

CACRC - Repair Techniques Task Group

Repair Techniques Task Group Status Report

Future plans

AMSTERDAM MAY 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

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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

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MEETINGS

3-5 DEC 91

25-27 FEB 92

12-13 MAY 92

27-29 OCT 92

Spring

23-25 FEB 93

10-12 JAN 94

30 AUG - 2 SEPT 94

25-27 JAN 95

30 MAY - 2 JUN 95

30/31 OCT 3 NOV 95

6/7/10 MAY 96

5/6/8 NOV 96

21/22/25 APR 97

3/7 NOV 97

18/22 MAY 98

26/30 OCT 98

10/15 MAY 99

15-16 NOV 99

5-6 JUNE 2000

6-7 Nov 2000

4-5 Jun 2001

20-21 May 2002

5-6 Nov 2002

27 Oct 2003

10-11 May 2004

18-21 Oct 2004

21-25 May 2004

24-27 Oct 2005

22-25 May 2005

Oct 2006

May 2007

CACRC MEETING IN WASHINGTON AND T.G. SET UP MEETING

TOULOUSE (AIRBUS)

HAMBURG (DLH)

TULSA (AAL)

LINKÖPING (SAAB)

AMSTERDAM (FOKKER)

STOCKHOLM (SAS)

SAN FRANCISCO (UAL)

AMSTERDAM (FOKKER)

CINCINNATI (GE)

SAN RAMON (HEXCEL)

BELFAST (SHORTS)

NASHVILLE (AEROSTRUCTURES)

PITTSBURGH (US AIR)

ATHENS (ACADEMY OF ATHENS & OLYMPIC AIRWAYS)

SEATTLE (UNIVERSITY OF WASHINGTON & BOEING)

LUBECK (DLH)

SAN DIEGO (BF GOODRICH)

PFAFFIKON (AERO CONSULTANTS & DEXTER)

TOULOUSE (AIRBUS)

WASHINGTON (FAA)

UPPSALA (SAS)

MIAMI (FLIGHT SAFETY BOEING)

BRISTOL (BRITISH AEROSPACE)

TULSA (NORDAM & ICES)

MADRID (AIRBUS)

MANASSAS (AURORA)

BREMEN (AIRBUS)

SEATTLE (BOEING)

PRESTWICK (BFG)

CINCINNATI (GE)

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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?

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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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FUTURE PLANS

1. Develop guidelines for “clean room”, a new definition will be submitted, survey will be sent to repair stations
2. Attract more repair stations

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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)

