

## **North Composites Engineering incorporating Aeroskills**

### ***Specialist Aircraft Composite Training***

North Composites Engineering (NCE) incorporating Aeroskills International have been providing world class composites and metal to metal bonding training to the aircraft and general composite sector for over 30 years. Our courses have been developed in co-operation with educational establishments and aerospace organisations. Our customers are positioned globally and consist of most of the Tier 1 and aircraft maintenance companies in the sector.

Our scheduled courses are offered throughout the year, in addition we also offer tailor made courses to customers' specifications. We will actively work with your company to introduce specific challenging aircraft repairs into our training activities to provided added value and can supervise your ongoing in-house training and development activities.

Our aircraft courses comply with the requirements of AT 104 class IV specification, our courses and trainers meet the requirements of the CAA and Tier 1 aircraft manufactures training recommendations for composite training, our instructors are all professionally qualified engineers compliant at the highest grade by the Boeing advisory circular FAA AC65-33.

We endeavour to promote and encourage best practice, knowledge transfer and development in advanced materials and technologies through the provision of quality training, consultancy and products to improve our customer's competitive edge. NCE expertise extends to the design and manufacture of original equipment and the supply of SRM recommended equipment.



**Composite Courses 2016**

**Contents**

Aircraft Composite Course Schedule 2016-17 ..... 3

Safety Wear ..... 4

Course Descriptions..... 5

    Course Title: Aircraft Composite Repair 1 ..... 5

    Course Title: Advanced Aircraft Composite Repair 2..... 7

    Course Title: 787 Series Composite Aircraft Repair ..... 9

    Course Title: Composites for Engineers 1 Design, Test and Manufacture ..... 11

    Course Title: Composites for Engineers 2 Structural Performance ..... 13

Location and contact details ..... 15

### Aircraft Composite Course Schedule 2016-17

Course Code	Title	Dates
AC001	Aircraft Composite Repair 1	21 <sup>st</sup> November – 2 <sup>nd</sup> December 16 30 <sup>th</sup> January – 10 <sup>th</sup> February 17 27 <sup>th</sup> March – 7 <sup>th</sup> April 17 19 <sup>th</sup> – 30 <sup>th</sup> June 17 14 <sup>th</sup> – 25 <sup>th</sup> August 17 2 <sup>nd</sup> – 13 October 17 27 <sup>th</sup> November – 8 <sup>th</sup> December 17
AC003	Advanced Aircraft Composite Repair 2	15 <sup>th</sup> – 26 <sup>th</sup> May 17 18 <sup>th</sup> – 29 <sup>th</sup> September 17
AC007	787 Series Composite Aircraft Repair	3 <sup>rd</sup> – 14 <sup>th</sup> July 17
AC010	Composites for Engineers 1 Design, Test and Manufacture	20 <sup>th</sup> – 24 <sup>th</sup> February 17 13 <sup>th</sup> – 17 <sup>th</sup> November 17
AC011	Composites for Engineers 2 Structural Performance	24 <sup>th</sup> – 28 <sup>th</sup> April 17 11 <sup>th</sup> – 15 <sup>th</sup> December 17

### Bespoke Courses

Bespoke courses can be specifically tailored to your own requirements please call to discuss your needs; training can be arranged on a one to one basis or for company based groups. Bespoke courses are individually priced following discussion of requirements and include trainer related expenses.

### **Safety Wear**

- ⤴ All course fees are per delegate per course and include provision of materials, tools, protective clothing (excluding footwear) course hand outs and refreshments.
- ⤴ Delegates must wear full length trousers and closed leather shoes or safety footwear as appropriate to the course.
- ⤴ All courses incorporating a practical element require safety footwear.
- ⤴ Where a delegate does not have appropriate footwear or clothing they will not be able to fully engage in the course



## Course Descriptions

**Course Title: Aircraft Composite Repair 1**

**Course Code: AC001**

**Duration: 10 Days**

**Fees: £2035.00 + VAT at standard rate**

**Course structure: 20% theory, 80% practical**

**Who is it for:** This course is intended for those members of staff who will be carrying out repairs on composite aircraft structures. It will give them sufficient knowledge to be able to complete the repair to approved aerospace standards. No previous knowledge required.

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### Course content

The approach to composite repair and the recommendations given by manufacturers are constantly changing as more experience has been gained by the industry. The course content has been devised to respond to these changes and now reflects the current requirements for composite repair within the industry.

The repair techniques specified in the aircraft manufacturers' structural repair manuals will form the basis of the course. These techniques can be related directly to a number of aircraft types such as the Boeing 747, 757, 767, 787, Airbus A319/320/321. The theory elements support and are appropriate to enable the delegates to understand the important principles and safety requirements of composite materials and produce quality repairs.

The techniques used are those currently recommended in manufacturers structural repair manuals and emphasis is placed on the requirements to adhere to these procedures. The importance of quality assurance is stressed throughout and particular attention is paid to the adoption of quality control procedures and safety within the repair process. The course satisfies ATA 104 IV objectives.

### The course aims to:

- familiarise the delegate with the materials and techniques used to manufacture and repair composite components.
- provide the delegate with the knowledge to satisfy the appropriate health and safety requirements.
- equip the delegate with the knowledge and practical skills required to carry out sound and effective repairs on composite aircraft components, according to the methods recommended and accepted by the aircraft manufacturers.
- provide the knowledge required to interpret standard structural repair manuals and to relate them to a given repair situation.
- familiarise the delegate with a wide range of structural repair methods so they can find all the relevant information relating to a particular repair.

## **The course covers:**

### Week 1

Delegates will be introduced to composites, the fibres and resins used their structure, properties, behaviours and the reasons for their use in aircraft components. The importance of correct resin/fibre/harder ratios and the requirement for good health and safety practices are emphasised. Delegates prepare a reinforced composite 'plug' by hand lay-up to familiarise them with the materials and correct procedures in the handling of composites.

The techniques of vacuum bagging and various heat curing methods used for advanced composite repair on aircraft structures are introduced and the delegates produce vacuum bags and heat cured monolithic structures.

The delegates produce laminates with different orientations to use in an exercise to explore the impact of fibre orientation. The impact of surface preparation the importance of following the correct procedures is demonstrated during the manufacture of the laminates. Correct and incorrect procedures for surface preparation will be demonstrated continual use of good practice is emphasised throughout the course.

The advantages, reasons for use and special characteristics of honeycomb cores and their use within aircraft structures is demonstrated. The techniques demonstrated are practiced in the manufacture of a Nomex cored composite panel.

The delegates are introduced to the different types of damage and repair that can occur in operation. The manufactured panels are damaged and repaired in accordance with the appropriate structural repair methods by the delegates. This includes methods of cutting cores and laminates, with details of the tools to use, recommended cutting speeds and handling. The group prepare curved panels which replicate an aircraft structure such as an engine cowling which will later be repaired.

### Week 2

Manufacturers SRM's are introduced, the structural repair manuals of several manufacturers will be compared with a view to discovering the different approaches to repair favoured by each manufacturer. This will be related to the practical experience gained during the course in terms of ease of use, quality of repair and common sense considerations.

Methods of damage assessment and guidance in choosing the most appropriate method of repair are explored, including the choice between wet lay-up and pre-preg repair. Full puncture damage repair to the curved panel will be carried out using pre-preg materials along with recommended methods of moisture removal and finishing.

Allowable damage, repair decision making and test procedures will be introduced, Interpretation of the data relating to choice of materials and repair method will be discussed in depth. Both destructive and simple non-destructive test methods are demonstrated.

An on-going exercise will be carried out by each delegate throughout the second week. This will be based on a real repair situation and involve damage assessment, determination of the component construction, choice of repair method and materials. All relevant information sources will be available including manufacturers' SRMs, data sheets and part drawings.

The delegates knowledge of the subject will be assessed through a multiple choice assessment paper.

**Course Title: Advanced Aircraft Composite Repair 2**

**Course Code: AC003**

**Duration: 10 Days**

**Fees: £2035.00 + VAT at standard rate**

**Course structure: 20% theory, 80% practical**

**Who is it for:** This course is intended for those members of staff who will be carrying out repairs on composite aircraft structures. The course is a follow on course from the Aircraft Composite Repair 1 course AC001, delegates will have satisfactorily completed AC001 or equivalent prior to attending this advanced course.

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### **Course content**

The approach to composite repair and the recommendations given by manufacturers are constantly changing as more experience has been gained by the industry. This course has been devised to respond to these changes and now reflects the current and upcoming requirements for composite repair within the industry.

The Advanced Composite Repair course has been developed in response to our aircraft customers demand for a follow up course to address in detail more complex repair requirements as stipulated in the SRMs. Alongside developing skills in repair techniques the course introduces some of the newest techniques that have been introduced for the 787 aircraft.

All the techniques used in the training have been well proven and are based on those given by aircraft manufacturers; these are supported by appropriate current and relevant theory as appropriate, this theoretical content allows the delegate to produce quality repairs using the correct materials and procedures and to work safely. The importance of quality assurance is stressed throughout and the particular attention is paid to the adoption of quality control procedures throughout the repair process. The course satisfies ATA 104 IV objectives.

### **The course aims:**

- to provide an in-depth knowledge of repair rationales across a breadth of repair situations.
- to equip the delegate with the knowledge to undertake complex repairs in line with SRM stipulations.
- to equip the delegate with the knowledge and practical skills required to carry out effective repairs to bolted, riveted and bonded assemblies.
- to provide the delegates with the appropriate experience of manufacturing tooling required to complete complex repairs requiring designated tooling.
- to familiarise the delegate with a wide range of structural repair methods so that they can implement the latest methods of repair.
- to satisfy all the relevant quality assurance and safety requirements.

## **The course covers:**

### Week 1

Review material processes and repair methodology for Boeing and Airbus SRMs. Extend programming of hot bonders, ovens and infra-red lamps followed by methods of calibration for heat mats and cure equipment. Implement and complete a repair to a structural leading edge on an aircraft part.

Delegates select a repair approach and document the repair using the SRM for both a circular and split (non-circular) inboard damage to cellular system with gradual curved aerodynamic faces, delegates implement and carry out the documented repairs.

Complex edge damage repair techniques are introduced with the requirements for designated tooling and tooling manufacture methods and the behaviour of different tooling. Delegates identify, assess and carry out a repair to a structural part with significant corner edge damage in accordance with SRM specification using tooling they have produced.

Thickness and depth measurement techniques and uses are introduced along with the use of NDT methods. Delegates perform NDT evaluations on the completed repairs.

### Week 2

The value and place of cosmetic, quick and flush repairs for aircraft structures is introduced and the delegates complete both a cosmetic and a quick repair in line with SRM guidelines.

Complex curved part with mechanical fixing points are evaluated, methods of mechanical joining at repair sites are demonstrated with both permanent and temporary fastenings. Delegates plan, document and carry out a repair to a complex geometrical part with mechanical fastenings at the repair site with surface and penetrating damage.

The impact of implementing a restricted access penetrating damage repair is discussed and different methodologies for completing successful repairs where access is limited are evaluated. Delegates perform a through panel repair where access is limited to one side in accordance with the discussed methodologies.

New techniques used for 787 aircraft are introduced delegates have the opportunity to carry out a DVD - double vacuum bagged debulk repair following the designated new procedures.

The delegates knowledge of the subject will be assessed through a multiple choice assessment paper.

## **Invitation**

Instead of using NCE stocked aircraft parts we welcome the opportunity to work with employers to utilise specific aircraft parts that are normally seen in their workshops to provide enhanced added value for the delegates. Please note any donated parts would be deemed scrapped following use within a course.



**Course Title: 787 Series Composite Aircraft Repair**

**Course Code: AC007**

**Duration: 10 Days**

**Fees: 10 day course £2800.00 + VAT at standard rate**

**Course structure: 35% theory, 65% practical**

**Who is it for:** This course is intended for those members of staff who will be or are planning to carry out composite repairs or who are responsible for QA inspection on the Boeing 787 aircraft. The course is a follow on course from the Aircraft Composite Repair 1 course AC001; delegates will have satisfactorily completed AC001 or equivalent prior to attending this specialist course.

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### **Course content**

This course focuses on the latest techniques required to perform bonded and bolted repairs for the Boeing 787 aircraft as specified in the 787 SRM chapter 51. The course explores the types and application of composite materials used on the 787 along with the newest repair techniques specified for the particular application of the material. The course also expands the latest bagging techniques and the underlying principles for the new techniques.

### **The course aims:**

- to provide a knowledge of the materials and applications used in the 787 aircraft.
- to equip the delegate with the knowledge of the 787 SRM to undertake both bonded and bolted complex repairs in line with SRM stipulations for the 787.
- to equip the delegate with the knowledge and practical skills required to carry out effective repairs to bolted, and bonded structures for the 787 aircraft.
- to provide the delegates with the appropriate experience of vacuum bagging requirements as set out in the 787 SRM.
- to familiarise the delegate with a wide range of structural repair methods for skin and stringer repairs enabling them to implement the latest methods of repair.
- to satisfy all the relevant quality assurance and safety requirements.

### **The course covers:**

#### Week 1

The course starts with an introduction to the types and applications of composite materials on the 787.

The principal steps related to composite repair processes as specified in the SRM and the differences between the 787 procedures and previous aircraft are identified and explored. Delegates will have the opportunity to use the 787 SRM chapter 51 and identify how this is

applied to unique repair processes, tooling, bonded and bolted joints.

Review of ramp damage detection systems and recommendations using NDT methods specific for the 787 with identification of fixtures and specified tooling.

The differences between the requirements of the 787 SRM and previous aircraft will be expanded with the delegates performing repairs to the new procedures including management of dust and fume, location of boundaries and ply locations, cure cycles, new bagging procedures with leak test verification including the double vacuum debulking (DVD) technique applied to bonded skin repairs with and without cores. New tooling requirements will be identified and delegates will have an opportunity to use these tools while performing repairs.

The delegates are encouraged to discuss the issues arising in relation to complex geometries and the use of the new techniques and how they may be applied.

## Week 2

Following on from the skin repairs previously completed the techniques involved in performing quick composite repairs (QCR) using specialist heat packs is introduced. Delegates complete a quick repair using the SRM specified method.

The focus is then on repairs which involve mechanical fastenings, the 787 SRM has a more extensive range of and requirements for bolted repairs due to the extensive use of solid laminate construction within the 787 aircraft. The challenges associated with bonded repairs in terms of ensuring correct load transfer between the original structure and the repair are considered with particular reference to mechanical properties, loads and design requirements.

The principal steps related to bolted composite repair processes as specified in the SRM and the will be identified and explored. Delegates use the SRM to select a suitable bolted repair approach for a skin to stringer repair, delegates implement and carryout the bolted repair/s.

The delegates are introduced to the use and manufacture of tooling and fixtures which may be required for the new bolted repairs.

**Course Title: Composites for Engineers 1 Design, Test and Manufacture**

**Course Code: AC009**

**Duration: 5 Days**

**Fees: £985.00 + VAT at standard rate**

**Course structure: 60% theory, 40% practical**

**Who is it for:** This course is intended for delegates with a good technical background in engineering, materials or mechanical design who require a comprehensive technical understanding of advanced materials, their use manufacture and test.

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### **Course content**

Composites for Engineers 1 is designed to provide engineers and technicians with a comprehensive technical overview of the materials and processes and the affect the materials and process choices have upon composite material performance.

The course considers in detail good practice in design, orientation effects, use of cellular systems, finish considerations, wet and dry layup techniques , laminate performance analysis, causes of laminate distortion, Non Destructive Testing (NDT) and other testing requirements in both components and tool design. Practical activities support the theory and are used to demonstrate the interaction between design, material and process choice along with the opportunity to practice NDT and analysis techniques. The course satisfies ATA 104 IV objectives

### **The course aims to:**

- compare composite material their uses and application.
- specify suitable material characteristics for a given application.
- enable delegates to be able to describe the difference between traditional and advanced materials in relation to the appropriate design criteria.
- give an appreciation of the use of composite materials and their effects upon component design and manufacture.
- develop an appreciation the impact of mould design to maximise performance expectations of composites.
- develop an understanding of mechanical testing and the use of NDT in the design and manufacture of composite components.

### **The course covers:**

Introduction to laminate theory, orientation effects, fibre and resin properties. Good practice in design and the impact of loading parameters taking into account the principle stresses and maximum shear that the component is subject to are considered along with the load paths and supporting structural needs to produce fit for purpose design. The impact of fibre orientation, curing schedules and hygrothermal effects and the influence of the tooling design and the manufacturing process will be taken into account.

The key weaknesses of component performance will be evaluated with regard to inter lamina shear and how these effects can be overcome by good design practice and the application of design centred criteria.

Consideration of tool design in terms of the impact of thermal expansion, surface finish and release surfaces influences will be explored in terms of component, mould design and component release influences.

Laminate performance analysis, causes of laminate distortion will be demonstrated through the use of physical testing.

Non Destructive Testing (NDT) and other testing requirements in both components and tool design will be reviewed with simple NDT techniques being utilised through-out the practical activities.

Practical activities – manufacture laminates of different orientation to carry out mechanical testing to evaluate tensile, torsional and bending properties of laminates against laminate theory.

Delegates will have the opportunity to experience handling a variety of fabrics in the form of dry fabrics and pre-pregs used for manufacture. Delegates will have the opportunity to use wet lay-up and pre pregs to produce their own parts, considering the theoretical elements discussed.

Delegates have the opportunity to produce a part using resin infusion techniques and compare this to the hand layup techniques previously used.

**Course Title: Composites for Engineers 2 Structural Performance**

**Course Code: AC011**

**Duration: 5 Days**

**Fees: £1020.00 + VAT at standard rate**

**Course structure: 50% theory, 50% practical**

**Who is it for:** This course is intended for delegates with a good technical background in engineering, materials or mechanical design who have completed composites for engineers 1 and wish to further their knowledge of composite materials, manufacture and analysis.

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### **Course content**

Composites for Engineers 2 builds on the principles and practices developed in Composites for Engineers 1. The course focus is upon taking a product from concept, through design and manufacture to prototype and analysis with consideration of ROI. This approach enables the further understanding of the design of materials for structural performance, the design of joints and bonds, mould design, repair methods and surface treatments. Greater emphasis is placed upon material performance analysis and resin flow characteristics and the latest processing techniques of Resin Infusion and Resin Transfer Moulding. The course satisfies ATA 104 IV objectives.

### **The course aims to:**

- develop an understanding of component development from concept design to analysis and manufacture.
- develop design parameters to aid in good design for manufacture
- show the use of design envelopes to support the design process
- enable the delegates to select appropriate prototype build methods and manufacturing methods for cost effective solutions.
- enable delegates to select materials and specify mould design for ROI.
- develop an understanding of the use of computational analysis in the design process.

### **The course covers:**

The course extends the understanding of the design of materials for structural performance, examining the impact and role played by the choice of fabric, weave pattern the impact of cutting, draping and shaping for complex parts while maintaining the orientations specified by the design parameters. Such areas as the effects of spring back within design and manufacture and the methods used to reduce the effect are introduced.

The principles and practical effects of joining composites using mechanical fastenings, inserts and adhesive joints along with the impact of each on the mechanical properties of assemblies is demonstrated using real applications and case studies.

Complex and multi part mould design and the routes to failure due to poor mould design and preparation are evaluated along with issues of part separation. The need for effective repair methodologies within manufacture and service are explored along with the effect of human factors in the design and manufacturing operations.

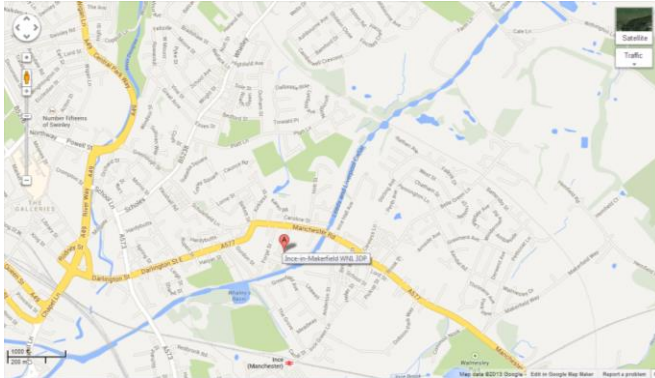
Greater emphasis is placed upon material performance analysis and resin flow characteristics to enable an understanding of the influence of these parameters on the latest processing techniques of Resin Infusion and Resin Transfer Moulding.

The theory and practical aspects of the course focus upon the development of a product from concept to prototype, the product is utilised to develop the design, manufacturing and analysis elements of the course alongside the volume requirements which influence the manufacturing options and the overall ROI.

Practical activities support the theory and are used to demonstrate the interaction the processing techniques and analysis of performance, thermal effects and flow characteristics and underlying theoretical principles and includes the use of computational analysis to support design and processing parameters.

## Location and contact details

We are located within 1 mile of Wigan town centre and 22 miles from central Manchester.



### By Car

We are located close to the main M6 motorway for north and south bound carriageways. From Manchester we are off the M61 at junction 5. Follow signs for Wigan when leaving the motorways.

North Composites Engineering Ltd  
Unit 6 Rosebridge Court  
Rosebridge Way  
Ince  
Wigan

### Sat Nav location

WN1 3DP

### Rail Link

We are easily accessed by rail link with Wigan North Western and Wigan Wallgate stations are only 1.8 miles away and Ince rail station is 0.7 of a mile away all have links to Manchester Piccadilly Station.

### Contact Details

For further details of our other courses and service or to reserve a place please contact us on:

**Phone:** +44(0)1942 665292

**Email:** [info@northcompositesengineering.co.uk](mailto:info@northcompositesengineering.co.uk)

**Or via our web page:** [www.northcompositesengineering.co.uk](http://www.northcompositesengineering.co.uk)