

# Airline Operational Composites

Ian Fidler

BA Structures Senior Technical Engineer  
(CVE)

# Overview

- Design (r)evolution.
- Fleet type and usage.
- Maintenance periods.
- Maintaining operational expedience.
- Operational examples

# 50 years of change



# 50 years of change





# 50 years of change



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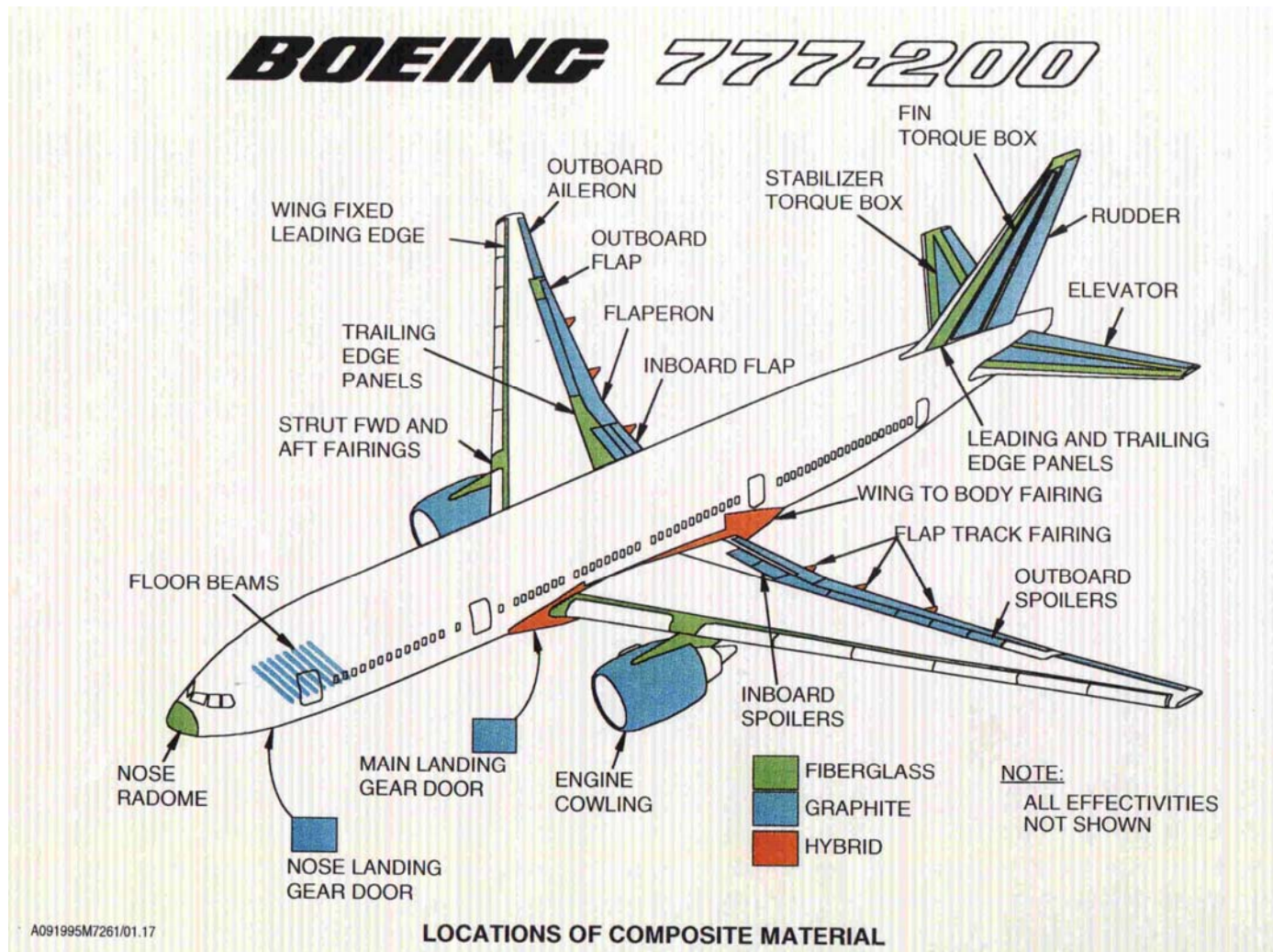
# 50 years of change



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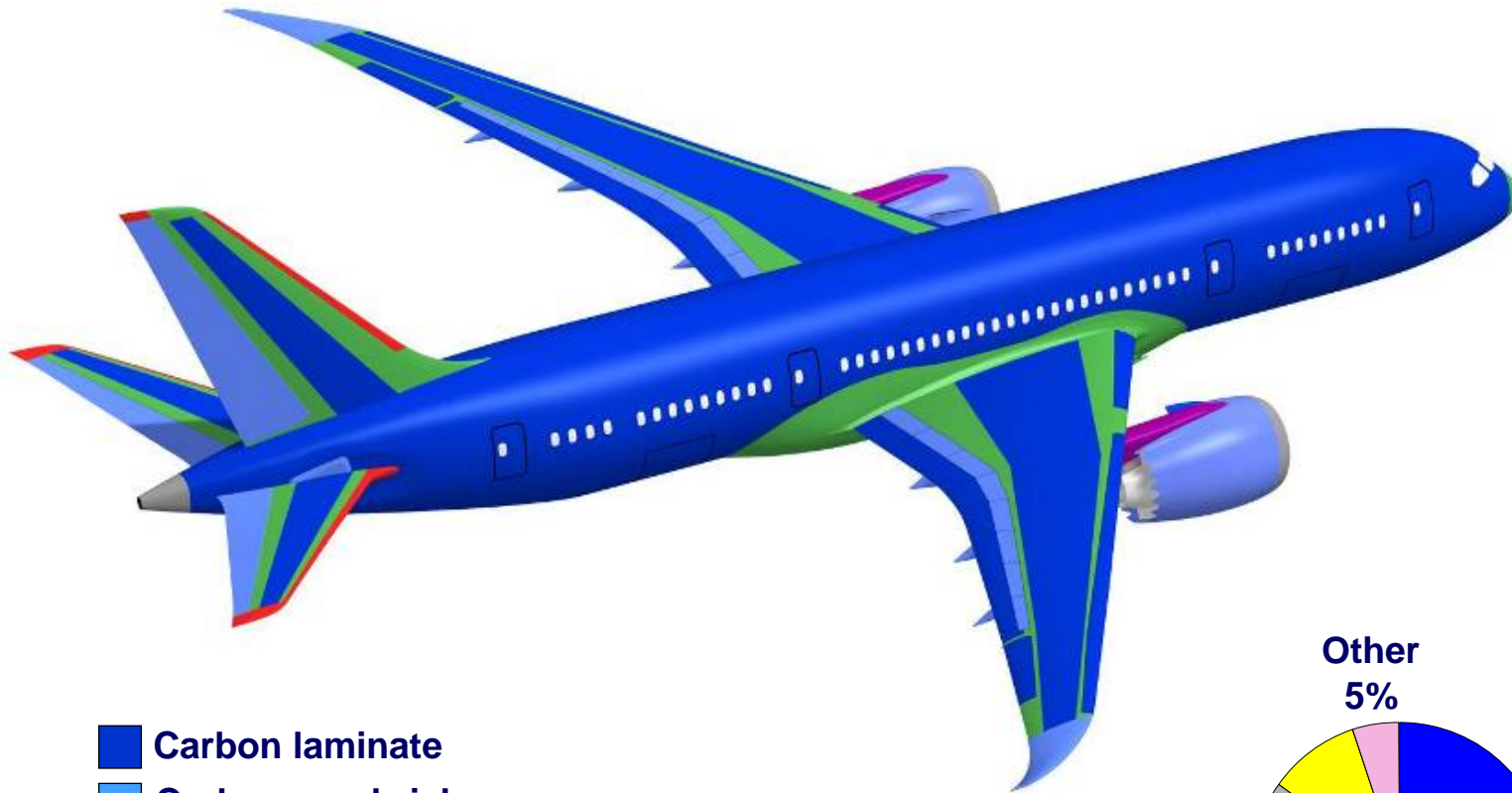


# Composite Structure Development B777

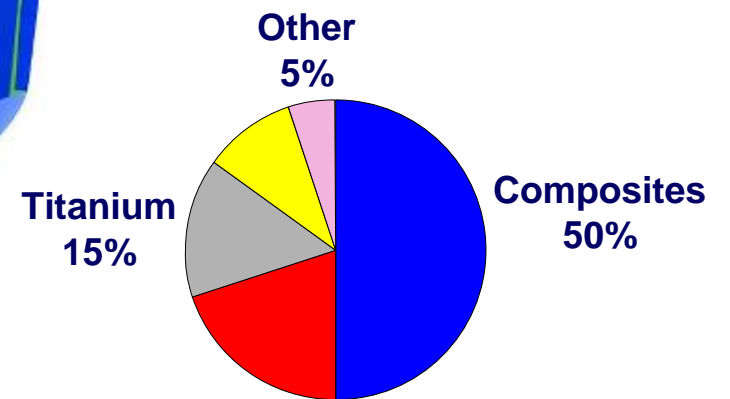




# Composite Structure Development B787



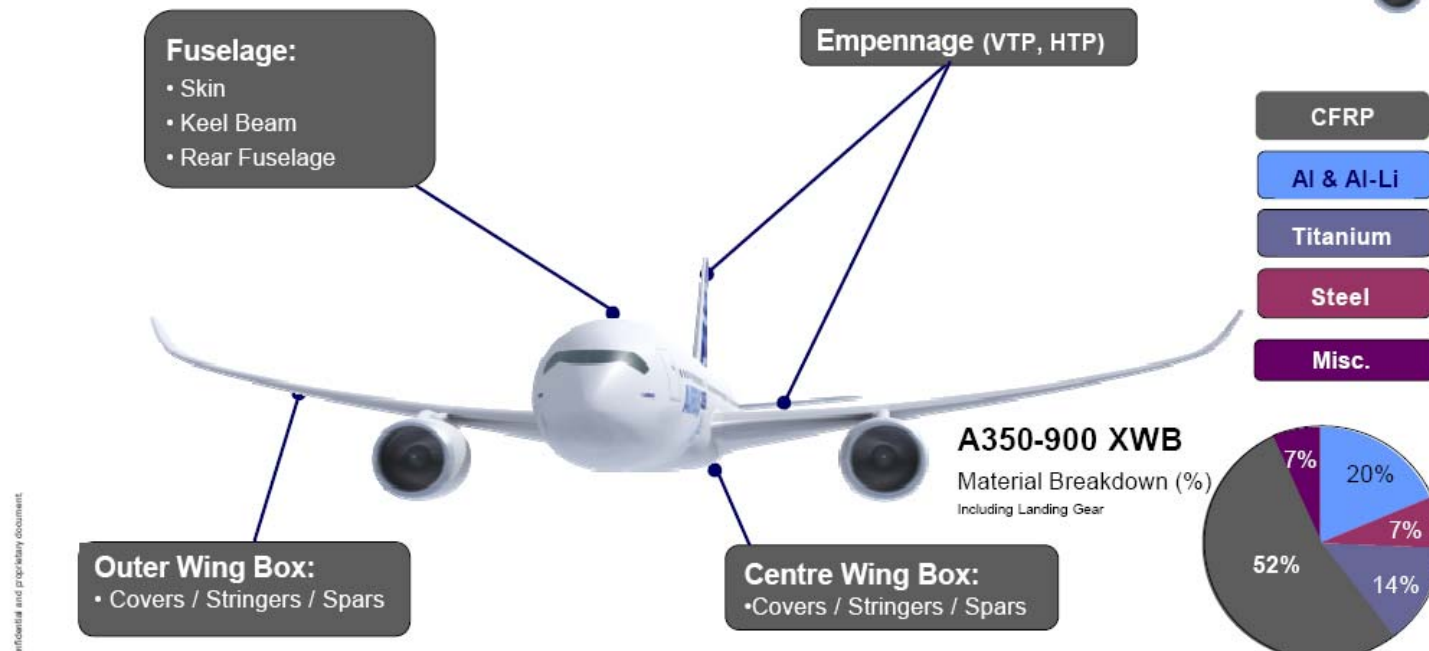
- Carbon laminate
- Carbon sandwich
- Other composites
- Aluminum
- Titanium
- Titanium/steel/aluminum



# Composite Structure Development A350

A350 **XWB** XTRA WIDE BODY Composite applications

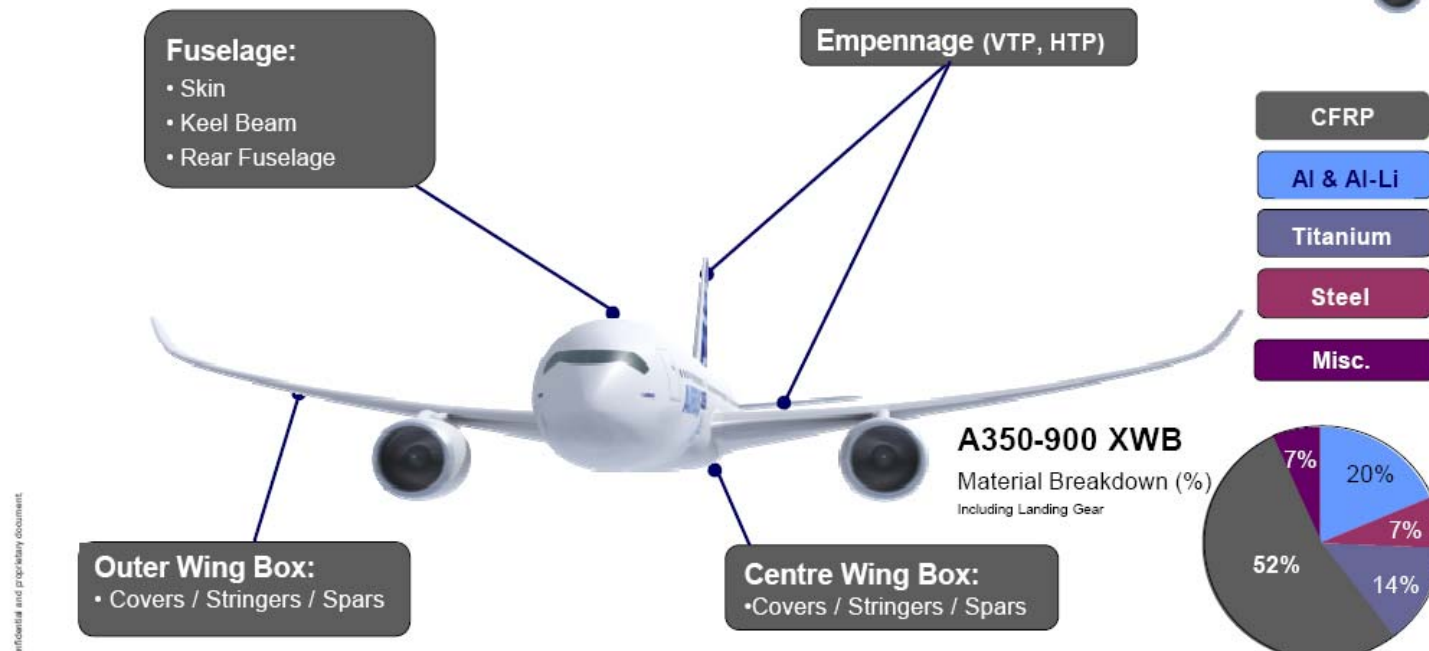
A350 **XWB** XTRA WIDE BODY *Innovative Material Applications*



# Composite Structure Development A350

A350 **XWB** XTRA WIDE BODY Composite applications

A350 **XWB** XTRA WIDE BODY *Innovative Material Applications*



# BA Fleet

247 Aircraft.

6 main types and variants.

Airbus	(83)	B737-300/400/500	(31)
B747-400	(57)	B757-200	(13)
B767-300	(21)	B777-200	(43)

Variants are strategically 'route aligned' to meet premium load factors.

## Typical Maintenance periods

<b>A/c</b>	<b>A check</b>	<b>C check</b>	<b>4C check</b>
Airbus	Overnight ea 600FH	10 Days ea 18mths	16 Days /6 years
B737	Overnight ea 300FH	11 Days ea 24mths	26 Days /8years
B747	1 Day ea 500FH	19 Days ea 18mths	33 Days /6 years
B757	Overnight ea 525FH	12 Days ea 24mths	25 Days /6 years
B767	Overnight ea 525FH (1000FH long haul)	10 Days ea 24mths	25 Days /6 years
B777	1 Day ea500hrs	8 Days ea 24mths	20 Days /8 years



## Typical utilisation

<b>A/c Type</b>	<b>Flying Hrs/day</b>	<b>Cycles/day</b>
Airbus (319/20/21)	6-7	4-5
B737	7	4-5
B747	13	1-2
B757	6.5	4
B767(lh+sh)	11	2-6
B777	14	2

# Operational Damage OPTIONS

- SRM Fix within ADL, Time limited repair or permanent repair
- In-house permanent approved design fix
- In-house temporary approved design fix at terminal
- Dispatch A/c iaw MEL or CDL
- In-house temporary approved design fix at hangar
- Roll A/c down the schedule (change A/c)
- TCH AOG temporary approved design fix
- Use spare A/c (type/variant dependant)
- Replace the part (lease OEM/surplus dealer spare, buy new item, pool loan)
- Rob Part from later A/c or Heavy maintenance
- Delay service
- Cancel service

# Operational Dependencies

- Crew hours
- Inter terminal tow availability
- Catering change available
- Cabin maintenance completed
- Engineering resource
- Take off ETS slot availability
- Destination ETA availability
- Spare A/c
- Refuel/ defuel capability

# Repair Limitation and Dependencies

- Composite design, Sandwich or monolithic
- Engineering substantiation
- Environment, Capability and access
- Component Size/Type
- Immediate materials/parts availability
- A/c location and Weather
- Appropriately licensed Technician
- Risk of down line failure
- Repeat inspection capabilities

# Impact Due to A/c Change

- A/c cabin configuration affects pax seat availability
- Re-ticketing and seat allocation changes
- BAA stand change
- IFE variations
- Galley loading configurations
- Route changes if Non ETOPS is spare A/c
- Airline credibility /passenger perception
- Increased cost



# Continued airworthiness

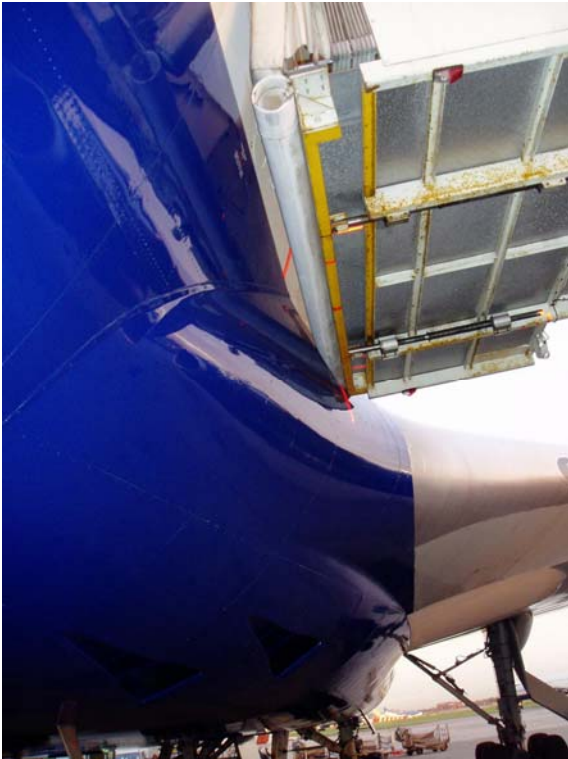
- Maintenance Check alignment
- Type of inspection.
- Threshold and Frequency
- Specialised NDT equipment and access
- A/c location
- Terminating action

# Decision - Winglet



Remove winglet,  
inspect attachments  
and despatch to CDL  
with performance  
penalties

# Decision - body panel



Temporary repair at hangar –delay service

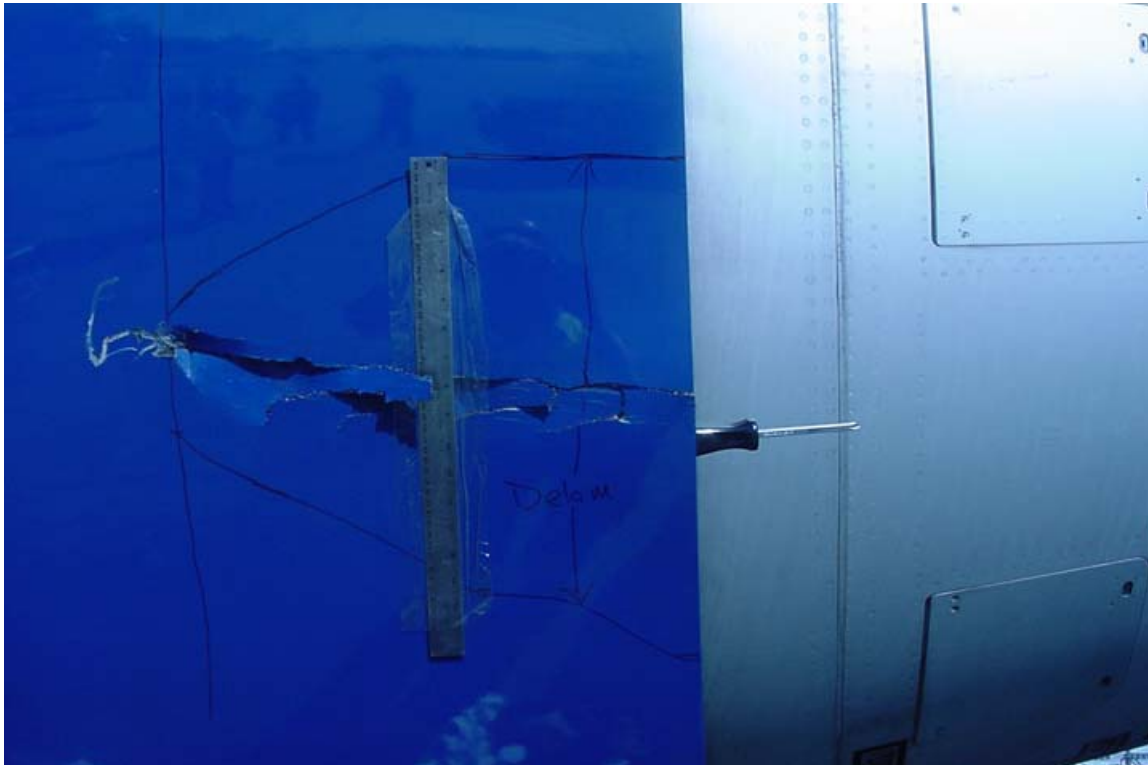
# Decision – Aileron TE strip



Despatch A/c.

Do an in house  
permanent repair  
next A check

# Decision - D Duct TE



- Fracture and delamination of D Duct TE at mainline station

# Decision – D Duct TE



## Immediate Operation

- Temporary In house approved bolt up repair for return trip only
- 4 hour flight delay

## Longer term

- Lease D Duct half
- Immediate permanent repair
- Repair £240K
- Tool cost £77K

# Repair statistics 2005/6

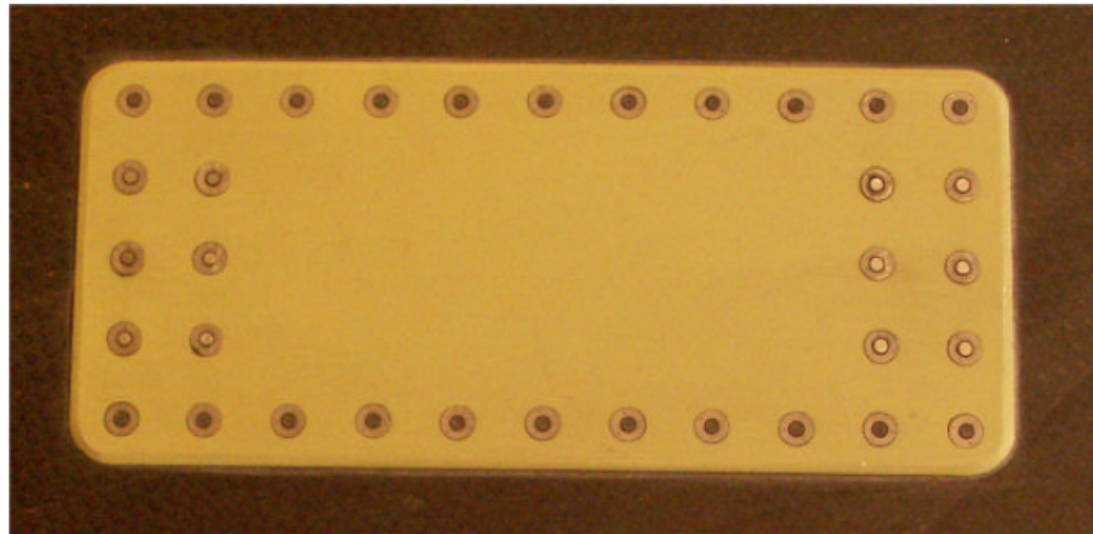
- 700 different part numbers.
- ~2600 bonded repairs.
- ~780 (30%) Composite repairs plus,
- >172 Attrition lining panel repairs in 2006 plus,
- ~160 On wing Engine nacelle repairs, plus
- ~700 On wing Composite airframe repairs



# All Composite Pressure Hull

## ***Monolithic structures***

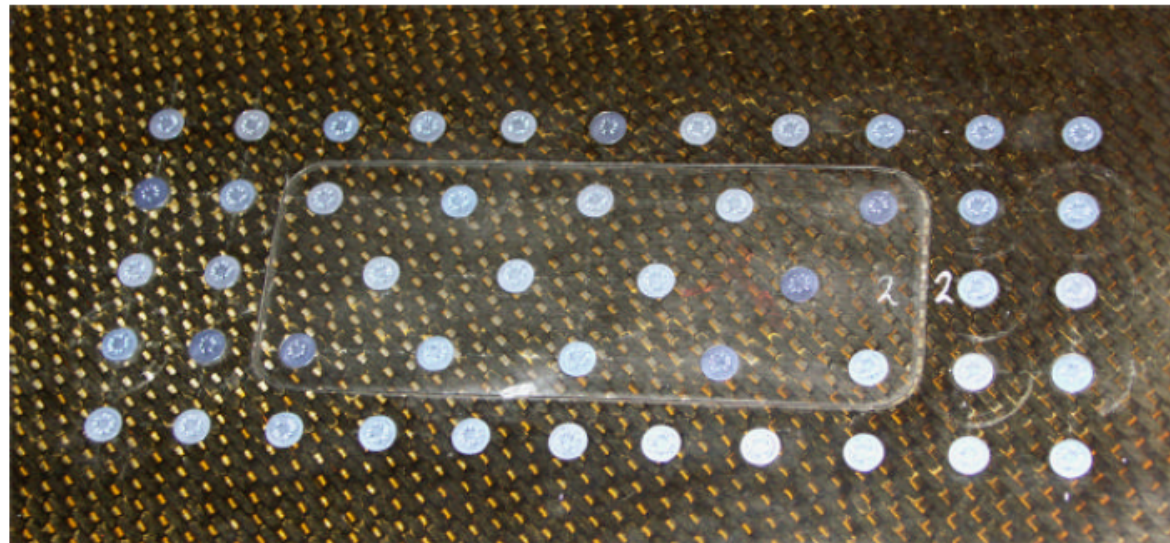
- ▶ **Temporary Bolted Repairs - Metallic (Al) doublers**



# All Composite Pressure Hull

## *Monolithic structures*

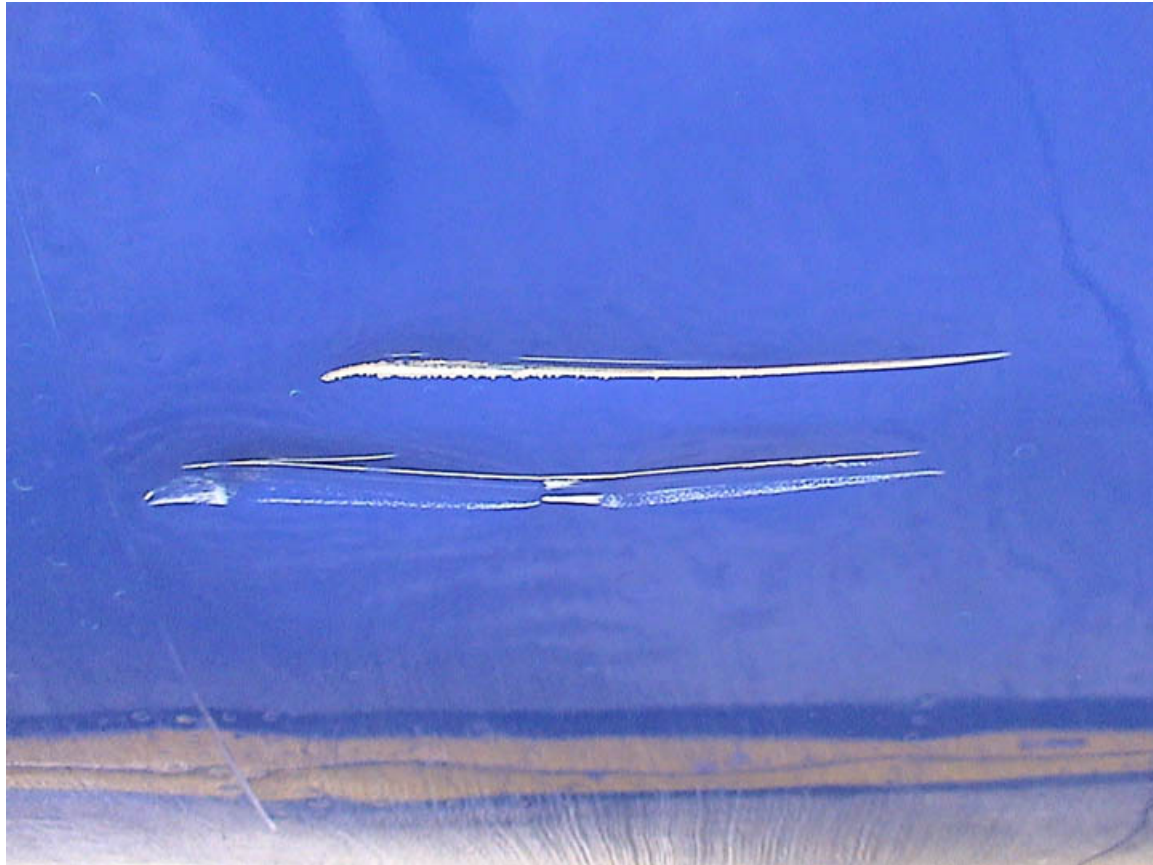
- ▶ **Permanent Bolted Repairs - CFRP and Metallic (Ti) doublers**
  - Example shown : CFRP / Flush



# Typical Fuselage damage 1



# Typical Fuselage damage 2



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# QUESTIONS