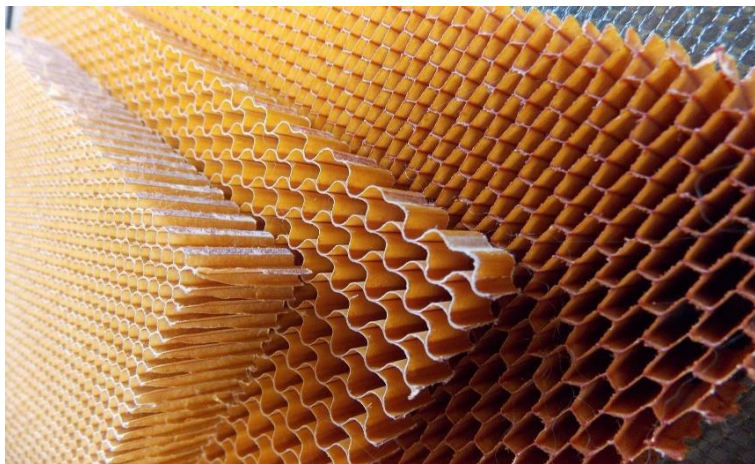


NCE *North Composites Engineering*

World class provider of industrial know-how composite skill training.



Reputation

Our training is focused on your skills and learning it is not dictated by time dependent schedules and activities. Your understanding is our prime driver.

Our staff are established practitioners and composite trainers with 25+ years' experience.

We have an international unrivalled reputation of achievement and excellence in composite training, consultancies, project management and equipment design and manufacture.

100% of our delegates state the course(s), they attended surpassed their expectation.

Composites a Competitive Advantage

If you work in the highly competitive Aerospace, Marine, Wind Turbine or Automotive sectors it is essential that you maintain your competitive edge.

Let the highly qualified engineers at North Composites Engineering share their experiences and knowledge base to develop and apply competitive composite design, repair and processing abilities to your skill set. With both bespoke and scheduled programmes of training, 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.

Industry Ready Composite Training

NCE are a unique provider of industrial approved composite training and provide an integral part of our composite retention and recruitment for many of our customers, which fall into general categories of design, analysis, manufacture and repair.

Our courses are structured to provide a progression path from those new to composites to delivery of advanced methods and techniques.



Aviation Training

NCE is the leading provider of aviation courses through our Aeroskills International brand www.aeroskills.co.uk. We train in civil and military structural repairs in both composite and metallic structures.

NCE is the only global approved trainer for composite structural repairs to the Eurofighter and member of their accredited supply chain network.

5 Day Composite Course Schedule 2024

| Course Code | Title | Dates | Prices* |
|-------------|---|---|----------|
| 001 | Introduction to Composites Wet Layup and Pre-Pregs. | 8 th – 12 th January 2024 15 th – 19 th July 2024 4 th – 8 th November 2024 | £1086.00 |
| 005 | Composite Repair Methods | 12 th – 16 th February 2024 29 th July – 2 nd August 2024 | £1501.00 |
| 006 | Composite Repair Advanced | 11 th – 15 th March 2024 19 th – 23 rd August 2024 | £1501.00 |
| 007 | Manufacturing, Finishing and Assembling Composites | 15 th - 19 th April 2024 | £1501.00 |
| 008 | Comprehensive Application of Resin Infusion | 8 th – 10 th May 2024 28 th – 30 th August 2024 | £844.00 |
| 010 | Master and Working Tool Design and Manufacture | 30 th September – 4 th October 2024 | £1501.00 |
| 011 | Pre-Preg Laminating Stage 1 | 3 rd – 7 th June 2024 25 th – 29 th November 2024 | £1086.00 |
| 012 | Pre-Preg Laminating Stage 2 | 24 th – 28 th June 2024 | £1086.00 |
| AC010 | Composites for Engineers 1 Design, Test and Manufacture | 5 days dates on application | £1512.50 |
| AC011 | Composites for Engineers 2 Structural Performance | 5 days dates on application | £1512.50 |

*All quoted prices are subject to VAT at the standard rate at the time of booking

Group Rates for 8 plus delegate available on application.

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



Safety Footwear
Must be worn

Course Descriptions

Course Title: Introduction to Composites, Wet Layup and Pre-pregs

Course Code: 001

Duration: 5 Days

Course structure: 30% theory, 70% practical

Who is it for: This course is aimed at anyone who requires a sound understanding of the terms, concepts and practices involved in producing composite parts and to gain a practical understanding of wet layup and pre-preg manufacturing techniques along with the health and safety requirements associated with them. The course is suitable for technicians, designers, engineers, managers and sales staff.

Course content

This course introduces the concepts, properties, structures and uses of advance and composite materials now being used across a number of different industries. This is combined with practical sessions which show the different manufacturing approach for wet layup and pre-preg layup at room and elevated temperatures; delegates produce simple forms with and without cellular thickening to aid their understanding of the different techniques. Safe handling and the risks involved in handling the materials involved in producing composites and damage prevention for completed parts along with the specific health and safety requirements needed are the backbone of this course.

The course will cover:

- ▲ Health, safety and handling
- ▲ Composite terminology, materials structure, properties and performance characteristics
- ▲ Examining fibres, fabrics and drape.
- ▲ Resin types, properties storage and disposal and rules of mixture
- ▲ Materials life, cure methods - cure, secondary cure and bonding
- ▲ Tooling requirements and bagging
- ▲ Manufacture methods
- ▲ Gel coat application
- ▲ Laminating
- ▲ Component surface finish and treatments effects
- ▲ Material selection parameters, component and tool
- ▲ Material and tool preparation
- ▲ Wet layup techniques, with and without vacuum bagging
- ▲ Vacuum bagging options
- ▲ Curing methods, temperature and pressure control
- ▲ Carbon and Glass Fibre pre-pregs
- ▲ De-moulding
- ▲ Causes, detection and effects of damage



Course Title: Composite Repair Basics

Course Code: 005

Duration: 5 Days

Course structure: 30% Theory, 70% practical

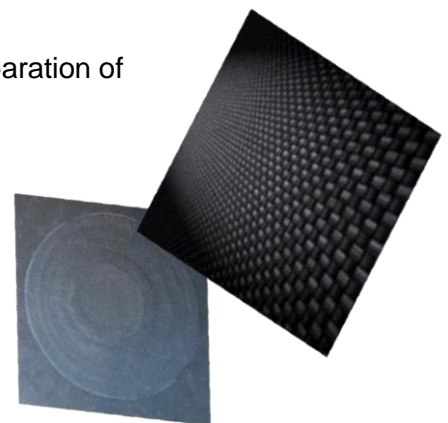
Who is it for: This course is aimed at repair technicians, supervisors, engineers, designers, and managers who need an understanding of the repair process.

Course content

This introduction to composite repairs course focuses on the identification of failure methods and the practical application of implementing repairs using the correct method for the repair. Coverage includes repair preparation consideration of laminate orientation, lay-up and resin selection and application. This is presented along with the use of vacuum bagging, the need for extraction and the tooling requirements for effective repairs. Each delegate will get the opportunity to practice the techniques demonstrated on different repairs. The course will implement an appropriate repair regime linked to the correct usage of repair materials, processes and associated repair.

The course will cover:

- ⤴ Health, safety and handling
- ⤴ Dust control and equipment use
- ⤴ Repair equipment focused upon room cure and elevated heat using hot bonder, Inferred amps and special tooling requirements
- ⤴ Preparing a part ready for damage method using various cure methods
- ⤴ Damage events and assessment methods
- ⤴ Repair processing equipment and materials
- ⤴ Cosmetic and gel coat repairs
- ⤴ Carrying out repairs to a multi layered laminate
- ⤴ Carrying out repairs to laminate with a core structure
- ⤴ Repair double sided repair with/without a core
- ⤴ Introduction to repair options available and implement preparation of a more complex repair of a curved item
- ⤴ Demonstration of NDT methods and simple testing of repairs



Course Title: Composite Repair Advanced

Course Code: 006

Duration: 5 Days

Course structure: 30% Theory, 70% practical

Prior learning (Pre requisite): 005 Composite Repair Basics

Who is it for: This course is aimed at repair technicians, supervisors, engineers, designers, and managers who need a comprehensive understanding of the repair process. The course builds upon the skills developed in the 005 Composite Repair Basics course.

Course content

This largely practical course follows on from the Composite Repair Basics course, expanding the knowledge of failure methods including repairs to planar and curved surface, damage assessment and the practical application of applying advanced, and structural repairs and extends the concepts of repair testing by the introduction to Non Destructive Testing (NDT). The courses mix of theory and practical application focuses on a range of repair techniques using the readily available repair equipment and explores the need for and the use of specialist repair tools.

The course will cover:

- ▲ Review health, safety and handling
- ▲ Repair equipment calibration and set-up for room and elevated repair processing
- ▲ Cosmetic repair of structural and non-structural components
- ▲ Repair of solid laminates with circular and non-circular damage forms
- ▲ Repair core panels with circular and non-circular damage form
- ▲ Material evaluations and options
- ▲ Scarf and stepped repairs
- ▲ Double sided repairs with different material types
- ▲ Failure methods
- ▲ Damage assessment
- ▲ Panning and application of advanced, extensive and structural repairs
- ▲ Use and application of Non Destructive Testing
- ▲ Introduction to resin infusion repair method



Course Title: Manufacturing, Finishing and Assembling Composites

Course Code: 007

Duration: 5 Days

Course structure: 30% theory, 70% practical

Who is it for: This course is aimed at technicians, engineers and supervisors who are involved or likely to become involved in the final manufacture, assembly and finishing of composite parts and those involved in the service and maintenance of such parts.

Course content

This course considers the impact of machining, final finishing and the crucial importance of assembly using mechanical fasteners and adhesive bonded joints. Consideration is given to safe practices, preparation and failure due to poor joint design and fastener selection together with the impact these factors have on inspection, maintenance and replacement.

The course will cover:

- ▲ Health, Safety and Handling
- ▲ Coolants and cooling methods
- ▲ Surface coatings and preparation
- ▲ Cutting and trimming
- ▲ Application and correct use of hand and power tools
- ▲ Component and tool, finishing and material options
- ▲ Tool forms: cutting angles, abrasive grades, material and coatings
- ▲ Material property affects resulting from local cutting heat and removal rates
- ▲ Part holding methods during machining and sub-processing options to avoid breakthrough and/or delamination
- ▲ Feeds, speeds and tooling options to achieve surface finish requirements on metallic and non-metallic tools
- ▲ De-burring and trimming options
- ▲ Defects due to machining
- ▲ Polishing and protection
- ▲ Fastener styles and performance: implementation with combinations of material types
- ▲ Installing and changing fasteners to solid and cellular systems
- ▲ Fasteners failure, defects and repair
- ▲ Bonded structural formation and integration



Course Title: Comprehensive Application of Resin Infusion

Course Code: 008

Duration: 3 Days

Course structure: 20% theory, 80% practical

Who is it for: Designed to support engineers, designers, researcher, lead technicians and technicians involved in development, tool design or component manufacture using resin infusion techniques.

Course content

This industry driven course in resin infusion is designed to cover a comprehensive practical approach to a wide range of component shapes and forms, using the latest resin infusion production techniques. Each delegate will produce composite mouldings, incorporating a variety of features and using a range of techniques and processes to include laminates and sandwich structures using different resin, fibre, core materials and bagging techniques.

The course will cover:

- ▲ Health, Safety and Handling
- ▲ Development of vacuum moulding techniques
- ▲ Material selection and performance, storage and life
- ▲ Resins, hardener and accelerant options
- ▲ Monolithic and cellular co-cured and co-bonded structures
- ▲ Tooling configuration
- ▲ Tool preparation and release systems
- ▲ Gel coat selection and application
- ▲ Feeder and vacuum systems
- ▲ Resin / fibre calculations linked to Darcy's Law
- ▲ Infusion flow: Layout options, effects of temperature, viscosity and permeability on flow rates, flow rate calculations against a variety of shapes.
- ▲ Effects of cellular materials on resin flow
- ▲ Bagging and auxiliary equipment selection
- ▲ Application of flow mesh and alternative methods
- ▲ Application open, closed and intensified moulds
- ▲ Curing cycles and faults caused by incorrect cycles
- ▲ Break out
- ▲ Defects causes and solutions
- ▲ Problems associated with Resin Infusion



Course Title: Master and Working Tool Design and Manufacture

Course Code: 010

Duration: 5 Days

Course structure: 25% theory, 75% practical

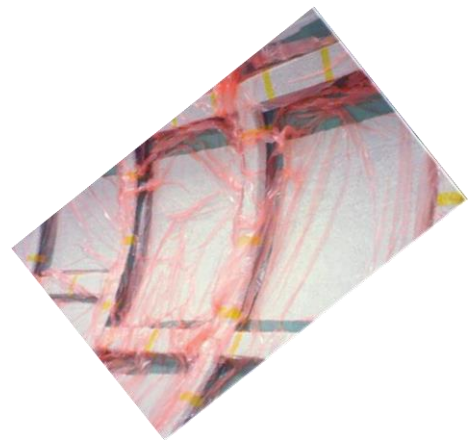
Who is it for: Designed to support engineers, designers, researcher, lead technicians and technicians involved in the development of tooling for composite component manufacture.

Course content

The course develops a wide ranging, understanding of the development and application of current and novel techniques in the production of composite tooling. Delegates will have the opportunity to produce a range of master and working mould tools with complex geometry which incorporate the use of templates and the correct finishing producing a quality self-supporting mould tool. They will have the opportunity to discover the common tool making problems and defects and how to overcome these by design and modification.

The course will cover:

- ⤴ Health, safety and handling
- ⤴ Composite materials and properties
- ⤴ Composite manufacturing – planning
- ⤴ Master tool design, material selection and construction
- ⤴ Use of traditional, novel, CNC and vac forming to produce master tools
- ⤴ Creation of a master tool from an existing component
- ⤴ Making a master tool
- ⤴ Working tooling design and material selection
- ⤴ Making working tools using different materials and cure temperature from a master tool
- ⤴ Use of closed tooling, intensifiers and vacuum bagging techniques
- ⤴ Curing and tool repair methods
- ⤴ Use of tooling to form a two part assembly
- ⤴ Introduction to resin infusion tooling
- ⤴ Inspection
- ⤴ Identifying and rectifying defects
- ⤴ Master and working tool storage and management



Course Title: Pre-Preg Laminating Stage 1

Course Code: 011

Duration: 5 Days

Course structure: 30% theory, 70% practical

Who is it for: This foundation course is aimed at technicians, manufacturers, designers, managers, quality inspectors and engineers who need a comprehensive understanding of current and progressive pre-preg manufacturing processes. The course supports delegates from across a wide range of industries including automotive and wind turbines through to sports equipment and prosthetics.

Course content

This industry driven course is designed to reflect the correct use of modern pre-preg laminating production techniques, incorporating up to date manufacturing and processing methods. Starting from a base of well-established techniques, the course gradually progresses through using co-bonding, co-cure and multi part component assembly. The course explores in detail the use of the latest manufacturing technologies and fabric architectures to develop an understanding and competence in the use of state-of-the-art laminating techniques developing self-sufficiency and confidence in the application of pre-preg techniques.

By combining manufacturing know how including reusable bagging, inflatable consolidators, intensifier forms, bladders, elastic consolidators and form stiffeners, the course is reflective of the advancing changes and industrial practices needed to keep ahead of competition.

Delegates produce a range of composite using a variety of material architectures and manufacturing techniques.

The course will cover:

- ▲ Review health, safety and handling.
- ▲ Composite terminology, materials structure, properties and performance characteristics.
- ▲ Examining fibres, fabrics and drape.
- ▲ Resin types, properties storage, shelf life and disposal.
- ▲ Thermal mapping, curing considerations exotherm and Tg impacts.
- ▲ Techniques and equipment requirements and the drivers for change.
- ▲ Tooling care, preparation and release agents.
- ▲ Templating, nesting and kitting for effective manufacture and material life management.
- ▲ Consideration and practices for joining placement techniques and methods to maintain load distribution.
- ▲ Debulking when and how.
- ▲ Vacuum bagging.
- ▲ Practices for convex parts including the effects of draping.
- ▲ Pre-preg manufacturing of internal and external corners, radii, returns and ply drop offs.
- ▲ Use of a working tool in the manufacture of a two-part cellular component with various curing temperatures.

- ⤴ Laminating into female tool incorporating joggle techniques.
- ⤴ Utilisation of inserts and multi-staged curing on caul and complex components.
- ⤴ Use of an internal intensifiers in the manufacture of thin walled component.
- ⤴ Consideration of the impact of current tooling design on the selection of processing and material component options.
- ⤴ Impact of manufacturing process on surface finish.
- ⤴ Out of autoclave manufacturing.
- ⤴ Inspection and defect identification.

Course Title: Pre-Preg Laminating Stage 2

Course Code: 012

Duration: 5 Days

Course structure: 20% theory, 80% practical

Prior learning (Pre-requisite): 011 Pre-Preg Laminating Stage 1.

Who is it for: This progression course is aimed at those who are processing pre-pregs including core materials and different resin systems. Those people working as technicians, manufacturers, designers, managers, quality inspectors and engineers within the composites pre-preg industries will benefit from this course which will allow the delegate to develop an in-depth understanding of laminating opportunities and issues for effective product and production methods.

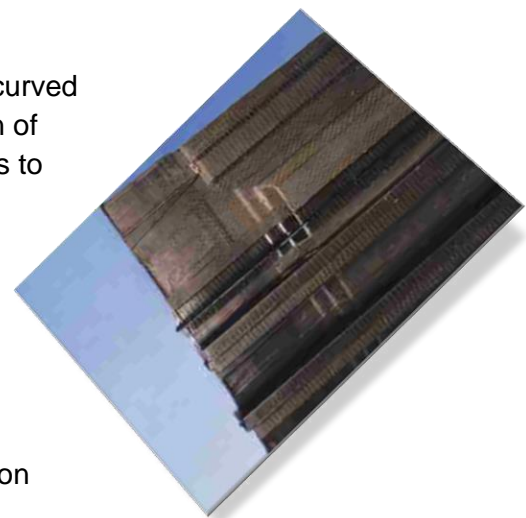
Course content

This continuously improving industry driven course is designed to reflect the correct use of modern pre-preg laminating production techniques, incorporating up to date manufacturing and processing methods. Expanding on the knowledge developed in the Pre-Preg Laminating Stage 1 course this course develops the requirements for bonding and mechanical fastening, issues associated with complex shapes and the latest rapid cure pre-preg systems along with techniques for shaping and using different core materials. This course introduces state of knowledge processes for the creation of composites.

Delegates will have the opportunity to produce a range of composite using a variety of material architectures and manufacturing techniques.

The course will cover:

- ▲ Review of Health and Safety issues, resins and prepregs.
- ▲ Sandwich panel theory, core materials and their use.
- ▲ Review of adhesive bonding, co-cure and co-bond.
- ▲ Review of moulding methods male, female moulds, tooling effects, undercuts.
- ▲ Optimisation of current state of knowledge mould release systems for various mould and resin systems with consideration against manufactures recommendations.
- ▲ Use of foam and honeycomb as spacer layers in flat and curved components with flat and chamfered edges; consideration of corner intensification, formation and joining considerations to avoid bridging affects. Cured by oven, PLC and inferred heat application.
- ▲ Core and pre-preg reinforcements for load attachment
- ▲ Bonding and laminating composites with integral attachment points.
- ▲ Co-cure and Co-bonding approaches to part production and dual vacuum bagging.
- ▲ The optimisation of fabric architecture in complex lamination forms.



- ⤴ Utilisation of intensifiers for intricate forms in prototype production.
- ⤴ Use of open, closed and mould return linked to effect upon bonding and surface finish.
- ⤴ Formalisation of pre-preg systems and their application reason for low to high temperature lamination systems.
- ⤴ The effect of vacuum and heat application during the cure process on defect formation, the effectiveness of vacuum seal technologies.
- ⤴ The use of different resin systems and application of purpose formulated rapid cure pre-impregnated system.
- ⤴ The creation and application of vacuum intensifiers for internal and external application
- ⤴ Aesthetics in design templating and their use.
- ⤴ Post manufacturing surface finishing.

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

Course Code: AC010

Duration: 5 Days

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.

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 considering 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

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.

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.

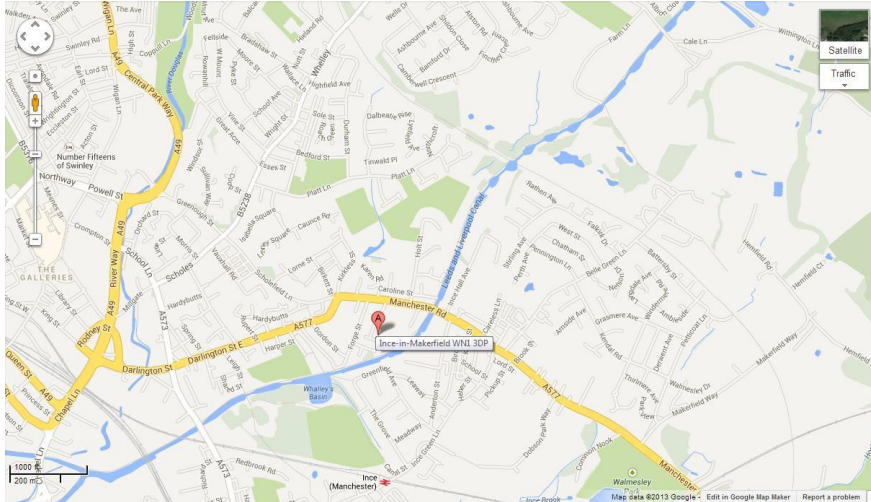
Greater emphasis is placed upon material performance analysis and resin flow characteristics to enable an understanding of the influence of these parameters on the latest processing techniques of Resin Infusion and Resin Transfer Moulding.

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 8 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

Or via our web page: www.northcompositesengineering.co.uk

Hotels and accommodation close to North Composites Engineering.

Premier Inn Wigan Town Centre

Harrogate Street,
Wigan, WN1 1BL
Contacts
T: 0871 527 9502
F: 0871 527 9503

Part of the premier inn group, approx. 2.4 miles to NCE

Premier Inn Wigan

Warrington Road,
Marus Bridge,
Wigan,
WN3 6XB
Contacts
Tel: 0871 527 9164
Fax: 0871 527 9165

Part of the premier inn group, approx. 3.1 miles to NCE.

<http://www.premierinn.com>