CLAIMS:

~~**1.** A computerized method of controlling a refueling device, comprising:~~

~~**(a)** providing the refueling device that is attached by means of a non-rigid hose to a tanker aircraft; the refueling device having a refueling device body connected to a refueling nozzle by a joint, the joint facilitating at least a degree of freedom of the refueling device body relative to the refueling nozzle when the refueling nozzle is engaged with a receptacle of a receiver aircraft, constituting an engaged state;~~

~~**(b)** repeatedly performing by a controller:~~

~~in an instance which the refueling device is not engaged with the receiver aircraft, constituting a non-engaged state:~~

~~**(b1)** receiving a first roll angle of the tanker aircraft from the tanker aircraft;~~

~~**(b2)** determining a first desired roll angle of the refueling device based on the first roll angle of the tanker aircraft; and~~

~~**(b3)** providing a first one or more commands related to the first desired roll angle of the refueling device for controlling one or more roll elements of the refueling device thereby attempting to achieve or maintain a first roll angle of the refueling device that is substantially the same as the first roll angle of the tanker aircraft; and~~

~~in an instance which the refueling device is engaged with the receiver aircraft in said engaged state:~~

~~**(b4)** receiving a second roll angle of the tanker aircraft from the tanker aircraft;~~

~~**(b5)** determining a second desired roll angle of the refueling device based on the second roll angle of the tanker aircraft; and~~

~~**(b6)** providing a second one or more commands related to the second desired roll angle of the refueling device for controlling one or more yaw elements of the refueling device thereby attempting to achieve or maintain a second roll angle of the refueling device that is substantially the same as the second roll angle of the tanker aircraft; wherein the second roll angle of the refueling device during the engaged state is~~

~~facilitated at least due to the degree of freedom between the refueling device body and the refueling nozzle.~~

1. A computerized method of controlling a refueling device, the method comprising:

(a) providing the refueling device that is attached by means of a non-rigid hose to a tanker aircraft; the refueling device having a refueling device body connected to a refueling nozzle by a joint, the joint facilitating at least a degree of freedom of the refueling device body relative to the refueling nozzle when the refueling nozzle is engaged with a receptacle of a receiver aircraft, constituting an engaged state;

(b) repeatedly performing by a controller:

in an instance which the refueling device is not engaged with the receiver aircraft, constituting a non-engaged state:

(b1) receiving a first roll angle of the tanker aircraft from the tanker aircraft;

(b2) determining a first desired roll angle of the refueling device based on the first roll angle of the tanker aircraft; and

(b3) providing a first one or more commands related to the first desired roll angle of the refueling device for controlling one or more roll elements of the refueling device thereby attempting to achieve or maintain a first roll angle of the refueling device that is substantially the same as the first roll angle of the tanker aircraft; and

in an instance which the refueling device is engaged with the receiver aircraft in said engaged state:

(b4) receiving a second roll angle of the tanker aircraft from the tanker aircraft;

(b5) determining a second desired roll angle of the refueling device based on the second roll angle of the tanker aircraft; and

(b6) providing a second one or more commands related to the second desired roll angle of the refueling device for controlling one or more yaw elements of the refueling device thereby attempting to achieve or maintain a second roll angle of the refueling device that is substantially the same as the second roll angle of the tanker aircraft;

wherein the second roll angle of the refueling device during the engaged state is facilitated at least due to the degree of freedom between the refueling device body and the refueling nozzle.

~~**2.** The computerized method of claim 1, wherein said stage (b3) is further comprising:~~

~~providing a first one or more commands related to the first desired roll angle of the refueling device for controlling said one or more yaw elements of the refueling device; and~~

~~wherein said stage **(b6)** is further comprising:~~

~~providing a second one or more commands related to the second desired roll angle of the refueling device for controlling said one or more roll elements of the refueling device;~~

~~thereby providing one or more commands to both the one or more roll elements and the one or more yaw elements seamlessly, irrespective of whether said refueling device is in said non-engaged state or said engaged state.~~

2. The computerized method of claim 1, wherein said stage (b3) is further comprising:

providing a first one or more commands related to the first desired roll angle of the refueling device for controlling said one or more yaw elements of the refueling device; and

wherein said stage (b6) is further comprising:

providing a second one or more commands related to the second desired roll angle of the refueling device for controlling said one or more roll elements of the refueling device;

thereby providing one or more commands to both the one or more roll elements and the one or more yaw elements seamlessly, irrespective of whether said refueling device is in said non-engaged state or said engaged state.

~~**3.** The computerized method of any one of the preceding claims, further comprising performing gain calibration to affect the first one or more commands and/or the second one or more commands provided to the one or more roll elements and/or the one or more yaw elements and thereby modify the effect that the one or more roll~~

~~elements and/or the one or more yaw elements has when attempting to achieve the first and/or second desired roll angle.~~

3. The computerized method of claim 1, further comprising performing gain calibration to affect the first one or more commands and/or the second one or more commands provided to the one or more roll elements and/or the one or more yaw elements and thereby modify the effect that the one or more roll elements and/or the one or more yaw elements has when attempting to achieve the first and/or second desired roll angle.

~~**4.** The computerized method of any one of the preceding claims, wherein said stage **(b2)** is further comprising:~~

~~receiving a first roll angle of the refueling device and determining a first difference between the first desired roll angle and the first roll angle of the refueling device and utilizing said first difference for providing said first one or more commands; and~~

~~wherein said stage **(b5)** is further comprising:~~

~~receiving a second roll angle of the refueling device and determining a second difference between the second desired roll angle and the second roll~~

~~angle of the refueling device and utilizing said second difference for providing said second one or more commands.~~

4. The computerized method of claim 1, wherein said stage (b2) is further comprising:

receiving a first roll angle of the refueling device and determining a first difference between the first desired roll angle and the first roll angle of the refueling device and utilizing said first difference for providing said first one or more commands; and

wherein said stage (b5) is further comprising:

receiving a second roll angle of the refueling device and determining a second difference between the second desired roll angle and the second roll angle of the refueling device and utilizing said second difference for providing said second one or more commands.

~~**5.** The computerized method of any one of the preceding claims, further comprising controlling the one or more roll elements and/or the one or more yaw elements based on the first and/or second one or more commands to attempt to achieve or maintain a roll angle of the refueling device that is substantially the same as the roll angle of the tanker aircraft.~~

5. The computerized method of claim 1, further comprising controlling the one or more roll elements and/or the one or more yaw elements based on the first and/or second one or more commands to attempt to achieve or maintain a roll angle of the refueling device that is substantially the same as the roll angle of the tanker aircraft.

~~**6.** The computerized method of any one of the preceding claims, wherein said stage **(b2)** and/or said stage **(b5)** is further comprising:~~

~~obtaining a relative position of the tanker aircraft and the refueling device;~~

~~obtaining a speed of the tanker aircraft; and~~

~~determining a side speed of the refueling device relative to the tanker based on the relative position of the tanker aircraft and the refueling device and the speed of the tanker aircraft; wherein the side speed of the refueling device relative to the tanker is used to prevent or reduce oscillation of the refueling device and thereby help to achieve~~

~~or maintain a roll angle of the refueling device that is substantially the same as the roll angle of the tanker aircraft.~~

6. The computerized method of claim 1, wherein said stage (b2) and/or said stage (b5) is further comprising:

obtaining a relative position of the tanker aircraft and the refueling device;

obtaining a speed of the tanker aircraft; and

determining a side speed of the refueling device relative to the tanker based on the relative position of the tanker aircraft and the refueling device and the speed of the tanker aircraft; wherein the side speed of the refueling device relative to the tanker is used to prevent or reduce oscillation of the refueling device and thereby help to achieve or maintain a roll angle of the refueling device that is substantially the same as the roll angle of the tanker aircraft.

7. ~~The computerized method of any one of the preceding claims, wherein said stage **(b2)** and/or said stage **(b5)** is further comprising obtaining a roll rate of the refueling device; wherein the roll rate is used to prevent or reduce oscillation of the refueling device and thereby help to achieve or maintain a roll angle of the refueling device that is substantially the same as the roll angle of the tanker aircraft.~~ The computerized method of claim 1, wherein said stage (b2) and/or said stage (b5) is further comprising obtaining a roll rate of the refueling device; wherein the roll rate is used to prevent or reduce oscillation of the refueling device and thereby help to achieve or maintain a roll angle of the refueling device that is substantially the same as the roll angle of the tanker aircraft.

~~**8.** The computerized method of any one of the preceding claims, wherein the refueling device is an unmanned aerial vehicle (UAV).~~

8. The computerized method of claim 1, wherein the refueling device is an unmanned aerial vehicle (UAV).

~~**9.** The computerized method of any one of the preceding claims, wherein the tanker aircraft is a UAV.~~

~~**10.** The computerized method of any one of the preceding claims, wherein the receiver aircraft is a UAV.~~

11. The computerized method of any one of the preceding claims, wherein the joint is a spherical shaped joint.

12. The computerized method of any one of the preceding claims, wherein the controller is a Proportional Integral (PI) controller.

13. The computerized method of any one of the preceding claims, wherein the one or more roll elements are one or more ailerons.

14. The computerized method of any one of the preceding claims, wherein the wherein the one or more yaw elements are one or more rudders.

15. An inflight refueling system, comprising:

a refueling device that is attached by means of a non-rigid hose to a tanker aircraft; the refueling device having a refueling device body connected to a refueling nozzle by a joint, the joint facilitating at least a degree of freedom of the refueling device body relative to the refueling nozzle when the refueling nozzle is engaged with a receptacle of a receiver aircraft, constituting an engaged state;

a sensor configured to determine a roll angle of the tanker aircraft; and

a controller configured to repeatedly perform the following:

when the refueling device is not engaged with the receiver aircraft, constituting a non-engaged state:

(1) receive a first roll angle of the tanker aircraft from the tanker aircraft;

(2) determine a first desired roll angle of the refueling device based on the first roll angle of the tanker aircraft; and

(3) provide a first one or more commands related to the first desired roll angle of the refueling device to control one or more roll elements of the refueling device to thereby attempt to achieve or maintain a first roll angle of the refueling device that is substantially the same as the first roll angle of the tanker aircraft; and

when the refueling device is engaged with the receiver aircraft in said engaged state:

~~(4) receive a second roll angle of the tanker aircraft from the tanker aircraft;~~

~~(5) determine a second desired roll angle of the refueling device based on the second roll angle of the tanker aircraft; and~~

~~(6) provide a second one or more commands related to the second desired roll angle of the refueling device to control one or more yaw elements of the refueling device to thereby attempt to achieve or maintain a second roll angle of the refueling device that is substantially the same as the second roll angle of the tanker aircraft; wherein the second roll angle of the refueling device during the engaged state is facilitated at least due to the degree of freedom between the refueling device body and the refueling nozzle.~~

9. An inflight refueling system, comprising:

a refueling device that is attached by means of a non-rigid hose to a tanker aircraft; the refueling device having a refueling device body connected to a refueling nozzle by a joint, the joint facilitating at least a degree of freedom of the refueling device body relative to the refueling nozzle when the refueling nozzle is engaged with a receptacle of a receiver aircraft, constituting an engaged state;

a sensor configured to determine a roll angle of the tanker aircraft; and

a controller configured to repeatedly perform the following:

when the refueling device is not engaged with the receiver aircraft, constituting a non-engaged state:

(1) receive a first roll angle of the tanker aircraft from the tanker aircraft;

(2) determine a first desired roll angle of the refueling device based on the first roll angle of the tanker aircraft; and

(3) provide a first one or more commands related to the first desired roll angle of the refueling device to control one or more roll elements of the refueling device to thereby attempt to achieve or maintain a first roll angle of the refueling device that is substantially the same as the first roll angle of the tanker aircraft; and

when the refueling device is engaged with the receiver aircraft in said engaged state:

(4) receive a second roll angle of the tanker aircraft from the tanker aircraft;

(5) determine a second desired roll angle of the refueling device based on the second roll angle of the tanker aircraft; and

(6) provide a second one or more commands related to the second desired roll angle of the refueling device to control one or more yaw elements of the refueling device to thereby attempt to achieve or maintain a second roll angle of the refueling device that is substantially the same as the second roll angle of the tanker aircraft;

wherein the second roll angle of the refueling device during the engaged state is facilitated at least due to the degree of freedom between the refueling device body and the refueling nozzle.

~~**16.** The system of claim **15**, wherein the controller is further configured to:~~

~~when the refueling device is in said non-engaged state:~~

~~provide a first one or more commands related to the first desired roll angle of the refueling device to control said one or more yaw elements of the refueling device; and~~

~~when the refueling device is in said engaged state:~~

~~provide a second one or more commands related to the second desired roll angle of the refueling device to control said one or more roll elements of the refueling device;~~

~~wherein one or more commands are thereby provided to both the one or more roll elements and the one or more yaw elements seamlessly, irrespective of whether said refueling device is in said non-engaged state or said engaged state.~~

10. The inflight refueling system of claim 9, wherein the controller is further configured to:

when the refueling device is in said non-engaged state:

provide a first one or more commands related to the first desired roll angle of the refueling device to control said one or more yaw elements of the refueling device; and

when the refueling device is in said engaged state:

provide a second one or more commands related to the second desired roll angle of the refueling device to control said one or more roll elements of the refueling device;

wherein one or more commands are thereby provided to both the one or more roll elements and the one or more yaw elements seamlessly, irrespective of whether said refueling device is in said non-engaged state or said engaged state.

11. The inflight refueling system of claim 9, wherein the controller is further configured to perform gain calibration to affect the first one or more commands and/or the second one or more commands to the one or more roll elements and/or the one or more yaw elements and thereby modify the effect that the one or more roll elements and/or the one or more yaw elements has when attempting to achieve the first and/or second desired roll angle.

12. The inflight refueling system of claim 9, further comprising:

a sensor configured to determine a roll angle of the refueling device; and

wherein the controller is further configured to obtain the determined roll angle of the refueling device and to:

when the refueling device is in said non-engaged state:

determine a first difference between the first desired roll angle and the obtained roll angle of the refueling device and utilize said determined first difference for providing said first one or more commands; and

when the refueling device is in said engaged state:

determine a second difference between the second desired roll angle and the obtained roll angle of the refueling device and utilize said determined second difference for providing said second one or more commands.

13. The system of claim 9, further comprising a steering control module configured to control the one or more roll elements and the one or more yaw elements

based on the first and/or second one or more commands to achieve or maintain a roll angle of the refueling device that is substantially the same as the roll angle of the tanker aircraft.

14. The inflight refueling system of claim 9, further comprising:

a speed sensor configured to determine a speed of the tanker aircraft; and

wherein the controller is further configured to:

obtain a relative position of the tanker aircraft and the refueling device;

obtain the speed of the tanker aircraft; and

determine a side speed of the refueling device relative to the tanker based on the relative position of the tanker aircraft and the refueling device and the speed of the tanker aircraft; wherein the side speed of the refueling device relative to the tanker is used to prevent or reduce oscillation of the refueling device and thereby help to achieve or maintain a roll angle of the refueling device that is substantially the same as the roll angle of the tanker aircraft.

15. The inflight refueling system of claim 9, further comprising a roll rate sensor configured to determine a roll rate of the refueling device; wherein the roll rate is used to prevent or reduce oscillation of the refueling device and thereby help to achieve or maintain a roll angle of the refueling device that is substantially the same as the roll angle of the tanker aircraft.

16. The inflight refueling system of claim 9, wherein the refueling device is an unmanned aerial vehicle (UAV).

17. The inflight refueling system of claim 9, wherein the tanker aircraft is a UAV.

18. The inflight refueling system of claim 9, wherein the receiver aircraft is a UAV.

19. The inflight refueling system of claim 9, wherein the joint is a spherical shaped joint.

20. The inflight refueling system of claim 9, wherein the controller is a Proportional Integral (PI) controller.

21. The inflight refueling system of claim 9, wherein the one or more roll elements are one or more ailerons.

22. A non-transitory program storage device readable by machine, tangibly embodying a program of instructions executable by the machine to perform the method of controlling a refueling device according to claim 1.

~~**17.** The system of any one of claims **15** to **16**, wherein the controller is further configured to perform gain calibration to affect the first one or more commands and/or the second one or more commands to the one or more roll elements and/or the one or more yaw elements and thereby modify the effect that the one or more roll elements and/or the one or more yaw elements has when attempting to achieve the first and/or second desired roll angle.~~

18. The system of any one of claims **15** to **17**, further comprising:

a sensor configured to determine a roll angle of the refueling device; and

wherein the controller is further configured to obtain the determined roll angle of the refueling device and to:

when the refueling device is in said non-engaged state:

determine a first difference between the first desired roll angle and the obtained roll angle of the refueling device and utilize said determined first difference for providing said first one or more commands; and

when the refueling device is in said engaged state:

determine a second difference between the second desired roll angle and the obtained roll angle of the refueling device and utilize said determined second difference for providing said second one or more commands.

19. The system of any one of claims **15** to **18**, further comprising a steering control module configured to control the one or more roll elements and the one or more yaw elements based on the first and/or second one or more commands to achieve or maintain a roll angle of the refueling device that is substantially the same as the roll angle of the tanker aircraft.

20. The system of any one of claims **15** to **19**, further comprising:

a speed sensor configured to determine a speed of the tanker aircraft; and

wherein the controller is further configured to:

obtain a relative position of the tanker aircraft and the refueling device;

obtain the speed of the tanker aircraft; and

determine a side speed of the refueling device relative to the tanker based on the relative position of the tanker aircraft and the refueling device and the speed of the tanker aircraft; wherein the side speed of the refueling device relative to the tanker is used to prevent or reduce oscillation of the refueling device and thereby help to achieve or maintain a roll angle of the refueling device that is substantially the same as the roll angle of the tanker aircraft.

21. The system of any one of claims **15** to **20**, further comprising a roll rate sensor configured to determine a roll rate of the refueling device; wherein the roll rate is used to prevent or reduce oscillation of the refueling device and thereby help to achieve or maintain a roll angle of the refueling device that is substantially the same as the roll angle of the tanker aircraft.

22. The system of any one of claims **15** to **21**, wherein the refueling device is an unmanned aerial vehicle (UAV).

23. The system of any one of claims **15** to **22**, wherein the tanker aircraft is a UAV.

24. The system of any one of claims **15** to **23**, wherein the receiver aircraft is a UAV.

25. The system of any one of claims **15** to **24**, wherein the joint is a spherical shaped joint.

26. The system of any one of claims **15** to **25**, wherein the controller is a Proportional Integral (PI) controller.

27. The system of any one of claims **15** to **26**, wherein the one or more roll elements are one or more ailerons.

28. The system of any one of claims **15** to **27**, wherein the one or more roll elements are one or more ailerons.

29. A non-transitory program storage device readable by machine, tangibly embodying a program of instructions executable by the machine to perform a method of controlling a refueling device according to any one of claims **1** to **14**.