EXTERNAL CONTAINMENT APPARATUS FOR UNMANNED AERIAL VEHICLE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Application No. 16/108,043, filed on August 21, 2018, the contents of which are incorporated herein by reference.

TECHNICAL FIELD

[0002] This disclosure relates generally to the field of unmanned aerial vehicles.

BACKGROUND INFORMATION

[0003] An unmanned vehicle, which may also be referred to as an autonomous vehicle, is a vehicle capable of travel without a physically-present human operator. An unmanned vehicle may operate in a remote-control mode, in an autonomous mode, or in a partially autonomous mode.

[0004] When an unmanned vehicle operates in a remote-control mode, a pilot or driver than is at a remote location can control the unmanned vehicle via commands that are sent to the unmanned vehicle via a wireless link. When the unmanned vehicle operates in autonomous mode, the unmanned vehicle typically moves based on pre-programmed navigation waypoints, dynamic automation systems, or a combination of these. Further, some unmanned vehicles can operate in both a remote-control mode and an autonomous mode, and in some instance may do so simultaneously. For instance, a remote pilot or driver may wish to leave navigation to an autonomous system while manually performing another task, such as operating a mechanical system for picking up objects, as an example.

[0005] Various types of unmanned vehicles exist for various different environments. For instance, unmanned vehicles exist for operation in the air, on the ground, underwater, and in space. Unmanned aerial vehicles (UAVs) or drones are becoming more popular in general. Designs that improve the efficiency and suitability of UAVs for commercial use will expand their mission capabilities.

SUMMARY OF INVENTION

[0005a] According to a first aspect of the present invention, there is provided a system for transporting a payload, comprising:

an unmanned aerial vehicle (UAV) including a payload coupling apparatus; and

a containment apparatus having an aerodynamic exterior and a hollow interior, wherein the aerodynamic exterior includes first and second openings, wherein the containment apparatus is located external to the UAV, and wherein the containment apparatus is selectively attached to an underside of the UAV,

wherein the payload coupling apparatus passes through the first and second openings of the containment apparatus to couple with the payload, and the payload passes through the second opening to be positioned inside or outside the hollow interior of the containment apparatus.

[0005b] According to a second aspect of the present invention, there is provided a payload containment apparatus comprising:

an aerodynamic exterior;

a hollow interior; and

first and second openings included at the aerodynamic exterior, wherein the aerodynamic exterior selectively attaches to an unmanned aerial vehicle (UAV), and

wherein a payload coupling apparatus included in the UAV passes through the first and second openings of the containment apparatus to couple with a payload, and the payload passes through the second opening to be positioned inside or outside the hollow interior.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] Non-limiting and non-exhaustive embodiments of the invention are described with reference to the following figures, wherein like reference numerals refer to

CLAIMS

What is claimed is:

1. A system for transporting a payload, comprising:

an unmanned aerial vehicle (UAV) including a payload coupling apparatus; and

a containment apparatus having an aerodynamic exterior and a hollow interior, wherein the aerodynamic exterior includes first and second openings, wherein the containment apparatus is located external to the UAV, and wherein the containment apparatus is selectively attached to an underside of the UAV,

wherein the payload coupling apparatus passes through the first and second openings of the containment apparatus to couple with the payload, and the payload passes through the second opening to be positioned inside or outside the hollow interior of the containment apparatus.

2. The system of claim 1, wherein the containment apparatus comprises a first containment apparatus and further comprising a second containment apparatus different from the first containment apparatus, wherein the second containment apparatus is attached to the underside of the UAV and the first containment apparatus is detached from the UAV.

3. The system of claim 2, wherein the first containment apparatus is configured for a first payload and the second containment apparatus is configured for a second payload having a different shape or size from the first payload.

4. The system of claim 1, wherein the payload coupling apparatus passes through the first opening when the payload is positioned inside the containment apparatus.

5. The system of claim 1, wherein the containment apparatus includes first and second portions, each of the first and second portions pivotally attached to the underside of the UAV, and wherein the containment apparatus is configurable in an open position when the first and second portions are separated from each other and configurable in a closed position when the first and second portions are in contact with each other.

6. The system of claim 5, wherein the second opening of the containment apparatus is absent when the containment apparatus is in the closed position.

7. The system of claim 1, wherein the containment apparatus comprises a unitary structure.

8. The system of claim 1, wherein the first opening is provided at a first side of the containment apparatus adjacent to the underside of the UAV and the second opening is provided at a second side different from the first side of the containment apparatus.

9. The system of claim 1, wherein the aerodynamic shape comprises a substantially teardrop aerofoil shape.

10. The system of claim 1, wherein the payload has one or both of a size larger than a payload space internal to the UAV and a non-aerodynamic shape.

11. A payload containment apparatus comprising:

an aerodynamic exterior;

a hollow interior; and

first and second openings included at the aerodynamic exterior, wherein the aerodynamic exterior selectively attaches to an unmanned aerial vehicle (UAV), and

wherein a payload coupling apparatus included in the UAV passes through the first and second openings of the containment apparatus to couple with a payload, and the payload passes through the second opening to be positioned inside or outside the hollow interior.

12. The apparatus of claim 11, further comprising a coupling mechanism configured to selectively attach and detach the aerodynamic exterior with the UAV.

13. The apparatus of claim 12, wherein the coupling mechanism comprises a coupling mechanism common to a plurality of payload containment apparatuses with the UAV, and wherein each payload containment apparatus of the plurality of payload containment apparatuses is associated with a particular size or shape of payload to be transported within the respective payload containment apparatus.

14. The apparatus of claim 11, wherein the payload coupling apparatus passes through the first opening when the payload is positioned within the hollow interior.

15. The apparatus of claim 11, wherein the aerodynamic exterior comprises first and second portions, each of the first and second portions pivotally attached to an underside of the UAV, and wherein the first and second portions are configurable in an open position when the first and second portions are separated from each other and configurable in a closed position when the first and second portions are in contact with each other.

16. The apparatus of claim 15, wherein the second opening is absent when the first and second portions are in the closed position.

17. The apparatus of claim 11, wherein the aerodynamic exterior comprises a unitary structure.

18. The apparatus of claim 11, wherein the first opening is provided at a first side of the aerodynamic exterior adjacent to an underside of the UAV and the second opening is provided at a second side different from the first side of the aerodynamic exterior.

19. The apparatus of claim 11, wherein the aerodynamic exterior comprises a substantially teardrop aerofoil shape.

20. The apparatus of claim 11, wherein the payload has one or both of a size larger than a payload space internal to the UAV and a non-aerodynamic shape.