CLAIMS

What is claimed is:

1. A method (200) for repairing a damaged portion (302, 602, 702) of a composite fuselage or wing on an aircraft, the method (200) comprising:

performing (204) a non-destructive inspection ("NDI") of the damaged portion (302, 602, 702) to determine a size and a location of the damaged portion (302, 602, 702);

determining (206) a repair (600) for the damaged portion (302, 602, 702) based on the size and location of the damaged portion (302, 602, 702); and

repairing (212) the damaged portion (302, 602, 702) with a composite repair kit, comprising:

utilizing a plurality of nested sections (320, 322, 324, 326, 328, 330, 332, 334) of the composite repair kit to repair (600) the damaged portion (302, 602, 702), wherein

each nested section (320, 322, 324, 326, 328, 330, 332, 334) of the plurality of nested sections is a single-ply of composite material, and

the plurality of nested sections include nested sections of varying physical shapes to repair (600) the damaged portion (302, 602, 702) ,

wherein the nested sections (320, 322, 324, 326, 328, 330, 332, 334) are constructed to be stacked with each other to form varying multi-ply composite structures (606, 608, 610, 614, 616, 618, 620).

2. The method (200) of claim 1, wherein determining (206) a repair (600) includes analyzing the damaged portion (302, 602, 702) and

designing a repair solution for the damaged portion (302, 602, 702) utilizing the composite repair kit.

3. The method (200) of claim 1 or 2, wherein repairing (212) the damaged portion (302, 602, 702) with the composite repair kit further includes

applying an adhesive (400) to attach a first nested section to a second nested section at the location of the damaged portion (302, 602, 702) on the aircraft.

4. The method (200) of claim 3,

wherein the plurality of nested sections includes at least one repair skin, a plurality of flat doublers (310, 620a, 620b, 620c, 620d, 710a, 710b, 712a, 712b, 752a, 752b, 754a, 754b), and a plurality of single-ply splice plates (706a, 706b, 706c, 706d, 708a, 708b, 708c, 708d),

wherein repairing (212) the damage portion (302, 602, 702) includes

internally placing the at least one repair skin over the damaged portion (302, 602, 702), wherein the damaged portion (302, 602, 702) includes a damaged portion (302, 602, 702) of a skin of the composite fuselage or wing,

placing the plurality of flat doublers (310, 620a, 620b, 620c, 620d, 710a, 710b, 712a, 712b, 752a, 752b, 754a, 754b) around a periphery (624) of the at least one repair skin in a staggered and stacked manner to match a thickness of the at least one repair skin to a thickness of the skin of the composite fuselage or wing at the damaged portion (302, 602, 702), and

placing the plurality of single-ply splice plates over the plurality of flat doublers (310, 620a, 620b, 620c, 620d, 710a, 710b, 712a, 712b, 752a, 752b, 754a, 754b) and at least one repair skin in a staggered manner, wherein the splice plates (706a, 706b, 706c, 706d, 708a, 708b,

708c, 708d) join the plurality of flat doublers (310, 620a, 620b, 620c, 620d, 710a, 710b, 712a, 712b, 752a, 752b, 754a, 754b) and repair skin together.

5. The method (200) of claim 4,

wherein the at least one repair skin (604) is a plurality (624) of repair skins and

wherein placing the at least one repair skin (604) over the damaged portion (302, 602, 702) includes

applying adhesive (400) between the plurality of repair skins and

stacking up the plurality of repair skins to form a multi-ply composite repair skin (704) that is internally placed over the damaged portion (302, 602, 702), and

further including curing the multi-ply composite repair skin (704) cured at the location of the damaged portion (302, 602, 702) on the aircraft.

6. The method (200) of claim 5, wherein placing the plurality of flat doublers (310, 620a, 620b, 620c, 620d, 710a, 710b, 712a, 712b, 752a, 752b, 754a, 754b) around the periphery(624) of the at least one repair skin (604) includes

applying adhesive (400) between the plurality of flat doublers (310, 620a, 620b, 620c, 620d, 710a, 710b, 712a, 712b, 752a, 752b, 754a, 754b),

stacking the plurality of flat doublers (310, 620a, 620b, 620c, 620d, 710a, 710b, 712a, 712b, 752a, 752b, 754a, 754b) in a staggered manner to form a multi-ply composite doubler (710, 712, 750, 752), wherein stacking the plurality of flat doublers (310, 620a, 620b, 620c, 620d, 710a, 710b, 712a, 712b, 752a, 752b, 754a, 754b) also includes matching the thickness of

the at least one repair skin (604) to the thickness of the skin of the composite fuselage or wing at the damaged portion (302, 602, 702) , and

curing the multi-ply composite doubler (710, 712, 750, 752) on the aircraft at the location of the damaged portion (302, 602, 702) .

7. The method (200) of any one of claims 4-6, wherein placing the plurality of single-ply splice plates (706a, 706b, 706c, 706d, 708a, 708b, 708c, 708d) over the plurality of flat doublers (310, 620a, 620b, 620c, 620d, 710a, 710b, 712a, 712b, 752a, 752b, 754a, 754b) and the at least one repair skin (604) includes

applying adhesive (400) between the plurality of single-ply splice plates (706a, 706b, 706c, 706d, 708a, 708b, 708c, 708d),

stacking the plurality of single-ply splice plates (706a, 706b, 706c, 706d, 708a, 708b, 708c, 708d) to form a multi-ply composite splice plate (618, 620), and

curing the multi-ply composite splice plate (618, 620) on the aircraft at the location of the damaged portion (302, 602, 702) .

8. The method (200) of any one of claims 3-7,

wherein the plurality of nested sections further includes a plurality of single-ply hat-shaped sections (608a, 608b, 608c, 608d),

wherein repairing the damage portion (302, 602, 702) includes

applying adhesive (400) between the plurality of single-ply hat-shaped sections (608a, 608b, 608c, 608d),

stacking the plurality of single-ply hat-shaped sections (608a, 608b, 608c, 608d) to form a multi-ply composite hat-shaped section (320, 322, 324, 326, 328, 330, 332, 334, 610a, 610b), and

curing the multi-ply composite hat-shaped section (320, 322, 324, 326, 328, 330, 332, 334, 610a, 610b) on the aircraft at the location of the damaged portion (302, 602, 702) .

9. The method (200) of claim 8,

wherein each of the single-ply hat-shaped sections (608a, 608b, 608c, 608d) includes a top surface, a first side surface, a second side surface, a first bottom surface, and a second bottom surface,

wherein the first bottom surface includes a first portion that has a first width and a second portion that has a second width, and

wherein one of the single-ply hat-shaped sections (608a, 608b, 608c, 608d) is a wide-bottom single-ply hat-shaped section that has the second width that is greater than the first width,

wherein stacking the plurality of single-ply hat-shaped sections (608a, 608b, 608c, 608d) to form the multi-ply composite hat-shaped section (320, 322, 324, 326, 328, 330, 332, 334, 610a, 610b) includes stacking the plurality of single-ply hat-shaped sections (608a, 608b, 608c, 608d) such that the wide-bottom single-ply hat-shaped section is at a bottom of the multi-ply composite hat-shaped section.

10. A composite repair kit for repairing a damaged portion (302, 602, 702) of a composite fuselage or wing, the repair kit comprising:

a plurality of nested sections, wherein

each nested section of the plurality of nested sections is a single-ply of composite material, and

the plurality of nested sections includes varying physical shapes to repair (600) the damaged portion (302, 602, 702),

wherein the nested sections of the plurality of nested sections are constructed to be stacked with each other to form varying multi-ply composite structures;

an adhesive (400), wherein the adhesive (400) attaches a first nested section of the plurality of nested sections to a second nested section of the plurality of nested sections.

11. The composite repair kit of claim 10, wherein the plurality of nested sections includes a nested section that is a repair skin constructed for internal placement over the damaged portion (302, 602, 702), wherein the damaged portion (302, 602, 702) includes a damaged portion (302, 602, 702) of the skin of the composite fuselage or wing.

12. The composite repair kit of claim 11, wherein the plurality of nested sections further includes a plurality of flat doublers (310, 620a, 620b, 620c, 620d, 710a, 710b, 712a, 712b, 752a, 752b, 754a, 754b) that are constructed to be staggeredly placed around a periphery (624) of the repair skin and stacked to match a thickness of the repair skin to a thickness of the skin of the composite fuselage or wing at the damaged portion (302, 602, 702).

13. The composite repair kit of claim 12, wherein the plurality of nested sections further includes a plurality of single-ply splice plates (706a, 706b, 706c, 706d, 708a, 708b, 708c, 708d) that are constructed to be staggeredly positioned over the plurality of flat doublers (310,

620a, 620b, 620c, 620d, 710a, 710b, 712a, 712b, 752a, 752b, 754a, 754b) and the repair skin, wherein the splice plates join the plurality of flat doublers (310, 620a, 620b, 620c, 620d, 710a, 710b, 712a, 712b, 752a, 752b, 754a, 754b) and repair skin together.

14. The composite repair kit of claim 12 or 13, wherein the plurality of nested sections further includes a plurality of single-ply hat-shaped sections (320, 322, 324, 326, 328, 330, 332, 334, 610a, 610b) that are constructed to bridge an edge of a stringer position over the repair skin.

15. The composite repair kit of any one of claims 12-14, wherein the plurality of nested sections includes a plurality of single-ply hat-shaped sections (320, 322, 324, 326, 328, 330, 332, 334, 610a, 610b) that are constructed to bridge an edge of a stringer positioned adjacent to the damaged portion (302, 602, 702) of the composite fuselage or wing,

wherein each of the single-ply hat-shaped sections (320, 322, 324, 326, 328, 330, 332, 334, 610a, 610b) includes a top surface, a first side surface, a second side surface, a first bottom surface, and a second bottom surface,

wherein the single-ply hat-shaped section (320, 322, 324, 326, 328, 330, 332, 334, 610a, 610b) has a first length,

wherein the top surface has the first length, and

wherein the first bottom surface and the second bottom surface have a second length, and

wherein the first length is greater than the second length.