CLAIMS:

1. A flight simulation system for enabling g-force training, comprising

a seating system configured for accommodating a human occupant and for providing to the human occupant physically simulated flight conditions corresponding to predetermined real flight conditions, said predetermined real flight conditions including g-forces, wherein said physically simulated flight conditions include application of non-g forces to the human occupant corresponding to said g-forces, and wherein said g-forces are considered sufficient to provide g-force induced physiological stress to the human occupant;

a sensor arrangement configured for providing real-time feedback data of predetermined physiological parameters of the human occupant, in operation of the flight simulation system with the human occupant accommodated in the seating system, wherein said predetermined physiological parameters are indicative of said g-force induced physiological stress;

a controller configured for controlling the seating system to provide said physically simulated flight conditions.

2. The flight simulation system according to claim 1, wherein said predetermined real flight conditions include real control moments in pitch, yaw and roll, and wherein said physically simulated flight conditions further include physically simulated control moments in pitch, yaw and roll applied to the human occupant corresponding to said respective real control moments in pitch, yaw and roll.

3. The flight simulation system according to any one of claims 1 to 2, wherein said g-force induced physiological stress includes at least one of: breathing difficulties; blood loss in the brain; g-LOC.

4. The flight simulation system according to any one of claims 1 to 2, wherein said g-force induced physiological stress includes at least one of: reduced vision; tunnel vision; loss of vision.

5. The flight simulation system according to any one of claims 1 to 4, including one of:

- wherein the flight simulation system further comprises a display device coupled to the controller and to the sensor system, the display device being configured for displaying to the human occupant at least said real-time feedback data;
- wherein the flight simulation system further comprises a display device coupled to the controller and to the sensor system, the display device being configured for displaying to the human occupant at least said real-time feedback data, and, wherein the display device is configured for comparing said real-time feedback data with first datum feedback data representative of first threshold levels of said predetermined physiological parameters, wherein said first threshold levels are considered to be representative of safe levels for said predetermined physiological parameters at least sufficient for avoiding onset of g-force induced loss of consciousness.

6. The flight simulation system according to claim 5, wherein the display device is configured for alerting the human occupant responsive to said real-time feedback data approaching or exceeding second datum feedback data representative of second threshold levels of said predetermined physiological parameters, wherein said second threshold levels are considered to be representative of minimum unsafe levels for said predetermined physiological parameters corresponding to onset of g-force induced loss of consciousness.

7. The flight simulation system according to claim 6, including one of the following:

- wherein the display device is configured for prompting the human occupant to initiate anti-g straining maneuvers (AGSM) for managing levels of said predetermined physiological parameters at least when said second threshold level is being approached or exceeded, and for reducing said levels to said first threshold level;
- wherein the display device is configured for prompting the human occupant to initiate anti-g straining maneuvers (AGSM) for managing levels of said predetermined physiological parameters at least when said second threshold level is being approached or exceeded, and for reducing said levels to said first

threshold level, and, wherein said AGSM comprises application of muscle tension procedures to predetermined muscle groups by the human occupant;

- wherein the display device is configured for prompting the human occupant to initiate anti-g straining maneuvers (AGSM) for managing levels of said predetermined physiological parameters at least when said second threshold level is being approached or exceeded, and for reducing said levels to said first threshold level, and, wherein said AGSM comprises application of muscle tension procedures to predetermined muscle groups by the human occupant, and, wherein said predetermined muscle groups include muscles in the abdomen and extremities of the human occupant.

8. The flight simulation system according to claim 7, wherein said AGSM comprises the human occupant applying rapid static contractions of muscles in at least one of the arms, legs and abdomen.

9. The flight simulation system according to any one of claims 7 to 8, wherein said AGSM comprises the human occupant applying specialized breathing cycle configured to maintain air pressure in the lungs.

10. The flight simulation system according to any one of claims 1 to 9, wherein said sensor arrangement includes at least one of: a sensor configured for determining an electromyography (EMG) parameter of the human occupant; includes a sensor configured for determining a pneumograph parameter of the human occupant; a sensor configured for determining a brain blood oxygenation level parameter of the human occupant.

11. The flight simulation system according to any one of claims 1 to 10, wherein said seating system comprises a mechanical force application system configured for applying said non-g forces to the human occupant corresponding to said g-forces being simulated by the system.

12. The flight simulation system according to claim 11, wherein said mechanical force application system comprises a plurality of belts configured for being peripherally wound around respective body portions of the human occupant when seated with

respect to the seating system, the belts being coupled to a tensioning device, the tensioning device being configured for selectively tightening or loosening a respective abutment contact between each respective said belt and the respective body portion of the human occupant, such as to respectively increase or decrease a magnitude of said non-g forces to the respective body portion of the human occupant corresponding to predetermined g-forces being simulated by the system.

13. The flight simulation system according to claim 11, wherein said mechanical force application system comprises a plurality of inflatable members configured for being peripherally wound around respective body portions of the human occupant when seated with respect to the seating system, the inflatable members being coupled to an inflation device, the inflation device being configured for selectively inflating or deflating the respective inflatable members to respectively increase or decrease a respective abutment pressure between each respective said inflatable member and the respective body portion of the human occupant, such as to respectively increase or decrease a magnitude of said non-g forces to the respective body portion of the human occupant corresponding to predetermined g-forces being simulated by the system.

14. The flight simulation system according to any one of claims 11 to 13, wherein said body portions include at least one of: the arms; the legs; the shoulders; the abdomen; the head; the chest; the neck.

15. The flight simulation system according to any one of claims 1 to 14, including one of:

- wherein the seating system comprises a seat including a seat cushion and a backrest, the seat being coupled to a rotary motion inducing structure configured for selectively generating said simulated control moments in pitch, yaw and roll to the seat corresponding to said real control moments in pitch, yaw and roll;
- wherein the seating system comprises a seat including a seat cushion and a backrest, the seat being coupled to a rotary motion inducing structure configured for selectively generating said simulated control moments in pitch, yaw and roll to the seat corresponding to said real control moments in pitch, yaw and roll, and, wherein said rotary motion inducing structure comprises a movable frame pivotably mounted to a base structure, wherein the seat is pivotably mounted to

the movable frame, such as to enable the seat to be pivoted with respect to the base structure in one, two or three degrees of freedom, and wherein said rotary motion inducing structure comprises a driving system for selectively pivoting the seat with respect to the base structure in said one, two or three degrees of freedom, to provide said control moments in pitch, yaw and roll to the seat responsive to receiving actuation command from the controller corresponding to said predetermined respective aircraft control moments being simulated by the flight simulation system;

- wherein the seating system comprises a seat including a seat cushion and a backrest, the seat being coupled to a rotary motion inducing structure configured for selectively generating said simulated control moments in pitch, yaw and roll to the seat corresponding to said real control moments in pitch, yaw and roll, and, wherein the seat is mounted in a cockpit mock-up, and wherein said rotary motion inducing structure comprises a movable frame pivotably mounted to a base structure, wherein the cockpit mock-up is pivotably mounted to the movable frame, such as to enable the seat to be pivoted with respect to the base structure in one, two or three degrees of freedom, and wherein said rotary motion inducing structure comprises a driving system for selectively pivoting the cockpit mock-up with respect to the base structure in said one, two or three degrees of freedom, to provide said control moments in pitch, yaw and roll to the cockpit mock-up responsive to receiving actuation command from the controller corresponding to said predetermined respective aircraft control moments being simulated by the flight simulation system.

16. The flight simulation system according to any one of claims 1 to 15, including one of the following:

- the flight simulation system comprising a visual display device configured for providing a visual display of a virtual simulation corresponding to said flight conditions from a subjective visual viewpoint of the human occupant when accommodated in said seating system;
- the flight simulation system comprising a visual display device configured for providing a visual display of a virtual simulation corresponding to said flight conditions from a subjective visual viewpoint of the human occupant when

accommodated in said seating system, and wherein the visual display device is in the form of virtual reality goggles;

- wherein the seating system comprises a manual control actuable by the human occupant when the human occupant is accommodated in the seating system, said manual control being operatively connected to the controller, wherein the manual control is configured for enabling the human occupant to define the flight conditions being simulated by manipulating said manual control, and wherein the manual control is configured for providing control signals to the controller to thereby cause the seating system to provide a corresponding said physical flight simulation to the human occupant corresponding to said predetermined g-forces and said predetermined respective aircraft control moments responsive to manual actuation of the manual control by the human occupant;
- wherein the seating system comprises a manual control actuable by the human occupant when the human occupant is accommodated in the seating system, said manual control being operatively connected to the controller, wherein the manual control is configured for enabling the human occupant to define the flight conditions being simulated by manipulating said manual control, and wherein the manual control is configured for providing control signals to the controller to thereby cause the seating system to provide a corresponding said physical flight simulation to the human occupant corresponding to said predetermined g-forces and said predetermined respective aircraft control moments responsive to manual actuation of the manual control by the human occupant, and, wherein said manual control is in the form of a joystick.

17. A method for enabling g-force training, comprising:

providing a flight simulation system as defined in any one of claims 1 to 16;

accommodating a human occupant in the flight simulation system;

choosing a real flight condition to be simulated by the flight simulation system;

causing the controller to provide to the human occupant a physical simulated flight condition corresponding to said real flight condition, said

physical simulated flight condition including corresponding physically simulated non-g forces.

18. The method according to claim 17, including at least one of the following:

- wherein said physical simulated flight condition further includes corresponding physically simulated respective aircraft control moments;
- wherein said real flight conditions include g-forces within a range 0 to 9g, or up to 35g, and comprising the step of operating said seating system to cause application to the human occupant of said physically simulated g-forces in the form of respective non-g forces;
- comprising providing real-time feedback data of said predetermined physiological parameters of the human occupant at said physically simulated flight conditions;
- comprising the step wherein the human occupant initiates anti-g straining maneuvers (AGSM) for managing levels of said predetermined physiological parameters responsive to application of said non-g forces to the human occupant.

19. The method according to any one of claims 17 to 18, comprising the step wherein the human occupant initiates anti-g straining maneuvers (AGSM) for managing levels of said predetermined physiological parameters responsive to application of said non-g forces to the human occupant, and further comprising the following steps:

a. setting said real flight conditions to correspond to a minimum g-force greater than 1g;
b. providing real-time feedback data of predetermined physiological parameters of the human occupant at the real flight conditions of step (a);
c. the human occupant initiates anti-g straining maneuvers (AGSM) for managing levels of said predetermined physiological parameters responsive to application of said non-g forces to the human occupant corresponding to said g-force;
d. providing real-time feedback data of predetermined physiological parameters of the human occupant at the flight conditions of step (c);
e. setting said real flight conditions to correspond to an increment in said g-force;

f. repeating steps (c) and (d) at the increased g-force of step (e);

g. checking whether the increased g-force of step (e) exceeds predetermined safety limits, wherein:

- if the increased g-force of step (e) exceeds predetermined safety limits, terminate the said flight simulation; or
- if the increased g-force of step (e) does not exceed said predetermined safety limits repeating steps (e) to (g).

20. The method according to claim 19, including at least one of the following:

- wherein said minimum g-force is 1.5g;
- wherein said increment in said g-force is 0.5g;
- wherein said predetermined safety limits corresponds to a g-force of 9g or to a g-force of 35g;
- wherein said step of initiating said AGSM comprises the human occupant applying muscle tension procedures to predetermined muscle groups;
- wherein said step of initiating said AGSM comprises the human occupant applying muscle tension procedures to predetermined muscle groups, and, wherein said predetermined muscle groups include muscles in the abdomen and extremities of the human occupant;
- wherein said step of initiating said AGSM comprises the human occupant applying rapid static contractions of muscles in the arms, legs and abdomen;
- wherein said step of initiating said AGSM comprises the human occupant applying specialized breathing cycle configured to maintain air pressure in the lungs.

21. The method according to any one of claims 17 to 20, including at least one of the following:

- wherein said sensor arrangement operates to provide an electromyography (EMG) parameter of the human occupant;
- wherein said sensor arrangement operates to provide a pneumograph parameter of the human occupant;
- wherein said sensor arrangement operates to provide a brain blood oxygenation level parameter of the human occupant;

- wherein said real flight conditions include any one of: evasive maneuvers, dog fight maneuvers, diving maneuvers.