



# Aircraft Structural Repair

## Training Course Descriptions

Support and Services

FLIGHT OPERATIONS SOLUTIONS



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## The Boeing Structural Repair Training Advantage

We are the only training provider authorized to utilize the latest Boeing Proprietary Structural Repair Manual Data in our training. We also fully utilize actual Boeing parts, materials, and facilities to maximize the applicability of our training to your job.

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### Course Recommendations

#### **For Aircraft Technicians Preparing to Repair Boeing Composite Structure (737-777):**

- 462 – Boeing Structural Repair Manuals (737-777)
- 466 – Basic Composite Repair for Technicians
- 467 – Advanced Composite Repair for Technicians

#### **For Aircraft Technicians Preparing to Repair Boeing 787 Composite Structure:**

- 662 – Boeing 787 Structural Repair Manual
- 475 – 787 Composite Repair for Technicians

#### **For Aircraft Engineers Preparing to Design and Analyze Repairs to Boeing Composite Structure (737-777):**

- 462 – Boeing Structural Repair Manuals (737-777)
- 468 – Composite Repair for Engineers

#### **For Aircraft Engineers Preparing to Design and Analyze Repairs to Boeing 787 Composite Structure:**

- 662 – Boeing 787 Structural Repair Manual
- 476 – 787 Composite Repair for Engineers with Practical Application

#### **For NDT Personnel Preparing to Inspect Boeing 787 Composite Damage and Repairs:**

- 478 – 787 Damage and Repair Non-Destructive Inspection

#### **For Aircraft Engineers Preparing to Design and Analyze Repairs to Boeing Metallic Structure:**

- 461 – Introduction to Aircraft Drawings
- 462 – Boeing Structural Repair Manuals (737-777)
- 460 – Corrosion Prevention and Control
- 463 – Aircraft Structural Repair for Engineers - Part I
- 464 – Aircraft Structural Repair for Engineers - Part II
- 472 – Aircraft Structural Repair for Engineers - Part III



Please visit [www.myboeingtraining.com](http://www.myboeingtraining.com) for the descriptions, locations, and dates of course offerings.

## 460 – Corrosion Prevention and Control

This course gives maintenance technicians and engineers training in the control and prevention of aircraft corrosion. Topics include the types of corrosion, removal methods, preventive maintenance and the corrosion prevention and control program. This course includes lectures, demonstrations and class exercises.

### Upon completion of the course the student will be able to:

- Identify the forms of corrosion found during normal aircraft maintenance and their contributing causes.
- Identify indications of corrosion on aircraft structures and inspection methods to detect and evaluate the size of the corrosion damage.
- Describe the actions necessary to correctly remove corrosion found on aircraft structure and repair the damage.
- Identify preventive processes and maintenance actions to eliminate or minimize corrosion problems.
- Identify the areas of special concern based on the latest operator reported corrosion experiences and proposed solutions.
- Identify available resources within Boeing to help solve corrosion-related problems.
- Explain the need for a comprehensive Corrosion Prevention and Control Program (CPCP) within each airplane maintenance program.
- Understand economic consequences of poor preventive maintenance or delayed corrective actions for corrosion control.

**Length: 3 days**

**This course is intended for metallic aircraft structural repair technicians and engineers.**

### Outline:

- Corrosion Basics
- Contributing Causes
- Forms of Corrosion
- Indications of Corrosion
- Inspection Methods
- Corrective Action
- Preventive Maintenance
- Corrosion Prone Areas
- Corrosion Prevention and Control Program



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## 461 – Introduction to Aircraft Drawings

This course provides the student with the skills to locate, identify, and interpret the correct drawing for a specific aircraft. The course includes classroom instruction, demonstrations, and student practice sessions on all aspects of the Boeing drawing systems. This includes detail parts, assemblies and installations, structure, wiring, tubing, tooling, and composite drawings. A significant amount of classroom time will be spent working with actual Boeing drawings and parts list, performing exercises to locate information and solving drawing problems. The drawings will be in electronic form downloaded from the Boeing on-line drawing system (REDARS).

### Upon completion of the course the student will be able to:

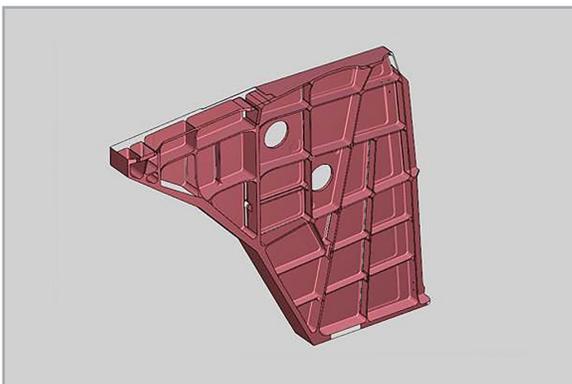
- Describe the Boeing drawing numbering system.
- Use the picture sheet views and section cuts to find dimensions and tolerances.
- Understand the drawing parts list: application list, revisions, parts usage -index, assembly breakdown list and notes.
- Locate, interpret and list the changes made to the drawings as shown on ADCNs and DCNs.
- Define abbreviations, acronyms, and aircraft terms.
- Understand how to access Product Standards and use the Aircraft Illustrated Parts Catalog.
- Become familiar with accessing the Boeing Information Delivery system through [www.MyBoeingFleet.com](http://www.MyBoeingFleet.com).
- Work with and understand how to extract information from lightweight geometry models.

**Length: 5 days**

**This course is intended for Boeing aircraft structural repair technicians and engineers.**

### Outline:

- Terminology
- Boeing Product Define Management
- Part, Drawing and Installation Numbers
- Airplane Identification Numbers
- Picture Sheet Introduction
  - Orthographic Production
  - Airplane Coordinate Planes
  - Picture Sheet Views
  - Line Standards and Drawing Symbols
  - Dimensions and Tolerances
  - Materials and Processes
  - Engineering Revisions
- Engineering Parts Lists
- Lightweight Geometry Drawings
- Engineering information delivery
- Using [www.MyBoeingFleet.com](http://www.MyBoeingFleet.com)



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## 462 – Boeing Structural Repair Manuals (737-777)

This course prepares the student to design repairs within the limits of the Boeing Structural Repair Manual (SRM). The course includes repair case studies that require the student to determine allowable damage limits, part identification, and detail metallic and composites repair options.

**Upon completion of the course, the students will be able to use the SRM to:**

- Identify specific airplane parts and locations.
- Find allowable damage limits in the SRM.
- Identify types of damage that can be repaired using the SRM.
- Identify the differences between repair types.
- Design repairs for specific damage.

**Length: 5 days**

**This course is intended for Boeing aircraft structural repair technicians and engineers.**

**Outline:**

- Structural Repair Manual (SRM) Format
- General Data (SRM Chapter 51)
  - Airplane Reference and Abbreviations
  - Structural Damage Tolerance Classification
  - Structural Repair Definitions
  - Definitions of Terms
- Standard Processes and Procedures
  - Protective Treatment of Materials
  - Sealant Usage
  - Shim Requirements
- Materials
- Fasteners
- General Repairs
- Damage Evaluation
  - Airplane Part Identification and Location
  - Allowable Damage Limits
  - Inspection Methods
  - Repair Design
- Case Studies
  - Nose Cowl Skin Damage
  - Door Skin Damage and Operating Limits
  - Fuselage Interior Structure Damage
  - Fuselage and Door Exterior Structure Damage
  - Nacelle Structure Damage
  - Composite Structure Damage



Please visit [www.myboeingtraining.com](http://www.myboeingtraining.com) for the descriptions, locations, and dates of course offerings.

## 463 – Aircraft Structural Repair for Engineers – Part I

This course prepares the student to assess, design and analyze metallic repairs for damage beyond the limits described in the Structural Repair Manual (SRM). The course includes a combination of lecture, discussion and practical exercises.

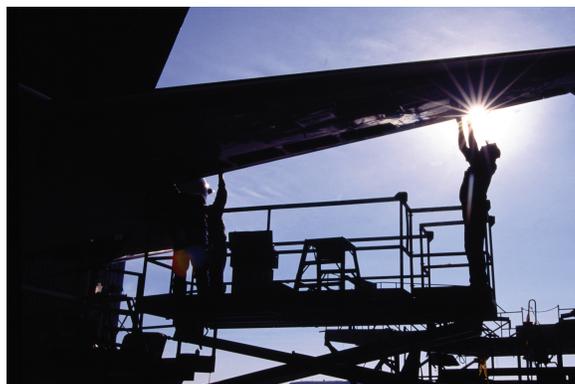
**Upon completion of the course the student will be able to:**

- Describe typical aircraft structures and loads.
- Identify typical metallic structures and the properties of metals.
- Identify fasteners and joints used in repairs.
- Identify the basic design requirements for structural repairs.
- Calculate ultimate load capabilities for repair and production joints.
- Describe basic design guidelines for durable metallic repairs.
- Design a metallic structural repair for damages beyond SRM limits with reasonable assurance of approval from Boeing or other approval agencies.

**Length: 10 days in Seattle, 9 days elsewhere.**

When taught in Seattle a 10th day is added to conduct a field trip to the Boeing factory.

**This course is intended for metallic aircraft structural repair engineers with 4 year engineering degrees who have attended the Boeing Heritage Structural Repair Manuals course (462).**



**Outline:**

- Design Considerations
  - Basic Design Goals
  - Testing
  - FAA Certification Process
- Aerodynamics
  - Lift Concepts
  - Drag
  - Effect on Repairs
- Loads
  - General External Loads
  - Internal Loads Distribution
  - Wing, Fuselage, Empennage
- Materials
  - Aluminum Alloys and Usage
  - Titanium Alloys and Usage
  - Steel Alloys and Usage
  - Material Properties
  - Static Strength
- Fasteners
  - Rivets
  - Hex-drive bolts, Lockbolts
  - Washers
  - Fastener Selection
- Joints
  - Joint Allowables
  - Joint Analysis
  - In-Line Row Joint Repair
  - Staggered Row Joint Repair
  - Eccentrically Loaded Joints
  - Structural Shims
- Durability
  - Corrosion Resistance
  - Fatigue Concepts
  - Stress Concentration
  - Design Techniques
  - Damage Tolerance
- Structural Repair Design
  - Tension Repairs
  - Shear Repairs

Please visit [www.myboeingtraining.com](http://www.myboeingtraining.com) for the descriptions, locations, and dates of course offerings.

## 464 – Aircraft Structural Repair for Engineers – Part II

This course is a continuation of the Aircraft Structural Repair for Engineers - Part I course. It is designed to further enhance the ability of the engineer to understand, design and assess repairs to metallic airframe structure. The focus of this course is on the restoration of bending and compression capabilities of damaged structure. The course contains a combination of lecture and practical exercises.

### Upon completion of the course the student will be able to:

- Assess repairs for compression column buckling and inter-fastener buckling.
- Assess repairs for compression crippling Johnson-Euler column failure modes.
- Design beam repairs that restore the bending and compression capability of damaged structure.

**Length: 5 days**

**This course is intended for metallic aircraft structural repair engineers with 4 year engineering degrees who have attended the Aircraft Structural Repair for Engineers – Part 1 course (463).**

### Outline:

- Structures Review
  - Sign Convention
  - Materials
  - Loads
  - Fatigue
  - Basic Repair Guidelines
- Beam
  - Design Philosophies
  - Centroid
  - Moment of Inertia
  - Bending Stress Distribution
  - Off-Axis Moment
  - Elastic Flexural Formula
  - Composite Beams
- Buckling
  - Euler Column Buckling
  - Euler-Engesser Column Buckling
  - Inter-fastener Buckling
- Crippling
  - Modified Needham Method
  - Lips and Bulbs
  - Johnson-Euler Buckling
  - Repair Philosophies
- Beam Repair



Please visit [www.myboeingtraining.com](http://www.myboeingtraining.com) for the descriptions, locations, and dates of course offerings.

## 466 – Basic Composite Repair for Technicians

This course prepares the student to perform bonded repairs to composite sandwich structure. It includes a combination of lecture and practical hands-on exercises in which students make wet layup and prepreg bonded repairs to carbon facesheets and honeycomb cores.

**Objectives: Upon completion of the course, the students will be able to:**

- Identify the types and applications of composite materials on Boeing aircraft.
- Identify the principal steps in common SRM composite repair processes.
- Find SRM composite repair options and allowable damage limits.
- Identify composite repair facility and material storage requirements.
- Manage cure cycles and thermocouples.
- Perform vacuum bagging procedures with leak test verification.
- Taper sand and locate ply boundaries and orientations.
- Use specialized equipment like Heatcon hotbonders.
- Perform wet lay-up and prepreg bonded repairs to carbon sandwich facesheets and honeycomb core.

**Length: 5 days**

**Locations: Miami and Singapore**

**This course is intended for composite aircraft structural repair technicians.**

**Outline:**

- Composite Structure
  - Materials
  - Applications
  - Repair Processing Materials
  - Repair Tooling, Facilities, Safety, Storage
- Composite Damage Inspection
- SRM Processes
  - Composite Allowable and Repairable Damage Limit Assessment
  - Prepreg Repair Process
  - Wet Layup Repair Process
- Practical Lab Exercises
  - Prepreg Core and Facesheet Repair Lab Exercises
  - Wet Layup Core and Facesheet Repair Lab Exercises



Please visit [www.myboeingtraining.com](http://www.myboeingtraining.com) for the descriptions, locations, and dates of course offerings.

## 467 – Advanced Composite Repair for Technicians

This course enhances the skills learned in the Basic Composite Repair for Technicians course in order to prepare the student to perform complex repairs to edge bands, core ramps, and critical ply drop off areas. It includes detailed classroom discussion of design requirements, composite drawings and material specifications. This course also includes practical hands-on exercises in which students make high temperature repairs to edge bands, core ramps, and critical ply drop off areas.

**Objectives: Upon completion of the course, the students will be able to:**

- Identify the principal steps in SRM composite edgeband, core ramp and ply drop off area repair processes.
- Identify SRM composite repair options for damage to edgebands, core ramps and ply dropoff areas.
- Manage high temperature cure cycles.
- Perform 350 degree F cure repairs to carbon sandwich edgebands, core ramps and ply dropoff areas.
- Read detail composite drawings and material specifications.

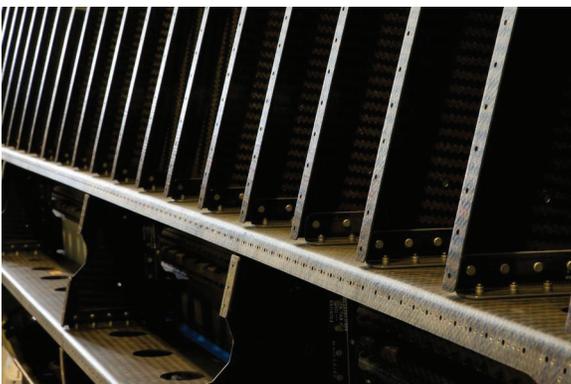
**This course is intended for composite aircraft structural repair technicians who have attended the Basic Composite Repair for Technicians course (466).**

**Duration: 5 days**

**Locations: Miami and Singapore**

**Outline:**

- Composite Design Requirements
- Composite Part Drawings
- Composite Repair Thermal Management
- Practical Edgeband Repair Lab Exercises
- Practical Core Ramp Repair Lab Exercises
- Practical High Temperature Repair Lab Exercises



Please visit [www.myboeingtraining.com](http://www.myboeingtraining.com) for the descriptions, locations, and dates of course offerings.

## 468 – Composite Repair for Engineers

This course prepares the student to submit composite repairs to Boeing for damage that is beyond the limits of the Structural Repair Manual. It includes detailed information on composite material properties, failure modes, stress analysis, design requirements and SRM repair modification analysis. This course also covers the preferred Boeing reporting criteria.

**Objectives: Upon completion of the course, the students will be able to:**

- Analyze the effects of modifying SRM bonded repairs.
- Verify repairs through stiffness analysis and use of composite design principles.
- Describe details of stress analysis, such as micro-mechanics and laminated plate theory.
- Identify the best composite repair option from the SRM.

**This course is intended for composite aircraft structural repair engineers with 4 year engineering degrees.**

**Duration: 5 days**

**Locations: Seattle and Remote**

**Outline:**

- Composite Structure
  - Materials
  - Applications
  - Repair Processing Materials
  - Repair Tooling, Facilities, Safety, Storage
  - Damage Inspection
- SRM Processes
  - Composite Allowable and Repairable Damage Limit Assessment
  - Prepreg Composite Sandwich Repair Process
  - Wet Layup Composite Sandwich Repair Process
- Composite Analysis
  - Repair Strength and Stiffness Analysis – Classical Laminated Plate Theory
  - Part Internal Loads
  - Part Design Considerations
  - Part Drawings
  - SRM Composite Repair Modification Strength and Stiffness Analysis



$$\begin{bmatrix} N_x \\ N_y \\ N_{xy} \end{bmatrix} = \begin{bmatrix} A_{11} & A_{12} & A_{16} \\ A_{12} & A_{22} & A_{26} \\ A_{16} & A_{26} & A_{66} \end{bmatrix} \begin{bmatrix} \epsilon_x^o \\ \epsilon_y^o \\ \gamma_{xy}^o \end{bmatrix} + \begin{bmatrix} B_{11} & B_{12} & B_{16} \\ B_{12} & B_{22} & B_{26} \\ B_{16} & B_{26} & B_{66} \end{bmatrix} \begin{bmatrix} \kappa_x \\ \kappa_y \\ \kappa_{xy} \end{bmatrix}$$

$$\begin{bmatrix} M_x \\ M_y \\ M_{xy} \end{bmatrix} = \begin{bmatrix} B_{11} & B_{12} & B_{16} \\ B_{12} & B_{22} & B_{26} \\ B_{16} & B_{26} & B_{66} \end{bmatrix} \begin{bmatrix} \epsilon_x^o \\ \epsilon_y^o \\ \gamma_{xy}^o \end{bmatrix} + \begin{bmatrix} D_{11} & D_{12} & D_{16} \\ D_{12} & D_{22} & D_{26} \\ D_{16} & D_{26} & D_{66} \end{bmatrix} \begin{bmatrix} \kappa_x \\ \kappa_y \\ \kappa_{xy} \end{bmatrix}$$

ASSEMBLED ABD MATRIX

$$A_{ij} = \sum_{k=1}^n \bar{Q}_{ij}^k \int_{z_{k-1}}^{z_k} dz \quad B_{ij} = \sum_{k=1}^n \bar{Q}_{ij}^k \int_{z_{k-1}}^{z_k} z dz \quad D_{ij} = \sum_{k=1}^n \bar{Q}_{ij}^k \int_{z_{k-1}}^{z_k} z^2 dz$$

Please visit [www.myboeingtraining.com](http://www.myboeingtraining.com) for the descriptions, locations, and dates of course offerings.

## 471 – Composite Repair Design with Practical Application

This course prepares the student to submit composite repairs to Boeing for damage that is beyond the limits of the Structural Repair Manual. It also prepares the student to perform common repairs to composite sandwich structure. This course includes detailed information on composite material properties, failure modes, stress analysis, design requirements and SRM repair comparisons. It also includes practical hands-on exercises in which students make composite repairs to carbon composite sandwich structure.

**Objectives: Upon completion of the course the student will be able to:**

- Identify the types and applications of composite materials on Boeing aircraft.
- Identify the principal steps in common SRM composite repair processes.
- Identify common SRM composite repair options.
- Identify composite repair facility and material storage requirements.
- Manage cure cycles and thermocouples.
- Perform vacuum bagging procedures with leak test verification.
- Taper sand and locate ply boundaries and orientations.
- Perform wet lay-up and prepreg bonded repairs to carbon sandwich facesheets and cores.
- Use specialized equipment like Heatcon hotbonders.
- Reduce the time necessary for the Boeing composite repair submittal and approval process.
- Verify repairs through stiffness calculations and use of sound composite design principles.
- Describe details of stress analysis, such as micro-mechanics and laminated plate theory.
- Identify the appropriate composite repair option from the SRM.

**This course is intended for composite aircraft structural repair engineers with 4 year engineering degrees.**

**Duration: 10 days**

**Location: Singapore and Miami**

**Outline:**

- Composite Structure
  - Materials
  - Applications
  - Repair Processing Materials
  - Repair Tooling, Facilities, Safety, Storage
  - Damage Inspection
- SRM Repair Process
  - Composite Allowable and Repairable Damage Limit Assessment
  - Prepreg Repair Process
  - Wet Layup Repair Process
  - Prepreg Composite Sandwich Repair Process
  - Wet Layup Composite Sandwich Repair Process
- Practical Prepreg Core and Facesheet Repair Lab Exercises
- Practical Wet Layup Core and Facesheet Repair Lab Exercises
- Composite Analysis
  - SRM Composite Repair Modification Strength and Stiffness Analysis
  - Repair Strength and Stiffness Analysis – Classical Laminated Plate Theory
  - Part Internal Loads
  - Part Design Considerations
  - Part Drawings



Please visit [www.myboeingtraining.com](http://www.myboeingtraining.com) for the descriptions, locations, and dates of course offerings.

## 472 – Aircraft Structural Repair for Engineers – Part III

This course is a continuation of the Aircraft Structural Repair for Engineers, Parts I and II. It focuses on the concept of fatigue and its application to the design and approval of repairs. Students will learn how to use comparative stress analysis to design repairs beyond the limits of the Structural Repair Manual that will satisfy durability and damage tolerance requirements.

### Upon completion of the course the student will:

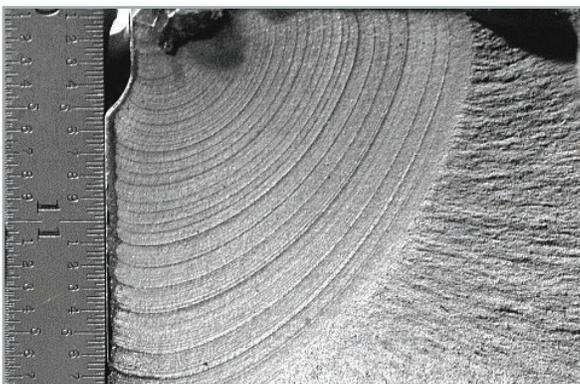
- Develop an understanding of proper fatigue design of repairs through: review of basic fatigue concepts; investigation of joint design; the use of joint modeling to quantify the joint load distribution effects on fatigue life; and application of matrix analysis, stress severity factors, and effective stress.
- Develop an understanding of the design of repairs for damage tolerance by studying: structural design principles; the elements of damage tolerance analysis including crack growth and residual strength analysis; and guidelines to damage tolerant repairs.
- Be able to calculate the load transfer in joints to determine fatigue-critical fastener holes.
- Be able to design repairs beyond the limits of the Structural Repair Manual (SRM) that satisfy durability requirements through the use of comparative stress analysis of the repairs
- Develop an understanding of the inspection techniques used on aircraft and be able to determine inspection requirements

**Length: 5 Days**

**This course is intended for metallic aircraft structural repair engineers with 4 year engineering degrees who have attended the Aircraft Structural Repair for Engineers – Part 2 course (464).**

### Outline:

- Fatigue Concepts
  - Stress Concentration
  - Testing
  - S-N Curves
  - Mean Stress Levels
  - Loading Environment
  - Cumulative Damage
  - Design for Durability
  - Repairs
- Joint Modeling
  - Springs
  - Fasteners
  - Deflection Equations
  - Matrix Algebra
- Stress Severity Factors
  - Peak Stress Calculations
- Effective Stress
  - Fatigue Life Estimation
- Damage Tolerance Concepts
  - Safe Life Design
  - Fail Safe Design
  - Damage Tolerance Design
  - Structural Classification
  - Residual Strength
  - Crack Growth
  - Inspection Techniques
  - Damage Tolerance Rating
- Repair Design Guidelines
- Aging Airplane Repair Assessment Program



Please visit [www.myboeingtraining.com](http://www.myboeingtraining.com) for the descriptions, locations, and dates of course offerings.

## 474 – 787 Composite Repair for Quality Assurance Inspectors

This course prepares the student to perform quality assurance for 787 composite repairs. It includes bonded repairs to 787 sandwich and solid laminate composite structure and bolted repairs to the 787 fuselage skin. The majority of the repair training for this course is conducted in a lab environment and includes hands-on repair exercises using actual 787 parts and the 787 structural repair manual. The lab exercises include the Double Vacuum Bag Debulk (DVD), Quick Composite Repair (QCR), Bolted, and traditional composite repairs processes.

**Objectives: Upon completion of the course the student will be able to:**

- Identify the types and applications of composite materials on the 787.
- Identify the principal steps in the bonded and bolted 787 SRM composite repair processes.
- Identify composite repair facility and material storage requirements.
- Identify proper cure cycles and thermocouple placement.
- Identify vacuum bagging procedures with leak test verification.
- Locate ply boundaries and orientations.
- Identify the steps to perform wet lay-up and prepreg bonded repairs to carbon sandwich facesheets.
- Identify the double vacuum bag debulk (DVD) process.
- Identify the 787 bonded fuselage skin repair process.
- Identify the 787 bolted fuselage skin repair process.
- Perform a Quick Composite Repair.
- Perform an inspection using the Ramp Damage Checker.
- Assess damage using the 787 Structural Repair Manual.

**This course is intended for Boeing 787 quality assurance inspectors who have attended the Boeing 787 Structural Repair Manual course (662).**

**Duration: 6 days**

**Location: Miami and Singapore**

**Outline:**

- 787 Composite Structure
  - Composite Materials
  - Repair Processing Materials
  - Repair Tooling, Facilities, Safety, Storage
  - Damage Inspection
  - Part Drawings
  - Applications
- 787 SRM Processes
  - Composite Allowable and Repairable Damage Limit Assessment
  - Prepreg Composite Sandwich Repair Process
  - Wet Layup Composite Sandwich Repair Process
  - Quick Composite Repair Process
  - 787 Fuselage Skin Bonded Repair Process
  - Double Vacuum Bag Debulk Process
  - 787 Fuselage Skin Bolted Repair Process
- Practical Repair Lab Exercises
  - Prepreg Core and Facesheet Repair
  - Wet Layup Core and Facesheet Repair
  - Edgeband Repair
  - Thermal Survey
  - Quick Composite Repair
  - Fuselage Skin Repair
  - Double Vacuum Bag Debulk Procedure
  - Fuselage Skin Bolted Repair
  - Fuselage Stringer Bolted Repair with Titanium Formed Angle
  - Titanium Angle Forming



Please visit [www.myboeingtraining.com](http://www.myboeingtraining.com) for the descriptions, locations, and dates of course offerings.

## 475 – 787 Composite Repair for Technicians

This course prepares the student to perform bonded and bolted repairs to the 787 composite structures. It includes bonded repairs to 787 sandwich and solid laminate composite structure and bolted repairs to the 787 fuselage skin and stringers. The majority of the repair training for this course is conducted in a lab environment and includes hands-on repair exercises using actual 787 parts and the 787 structural repair manual.

**Objectives: Upon completion of the course the student will be able to:**

- Identify the types and applications of composite materials on the 787.
- Identify the principal steps in the bonded and bolted 787 SRM composite repair processes.
- Identify composite repair facility and material storage requirements.
- Manage cure cycles and thermocouples.
- Perform vacuum bagging procedures with leak test verification.
- Taper sand and locate ply boundaries and orientations.
- Perform wet lay-up and high temperature prepreg bonded repairs to carbon sandwich facesheets, cores, and edge bands.
- Use specialized equipment like Heatcon hotbonders.
- Perform a double vacuum bag debulk (DVD) process.
- Perform a 787 bonded fuselage skin repair.
- Perform a 787 bolted fuselage skin and stringer repair.
- Form and stress relieve titanium angles for fuselage stringer repairs.
- Perform a Quick Composite Repair.

**This course is intended for Boeing 787 composite structural repair technicians who have attended the Boeing 787 Structural Repair Manual course (662).**



**Duration: 15 days**

**Location: Miami and Singapore**

**Outline:**

- 787 Composite Structure
  - Composite Materials
  - Repair Processing Materials
  - Repair Tooling, Facilities, Safety, Storage
  - Damage Inspection
  - Part Drawings
  - Applications
- 787 SRM Processes
  - Composite Allowable and Repairable Damage Limit Assessment
  - Prepreg Composite Sandwich Repair Process
  - Wet Layup Composite Sandwich Repair Process
  - Quick Composite Repair Process
  - 787 Fuselage Skin Bonded Repair Process
  - Double Vacuum Bag Debulk Process
  - 787 Fuselage Skin Bolted Repair Process
- Practical Repair Lab Exercises
  - Prepreg Core and Facesheet Repair
  - Wet Layup Core and Facesheet Repair
  - Edgeband Repair
  - Thermal Survey
  - Quick Composite Repair
  - Fuselage Skin Repair
  - Double Vacuum Bag Debulk Procedure
  - Fuselage Skin Bolted Repair
  - Fuselage Stringer Bolted Repair with Titanium Formed Angle
  - Titanium Angle Forming

Please visit [www.myboeingtraining.com](http://www.myboeingtraining.com) for the descriptions, locations, and dates of course offerings.

## 476 – 787 Composite Repair for Engineers with Practical Application

This course prepares the student to submit bolted and bonded composite repairs to Boeing for damage that is beyond the limits of the 787 Structural Repair Manual. It also prepares the student to perform common bonded repairs to 787 composite sandwich and solid laminate structure. This course includes detailed information on composite material properties, failure modes, stress analysis, design requirements and 787 SRM composite repair modification analysis. It also includes practical hands-on exercises in which students make bonded and bolted repairs to actual 787 composite parts and 787 SRM damage assessment scenarios.

**Objectives: Upon completion of the course the student will be able to:**

- Identify the types and applications of composite materials on the 787.
- Identify 787 SRM composite solid laminate bonded repair processes.
- Identify 787 SRM composite sandwich bonded repair processes.
- Identify 787 SRM composite bolted repair processes.
- Manage cure cycles and thermocouples.
- Taper sand and locate ply boundaries and orientations.
- Perform wet lay-up and prepreg bonded repairs to carbon sandwich facesheets and cores.
- Use specialized equipment like Heatcon hotbonders.
- Analyze the effects of modifying 787 SRM bolted and bonded repairs.
- Describe details of stress analysis, such as micro-mechanics and laminated plate theory.

**This course is intended for Boeing 787 composite structural repair engineers with 4 year engineering degrees who have attended the Boeing 787 Structural Repair Manual course (662).**



**Location: Singapore and Miami**

**Outline:**

- 787 Composite Structure
  - Composite Materials
  - Repair Processing Materials
  - Repair Tooling, Facilities, Safety, Storage
  - Damage Inspection
  - Part Drawings
  - Applications
- 787 SRM Processes
  - Composite Allowable and Repairable Damage Limit Assessment
  - Prepreg Composite Sandwich Repair Process
  - Wet Layup Composite Sandwich Repair Process
  - Quick Composite Repair Process
  - 787 Fuselage Skin Bonded Repair Process
  - Double Vacuum Bag Debulk Process
  - 787 Fuselage Skin Bolted Repair Process
- Practical Repair Lab Exercises
  - Prepreg Core and Facesheet Repair
  - Wet Layup Core and Facesheet Repair
  - Edgeband Repair
  - Thermal Survey
  - Quick Composite Repair
  - Fuselage Skin Repair
  - Double Vacuum Bag Debulk Procedure
  - Fuselage Skin Bolted Repair
- Composite Repair Analysis
  - Repair Strength and Stiffness Analysis – Classical Laminated Plate Theory
  - Bonded Repair Modification Strength and Stiffness Analysis
  - Part Internal Loads
  - Part Design Considerations
  - Part Drawings
  - Bolted Repair Strength Analysis
  - Bolted Repair Fastener Load Distribution Analysis
  - Bolted Repair Modification Analysis

Please visit [www.myboeingtraining.com](http://www.myboeingtraining.com) for the descriptions, locations, and dates of course offerings.

## 476A – 787 Composite Repair for Engineers – Academics Only

This course prepares the student to submit bolted and bonded composite repairs to Boeing for damage that is beyond the limits of the 787 Structural Repair Manual. This course includes detailed information on composite material properties, failure modes, stress analysis, design requirements and 787 SRM composite repair modification analysis.

**Objectives: Upon completion of the course the student will be able to:**

- Identify the types and applications of composite materials on the 787.
- Identify 787 SRM composite solid laminate bonded repair processes.
- Identify 787 SRM composite sandwich bonded repair processes.
- Identify 787 SRM composite bolted repair processes.
- Identify composite repair facility and material storage requirements.
- Analyze the effects of modifying 787 SRM bolted and bonded repairs.
- Describe details of stress analysis, such as micro-mechanics and laminated plate theory.

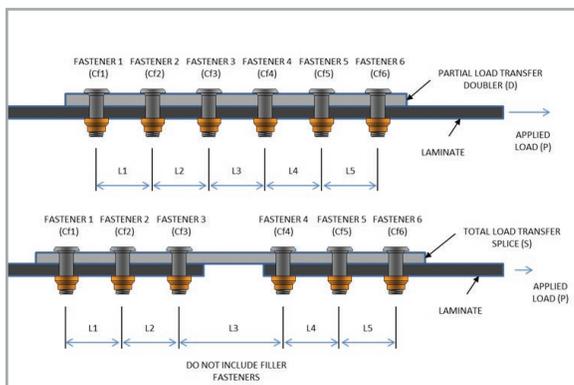
**This course is intended for Boeing 787 composite structural repair engineers with 4 year engineering degrees who have attended the Boeing 787 Structural Repair Manual course (662).**

**Duration: 9 days**

**Location: Seattle or Remote**

**Outline:**

- 787 Composite Structure
  - Composite Materials
  - Repair Processing Materials
  - Repair Tooling, Facilities, Safety, Storage
  - Damage Inspection
  - Part Drawings
  - Applications
- 787 SRM Processes
  - Composite Allowable and Repairable Damage Limit Assessment
  - Prepreg Composite Sandwich Repair Process
  - Wet Layup Composite Sandwich Repair Process
  - Quick Composite Repair Process
  - 787 Fuselage Skin Bonded Repair Process
  - Double Vacuum Bag Debulk Process
  - 787 Fuselage Skin Bolted Repair Process
- Composite Repair Analysis
  - Repair Strength and Stiffness Analysis – Classical Laminated Plate Theory
  - Bonded Repair Modification Strength and Stiffness Analysis
  - Part Internal Loads
  - Part Design Considerations
  - Part Drawings
  - Bolted Repair Strength Analysis
  - Bolted Repair Fastener Load Distribution Analysis
  - Bolted Repair Modification Analysis



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## 477 – Nondestructive Testing of Composite Structures

This course prepares the student to inspect damage and repairs to various composite materials and constructions. The course includes lecture, demonstration, and hands-on practice in the use of multiple NDT instruments.

**Objectives: Upon completion of the course, the student will be able to:**

- Identify the types and applications of various Non-Destructive Test methods
- Identify the proper NDT method for various composite materials and constructions
- Identify and utilize the proper Boeing NDT Manual procedure for each inspection application
- Inspect damage using pulse-echo and thru-transmission ultrasonic inspections
- Inspect damage using high frequency and low frequency bondtesting inspections
- Identify the proper inspection for repairs to composite materials

**This course is intended for all aircraft NDI personnel.**

**Duration: 4 days**

**Location: The course is currently only offered on-site at the airline/MRO facility using their existing equipment.**

**Outline:**

- Introduction to Composite Structures
- Current Composite Usage
- In-Service Inspection of Composite Structures
- Ultrasonic Inspection Methods
- Ultrasonic Bondtester Inspection
- Other Inspection Methods
- Inspection of Repairs



Please visit [www.myboeingtraining.com](http://www.myboeingtraining.com) for the descriptions, locations, and dates of course offerings.

## 478 – 787 Damage and Repair Non-Destructive Inspection

This course prepares the student to inspect damage and repairs to 787 solid laminate composite structure using the Olympus Omni Scan MX ultrasonic inspection tool. The course includes lecture, demonstration, and hands-on practice in the use of the Olympus Omni Scan MX ultrasonic pulse echo and phased array modules to assess damage and repairs to 787 composite solid laminate structure.

**Objectives: Upon completion of the course, the students will be able to:**

- Inspect 787 composite damage using the Olympus Omni Scan MX ultrasonic inspection tool per the Structural Repair Manual and the Non-Destructive Testing Manual.
- Inspect 787 bonded composite repairs using the Olympus Omni Scan MX ultrasonic inspection tool per the Structural Repair Manual and the Non-Destructive Testing Manual.
- Inspect damage using the Ramp Damage Checker.
- Identify the types and applications of composite materials on the 787.
- Identify the 787 bonded composite repair acceptance criteria

**This course is intended for Boeing 787 composite NDI personnel.**

**Duration: 4 days**

**Locations: Seattle**



**Outline:**

- 787 Structural Configuration
- Introduction to 787 Maintenance Documents
- Ramp Damage Checker
- 787 NDT Manual Ultrasonic Inspection Methods
  - A-Scan Damage Inspection Methods
  - A-Scan Damage Inspection Exercises
  - C-Scan Damage Inspection Methods
  - C-Scan Damage Inspection Exercises
  - A-Scan Bonded Repair Inspection Methods
  - A-Scan Bonded Repair Inspection Exercises
  - C-Scan Bonded Repair Inspection Methods
  - C-Scan Bonded Repair Inspection Exercises

Please visit [www.myboeingtraining.com](http://www.myboeingtraining.com) for the descriptions, locations, and dates of course offerings.

## 662 – Boeing 787 Structural Repair Manual

This course prepares the student to use the 787 Structural Repair Manual (SRM) to find 787 composite repair data. It includes new Chapter 51 composite repair processes, structural identification, allowable damage limits, and repairable damage limits. The majority of the course involves line oriented scenarios that allow the student to use the SRM to find allowable damage and repairable damage limits and determine the repair options for composite damage at several locations on the airplane.

**Objectives: Upon completion of the course, the students will be able to:**

- Find allowable damage limits in the 787 SRM.
- Determine if composite damage is repairable by the 787 SRM.
- Identify the new 787 composite repair processes.
- Identify the composite ply materials, sequences and orientations for various 787 structures.

**This course is intended for Boeing 787 structural repair technicians and engineers.**

**Duration: 4 days**

**Location: Seattle or Remote**

**Outline:**

- 787 Structural Configuration
- 787 SRM Format
- 787 Toolbox
- 787 SRM Chapter 51
- Composite Damage Assessment
- 787 SRM Allowable Damage Limits
- Allowable Damage Limit Line Oriented Scenarios
- 787 SRM Repairable Damage Limits
- Repairable Damage Limit Line Oriented Scenarios



Please visit [www.myboeingtraining.com](http://www.myboeingtraining.com) for the descriptions, locations, and dates of course offerings.

## Our Structures Training Team

Each structures training instructor has extensive experience supporting commercial and defense related aircraft programs at the Boeing company.

Instructor expertise includes composites and metallic structural repair manufacturing, design, analysis, damage tolerance, and customer fleet support.

Their expertise is enhanced through continuing education, Boeing project support and international structural repair committee involvement.

### Training Locations

The Seattle Training Center includes a state-of-the-art classroom facility and the resources to provide Boeing factory field trips.

1301 SW 16th Street  
Renton, WA 98057  
United States

The Miami and Singapore Training Centers have the latest in composite repair tooling and fully equipped classrooms.

6601 NW 36th Street  
Miami, FL 33166-6922  
United States

30 Changi North Rise, #01-01  
Singapore, 498780

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Most structures courses can also be taught at your location upon request.

### Classes are also offered at the:

- Gatwick Training Center  
Boeing House, Crawley Business Quarter, Manor Royal  
Crawley, West Sussex RH10 9AD  
United Kingdom
- Brisbane Training Center  
3 Melia Street, Brisbane International Airport  
Queensland, 4007  
Australia
- Shanghai Training Center  
Base 1 Rd (Jidi Yi Lu) K2 Shanghai Pudong Airport  
Shanghai Airlines Training Center, Shanghai 201207  
China



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