CLAIMS:

1. A composite structure for an aerodynamic component having an aerofoil-like cross-section and a leading edge, the composite structure being in the form of a torsion box arrangement having a core, the torsion box arrangement being made from composite materials, wherein the torsion box has a forward wall, an aft wall, a top wall and a bottom wall, together defining said core, and wherein said front wall is formed as the leading edge of the aerodynamic component.

2. The composite structure according to claim 1, wherein said top wall is formed with an external first surface corresponding to a suction surface of the aerodynamic component, and wherein said bottom wall is formed with an external second surface corresponding to a pressure surface of the aerodynamic component.

3. The composite structure according to claim 2, wherein:

said forward wall is longitudinally spaced from said aft wall by a longitudinal spacing;

said upper wall is transversely spaced from said bottom wall by a transverse spacing;

the forward wall is connected to a respective first edge of each one of said top wall and said bottom wall;

the aft wall is connected to a respective second edge of each one of said top wall and said bottom wall;

said forward wall and said aft wall have a transverse dimension whereby to provide said transverse spacing;

said top wall and said bottom wall have a longitudinal dimension whereby to provide said longitudinal spacing.

4. The composite structure according to any one of claims 1 to 3, including at least one of the following:

- wherein said forward wall comprises an externally facing aerodynamic leading edge surface and an internally facing leading end inner surface;
- said top wall comprises an externally facing first aerodynamic surface and an internally facing first inner surface, and, said bottom wall comprises an

externally facing second aerodynamic surface and an internally facing second inner surface.

5. The composite structure according to any one of claims 1 to 4, including one of the following:

- wherein said aft wall is configured structurally as a trailing end spar and includes an externally facing trailing end surface and an internally facing leading end inner surface;
- wherein said aft wall is configured structurally as a trailing end spar and includes an externally facing trailing end surface and an internally facing leading end inner surface, and, wherein said forward wall, said aft wall, said top wall, and said bottom wall are made from composite materials, and wherein said internally facing leading end inner surface, said internally facing first inner surface, said internally facing second inner surface, and said internally facing leading end inner surface enclose said core.

6. The composite structure according to any one of claims 1 to 5, including one of the following:

- wherein said torsion box arrangement extends laterally between a first torsion box end and a second torsion box end;
- wherein said torsion box arrangement extends laterally between a first torsion box end and a second torsion box, and, wherein said torsion box arrangement has a lateral dimension between a first torsion box end and a second torsion box end.

7. The composite structure according to any one of claims 1 to 6, including at least one of the following:

- wherein said torsion box arrangement has an absence of any structural member, different from said aft wall, transversely spanning said hollow core between said top wall and said bottom wall;
- wherein said core is spar-less;
- wherein said torsion box arrangement has an absence of any structural member, different from said aft wall, accommodated in said core and extending in a spanwise direction;

- wherein the torsion box arrangement, has an absence of a main spar, or of a web of such a main spar, at the respective conventional location of such a main spar in conventional wings;
- wherein the torsion box arrangement, has an absence of a main spar, or of a web of such a main spar, at least between the aerofoil leading edge and 60% of a chord of the aerofoil, or at least between the aerofoil leading edge and 50% of the chord of the aerofoil, or at least between the aerofoil leading edge and 40% of the chord of the aerofoil, or at least between the aerofoil leading edge and 30% of the chord of the aerofoil, or at least between 20% and 30% of the chord of the aerofoil aft of the aerofoil leading edge;
- wherein said core is rib-less;
- wherein said torsion box arrangement has an absence of any rib structural member, accommodated in said core between said top wall and said bottom wall;
- wherein said top wall and said bottom wall each extends aft in a chordwise direction at least past between 20% and 30% of a chord of the aerofoil;
- wherein said top wall and said bottom wall each extends aft in a chordwise direction at least past between 20% and 30% of a chord of the aerofoil, and, wherein said top wall and said bottom wall each extends aft in a chordwise direction more than 40%, or more than 50% or more than 60% or more than 70% of the chord.

8. The composite structure according to any one of claims 1 to 7, wherein said top wall and said bottom wall each extends aft in a chordwise direction at least past a chordwise location of the neutral point NP of the aerofoil.

9. The composite structure according to any one of claims 1 to 8, wherein said forward wall is configured structurally as a leading end spar.

10. The composite structure according to any one of claims 1 to 9, wherein said forward wall, said aft wall, said top wall, and said bottom wall are made exclusively from a first composite material, or, wherein said forward wall, said aft wall, said top wall, and said bottom wall are made from a first composite material comprising multiple layers of composite fibers embedded in a matrix, and further comprising a second composite material comprising a stiffening structure.

11. The composite structure according to any one of claims 1 to 10, wherein said forward wall, said aft wall, said top wall, and said bottom wall have an absence of metallic materials.

12. The composite structure according to any one of claims 1 to 11, including at least one of the following:

- wherein said torsion box arrangement has a closed transverse section;
- wherein said core is a hollow core, or, wherein said core is at least partially fillable with a liquid material.

13. The composite structure according to any one of claims 1 to 12, including one of the following:

- wherein said top wall comprises at least one first stiffening member co-extensive therewith and joined thereto;
- wherein said top wall comprises at least one first stiffening member co-extensive therewith and joined thereto, and, wherein said at least one first stiffening member is made from third composite materials comprising a unidirectional fiber structure embedded in a matrix.

14. The composite structure according to any one of claims 1 to 13, including one of the following:

- wherein said bottom wall comprises at least one second stiffening member co-extensive therewith and joined thereto;
- wherein said bottom wall comprises at least one second stiffening member co-extensive therewith and joined thereto, and, wherein said at least one second stiffening member is made from fourth composite materials comprising a unidirectional fiber structure embedded in a matrix.

15. The composite structure according to any one of claims 4 to 14, including at least one of the following:

- wherein said externally facing aerodynamic leading edge surface, said first externally facing first aerodynamic surface, said externally facing second aerodynamic surface and said externally facing trailing end surface define an outer mold line;

- wherein said internally facing leading end inner surface, said internally facing first inner surface, said internally facing second inner surface, and said internally facing leading end inner surface define an inner mold line.

16. The composite structure according to any one of claims 1 to 15, including one of the following:

- wherein the aerodynamic component is a wing, and wherein said forward wall is configured aerodynamically as a leading edge of the wing;
- wherein the aerodynamic component is any one of: a vertical stabilizer, horizontal stabilizer, vane, canard, rudder, other aerodynamic control surfaces.

17. The composite structure according to any one of claims 1 to 16, further comprising a load-bearing composite structure for use with the aerodynamic component, the aerodynamic component having an external aerodynamic surface including said leading edge and a trailing edge, said suction surface extending between the leading edge and the trailing edge, and said pressure surface extending between the leading edge and the trailing edge, the load bearing composite structure being made from composite materials and configured for being joined to the external aerodynamic surface such as to be in overlying abutting relationship with at least a contact surface portion of the external aerodynamic surface, the contact surface portion including the leading edge, at least a forward portion of the suction surface and at least a forward portion of the pressure surface of the external aerodynamic surface, the load-bearing composite structure being further configured for supporting at least one external load, and optionally including at least one of the following:

- wherein the load-bearing composite structure comprises a wing-coupling portion configured for coupling to the aerodynamic component, and an external load coupling portion configured for coupling to said at least one external load;
- wherein the load-bearing composite structure comprises a wing-coupling portion configured for coupling to the aerodynamic component, and an external load coupling portion configured for coupling to said at least one external load, and, wherein said wing-coupling portion is configured for being joined or otherwise connected to the external aerodynamic surface such as to be in overlying abutting and load bearing relationship with at least said contact surface portion;

- wherein the load-bearing composite structure comprises a wing-coupling portion configured for coupling to the aerodynamic component, and an external load coupling portion configured for coupling to said at least one external load, and, ;
- wherein the load-bearing composite structure comprises a wing-coupling portion configured for coupling to the aerodynamic component, and an external load coupling portion configured for coupling to said at least one external load, and, wherein said wing-coupling portion is configured for being joined or otherwise connected to the external aerodynamic surface such as to be in overlying abutting and load bearing relationship with at least said contact surface portion, and, wherein said wing-coupling portion comprises a functional surface conforming to the contact surface portion of the external aerodynamic surface;
- wherein the load-bearing composite structure comprises a wing-coupling portion configured for coupling to the aerodynamic component, and an external load coupling portion configured for coupling to said at least one external load, and, wherein said external load coupling portion comprises a pair of spaced lateral walls for holding therein at least a part of said at least one external load, and further comprising at least one peg configured for concurrently traversing said pair of spaced lateral walls and said part of said at least one external load;
- wherein said external load is in the form of any one of:
    - a boom connected to an empennage;
    - an external store having a pylon structure;
    - an external store having a pylon structure, wherein said external stores includes any one of: engine, a fuel tank, a camera, weapons.

18. A load-bearing composite structure for use with an aerodynamic component, the aerodynamic component having an external aerodynamic surface including a leading edge and a trailing edge, a suction surface extending between the leading edge and the trailing edge, and a pressure surface extending between the leading edge and the trailing edge, the composite structure being made from composite materials and configured for being joined to the external aerodynamic surface such as to be in overlying abutting relationship with at least a contact surface portion of the external aerodynamic surface, the contact surface portion including the leading edge, at least a forward portion of the suction surface and at least a forward portion of the pressure

surface of the external aerodynamic surface, the load-bearing composite structure being further configured for supporting at least one external load.

19. The load-bearing composite structure according to claim 18, including one of the following:

- comprising a wing-coupling portion configured for coupling to the aerodynamic component, and an external load coupling portion configured for coupling to said at least one external load;
- comprising a wing-coupling portion configured for coupling to the aerodynamic component, and an external load coupling portion configured for coupling to said at least one external load, and wherein said wing-coupling portion is configured for being joined or otherwise connected to the external aerodynamic surface such as to be in overlying abutting and load bearing relationship with at least said contact surface portion;
- comprising a wing-coupling portion configured for coupling to the aerodynamic component, and an external load coupling portion configured for coupling to said at least one external load, and, wherein said wing-coupling portion comprises a functional surface conforming to the contact surface portion of the external aerodynamic surface;
- comprising a wing-coupling portion configured for coupling to the aerodynamic component, and an external load coupling portion configured for coupling to said at least one external load, and wherein said wing-coupling portion is configured for being joined or otherwise connected to the external aerodynamic surface such as to be in overlying abutting and load bearing relationship with at least said contact surface portion, and, wherein said wing-coupling portion comprises a functional surface conforming to the contact surface portion of the external aerodynamic surface;
- comprising a wing-coupling portion configured for coupling to the aerodynamic component, and an external load coupling portion configured for coupling to said at least one external load, and, wherein said external load coupling portion comprises a pair of spaced lateral walls for holding therein at least a part of said at least one external load;
- comprising a wing-coupling portion configured for coupling to the aerodynamic component, and an external load coupling portion configured for coupling to said

at least one external load, and, wherein said external load coupling portion comprises a pair of spaced lateral walls for holding therein at least a part of said at least one external load, and, comprising at least one peg configured for concurrently traversing said pair of spaced lateral walls and said part of said at least one external load.

20. The load-bearing composite structure according to any one of claims 18 to 19, including one of the following:

- wherein said external load is in the form of a boom connected to an empennage;
- wherein said external load is in the form of an external store having a pylon structure;
- wherein said external load is in the form of an external store having a pylon structure, and, wherein said external stores includes any one of: engine, a fuel tank, a camera, weapons;
- wherein the aerodynamic component is a wing.