The foregoing method may further comprise: issuing an alert signal in response to a determination in step (g) that the identified differences indicate structural change to the surrounding composite material in excess of a specified threshold; and/or processing the post-loading data to compensate for effects due to differences in local conditions at or about the times when steps (c) and (e) were performed.

In instances where the laminated structure comprises a parent structure having a repair site and a repair patch bonded to the repair site, the method may further comprise: evaluating a current repair dispatch status of the repair based on the results of steps (e) through (g); and specifying an updated maintenance schedule that takes into account the current repair dispatch status.

In accordance with a further aspect of the foregoing method, steps (a) through (g) are performed for each of a plurality of repairs, and the output from respective sensors comprises respective post-loading data for respective repairs and respective sensor identification data for respective sensors. When the laminated structure is part of an aircraft, that laminated structure will be subjected to loads in step (d) during flight of the aircraft. In the latter case, the method may further comprise communicating the post-loading data from the sensor to a computer system onboard the aircraft, wherein steps (e) through (g) are performed while the aircraft is airborne; and/or communicating the post-loading data from the sensor to a computer system on the ground after the aircraft has landed, wherein steps (e) through (g) are performed on the ground.

Another aspect of the subject matter disclosed herein is a system comprising: a laminated structure made of composite material and having a repair site, wherein said laminated structure is part of an aircraft skin including interwoven wire fabric wires for providing lightning protection, and wherein said laminated structure is subjected to loads during flight of said aircraft; a repair patch made of composite material and including an interwoven wire fabric layer, the repair patch being bonded to the parent structure at the repair site;

and a sensor embedded in the repair patch, wherein said sensor is capable of outputting data representing a current structural characteristic of surrounding composite material. The system may further comprise non-volatile memory and an interface unit embedded in the repair patch and electrically connected to the sensor. The system may further comprise a transceiver within the interface unit. The system may further comprise a power supply supported by the parent structure and connected to provide power to the sensor.

A further aspect is a method of monitoring structural integrity of a repair made to a laminated structure made of composite material, wherein the laminated structure is part of an aircraft skin including interwoven wire fabric wires for providing lightning protection, and wherein the laminated structure is subjected to loads during flight of the aircraft, comprising: (a) placing a sensor between layers of composite material of a repair patch, the repair patch including an interwoven wire fabric layer, and the sensor being capable of outputting data representing a current structural characteristic of surrounding composite material after the composite material has been cured; (b) curing the composite material while the repair patch is in contact with a repair site of a parent structure made of composite material such that the wires of the interwoven wire fabric layer of the repair patch overlap the interwoven fabric wires of the aircraft skin to produce a repaired parent structure having an embedded sensor; (c) after the curing step, acquiring and recording baseline data from the embedded sensor which represents a structural characteristic of the repaired parent structure; (d) after the baseline data has been acquired and recorded, subjecting the repaired parent structure to loads; (e) acquiring and recording post-loading data from the embedded sensor at a time subsequent to or during step (d), the post-loading data representing a structural characteristic of the surrounding composite material; (f) processing the baseline data and post-loading data in a manner that identifies differences between the respective baseline and post-loading data indicative of structural change in the surrounding composite material; and (g) determining whether the identified differences indicate structural change to the surrounding composite material in excess of a specified threshold. Steps (e) through (g) are performed by a computer system.

In the method step (f) may comprise creating a baseline signature based on said baseline sensor data, creating a post-loading signature based on said post-loading sensor data, and comparing said baseline and post-loading signatures. The method may further comprise evaluating a current repair dispatch status based on the results of steps (e) through (g), and specifying an updated maintenance schedule that takes into account the current repair dispatch status. Advantageously, the method may include performing steps (a) through

(g) for each of a plurality of repairs, and the output from respective sensors comprises respective post-loading data for respective repairs and respective sensor identification data for respective sensors. Advantageously, the laminated structure is part of an aircraft and is subjected to loads during flight of the aircraft. Preferably the method further comprises communicating the post-loading data

CLAIMS

1. A system comprising:

a laminated structure made of composite material and having a repair site, wherein said laminated structure is part of an aircraft skin including interwoven wire fabric wires for providing lightning protection, and wherein said laminated structure is subjected to loads during flight of said aircraft;

a repair patch made of composite material and including an interwoven wire fabric layer, said repair patch being bonded to said parent structure at said repair site; and

a sensor embedded in said repair patch, wherein said sensor is capable of outputting data representing a current structural characteristic of surrounding composite material.

2. The system as recited in claim 1, further comprising non-volatile memory embedded in said repair patch and electrically connected to said sensor.

3. The system as recited in claim 1 or 2, further comprising an interface unit embedded in said repair patch and electrically connected to said sensor.

4. The system as recited in claim 3, wherein said interface unit comprises a transceiver.

5. The system as recited in any one of claims 1 to 4, further comprising a power supply supported by said parent structure and connected to provide power to said sensor.

6. A method of monitoring structural integrity of a repair made to a laminated structure made of composite material, wherein the laminated structure is part of an aircraft skin including interwoven wire fabric wires for providing lightning protection, and wherein the laminated structure is subjected to loads during flight of the aircraft, comprising:

(a) placing a sensor between layers of composite material of a repair patch, the repair patch including an interwoven wire fabric layer, and the sensor being capable of outputting data representing a current structural characteristic of surrounding composite material after the composite material has been cured;

(b) curing the composite material while the repair patch is in contact with a repair site of a parent structure made of composite material such that the wires of the interwoven wire fabric layer of the repair patch overlap the interwoven fabric wires of the aircraft skin to produce a repaired parent structure having an embedded sensor;

(c) after the curing step, acquiring and recording baseline data from the embedded sensor which represents a structural characteristic of the repaired parent structure;

(d) after the baseline data has been acquired and recorded, subjecting the repaired parent structure to loads;

(e) acquiring and recording post-loading data from the embedded sensor at a time subsequent to or during step (d), said post-loading data representing a structural characteristic of the repaired parent structure;

(f) processing the baseline data and post-loading data in a manner that identifies differences between the respective baseline and post-loading data indicative of structural change in the repaired parent structure; and

(g) determining whether the identified differences indicate a structural integrity change to the repaired parent structure in excess of a specified threshold,

wherein steps (e) through (g) are performed by a computer system.

7. The method as recited in claim 6, wherein step (f) comprises creating a baseline signature based on said baseline sensor data, creating a post-loading signature based on said post-loading sensor data, and comparing said baseline and post-loading signatures.

8. The method as recited in claim 6 or 7, further comprising:

evaluating a current repair dispatch status based on the results of steps (e) through (g); and

specifying an updated maintenance schedule that takes into account the current repair dispatch status.

9. The method as recited in any one of claims 6 to 8, wherein steps (a) through (g) are performed for each of a plurality of repairs, and the output from respective sensors comprises respective post-loading data for respective

repairs and respective sensor identification data for respective sensors.

10. The method as recited in claim 9, further comprising communicating the post-loading data from the sensor to a computer system onboard the aircraft, wherein steps (e) through (g) are performed while the aircraft is airborne.

11. The method as recited in claim 9 or 10, further comprising issuing an alert signal in response to a determination in step (g) that the identified differences indicate a structural integrity change to the repaired aircraft component in excess of a specified threshold.

12. The method as recited in any one of claims 9 to 11, further comprising processing the sensor data acquired during or after the flight to compensate for effects due to differences in local conditions at the times when the sensor data is acquired in steps (c).