

MRJ Composite Structure Substantiation Approach

A Mitsubishi MRJ aircraft is shown in flight on a runway, banking to the right. The aircraft is white with red and black accents on the tail and fuselage. The tail features the 'MRJ' logo. The background shows a large airport terminal building with a 'MAYRA' sign and other airport infrastructure.

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Contents

- MRJ Overview
- Composite Application
- Substantiation Approach
- Structural Tests
- Summary

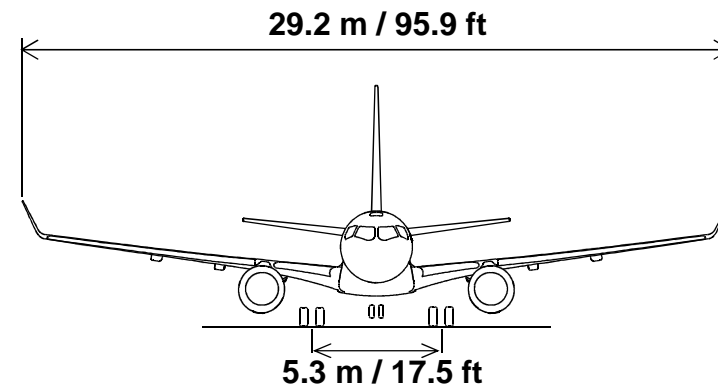
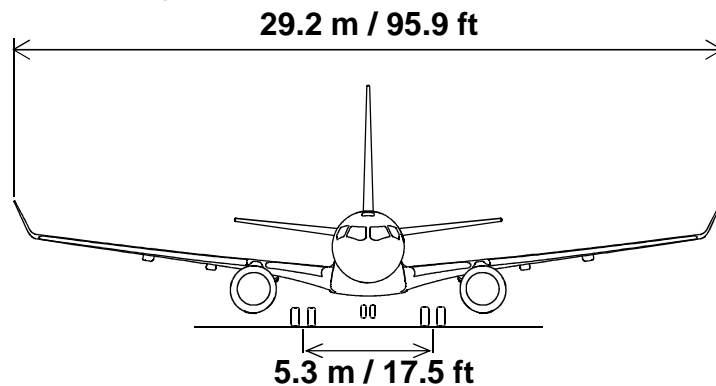
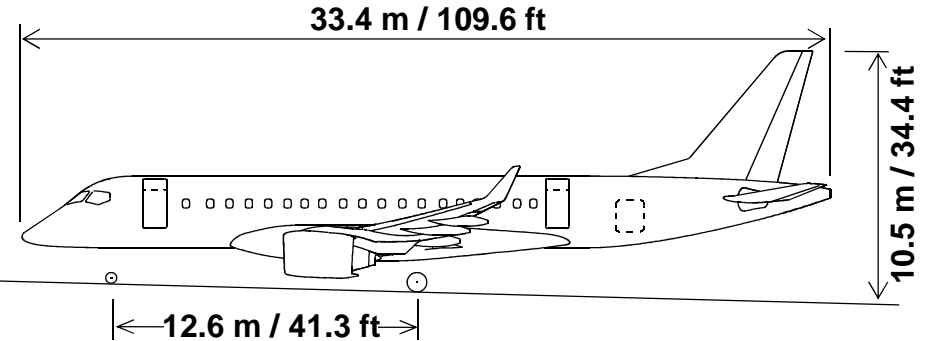
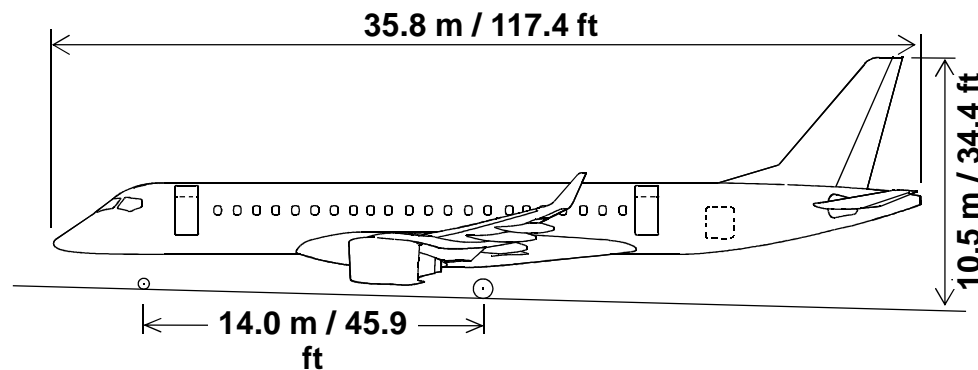


MRJ Overview



MRJ90

MRJ70



MRJ90LR	Model	MRJ70LR
92 (typical Single class)	Passengers	78 (typical Single class)
PW Geared Turbofan™	Engine	PW Geared Turbofan™
78.2 (17,600) x 2	Thrust kN (lb)	69.3 (15,600) x 2
42,800	Maximum takeoff weight kg	40,200
38,000	Maximum landing weight kg	36,200
M 0.78	Cruise Mach Number	M 0.78
1,740	Takeoff Field Length (MTOW, SL, ISA) m	1,720
1,480	Landing Field Length (MLW, Dry) m	1,430

MRJ Overview (cont'd)



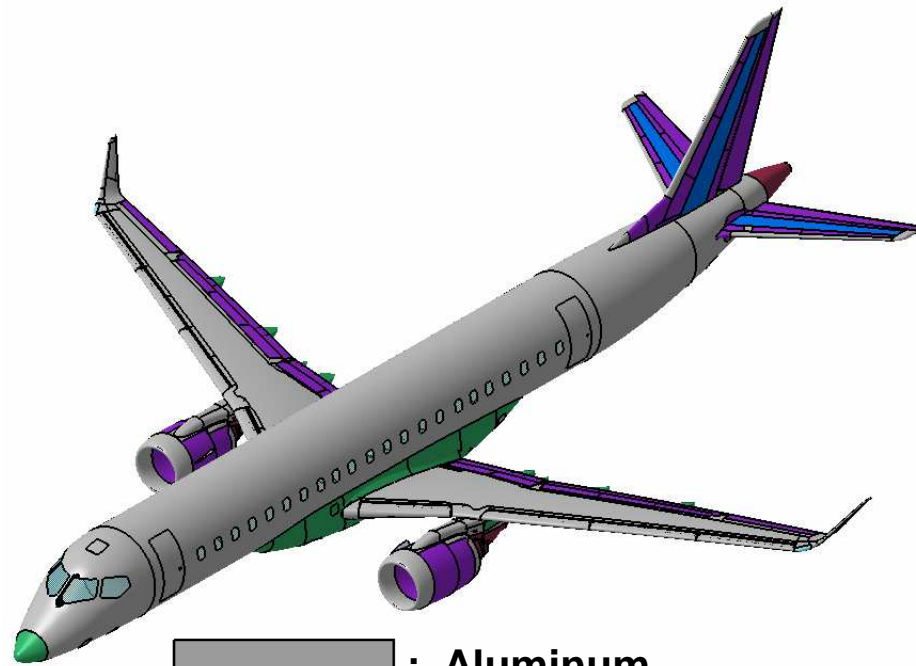
2008	Launch
2013	Flight Test Aircraft Final Assembly Started
2014	Ground Test Started
2015	First Flight
2018	First Delivery










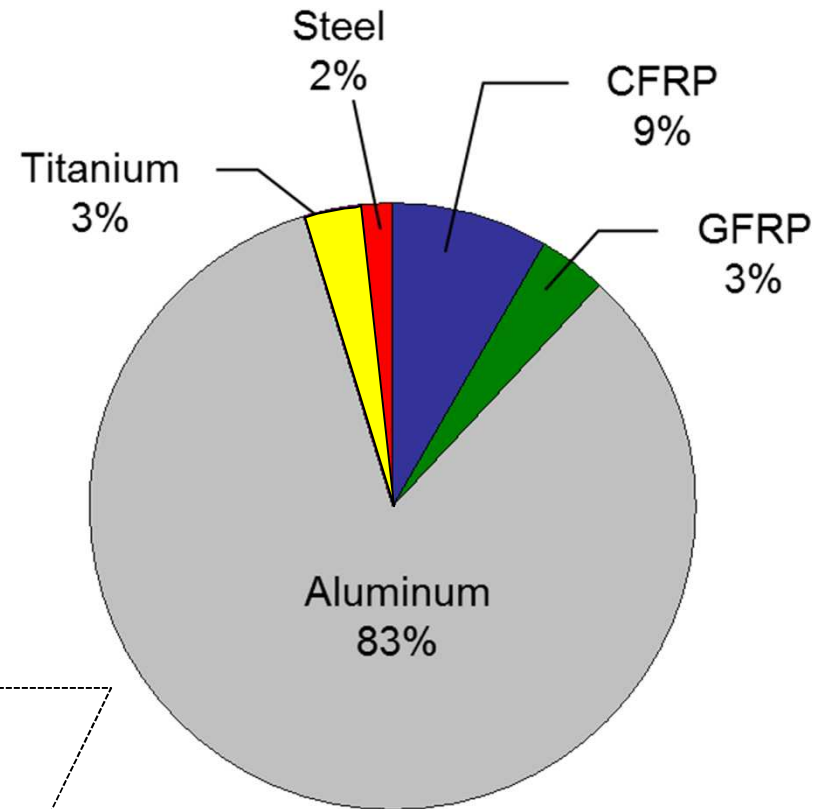


Composite Application

Structural Material : MRJ90 (Flight Test Airplane)



-  ; Aluminum
-  ; CFRP (Prepreg)
-  ; CFRP (VaRTM)
-  ; GFRP
-  ; Heat Resistance Material
-  ; Other (Glass/Acrylic)
-  ; Other (Rubber etc)

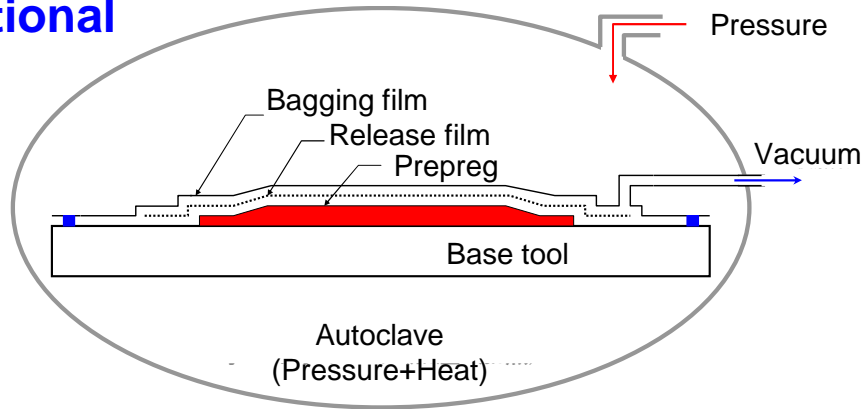


Composite = 12%

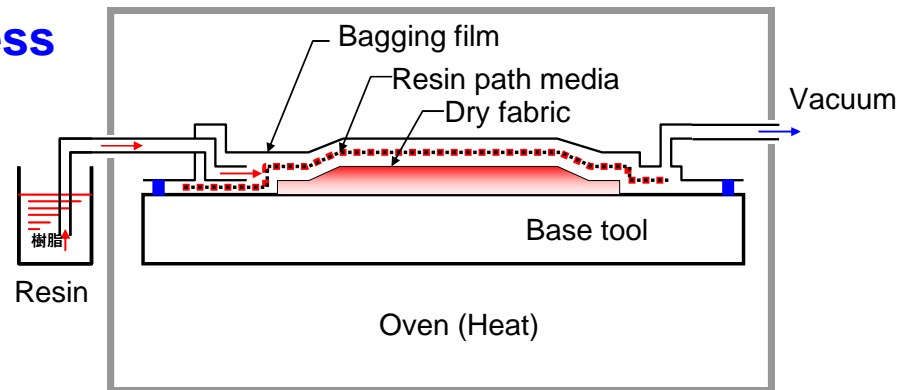
Composite Application (cont'd)

VaRTM (Vacuum-assisted Resin Transfer Molding)

Conventional Process



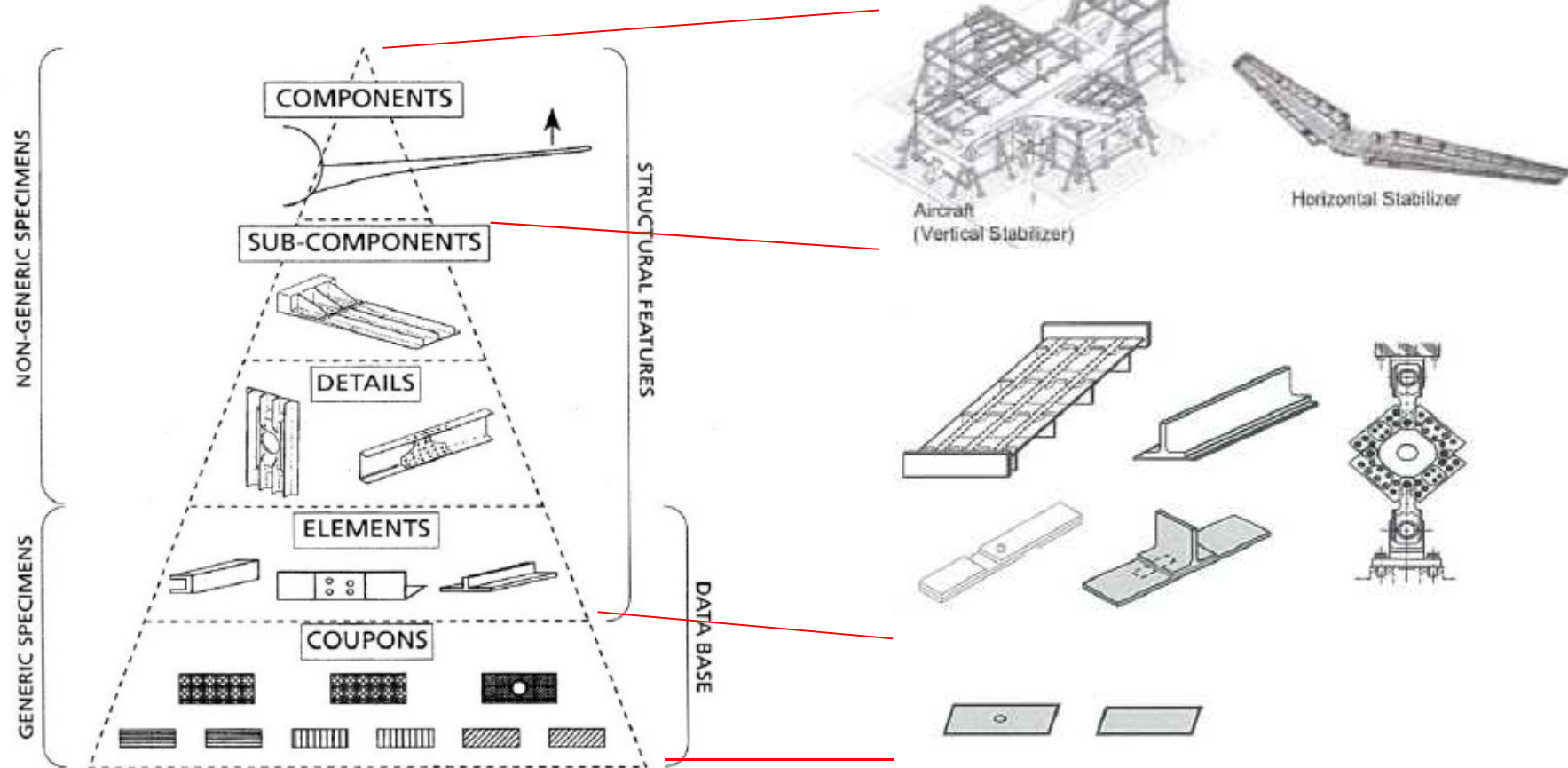
VaRTM Process



Vertical fin structure :
VaRTM process

Substantiation Approach

- Analysis supported by Test Evidence
- Building block approach
- Follow AC20-107B, AMC20-29

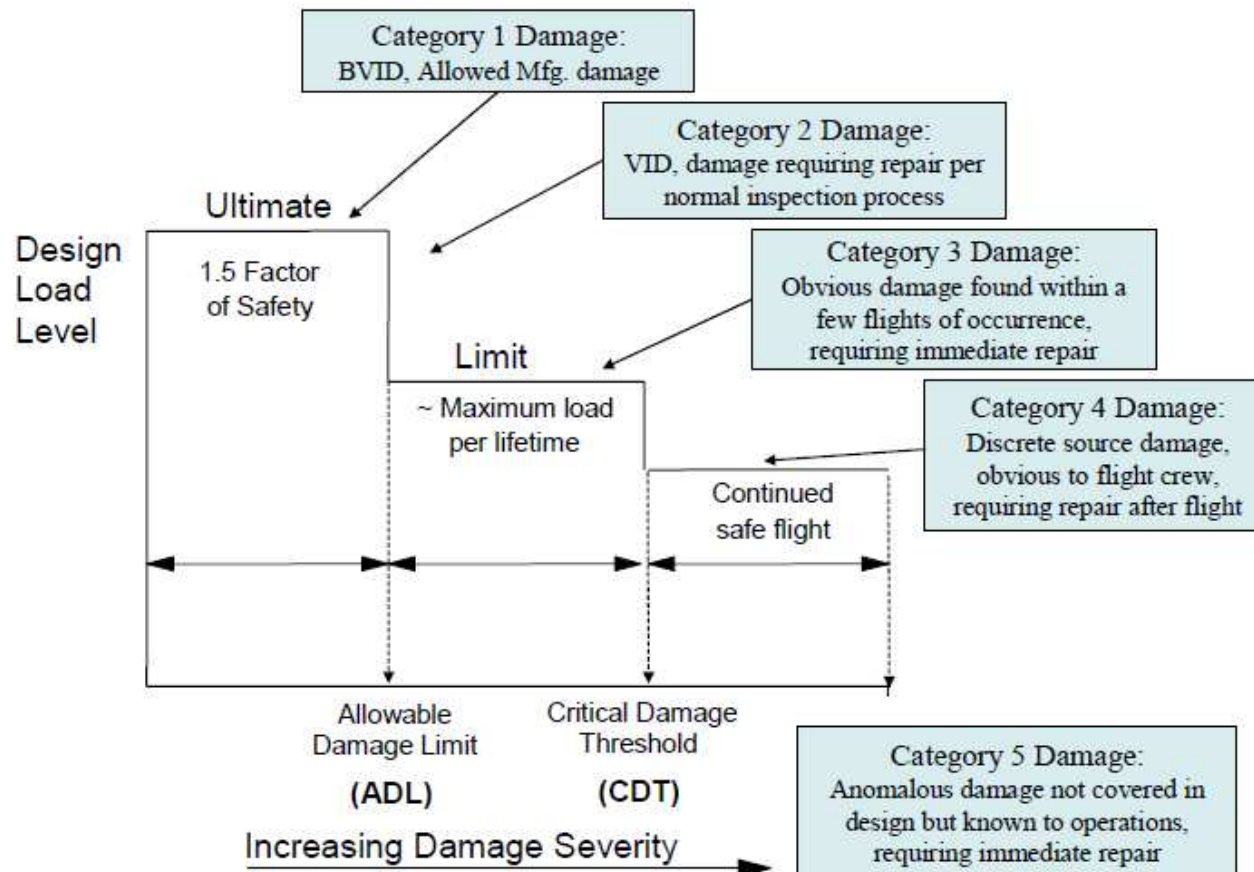


Substantiation Approach (cont'd)



Damage tolerance

- Category 1 thru 5



MRJ Approach	
CAT 1	- BVID - Allowable MFG defect - ULT after DSG
CAT 2	- Visible damage - LMT load after inspection interval
CAT 3	- Obvious damage - Static LMT
CAT 4	- DSD - Static get home load
CAT 5	- Determine conditional inspection requirement in AMM

Substantiation Approach (cont'd)

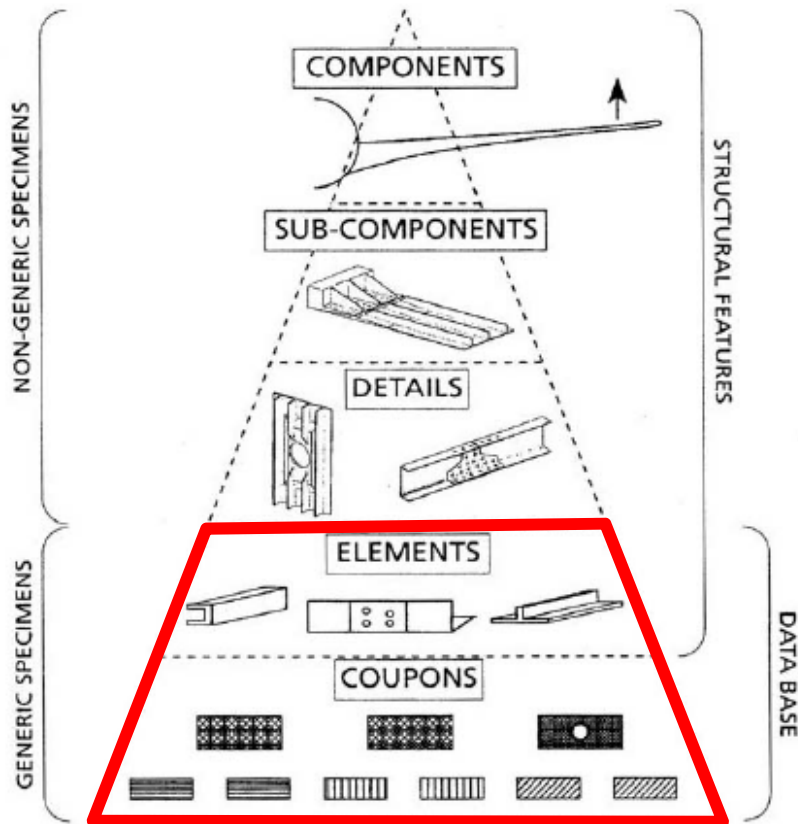


Design consideration

- **Temperature range -54deg C to +82deg C (-65F to 180F)**
- **Moisture content : 85%RH saturation**
- **UV protection by painting**
- **Established quality control means
(material and process specification)**
- **One bay disbond**
- **No detrimental damage growth
(manufacturing anomalies and impact damages)**

Structural Tests

Allowable

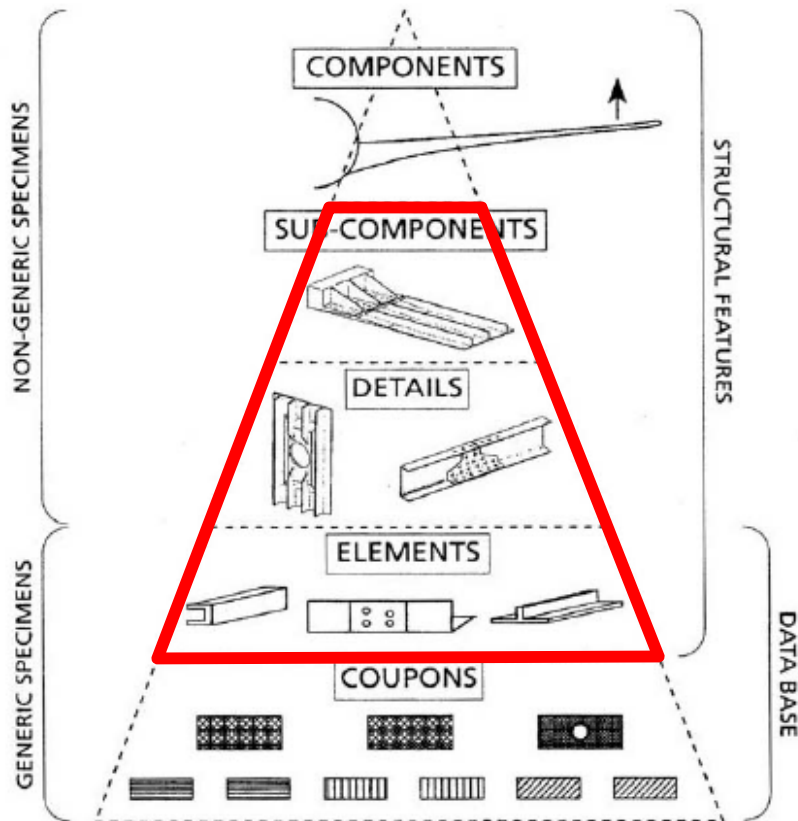


- Establish allowables in statistical base (B basis)
- Various layup, unnotched, open hole, filled hole ---
- Utilize STAT17 program



Structural Tests (cont'd)

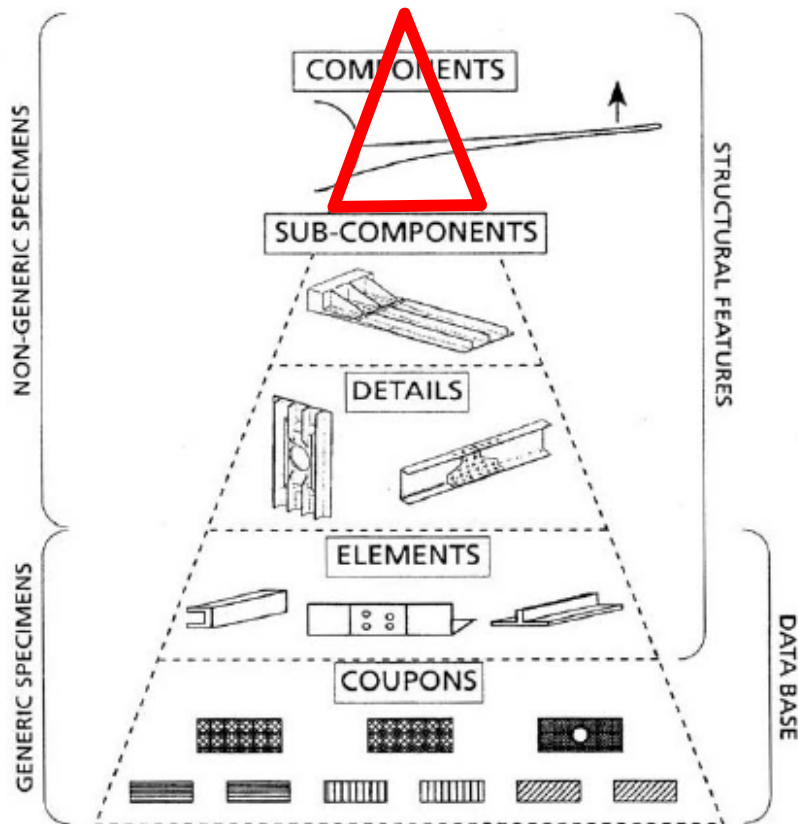
Structural element & Subcomponent



- Establish and verify design value
- Incorporate CAT 1 to CAT 3 damage
- Validate analysis method

Structural Tests (cont'd)

Full-scale Component



- Demonstrate sustaining capability (LMT load, ULT load)
- Incorporate CAT 1 to CAT 2 damage
- Validate internal load analysis FEM





Summary

- **Introduced MRJ composite substantiation approach (high level, no detail)**
 - **In accordance with AC20-107B, AMC20-29**
 - **Building block approach – Lots of testing**
 - **Consider CAT 1 to CAT 5**



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Thank You. Any Questions ?

<http://www.mrj-japan.com/>