

Composite structures repair case
study for standardization

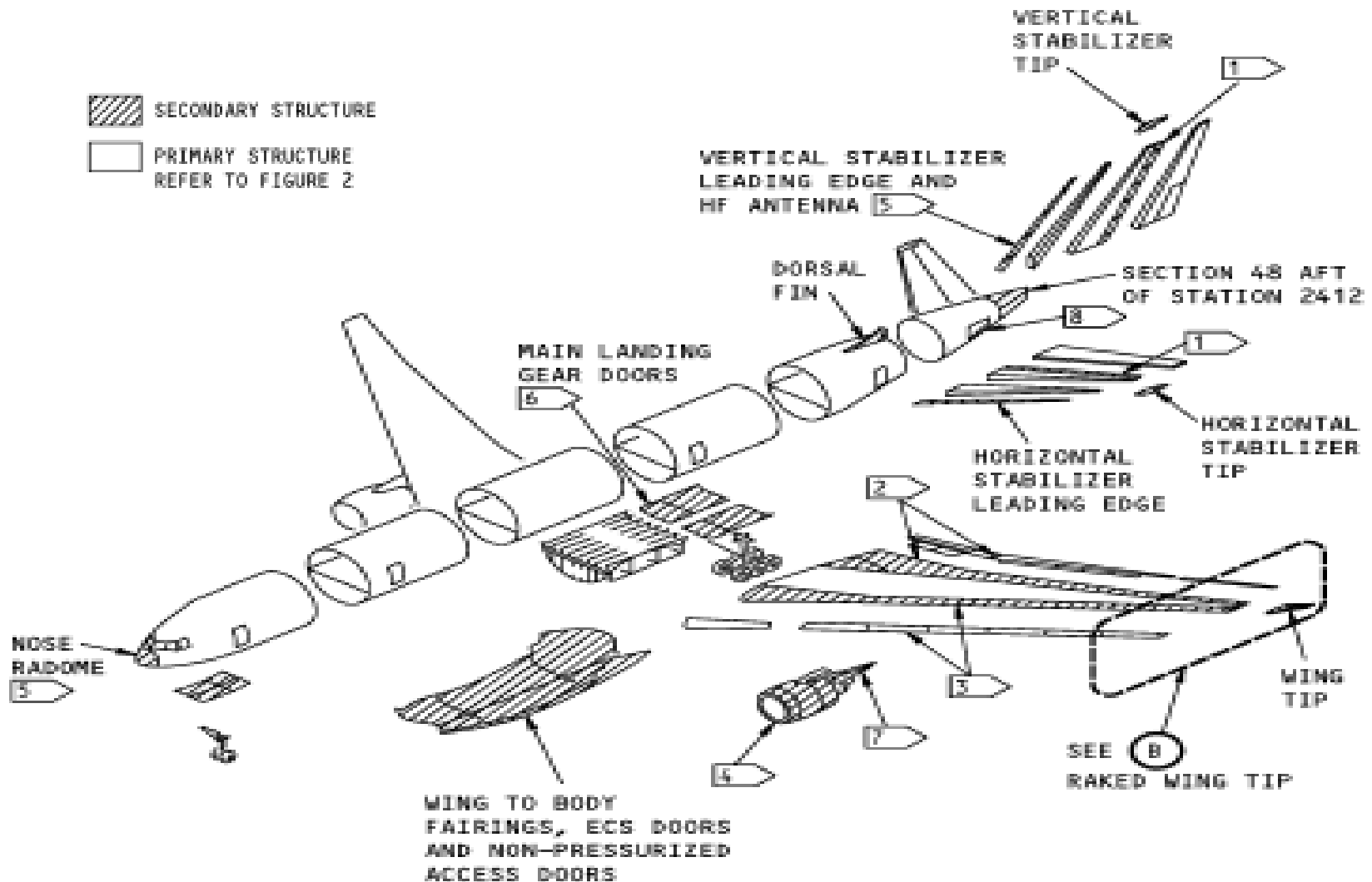
TOPICS

- Instead of A Case study – Summarizing All exterior Composite structures
- Which parts on the airplane are the majority of cost?
- When in the repair process does non-standardization drive up the cost?

What parts are we talking about?

- Primary Structure: Structural components or assemblies that are necessary to sustain design ultimate flight and ground loads. **Refer to 51-00-04, GENERAL** for the locations of primary and secondary structure. (*Includes Principal Structural Elements*).
- Secondary Structure: Structural components that unload into primary structure, such as fairings and most control surfaces.

STRUCTURAL CLASSIFICATION



What parts are PSE?

ATA Chapter	Name	737-300/500	747-400	757-200	767-300	A320	777-200
53	Fuselage	X	X	X	X	X	X
55	Fixed Empennage					X	X
55	Elevator			X		1,2,4	4,7
55	Rudder			1,2,3,4		1,2,3,4	4,7,8
57	Spoilers					2,3	
57	Aileron					4	
57	OB Flap	7	7	7	7	1,2,4	X
57	IB Flap	7	7	7	7	,2,3,4,5,8	X
57	LE Devices			X	X	2,6	
<u>Notes:</u>	<u>Sub-components</u>				<u>Color Code</u>		
1	Spar					=	Graphite
2	Skin					=	Fiberglass
3	Ribs					=	Metalbond
4	Fittings					=	Sheetmetal
5	Nose cap					=	PSE
6	TE Wedge						
7	Main box						
8	Tab						

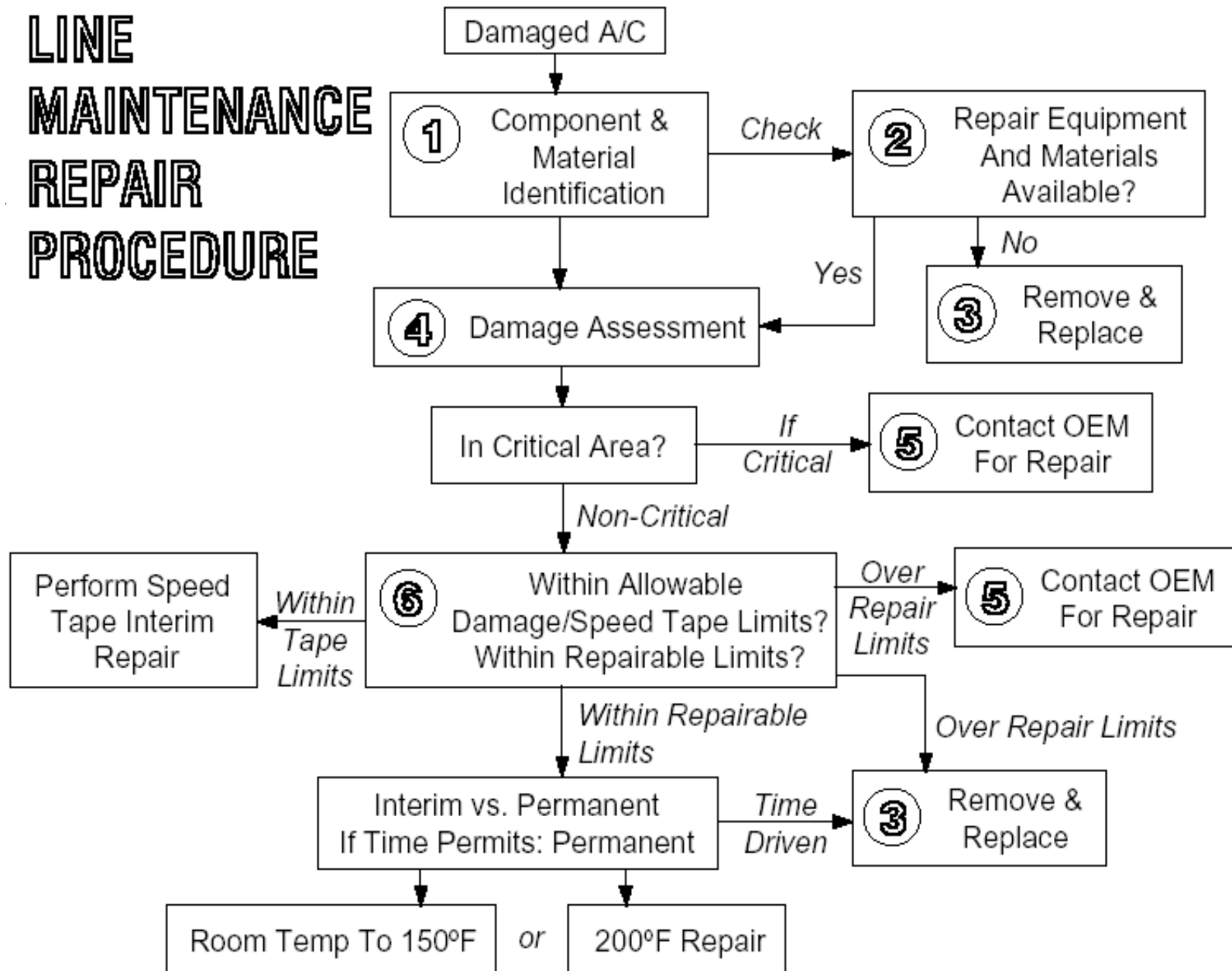
What parts are we talking about?

- 777 Parts composite parts classification
 - 13 are PSE (all are LRUs plus floorbeams and empennage)
 - 78 are Primary (15 are LRUs)
 - 230+ are Secondary
- Top Line non-routine removals (SHOP WORK):
 - Radomes
 - Fan Cowls
 - Thrust Reverser Translating Sleeves
 - Inlet Cowls
- Top Shop drivers – design deficiencies
- Secondary structure majority of work for mechanics, inspectors, engineers

Damage Assessment Process

- When in the repair process does non-standardization drive up the cost?
 - Manuals
 - Expected to cover common in-service events
 - Improved based on in-service feedback
 - NDI
 - Engineering support
 - One-off repairs
 - Shop-level repairs versus on-wing

LINE MAINTENANCE REPAIR PROCEDURE

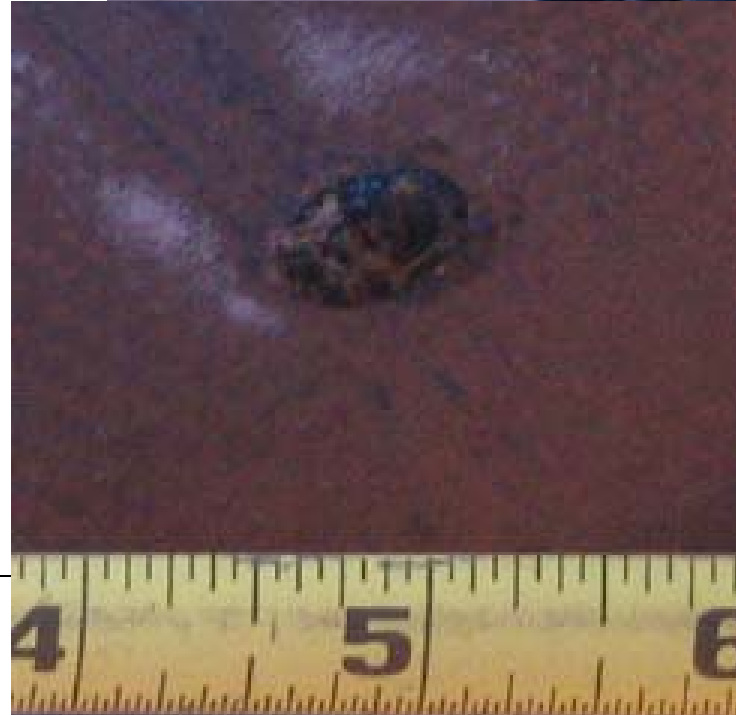


Elevator Upper skin

DAMAGE ASSESSMENT:
Hole in upper skin, 0.5 inch diam.

IDENTIFY SRM REPAIR: Not in a critical area, but “Note: no wet layup repair within 6 inch of edge,” therefore 350F prepreg repair

CONTACT OEM.
Engineering called, telex to OEM, 1 to 3 days time lapse. Resulted in 200F wet layup repair.



Elevator Upper skin

COST COMPARISON

	ON-WING	ON-WING	ON-WING	SHOP	SHOP	OUTSIDE
	Damage assessment	Wet layup Hotbond repair	350 Prepreg Hotbond repair R&R	350 Prepreg Hotbond repair R&R	Autoclave Repair	OSV Repair
Labor Hours	1	16	24	36	40	
Labor cost	\$120	\$1,920	\$2,880	\$4,320	\$4,800	
Material Cost	\$5	\$500	\$2,000	\$2,000	\$4,000	
Tooling/Equipment Cost (pro-rated)	<u>\$0</u>	<u>\$500</u>	<u>\$500</u>	<u>\$500</u>		
Total Repair Cost	\$125	\$2,920	\$5,380	\$6,820	\$8,800	\$20,000
Schedule Interruption Effect	15 minute delay	1 cnx + 1 day OOS	1 cnx	1 cnx + 3 day OOS	1 cnx	1 cnx
Schedule Interruption Cost	\$855	\$47,350	\$37,000	\$68,050	\$37,000	\$37,000
Spare Cycle Time	0	0	0	0	90 days	6 months
Spares Cost (pro-rated)	0	0	0		\$10,000	\$20,000
Lease Cost (reference)	0	0	0		\$49,315	\$98,630
TOTAL COST	\$980	\$50,270	\$42,380	\$74,870	\$95,115	\$155,630

Fan Cowl Hail

DAMAGE ASSESSMENT:

Visual damage, SRM requires lots of measurements

IDENTIFY SRM REPAIR:

Beyond the SRM wet layup repair limits, so replaced with spare

-Shop: prepreg repair per SRM.

IF MATERIAL NOT

AVAILABLE: Either purchase and wait or send to OEM for repair or develop own repair with alternate material



Fan Cowl Hail Damage Case study

COST COMPARISON

	ON-WING	ON-WING	ON-WING	SHOP	SHOP	OUTSIDE
	Damage assessment	Wet layup Hotbond repair	350 Prepreg Hotbond repair R&R	350 Prepreg Hotbond repair R&R	Autoclave Repair	OSV Repair
Labor Hours	6	16	24	16	40	
Labor cost	\$720	\$1,920	\$2,880	\$1,920	\$4,800	
Material Cost	\$10	\$500	\$2,000	\$2,000	\$4,000	
Tooling/Equipment Cost (pro-rated)	<u>\$0</u>	<u>\$500</u>	<u>\$500</u>	<u>\$500</u>		
Total Repair Cost	\$730	\$2,920	\$5,380	\$4,420	\$8,800	\$50,000
Schedule Interruption Effect	15 minute delay	1 cnx + 1 day OOS	1 cnx	1 cnx + 3 day OOS	1 cnx	1 cnx
Schedule Interruption Cost	\$855	\$47,350	\$37,000	\$68,050	\$37,000	\$37,000
Spare Cycle Time	0	0	0	0	90 days	6 months
Spares Cost (pro-rated)	0	0	0		\$10,000	\$20,000
Lease Cost (reference)	0	0	0		\$49,315	\$98,630
TOTAL COST	\$1,585	\$50,270	\$42,380	\$72,470	\$55,800	\$107,000