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**CLAIMS:**

1. A wing system for an air vehicle, the wing system having a stowed configuration, a pre-deployed configuration and a deployed configuration, the wing system comprising:

two wings, each said wing having aerofoil profiles and being pivotably  
5 deployable about a respective pivot axis between the pre-deployed configuration and the deployed configuration, wherein:

in the stowed configuration the two wings are in first general superposed spatial relationship with respect to one another and are capable of being accommodated within an envelope having an envelope cross-sectional profile  
10 and a corresponding envelope cross-sectional area;

in the pre-deployed configuration the two wings are in second general superposed spatial relationship with respect to one another and capable of deploying to the deployed configuration; and

in the deployed configuration the wings are each capable of generating  
15 aerodynamic lift in an airstream;

each said aerofoil profile of each wing being a slotted aerofoil having a primary element, a secondary element and a chord, the secondary element being pivotable with respect to the primary element and spaced therefrom by a gap, each said aerofoil profile having a respective maximum thickness, and a respective  
20 maximum absolute thickness;

wherein in said stowed configuration, the respective second element of each said aerofoil of one said wing is set at a different flap angle as compared with the respective second element of each said aerofoil of the other said wing.

25 2. The wing system according to claim 1, wherein said two wings comprise a first said wing having a first said aerofoil profile, the first aerofoil profile comprising a first leading edge and a first trailing edge, and a said second wing having a second said aerofoil profile, the second aerofoil profile comprising a second leading edge and a second trailing edge.

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3. The wing system according to claim 2, wherein in said pre-deployed configuration, said first leading edge is generally superposed over said second trailing edge.

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4. The wing system according to any one of claims 1 to 3, wherein a respective maximum absolute thickness to chord ratio of each said wing is such as to enable the wings to deploy from the pre-deployed configuration to the deployed configuration without interference therebetween.
5. The wing system according to any one of claims 1 to 4, wherein the respective second element of each said aerofoil profile of each said wing has a hinge axis for enabling pivoting of the respective second element with respect to the respective primary element.
6. The wing system according to claim 5, wherein said hinge axis is facing a pressure surface of the respective secondary element.
7. The wing system according to claim 5 to claim 6, wherein for each said aerofoil profile, the respective hinge axis is spaced from the pressure surface of the respective secondary element by a spacing.
8. The wing system according to claim 7, wherein said spacing is less than 50% of a maximum thickness of the secondary element.
9. The wing system according to any one of claims 1 to 8, wherein in said pre-deployed configuration, the respective second element of each said aerofoil profile of each said wing is set at a respective negative flap angle.
10. The wing system according to any one of claims 1 to 9, wherein in said pre-deployed configuration, the respective second element of each said aerofoil profile of each said wing is set at an identical flap angle.
11. The wing system according to any one of claims 1 to 10, wherein in said pre-deployed configuration, the respective second element of each said aerofoil profile of each said wing is set at a respective first flap angle such that no part of the respective

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second flap intersects an imaginary line that is tangential to the respective aerofoil leading edge and that intersects the respective hinge axis.

12. The wing system according to any one of claims 1 to 11, wherein each said  
5 aerofoil profile is configured with a minimum respective said absolute thickness and a maximum said chord such that in said stowed configuration the respective said aerofoil profiles of said two wings in said first general superposed spatial relationship are capable of being accommodated within said envelope cross-sectional profile while concurrently maximizing occupancy of said envelope cross-sectional area.

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13. The wing system according to any one of claims 1 to 12, wherein the wing system is configured for being mounted to an underside of a fuselage of the air vehicle.

14. The wing system according to claim 13, wherein in said stowed configuration, the  
15 respective second element of each said aerofoil profile of each said wing is set at a respective negative flap angle.

15. The wing system according to claim 13 to claim 14, wherein in said stowed configuration, the respective second element of each said aerofoil profile of an uppermost  
20 said wing is set at a respective negative flap angle in a range  $-25^{\circ}$  to  $-35^{\circ}$ , and wherein the respective second element of each said aerofoil profile of an lowermost said wing is set at a respective negative flap angle in a range  $-55^{\circ}$  to  $-65^{\circ}$ .

16. The wing system according to any one of claims 13 to 15, wherein in said stowed  
25 configuration, the respective second element of each said aerofoil profile of each said wing is set at a respective second flap angle such that the respective said trailing edge and the respective hinge axis of the respective second element are on opposite sides of the respective chord line of the aerofoil profile.

30 17. The wing system according to any one of claims 1 to 12, wherein the wing system is configured for being mounted to an upper side of a fuselage of the air vehicle.

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18. The wing system according to claim 17, wherein in said stowed configuration, the respective second element of each said aerofoil profile of each said wing is set at a respective positive flap angle.

5 19. The wing system according to claim 13 to claim 14, wherein in said stowed configuration, the respective second element of each said aerofoil profile of an uppermost said wing is set at a respective positive flap angle in a range  $+15^{\circ}$  to  $+25^{\circ}$ , and wherein the respective second element of each said aerofoil profile of a lowermost said wing is set at a respective positive flap angle in a range  $+1^{\circ}$  to  $+10^{\circ}$ .

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20. The wing system according to any one of claims 1 to 19, wherein each said aerofoil profile has a first maximum spacing of the respective pressure surface from the chord line, and a second maximum spacing of the respective hinge axis from the chord line, wherein said first maximum spacing and said second maximum spacing are within

15 10% of one another.

21. The wing system according to any one of claims 1 to 11, wherein for each said aerofoil profile, the respective said maximum thickness to chord ratio, and the respective said maximum absolute thickness to chord ratio have magnitudes that are within 1% of

20 the chord.

22. The wing system according to any one of claims 1 to 21, wherein for each said aerofoil profile, the respective said maximum thickness to chord ratio is in the range 0.10 to 0.14.

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23. The wing system according to any one of claims 1 to 22, wherein for each said aerofoil profile, the respective said maximum absolute thickness to chord ratio is in the range 0.10 to 0.15.

30 24. The wing system according to any one of claims 1 to 23, wherein each said aerofoil profile has a respective said maximum thickness at a position less than 25% of the chord from the leading edge of the aerofoil profile.

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25. The wing system according to any one of claims 1 to 24, wherein each said aerofoil profile has a respective said maximum thickness at a position about 20% of the chord from the leading edge of the aerofoil profile.

5 26. The wing system according to any one of claims 1 to 25, wherein each said aerofoil profile has a camber profile with a maximum camber of about 6% or less of the chord.

27. The wing system according to any one of claims 1 to 26, wherein for each said  
10 aerofoil profile, including at least one of the following:

- the respective said gap varies between about 2.3% to about 1.2% of the chord, as the respective said flap angle increases from 0° to 30°;
- the respective said gap varies between about 2.3% to about 2.5% of the chord, as the respective said flap angle decreases from 0° to -20°.

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28. The wing system according to any one of claims 1 to 27, wherein for each said aerofoil profile, the respective leading edge radius is about 2% of the chord.

29. The wing system according to any one of claims 1 to 28, wherein for each said  
20 aerofoil profile, the respective said primary element has a primary element trailing edge, and wherein the respective said secondary element has a secondary element leading edge including one of the following:

- wherein the primary element trailing edge overlaps the secondary element leading edge by a longitudinal overlap in a direction parallel to the chord;
- 25 • wherein the primary element trailing edge overlaps the secondary element leading edge by a longitudinal overlap in a direction parallel to the chord, and, the respective said longitudinal overlap varies between about 5% to about 3% of the chord, as the respective said flap angle increases from 0° to 30°;
- wherein the primary element trailing edge overlaps the secondary element leading  
30 edge by a longitudinal overlap in a direction parallel to the chord, and, wherein for each said aerofoil profile, the respective said longitudinal overlap varies

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between about 5% to about 5.5% of the chord, as the respective said flap angle decreases from 0° to -20°.

30. The wing system according to any one of claims 1 to 29, wherein each said  
5 aerofoil profile is configured as a high lift aerofoil profile.

31. The wing system according to claim 30, wherein said aerofoil profile is configured as having a maximum lift coefficient of at least 2.5 at zero flap angle.

10 32. The wing system according to claim 30, wherein said aerofoil profile is configured as having a maximum lift coefficient of greater than 2.3 at zero flap angle.

33. The wing system according to any one of claims 31 to 32, wherein said maximum lift coefficient corresponds to an angle of attack of between about 15° and about 16°.

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34. The wing system according to any one of claims 1 to 33, wherein said aerofoil profile is configured as having a lift coefficient of 1.0 corresponds to an angle of attack of about 0°.

20 35. The wing system according to any one of claims 1 to 34, wherein said aerofoil profiles of said two wings have an aggregate cross-sectional area corresponding to a said occupancy of between 40% to 30% of said envelope cross-sectional area.

25 36. The wing system according to any one of claims 1 to 35, wherein said envelope cross-sectional profile is in the form of a segment of a circle of predetermined diameter, the segment being defined by a corresponding arc portion and a corresponding chord portion.

30 37. The wing system according to claim 36, wherein for each said aerofoil profile, a respective first ratio of said chord to said diameter is in the range 70% to 87%.

38. The wing system according to claim 37, wherein for each said aerofoil profile, the respective first ratio is in the range 75% to 85%.

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**39.** The wing system according to any one of claims 36 to 38, including at least one of the following:

- wherein for each said aerofoil profile, a respective second ratio of said maximum thickness to said diameter is in the range 7% to 12%;
- wherein for each said aerofoil profile, a respective second ratio of said maximum absolute thickness to said diameter is in the range 8% to 14%.

**40.** The wing system according to any one of claims 1 to 39, wherein each said wing is configured with zero taper, and wherein each wing has a uniform said aerofoil profile along a respective span thereof.

**41.** The wing system according to any one of claims 1 to 39, wherein each said wing is configured with non-zero taper, and wherein each wing has a uniform said aerofoil profile along a respective span thereof.

**42.** The wing system according to any one of claims 1 to 41, configured for selectively enabling the wings to transition from the stowed configuration to the pre-deployed configuration under predetermined conditions.

**43.** The wing system according to any one of claims 1 to 42, configured for maintain a negative said deflection angle for each aerofoil of each wing during deployment from the pre-deployed configuration through to the deployed configuration.

**44.** A wing system for an air vehicle, the wing system having at least a stowed configuration, a pre-deployed configuration and a deployed configuration, the wing system comprising:

two wings, each said wing being pivotably deployable about a respective pivot axis between the pre-deployed configuration and the deployed configuration, wherein:

in the stowed configuration the two wings are in first general superposed spatial relationship with respect to one another and are capable of being accommodated within an envelope having an envelope cross-sectional profile and a corresponding envelope cross-sectional area; and

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in the pre-deployed configuration the two wings are in second general superposed spatial relationship with respect to one another and capable of deploying to the deployed configuration; and

in the deployed configuration the wings are each capable of  
5 generating aerodynamic lift in an airstream;

each said wing having a span and an aerofoil profile at least at one respective transverse cross-section orthogonal to the respective span;

each said aerofoil profile being a slotted aerofoil having a primary element, a secondary element and a chord, the secondary element being pivotable with  
10 respect to the primary element and spaced therefrom by a gap, each said aerofoil profile having a respective maximum thickness, and a respective maximum absolute thickness;

wherein each said aerofoil profile is configured with a minimum respective said absolute thickness and a maximum said chord such that in said stowed  
15 configuration the respective said aerofoil profiles of said two wings in said first general superposed spatial relationship are capable of being accommodated within said envelope cross-sectional profile while concurrently maximizing occupancy of said envelope cross-sectional area.

20 **45.** An air vehicle, comprising the wing system as defined in any one of claims 1 to 44.

**46.** The air vehicle according to claim 45, wherein the air vehicle is a UAV.

25 **47.** A launch system comprising an air vehicle as defined in claim 45 or claim 46, accommodated in a fairing having an internal chamber defining said envelope, said envelope cross-sectional profile and said envelope cross-sectional area.

**48.** The launch system according to claim 47, configured for selectively releasing said  
30 air vehicle from said fairing.

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- 49.** The launch system according to claim 48, configured for selectively transitioning the wing system from the stowed configuration to the pre-deployed configuration following release of said air vehicle from said fairing.
- 5 **50.** The launch system according to claim 49, configured for selectively transitioning the wing system from the pre-deployed configuration to the deployed configuration and for subsequently enabling aerodynamic flight of the air vehicle.