

# ***CACRC - Repair Techniques Task Group***

## **Repair Techniques Task Group Status Report**

### **Future plans**

**WICHITA NOV 2007**

# ***CACRC - Repair Techniques Task Group***

## ***WHY DO WE NEED TO STANDARDIZE REPAIR TECHNIQUES***

The Airlines have multi-airframe, multi-engine fleets

### ***NEEDS***

To be able to use standard methods when repairing any of the composite parts in their fleet.

To minimize risk of using one OEM's method on another OEM's part

To minimize training costs

To develop their own repairs knowing that when they reference ARP's the approver will recognize the method and know the best practice will be used

# ***CACRC - Repair Techniques Task Group***

## **OBJECTIVES**

To develop a set of standard methods for common steps in performing repairs by using the best practices in the industry

To provide some education on the reasoning behind the methods

To describe the advantages and disadvantages of the methods and materials used

# CACRC - Repair Techniques Task Group

## MEETINGS

3-5 DEC 91	CACRC MEETING IN WASHINGTON AND T.G. SET UP MEETING
25-27 FEB 92	TOULOUSE (AIRBUS)
12-13 MAY 92	HAMBURG (DLH)
27-29 OCT 92	TULSA (AAL)
Spring	LINKÖPING (SAAB)
23-25 FEB 93	AMSTERDAM (FOKKER)
10-12 JAN 94	STOCKHOLM (SAS)
30 AUG - 2 SEPT 94	SAN FRANCISCO (UAL)
25-27 JAN 95	AMSTERDAM (FOKKER)
30 MAY - 2 JUN 95	CINCINNATI (GE)
30/31 OCT 3 NOV 95	SAN RAMON (HEXCEL)
6/7/10 MAY 96	BELFAST (SHORTS)
5/6/8 NOV 96	NASHVILLE (AEROSTRUCTURES)
21/22/25 APR 97	PITTSBURGH (US AIR)
3/7 NOV 97	ATHENS (ACADEMY OF ATHENS & OLYMPIC AIRWAYS)
18/22 MAY 98	SEATTLE (UNIVERSITY OF WASHINGTON & BOEING)
26/30 OCT 98	LUBECK (DLH)
10/15 MAY 99	SAN DIEGO (BF GOODRICH)
15-16 NOV 99	PFÄFFIKON (AERO CONSULTANTS & DEXTER)
5-6 JUNE 2000	TOULOUSE (AIRBUS)
6-7 Nov 2000	WASHINGTON (FAA)
4-5 Jun 2001	UPPSALA (SAS)
20-21 May 2002	MIAMI (FLIGHT SAFETY BOEING)
5-6 Nov 2002	BRISTOL (BRITISH AEROSPACE)
27 Oct 2003	TULSA (NORDAM & ICES)
10-11 May 2004	MADRID (AIRBUS)
18-21 Oct 2004	MANASSAS (AURORA)
21-25 May 2004	BREMEN (AIRBUS)
24-27 Oct 2005	SEATTLE (BOEING)
22-25 May 2005	PRESTWICK (BFG)
Oct 2006	CINCINNATI (GE)
May 2007	AMSTERDAM
Nov 2007	WICHITA

# ***CACRC - Repair Techniques Task Group***

## ***GENERAL FORMAT FOR REPAIR TECHNIQUES ARP's***

Introduction

References

Safety information, personal protective equipment

Descriptions of the materials and/or equipment used in the ARP. In some ARP's this may also include detail information on how to use the material or equipment

Detail methods for performing a particular technique in a suitable format for putting into OEM manuals as standard practices or procedures

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## ***REPAIR TECHNIQUES DOCUMENT PHILOSOPHY***

The aim of these ARP's is to provide standard instructions reflecting the best practices available today that can be accepted by all OEM's

Where more than one method is given the methods are *NOT* interchangeable unless specifically stated. The different methods usually have different applications or, as in the case of the heat application document, use different types of equipment that may be available

Occasionally one OEM may define the use of a particular method for extended repair sizes based on that particular OEM's data using that particular method. Other OEM's may not use that method for extended repairs.

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## ***REPAIR TECHNIQUES DOCUMENT STATUS***

Where are we today?

# ***CACRC - Repair Techniques Task Group***

***DRYING (ARP 4977)***

**STATUS – PUBLISHED - 5 YEAR REVIEW  
REAFFIRMED**

## ***CONTENTS***

Background information on reasons that drying is required

Definition of differences between liquid and absorbed moisture

Discussion of non water based contaminants

Methods for drying parts both in the shop and on wing for both liquid and absorbed moisture



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## ***MASKING AND CLEANING (ARP 4916)***

**STATUS – PUBLISHED  
5 YEAR REVIEW  
REAFFIRMED**

### ***CONTENTS***

Background information on masking materials, cleaning materials, and personal protective equipment

Masking methods covering masking for continued service and masking for protection during cleaning or performance of the repair

Cleaning methods for removal of grease, oil and general road grime.

Cleaning methods for use before bonding

A technique for performing a water break check

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## ***CORE RESTORATION (ARP 4991)***

**STATUS – PUBLISHED  
REV A APPROVED**

### ***CONTENTS***

Background information on methods and materials

Methods for resin injection

Methods for applying potting and using potting for core restoration

Methods for preparation of core plugs and the installation of both full depth and partial depth core

Methods on core closing added in rev A

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## ***RESIN MIXING (ARP 5256)***

**STATUS - PUBLISHED**

**5 YEAR REVIEW**

**REAFFIRMED**

## ***CONTENTS***

This document describes the correct procedures for safely and efficiently mixing the typical two component epoxies

The use of additives is discussed

A method is given for determining the correct amount of resin to mix for a given size of repair. This is a useful quality control to prevent resin rich or resin starved laminates

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## ***HEAT APPLICATION (ARP 5144)***

STATUS – PUBLISHED  
5 YEAR REVIEW –to be

### ***CONTENTS***

***REAFFIRMED***

Gives information on cure cycles

Defines heat transfer methods and their applicability

Describes the use and validation of thermocouples and heat blankets

Describes the properties and uses of many different heating devices for both shop and on wing use

Defines typical quality control requirements

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***RESIN IMPREGNATION (ARP 5319)***

**STATUS – PUBLISHED**

## ***CONTENTS***

Background information on the equipment and materials

Health and safety guidance

Required preparation including the making of templates and the layout of templates on the cloth to ensure ply angle requirements are maintained

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## **3 METHODS**

- Squeeze out method (with manual impregnation)
- Vertical bleed method (with manual impregnation)
- Vacuum impregnation method (with vertical bleed)

The first two methods are used in the wet lay up material qualification

The third method represents the expanded scope of the document for larger repairs.

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## ***VACUUM BAGGING (ARP 5143)***

**STATUS – PUBLISHED**

### ***CONTENTS***

Describes the materials and the function of the materials used in the assembly of a vacuum bag.

Hints and tips are given on ways to obtain a good leak proof bag and on the function of caul plates and the advantages and disadvantages of single side versus envelope bagging

Methods are given for vacuum bagging for:

- Drying
- vertical bleed
- zero bleed
- squeeze out

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***TOOLING (AIR 5431)***

**STATUS –PUBLISHED**

## ***CONTENTS***

Gives information to enable the wise selection of tooling methods and materials taking into account such variables as cost, heat mass and coefficient of thermal expansion

Gives examples of tool types in typical repair situations with hints and tips in the production of a cost effective efficient tool

Review in progress



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## ***MACHINING (AIR 5367)***

**STATUS – TO BE  
BALLOTTED**

### ***CONTENTS***

Gives guidance information on typical machining operations performed in the completion of a composite repair

Paint removal

Taper or step sanding

Drilling

Countersinking

Deburring

Trimming

Covers glass, aramid and carbon fiber composite materials

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## ***REPAIR PREPREG LAY-UP (ARP 5702) DRAFT AVAILABLE***

### ***CONTENTS***

Give guidance how to install prepreg repair plies and bagging for debulking and final cure.

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***HANDLING AND STORAGE (AIR 5701)      DRAFT AVAILABLE***

## ***CONTENTS***

Give Guidance how to manage cold storage, in and out times, kitting, thawing times before opening.

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## ***CLEAN ROOM AIR XXXX***

Goal is to provide guidelines for “clean room” where you lay up repair plies or perform metal bond

survey by questionnaire ready

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## ***FUTURE PLANS***

1. New document describing inspection tasks during composite repair
2. Revision proposal of AC145-6
3. List of recommended auxiliary materials
4. Attract more repair stations
5. Bonding of anti erosion plates
6. Maintenance issues such removal of fittings

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## HOW WILL WE USE THE ARP's

### DECISIONS MADE BEFORE REPAIR

Is repair in the manual?

Will the repair be done on wing or in the shop

Is tooling required?

### REPAIR FLOW

Part rejected at OEM manual inspection repair / Replace decision is to repair

Develop Repair using ARP's or ARP based standard methods in OEM manuals

OR Yes, repair in OEM manual uses ARP based standard methods in OEM manuals

Build Tool ←

### STANDARD PRACTICES

Tooling

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## DECISIONS MADE BY REPAIR DOCUMENT

Clean whole part or local area and mask uncleaned areas?

What cleaning method is needed

Determine size and shape of damage area to remove

Does visible water require removal

What cleaning method is needed

Is their damaged core?

What method of core restoration is required?

What materials are required for core restoration?

How should the core restoration be cured?

What cleaning method is needed

What resin and reinforcement is required for repair plies? (Can standard materials be used?)

How many plies, in what order and at what orientations?

Is peel ply required

Is a caul sheet required? for surface finish? for heat distribution?

How will the resin be cured?

What inspection method will be used? What is the defect size allowed and how many?

## START REPAIR

Clean and mask

Machine

Dry

Clean and mask

Restore core

Cure core restoration

Clean and mask

Mix resin

Impregnate and lay up repair plies

Vacuum bag

Cure repair plies

Inspect the repair

## STANDARD PRACTICES

Cleaning and masking

Machining

Drying

Core restoration

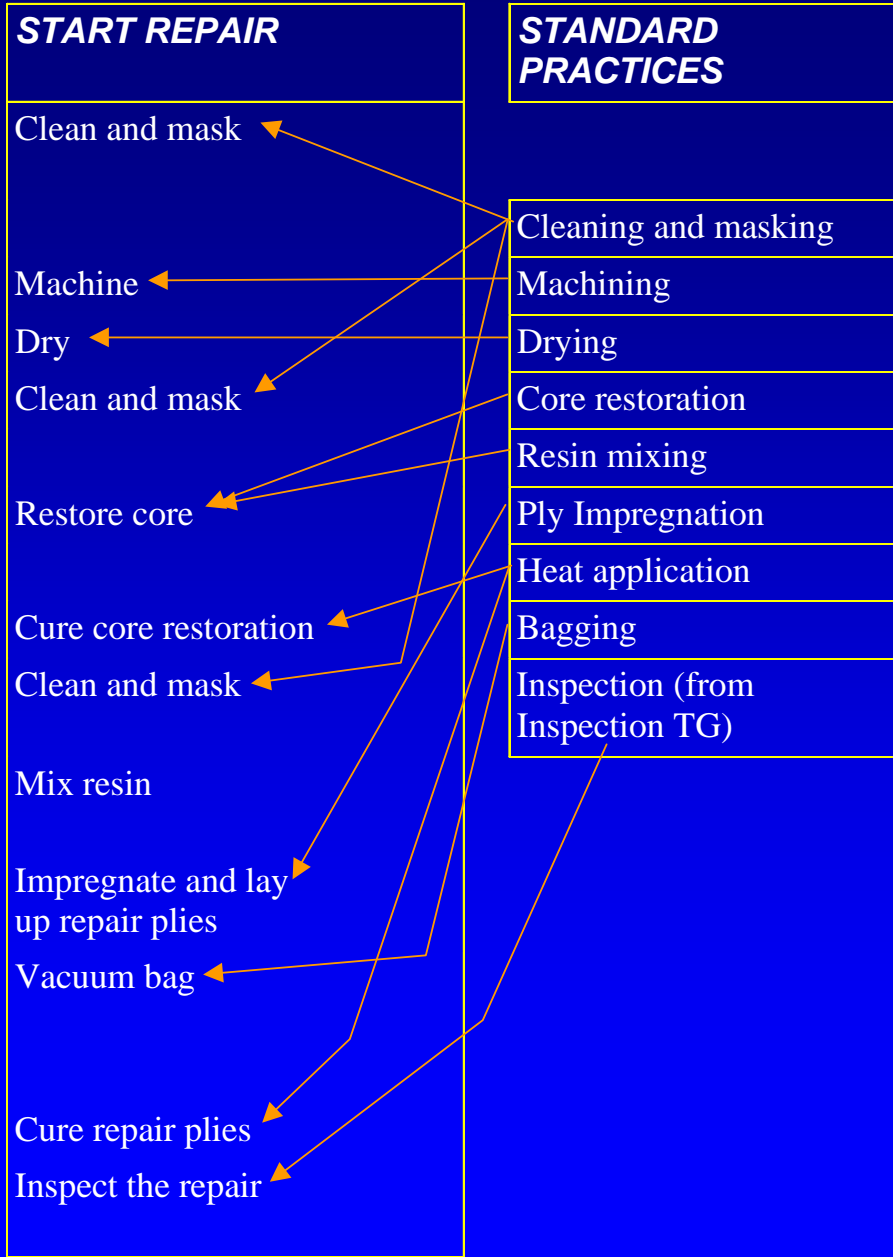
Resin mixing

Ply Impregnation

Heat application

Bagging

Inspection (from Inspection TG)



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## ***HOW DO WE INTEGRATE THE ARP's***

To be useful the ARP's have to be able to be used within the framework of the existing ATA and regulatory rules

### OEM Decision

1. Refer to AIRs & ARPs by number and title “For additional information”
2. ***Incorporate data as applicable !!!!!*** SAE IP