



## **Course R-14**

### ***Advanced Composite Automotive Structural Repair-1***

#### **Course Summary**

This automotive-specific repair course is designed for factory, field, body shop technicians, inspectors, and supervisors responsible for performing repairs to carbon fiber (and other) composite structures and components in the automotive industry.

#### **Introduction**

This class is devoted to hands-on repair practices with the appropriate balance of classroom time dedicated to learning about composite materials and processes, relative to both the original structure and the repair.

In this course, the student will first be challenged with learning the different types of materials (fibers & resins), and learning how to process them. Then the student will then be tasked to determine the extent of damage to various fiber reinforced plastic (FRP) sandwich and monolithic parts. After determining damage, the students will remove the damaged portion of the structure, prepare a taper scarf and perform repairs to the damaged areas in a manner that regains the original fiber axial loads in the structure.

This fundamental repair approach will be repeated again with different parts, so as to promote additional hands-on practice with the appropriate tools and equipment used in both factory and field repairs. During these repairs, the student teams will be introduced to the latest portable hot-bond repair equipment specifically designed for use in the automotive repair industry.

This equipment will then be used to perform hot-bond repairs on the structure, with the students learning how to position, secure, and control large area heat blankets (and other heat sources) in accordance with standard industry procedures. Much emphasis is made on proper thermocouple and heat blanket placement and exploration of different vacuum bag schedules and breather scenarios to achieve the best results.

# Topics

## Key Lecture Topics:

- Introduction to advanced composite materials/structures.
- Resin/adhesive systems: thermosets vs. thermoplastics, mix ratios, viscosity, service temperature limits, cold storage requirements/shelf life limits, pot life, etc.
- Material Forms: dry cloth and wet resins vs. prepregs, weave/styles, etc.
- Fundamentals of Fabrication: prepreg cloth handling, ply orientation, etc.
- Cure cycles and rheology of thermoset resin systems during cure.
- Repair design considerations and determination of proper approach.
- Bagging techniques for actual parts with limited vacuum integrity.
- Proper thermocouple placement and heat blanket selection criteria.
- Programming and use of portable process controllers (hot bonders).
- Identifying and responding to heat blanket and thermocouple problems.

## Workshop Exercises:

- Panel layup using prepreg carbon uni-tape materials; symmetric and asymmetric laminates.
- Vacuum bagging using non-autoclave bleeder/breather schedules.
- Use of repair instructions and determination of repair approach.
- Damage identification and assessment.
- Damage removal and taper-scarf preparation.
- Core removal and replacement in sandwich structures.
- Repair scarfing: including on actual or mock aircraft part surfaces.
- Cure programming and monitoring using portable process controllers (hot bonders).

## Course Benefits

Attendees will gain knowledge and skills in performing structural repairs to advanced composite automotive structures that can immediately be put into practice in the workplace.

## Prerequisites

None

## Teaching Method

Active classroom lecture and workshop exercises

## CEU

3.6