



The NORDAM REPAIR GROUP

2006 FAA Workshop for Composite
Damage Tolerance & Maintenance



MRO Repair of Composites

A 20 Year History

Where have we been?

Where are we today?

Where are we headed?

A look at Past, Present, & Future

Presented by: Jim Epperson, NORDAM Repair Division

July 20, 2006



Past

Most of the issues that existed 20 years ago still exist!

- *Materials*

- Numerous types, styles, and procurement specifications
- Limited and/or untimely availability
- Minimum purchase amounts and cost associated with the expiration of shelf life
- No standard means of determining substitutability



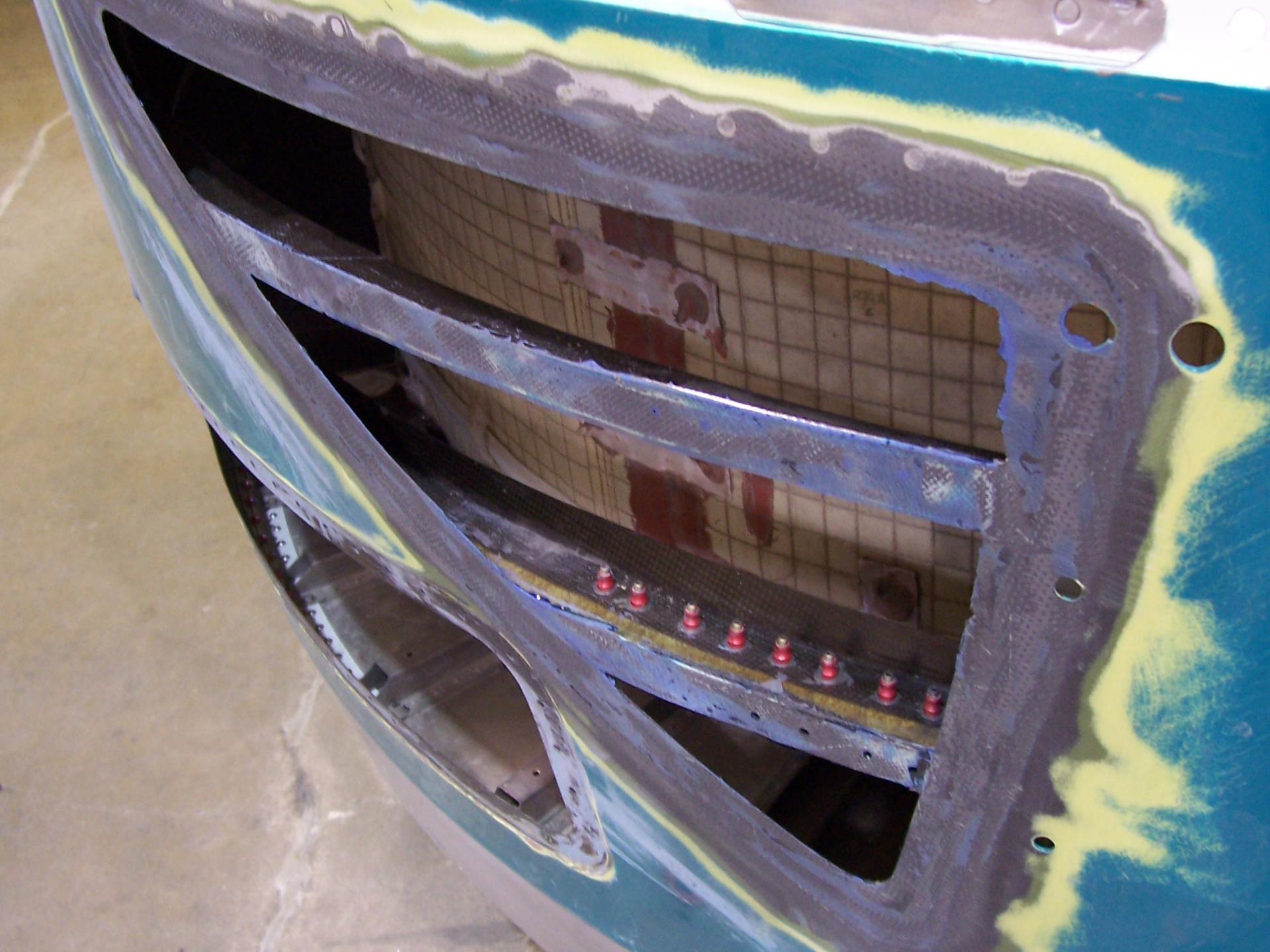


Past

Most of the issues that existed 20 years ago still exist!

- *Repair Techniques*

- Limited options, Component specific, OEM driven
- Inability to standardize materials and repair processing due to unknown effects on design properties
- Limited independent analysis capability
- Denied access to design loads and material allowables necessitating innovative repair solutions



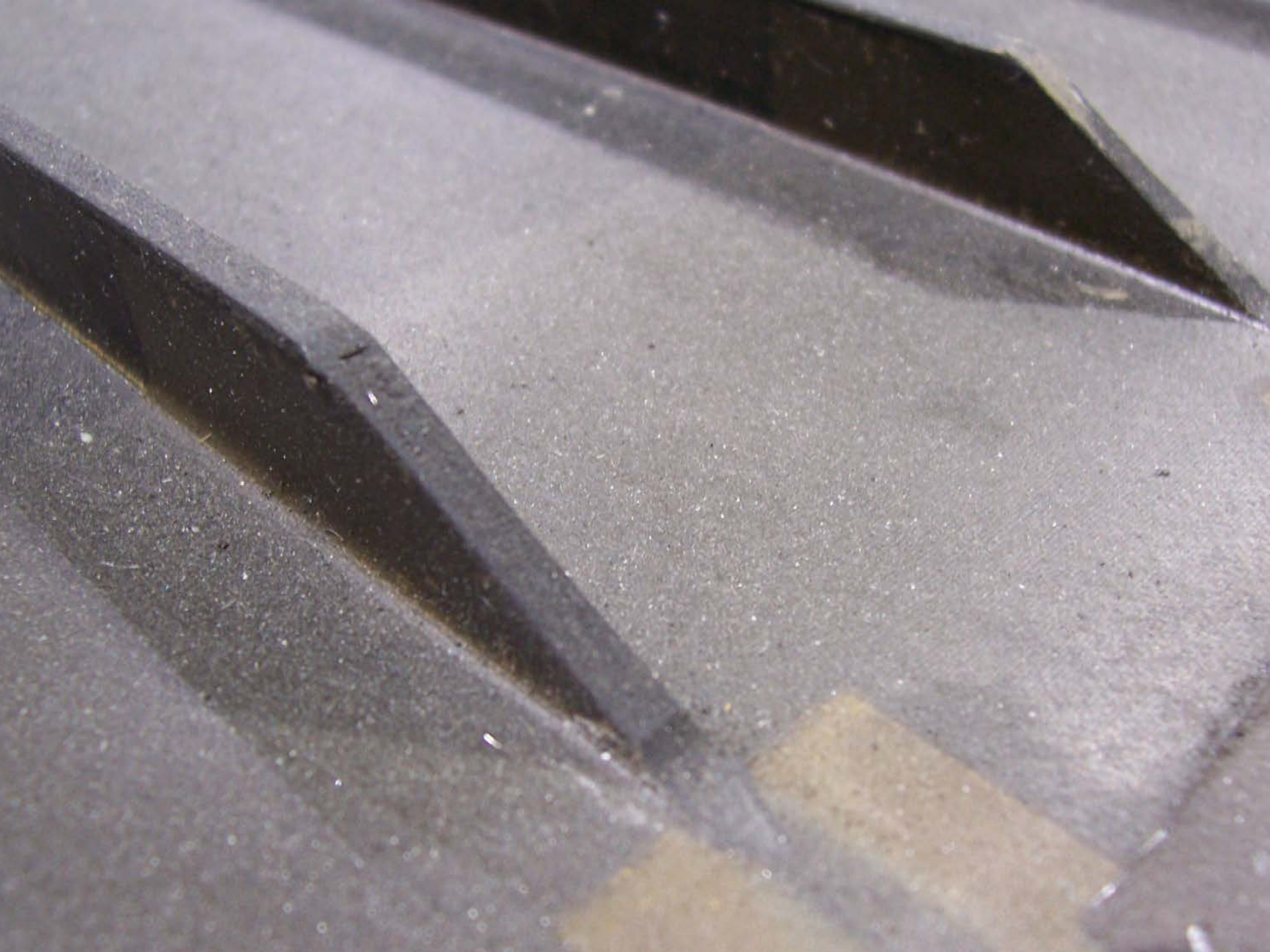


Past

Most of the issues that existed 20 years ago still exist

- *Repair Access*
 - Repairability in design
 - Self inflicted damage associated with obtaining back side access to damaged areas
 - Cost associated with a lack of access





ENG128C06-04H

ENG128C05-04H

DAN8-5A5
NSA 5075-5

DAN8-5A4
NSA 5075-5

-4

REMOVED
HL 1013-5

BIB #1/B

ENG12



SEARCHED CHD 01-01-2006

ORDER NUMBER: C Customer Order
 Invoice Type: 1 Issue

Order No	Qty	Customer Name	Issue Date
41888	100	JEKIDIAN BIRMOYS	10/1/05

Order Qty	In	Sta	Typ	Item
1.000	00	4	K	057570618027000
				FLAP, 0120/121

Lot/Eqsn: 0000 Component: 1G1516

Starting Qty	Can Typ	M	Pt Desc	Remaining Qty	Required Qty	Quantity	Stk Bin	lc	Issue Quantity
100				0	0	10.000		0	10.000

Barcode labels with various alphanumeric codes and barcodes.

10-1206142

10-1206142

10-1206142

10-1206142

10-1206142



Past

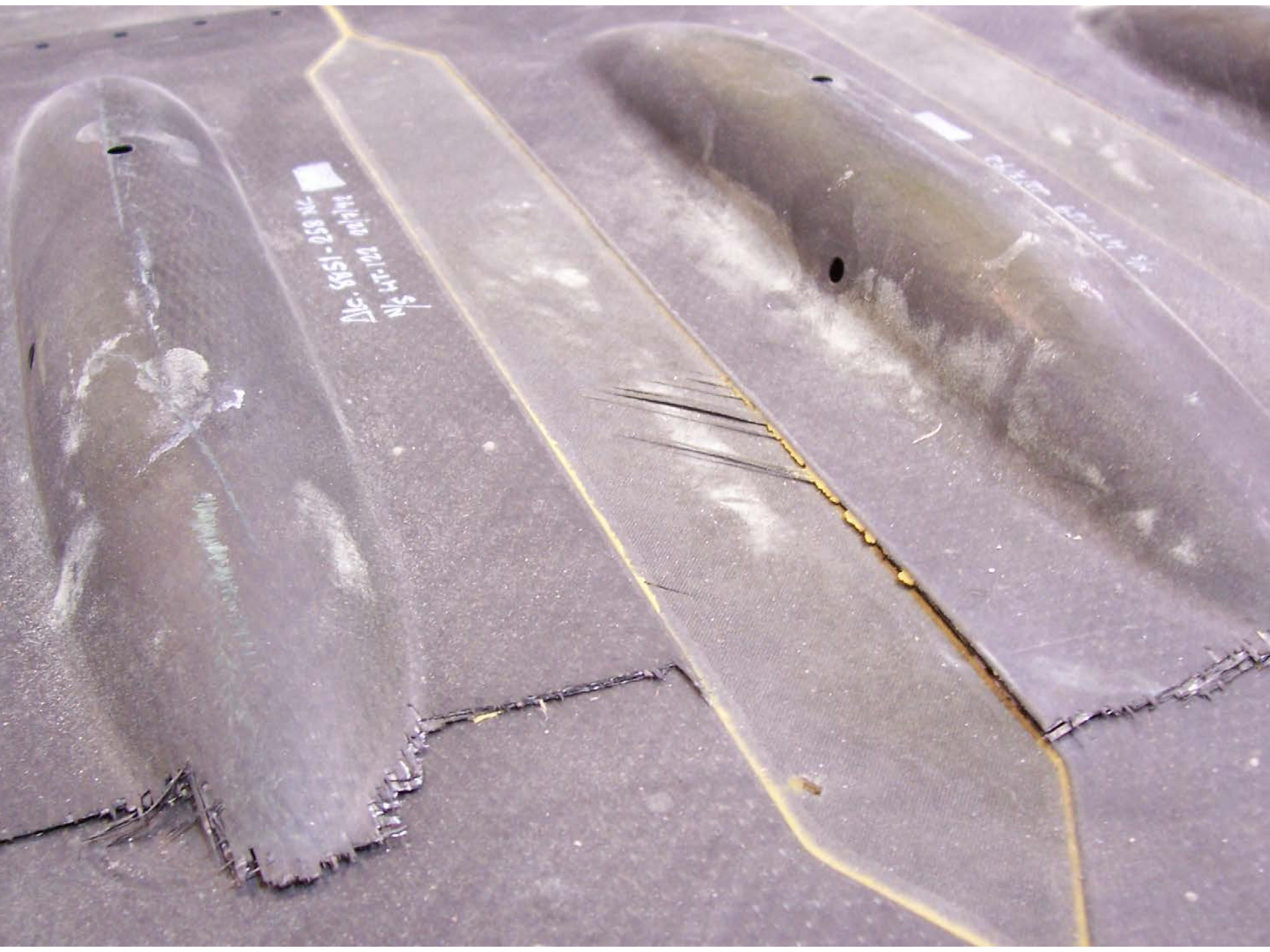
Most of the issues that existed 20 years ago still exist

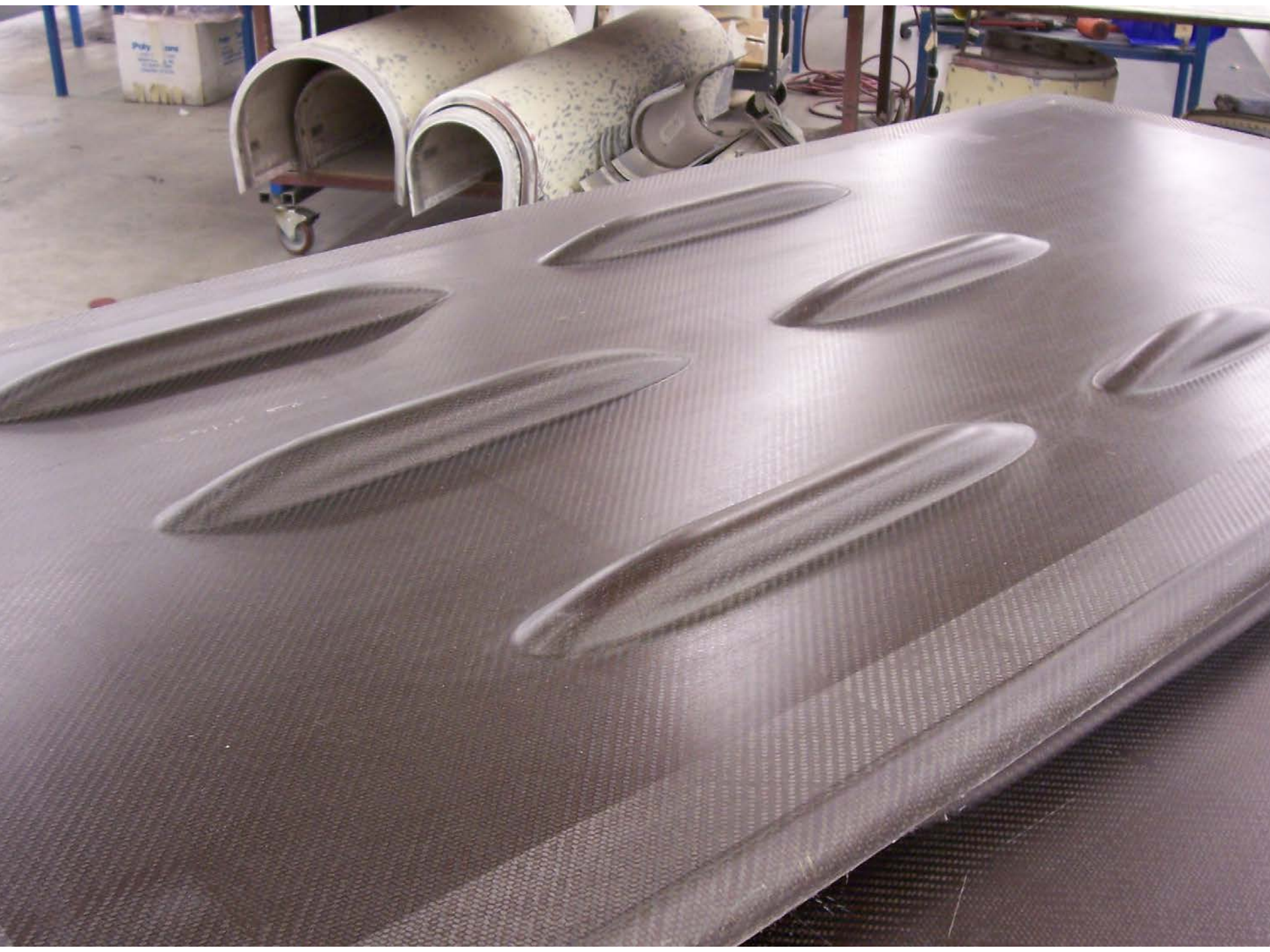
- *Tooling and Equipment*
 - Compatibility of tooling material selection
 - Consideration of thermal coefficient of expansion
 - Concern over exact replication of OEM tooling
 - Inability to obtain OEM loft data
 - Repair spring back vs. manufacturing spring back





ALC-6651-058 NC
NLS 44-120 0012141







Past

Most of the issues that existed 20 years ago still exist

- *Approval Legalities*

- A DER is the main means of obtaining FAA repair approval
- All process and/or material deviations require formal approval
- Repair processing must be approved by the customer's engineering department



Present

- *The post 9-11 loss of seasoned individuals that had an intuitive understanding of aircraft structures from both the FAA and Airlines*
 - Contributed to a less innovative repair approval workforce
 - Increased customer interface & tighter approval criteria



Present

- *Stricter FAA DER oversight affecting out of scope repair approvals*
 - Increased demand for OEM approvals by the operator and less acceptance of FAA/DER approvals
 - Tightening of FAA DER oversight policies with less FAA personnel
 - Increased need to obtain foreign regulatory repair approvals in addition to FAA approvals



Present

- *Heightened industry reluctance to deviate from type certificated design by giving consideration to the use of actual loads data that might allow an alternate repair approach .*
 - Little or no access to proprietary design data to support a non-published repair approach and substantiation
 - Reluctance to accept repair designs that are based on calculated load introduction path capability (Reverse Engineering Approach)



Present

- *Ever increasing amount and variable types of composite materials being utilized in today's designs*
 - 157 independent material listings within NRD
 - Multiple procurement specifications
 - Inability to purchase to an OEM specification



Present

- **Increased use of automation in the manufacturing process limiting repair options**
 - Repair not feasible due to limitations in restoring the original design
 - Processing parameters unknown
 - Repair equivalency verification and associated substantiation difficult



Transitional “Go Forward” Question

Given the existing level of complexity with regard to past and present repair of composite flight controls, doors, panels, and what we consider to be secondary structure,.....what standard will the MRO industry need to meet with regard to the repair of “New Generation Primary Composite Structure”?



Future

What will the Composite MRO Industry Need to be Prepared to Repair?

- *Increased categories of aircraft*
 - New generation commercial transports
 - General aviation jets and recipis
 - Unmanned drones
 - Space planes



Future

What will the Composite MRO industry need to assure “*REPAIR INTEGRITY*” for safe flight in the future?

- *Accredited and OEM sanctioned Engineering tools/programs that will facilitate expedient substantiation of innovative repair proposals.*



Future

What will the Composite MRO industry need to assure “*REPAIR INTEGRITY*” for safe flight in the future?

- *Shared access to OEM design loads and material allowables that can be used in support of the required substantiation.*



Future

What will the Composite MRO industry need to assure “*REPAIR INTEGRITY*” for safe flight in the future?

- *Standardized repair & inspection methodology guidance material.*



Future

What will the Composite MRO industry need to assure “*REPAIR INTEGRITY*” for safe flight in the future?

- *Owner/operator awareness of the do's and don'ts associated with the maintenance and repair of aircraft containing primary composite structure.*



Future

What will the Composite MRO industry need to assure “*REPAIR INTEGRITY*” for safe flight in the future?

- *Nationally accredited training, perhaps even licensing for both mechanics, inspectors, and engineers working with composites.*



Summary

- The past way of doing business will not allow the composite MRO Industry to survive in the future.*
- The MRO will need to undergo a paradigm shift from the “we can fix anything” mentality to one that is much more reliant upon a disciplined OEM partnering relationship.*