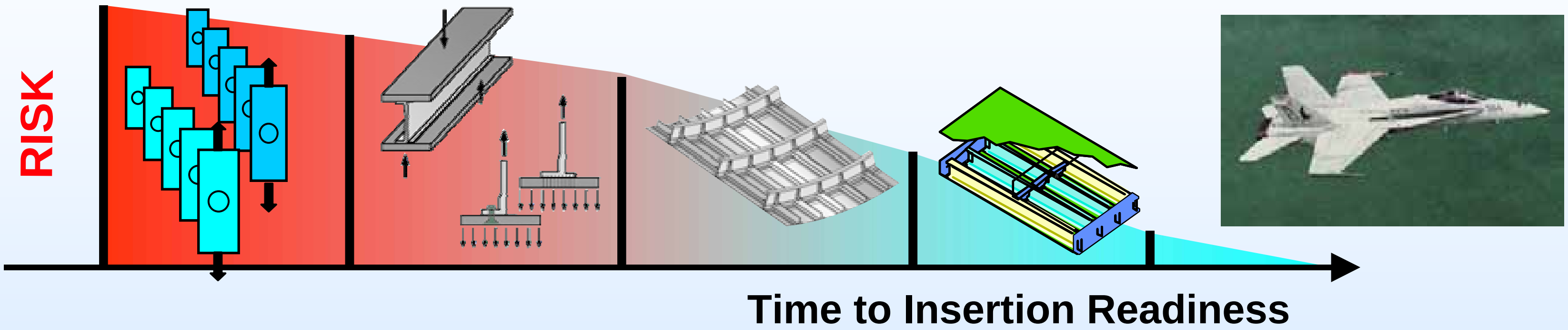


To Structural Reqs.

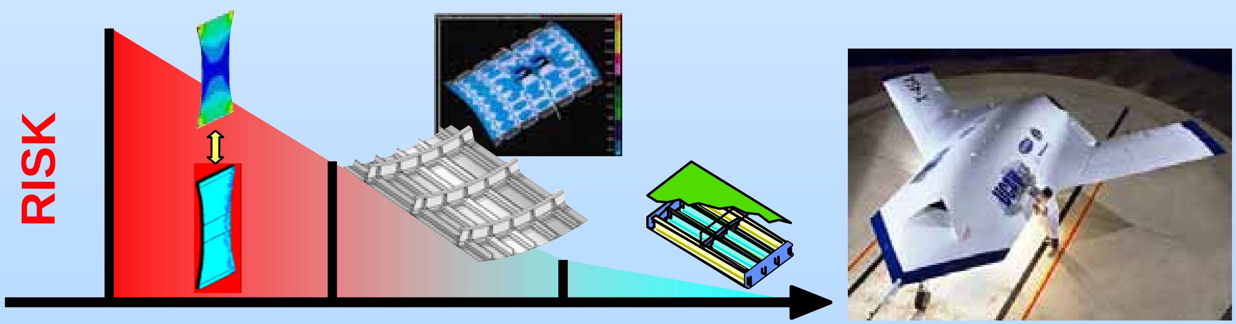
To Provide Analysis Supported by Test To Technology Readiness

What's the Benefit of AIM-C?

Traditional Test Supported by Analysis Approach



AIM Provides an Analysis Approach Supported by Experience, Test and Demonstration



Time to Insertion Readiness Reduced by 55%

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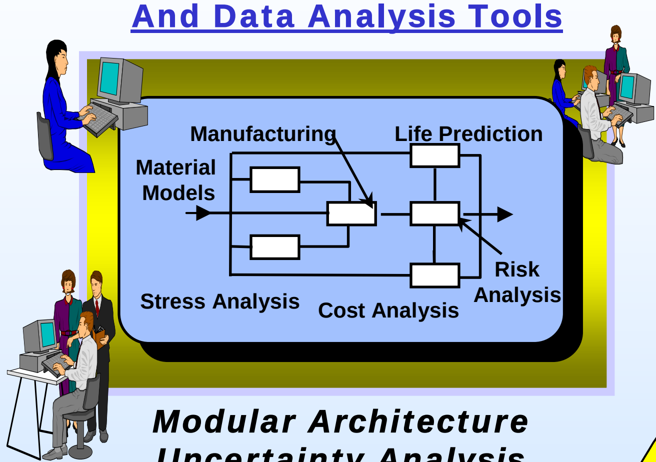
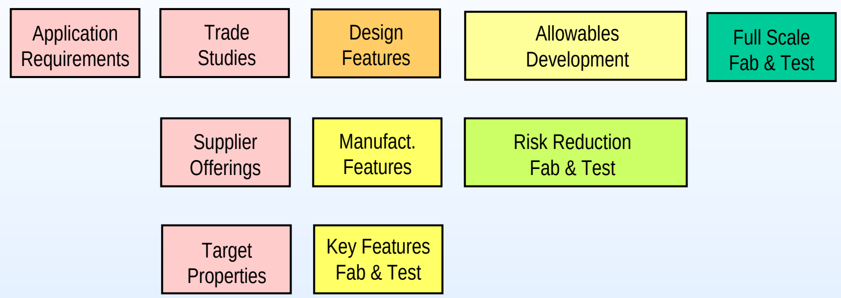
The Approach

Integrated Modeling/Simulation And Data Analysis Tools

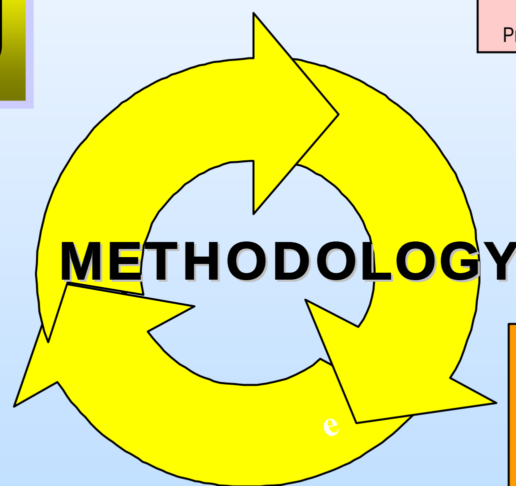


Modular Architecture Uncertainty Analysis

Optimized Building Block Approach

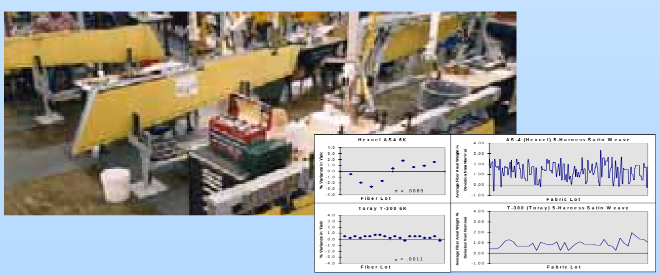


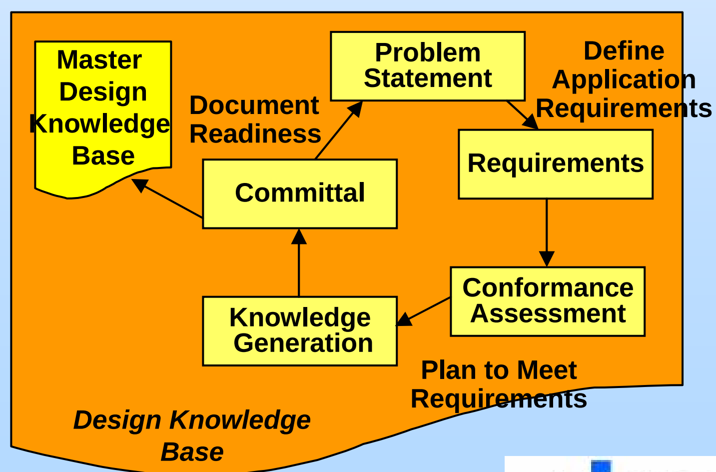
Technology Readiness Levels



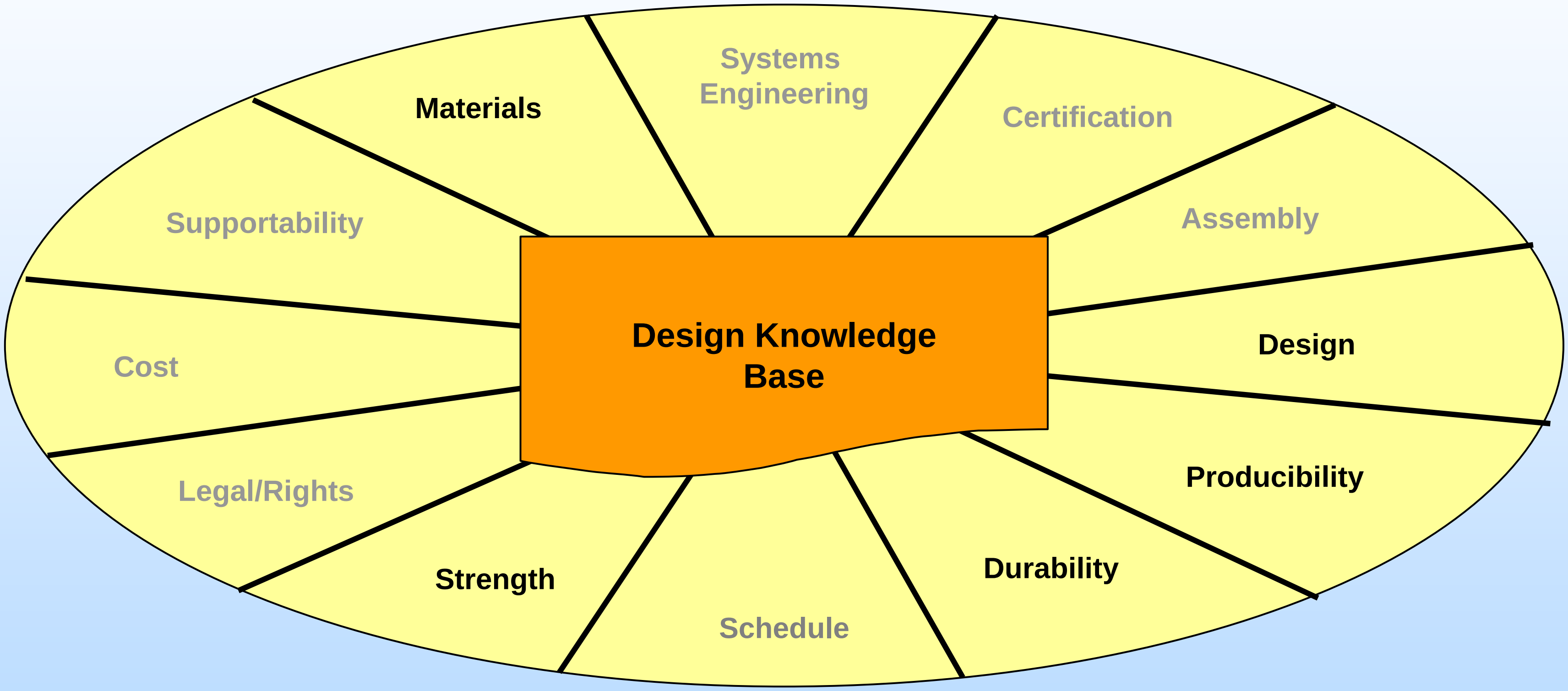
Producibility Issues

- Simulations
- Heuristics
- Lessons Learned





The AIM-C Process Uses the IPT to Commit Data to the DKB



All functions contribute – All receive data from the DKB

AIM Allows the IPT to Track and Plan Progress Toward Successful Insertion

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											

Technology Readiness Levels Differ in Focus

Technology Developers See TRLs Focused on That Development

Technology Readiness Levels													
Technology Development	1	2	3	4	5	6	7	8	9				
Application Development				1	2	3	4	5	6	7	8	9	10

Application Developers See TRLs Focused on Insertion Into Their Products

Technology Readiness Levels													
Technology Development	0.25	0.50	0.75	1	2	3	4	5	6				
				One Team									
Application Development			0	1	2	3	4	5	6	7	8	9	10

AIM Developed TRLs Focused on Insertion but Linked Technology and Application Developers Into One Team

At Each Step Each Discipline Follows A Defined Process for Knowledge Committal

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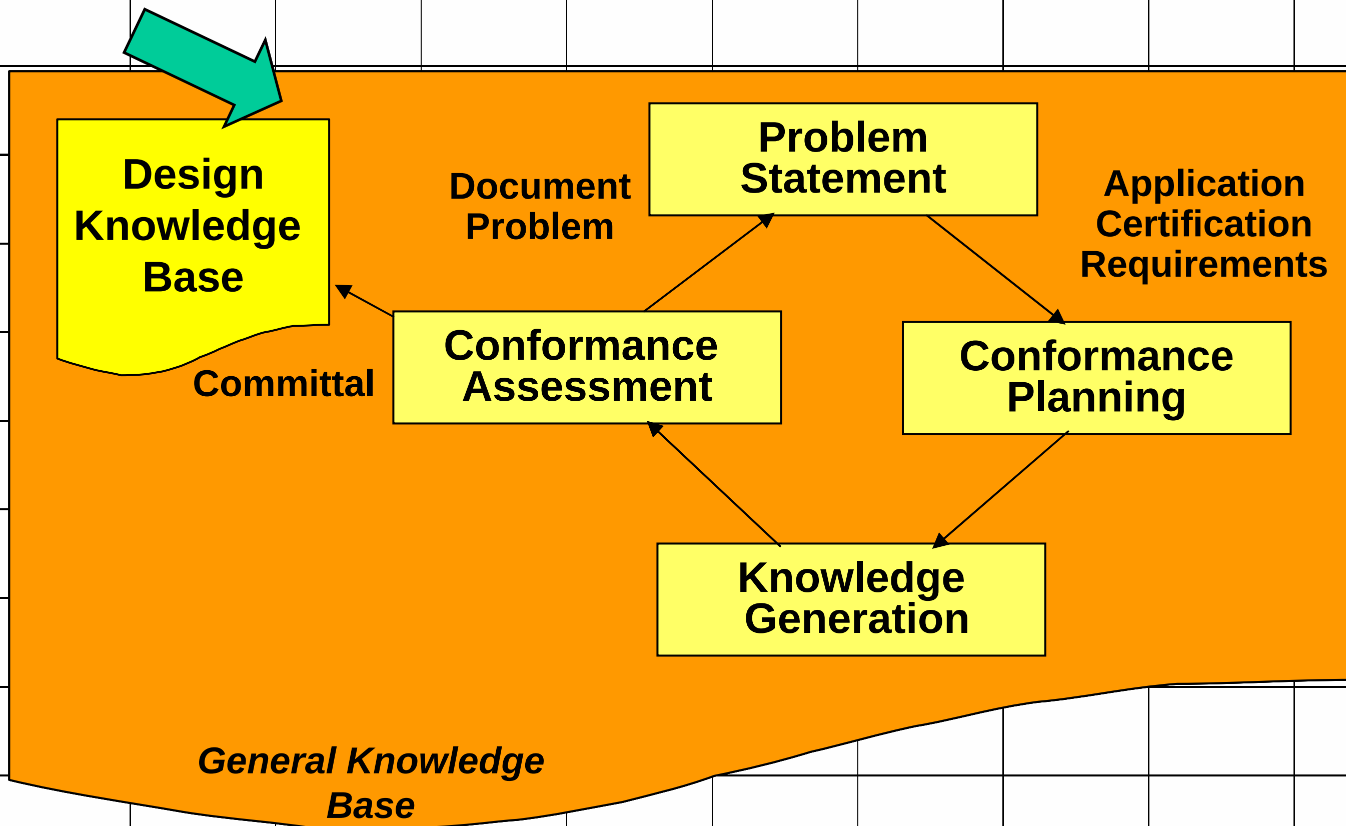
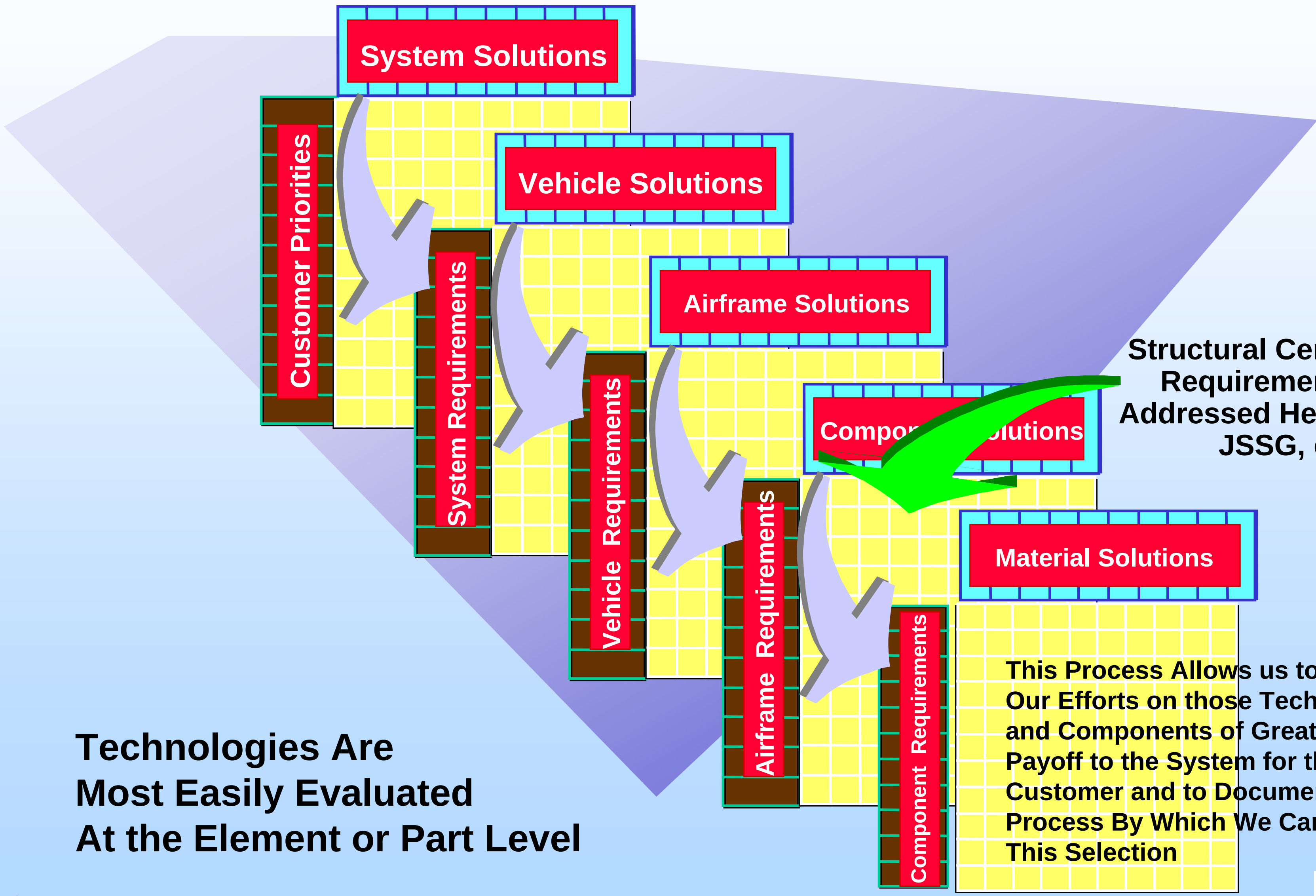


AIM-C Links Requirements from the System to the Technology / Material



Structural Certification Requirements Are Addressed Here: FARs, JSSG, etc

Technologies Are Most Easily Evaluated At the Element or Part Level

Conformance Planning

2.1		TEST TYPE/PROPERTIES - FIBER	0	1	2	3	4	5	6	7	8	9	10	
		Fiber Form and Type (Uni and Cloth, ie 5hs or plain or 8hs etc.)		x	x									
2.1.1	➢	Tensile Strength	x	x	x	x	x							Test-Analysis
2.1.2	➢	Tensile Modulus E11 (longitudinal)	x	x	x	x	x							Test-Analysis
2.1.3	➢	Tensile Strain to Failure	x	x	x	x	x							Test-Analysis
2.1.19		Compressive Strength				o								Analysis
2.1.20		Cost	x	x	x	x	x							Specified Value
2.1.21		T(g)		x										Test
2.1.22		wet T(g)		x										Test
2.1.23		Health and Safety		x										MSDS
2.1.10		CTE - Radial			o									Analysis
2.1.11		Filament Diameter	x		x		x							Test
2.1.12		Filament Count	x		x		x							Test
2.1.13		Transverse Bulk Modulus			o									Analysis
2.1.14		Youngs Modulus, E22 Transverse			o									Test
2.1.15		Shear Modulus, G12			o									Analysis
2.1.16		Shear Modulus, G23			o									Analysis
2.1.17		Poissons Ratio, 12			o									Analysis
2.1.18		Poissons Ratio, 23			o									Analysis
2.1.4	➢	Yield (MUL)	x	x	x	x	x							Analysis
2.1.5	➢	Density	x	x	x	x	x							Test
2.1.6		Heat Capacity (Cp)			x									Test
2.1.7		Thermal Conductivity Longitudinal			x-o									Analysis
2.1.8		Thermal Conductivity Transverse			x-o									Analysis

AIM-C Helps the IPT Plan Its Maturation Process