

# VTOL Special Condition AMC 2250(c) Design and Construction Principles

Interpretation of the single failure criteria for structure 2250(c)

*Laurent PINSARD*  
*Senior Structure Expert VTOL*

*Emily LEWIS*  
*Structure Expert VTOL*

**Your safety is our mission.**

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# General

# General



SC VTOL 2250 (c):

*The suitability of each design detail and part having an important bearing on safety in operations must be determined. For Category Enhanced, **a single failure must not have a catastrophic effect upon the aircraft.***

## DESIGN REQUIREMENT

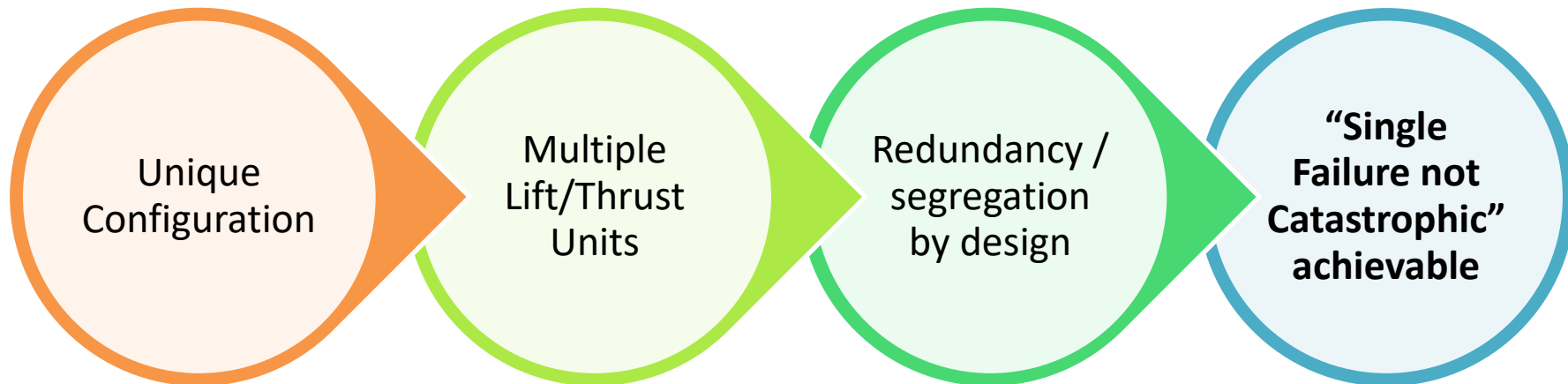
To ensure the design is robust against single failures.

Enhanced  
Category Only

# General – VTOL design examples



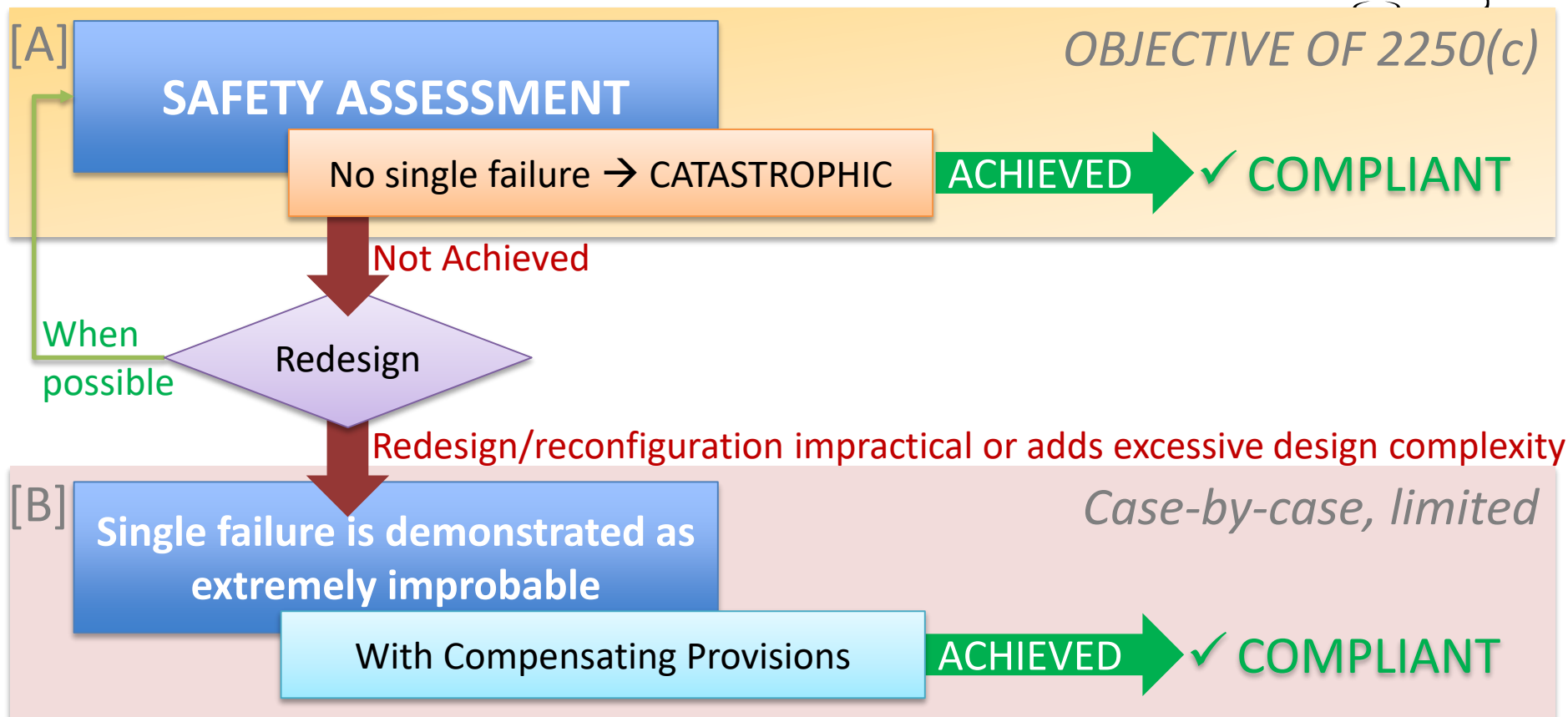
# General – VTOL design





# AMC Content and Interpretation

# AMC Overview





# Safety Assessment



1. Provide a complete and comprehensive list of structural elements or parts and its interfaces

2. Identify the functions that the structural elements or parts are to perform.

3. Perform a Function Hazard Assessment (FHA), identifying Catastrophic Failure Conditions considering the operating conditions

4. Perform a Failure Modes, Effects and Analysis (FMEA) → reasonably anticipated and conceivable failure modes

5. Conclusion: **NO CATASTROPHIC** single failures  
→ **direct compliance with SC-VTOL2250 (c)**

# Catastrophic Failure Classification

Failure conditions that would prevent continued safe flight and landing of the aircraft

Enhanced  
Category  
Only

Static residual  
strength  
(limit/ultimate)

Flutter

Controllability

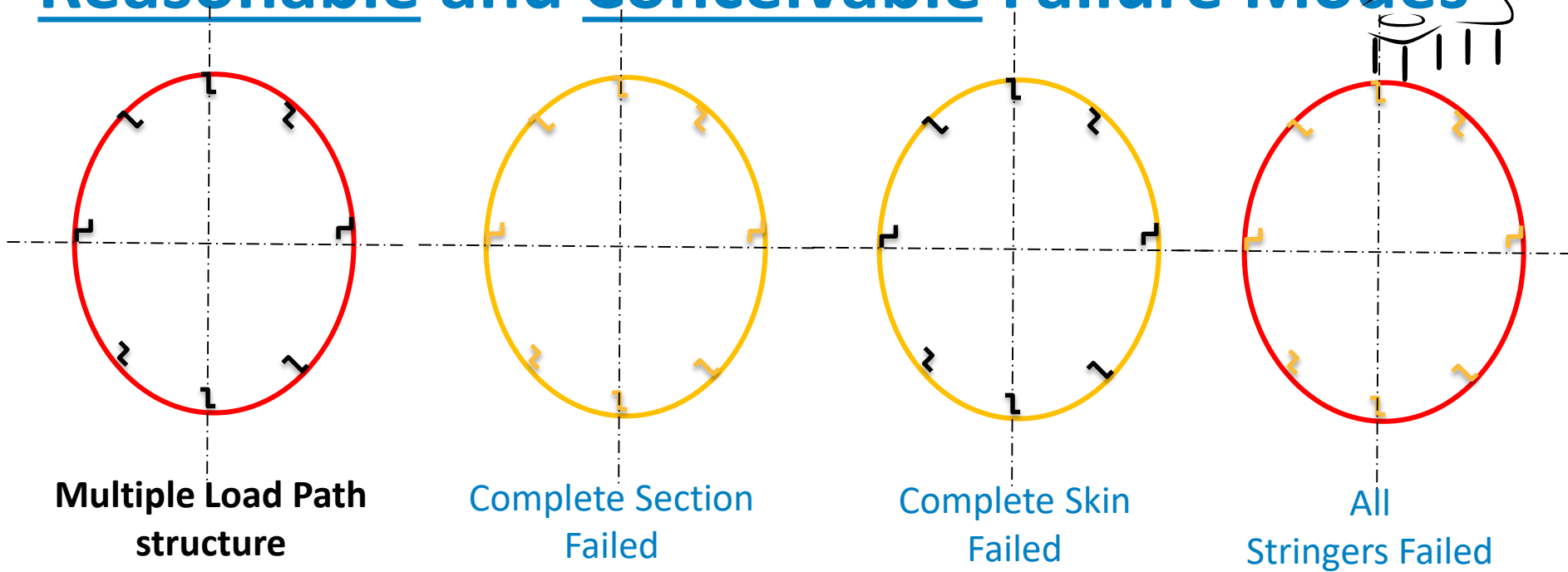
Fatigue following  
load redistribution

Vibration

Functionality /  
Performance

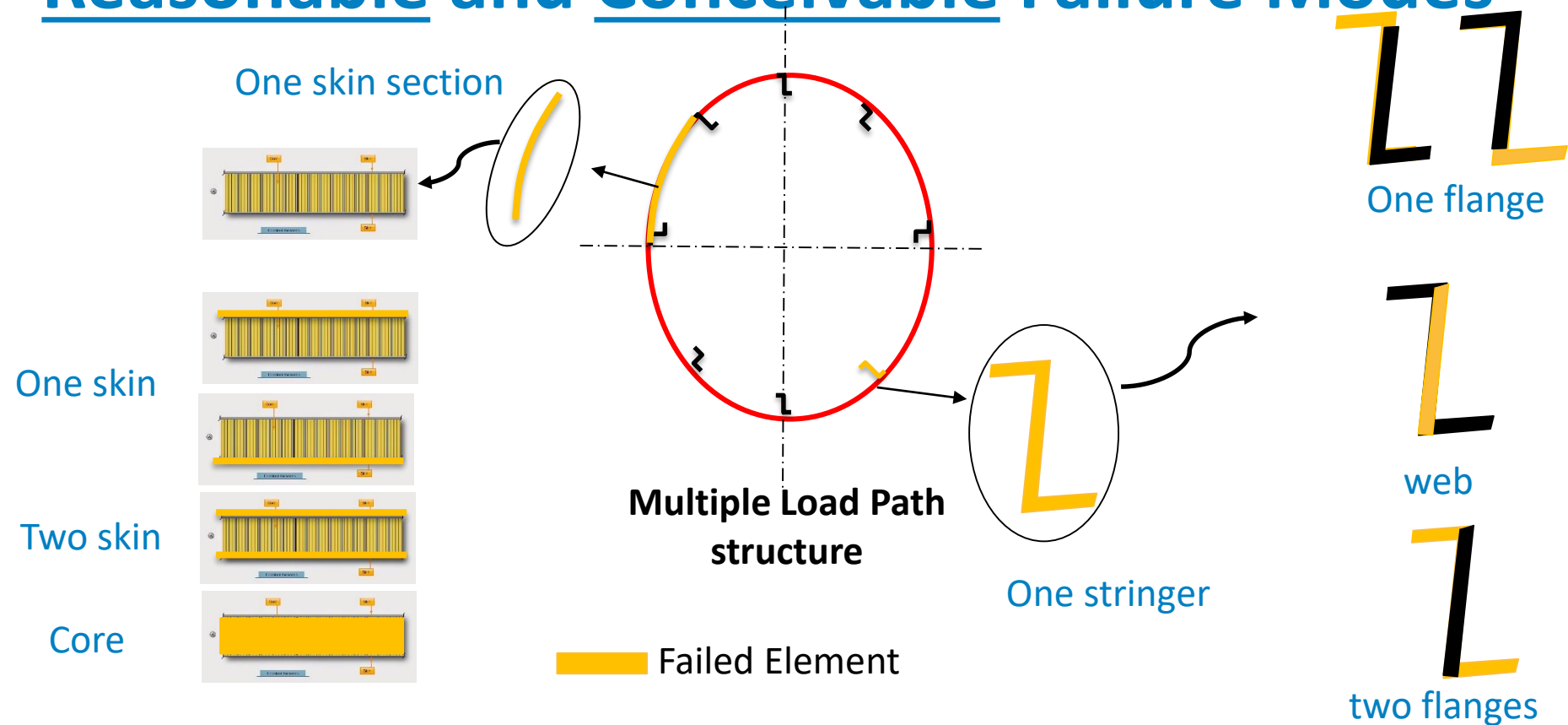
(not  
exhaustive)

# Reasonable and Conceivable Failure Modes



Reasonable Failures:  
Common cause failures / Crack arrest features

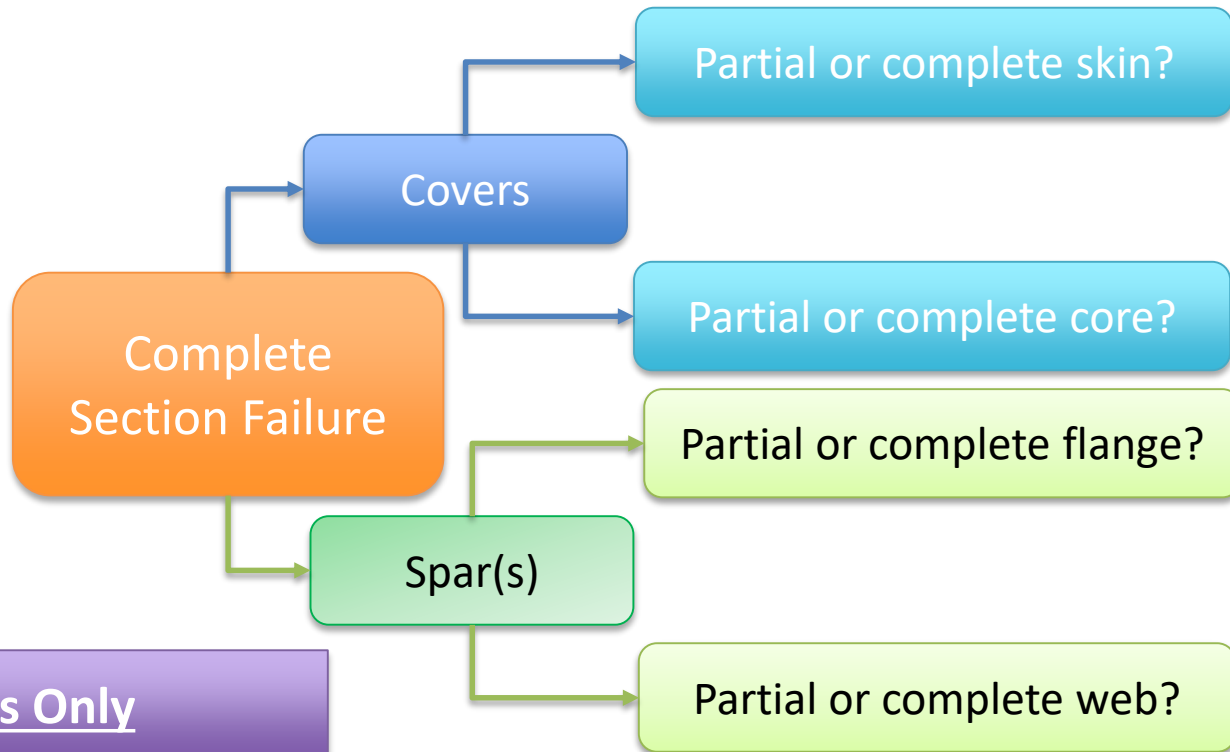
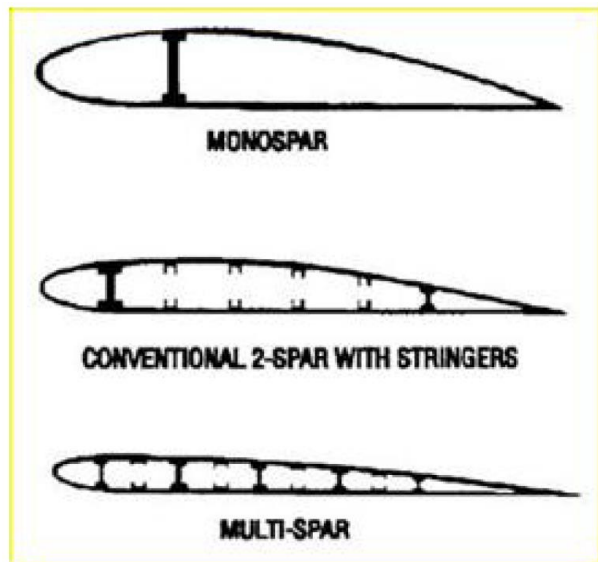
# Reasonable and Conceivable Failure Modes



# Reasonable and Conceivable Failure Modes

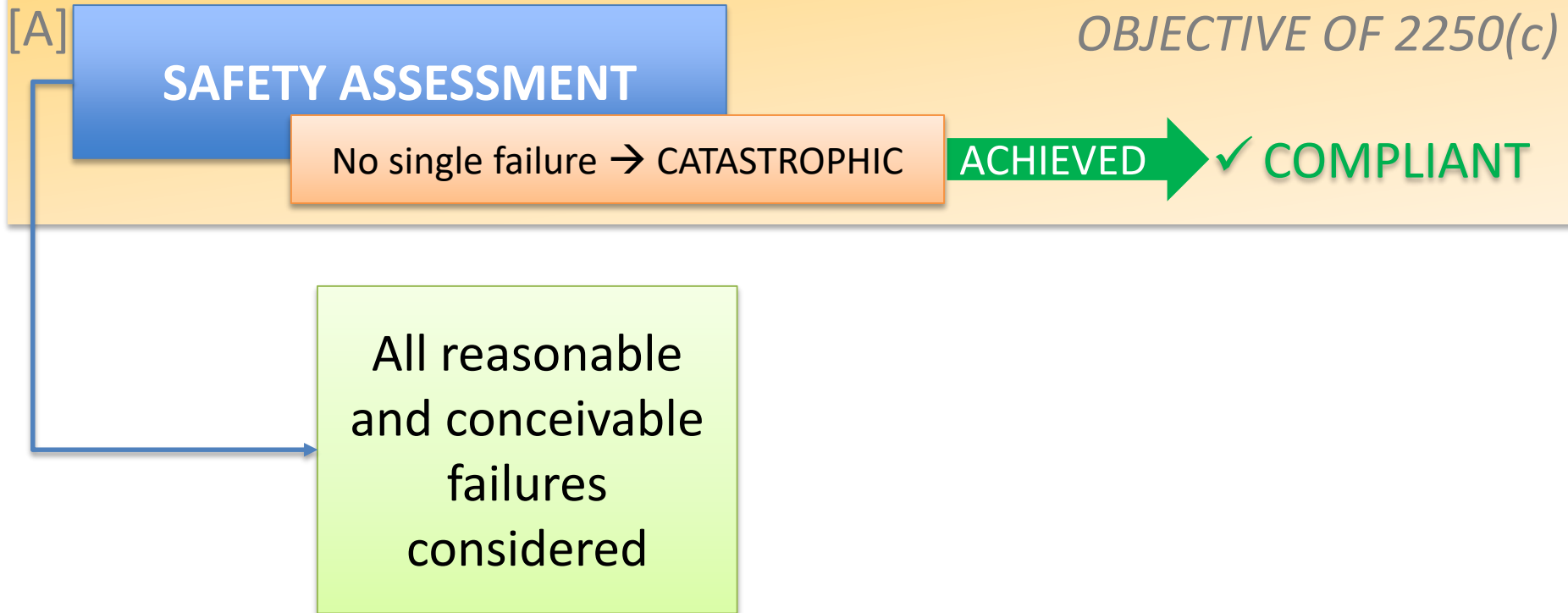


Wing Section:

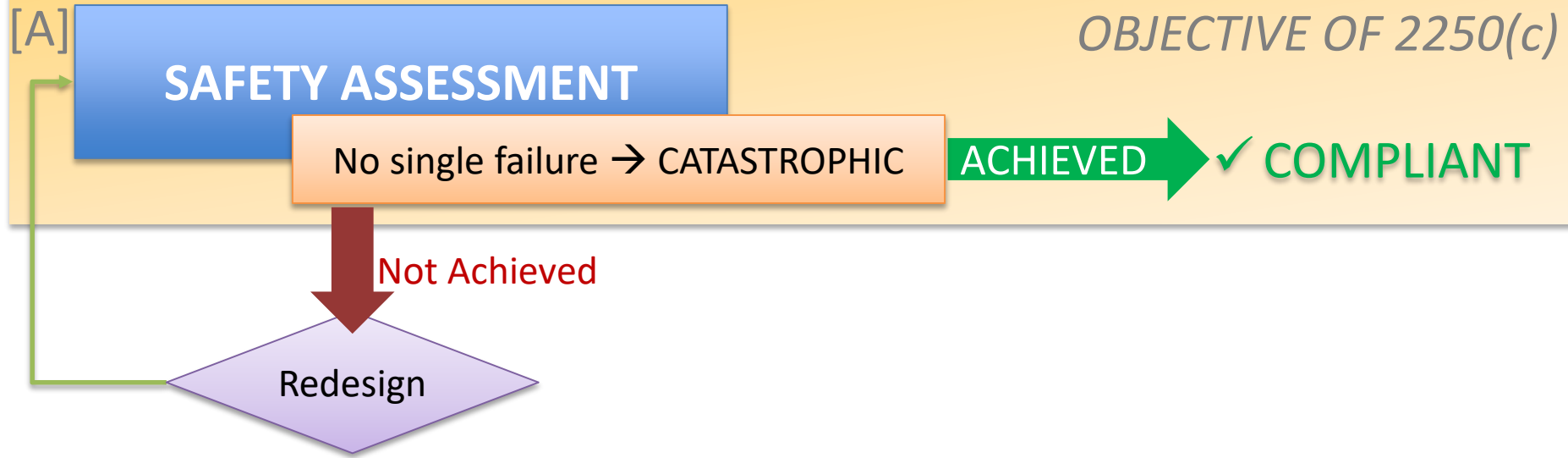


Reasonable Failures Only

# AMC Process



# AMC Process

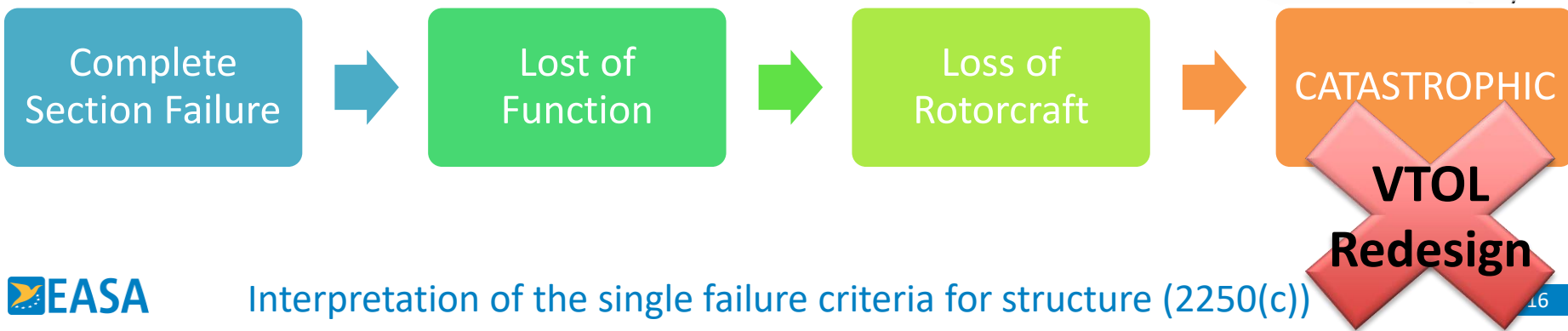
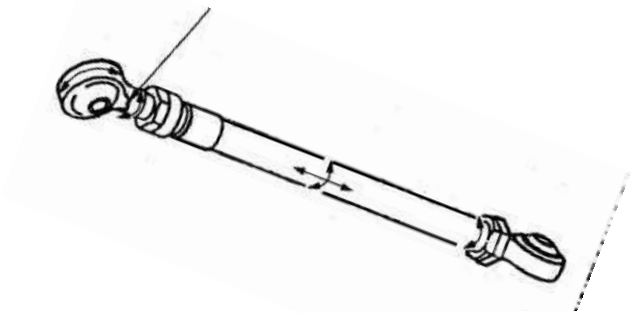


# Single load path example



Pitch control rod:

- Single element (no residual strength or fail safe capability)
- Single Load path
- Same batch & process
- Same stress in section

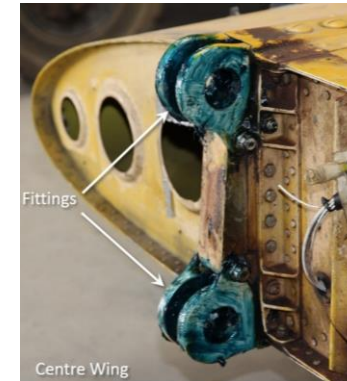
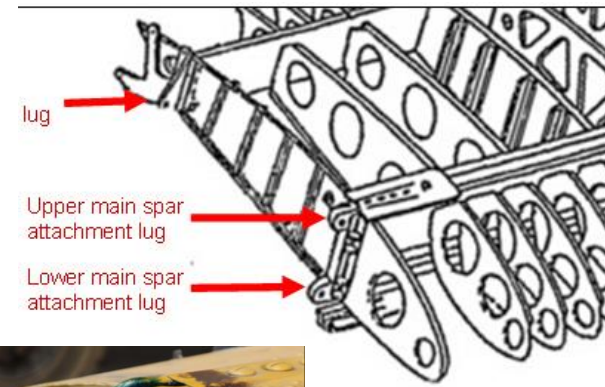




# Wing fittings example

Wing fittings:

- Single element
- Single Load path (no fail safe capability)
- Same batch & process
- Same stress distribution in lug sections



**VTOL  
Redesign**

Lug / bolt  
failure



Lost of  
Function

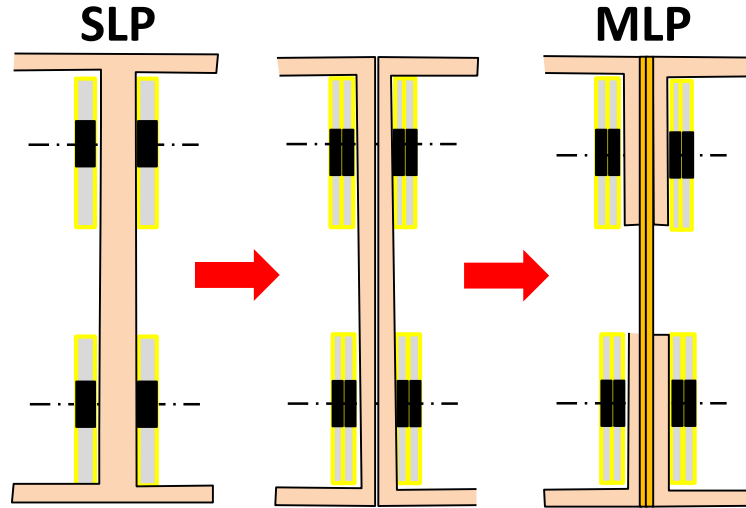
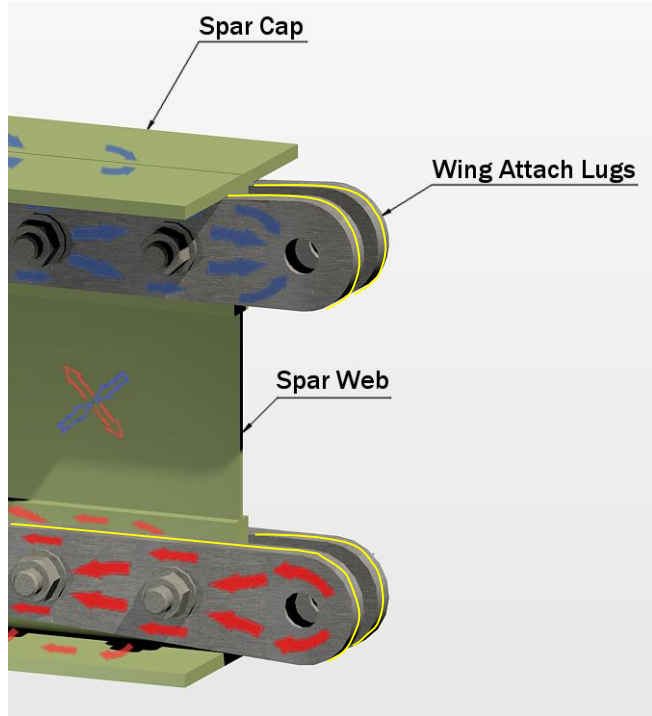


Loss of Wing



CATASTROPHIC

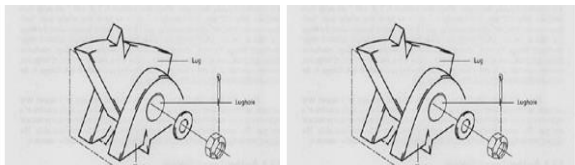
# Redesign: Wing fittings example



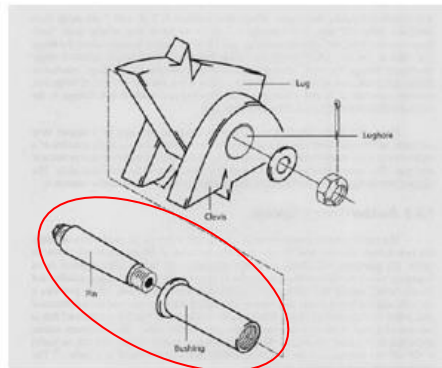
✓ no catastrophic single failure design

# Redesign: Lugs

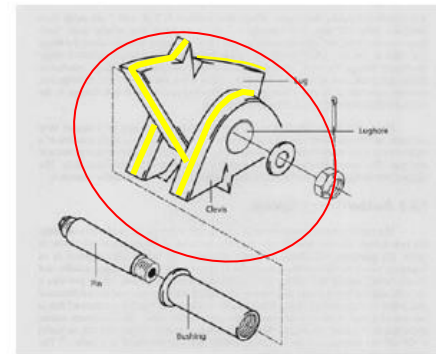
## Single Load Path Installation



X2 lugs



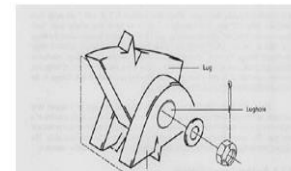
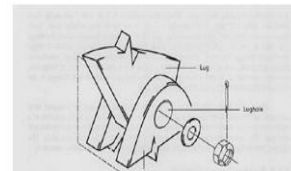
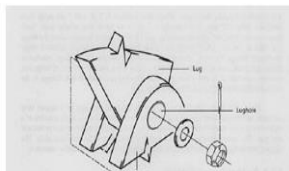
Partial MLP



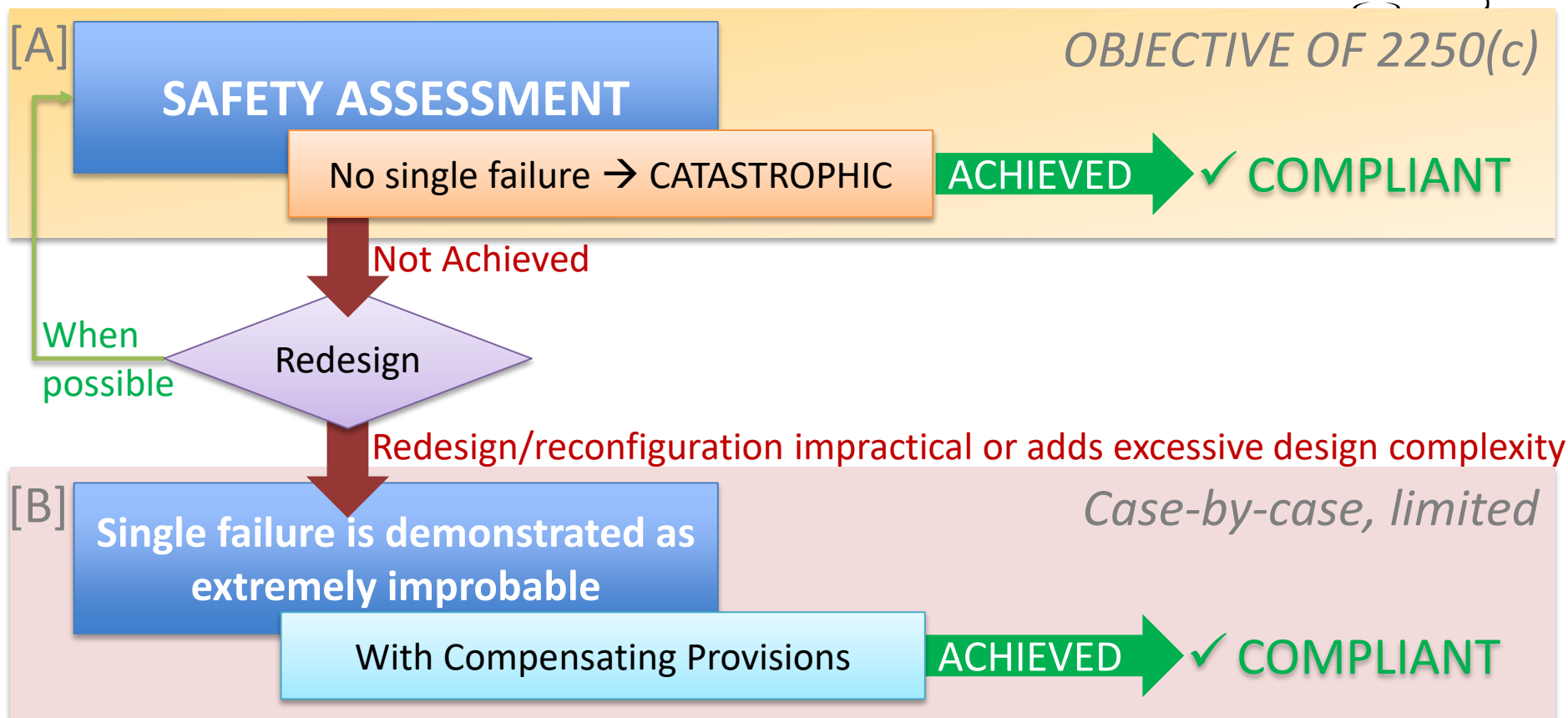
MLP Lugs

Multi Load  
Path  
Installation

X3 lugs



# AMC Process



# [B] Compensating Provisions Examples



## COMPENSATING PROVISIONS

combination of

Design  
Features

Special  
assembly  
procedures

Inspections

Preventative  
Maintenance

Fatigue and  
Damage  
Tolerance

Flight  
Limitations

Other Safety  
Devices

~~CRITICAL  
PARTS~~

# Conclusion

# Conclusion



- No single failure catastrophic
  - Achievable for VTOL by design/redundancy
  - Key Objective of Special Condition → robustness against single failure
- AMC Process:
  - Safety Assessment
  - Reasonable and Conceivable failures
  - Identification of Catastrophic Single Failures
  - Redesign / Reconfiguration
- “Extremely Improbable” accepted with compensating provisions
  - Limited and case-by-case basis



**Thank you**  
**Any further questions?**