Terminal Course Objectives (TCOs) Outcomes

Inputs collected at the workshop are organized in the table below by Terminal Course Objectives (TCOs), and subordinate objectives to the TCOs. It is estimated that a course, which includes all of these objectives as currently worded, would exceed the current time available in a 5-day survey course. As a result, efforts are currently being applied to generalize TCO and reword subordinate objectives to ensure the most important points are included, while maintaining broad coverage. In addition, some objectives linked to a basic understanding of composite materials will be moved to prerequisites that are covered in self-study or through other basic knowledge held by students entering the course. Short, web-based learning modules, which include a basic entrance test, are envisioned for any prerequisite. Some TCOs, as identified in the workshop, will be identified as advanced topics, which require study beyond the 5-day survey course.

Terminal Course Objectives		Subordinate Objectives	
A	Understand the basic art of composite materials technology	**A1**	Describe various processing parameters and basic composite materials properties
		A2	Distinguish among resin, fiber, and core applications and uses.
		A3	Describe storage and handling requirements
		A4	Describe solid laminate and sandwich structure composite structures, including applications and properties
		A5	Describe ply and core orientation requirements and properties, including the sources of warp
B	Understand the basic art of composite materials maintenance and repair, including the design issues associated with airframe structure and materials, processes and key quality controls used for bonded and bolted repair methods	**B1**	Adhere to personal and equipment safety requirements
		B2	Describe basic steps in repair process, including the repair processes from damage assessment through repair completion
		B3	List the necessary tooling and equipment to accomplish a simple laminate structural repair
		B4	List the key composite and expendable materials needed for simple laminate structure repair including appropriate storage requirements
		B5	Describe the differences in critical damage types, inspection methods, and repair procedures between repairing composite and metal structures
C	Understand the roles, responsibilities and relationship of technician, inspector and engineer in the composite repair process.	**C1**	Identify and chart the steps involved in repair design and approval
		C2	List basic NDI methods with their limitations, including pre- and post NDI
D	Identify sources of technical data and regulatory requirements	**D1**	Identify the requirements for material and process specifications and specification approval requirements.

Terminal Course Objectives		Subordinate Objectives	
E	Produce composite laminate, damage it under controlled conditions, and make proper repair procedures	**E1**	Assess and Identify typical composite manufacturing and in-service defects
		E2	Demonstrate and apply common surface preparation and drying techniques and how to inspect them for acceptability
		E3	Demonstrate and apply material lay down [including orientation] and compaction process for a simple laminate structure repair
		E4	Demonstrate how to prepare and cure a simple laminated structural repair and explain the types of defects to be avoided
		E5	Know the different process parameters that affect repair quality (surface preparation, moisture ingression, contamination, cure parameters, storage & handling of materials, proper calibration & standards).
F	Perform damage inspection on a composite part produced by student	**F1**	Select and use manuals and publications to research repair processes, practices, parts, and materials.
		F2	Demonstrate critical steps needed in making a damage disposition, including drafting a QA plan for a typical repair (material selection/orientation, process parameters, and inspection requirements
		F3	Describe two different post-repair inspection procedures
G	Assess effectiveness of the student-repaired composite part	**G1**	Verify that the repair environment was correct, the surfaces were properly pretreated and cleaned, and that the part was properly dried.
		G2	Verify that a repair cure was done correctly, the plies were properly impregnated, the resin was properly mixed, the # and orientation of the plies was correct, and that the repair was properly thermocoupled.
		G3	Demonstrate an awareness of post-repair visual inspection and NDI techniques.
		G4	Verify that the correct materials were used and that they were handled and stored correctly.
H	Distinguish between proper procedures for repairs that are and are not included in source documentation		

Terminal Course Objectives		Subordinate Objectives	
I	Utilize and identify source documents (e.g. revision systems, effectivity, drawing numbering systems, ply charts, repair drawings, M&P specifications)		
J	Utilize and identify regulatory documents (e.g. FARs Advisory Circulars, Airworthiness Directives		
K	Verify correct fastener selection, that fastener holes were properly machined, inspected, and fasteners were properly installed.		
L	Explain the impact of processing variables on NDI, and fiber waviness.		
M	Describe various electrical requirements and effects, including prevention of corrosion, hazards of electromagnetic interference and electrostatic discharge		
N	Perform various damage and repair assessments, including visual inspection, tap test, and ultrasonic inspection.	**N1**	Discuss other advanced assessment techniques, such as bond testing, moisture meters, interferometer (3D characterization)
		N2	Evaluate and name types of damage and their significance, such as delamination and moisture/heat damage
O	Demonstrate bolted repairs	**O1**	Select between bonded and bolted repairs