SUMMARY

[0007] The present embodiments provide a payload retrieval apparatus and method useful for automatic pickup of a payload at a payload retrieval site by a UAV having a payload retriever suspended from a tether attached to the UAV. The payload retrieval apparatus may be a non-permanent structure that includes an extending member that may be secured to a base or stand at a lower end of the extending member, and an angled extender may be attached at an upper end of the extending member. A channel may be attached to the angled extender, with a first end of the channel having one or more tether engagers extending therefrom. A payload holder secures a payload to a second end of the channel.

[0008] In operation, a UAV arrives at the payload retrieval site with a tether extending downwardly from the UAV and with the payload retriever suspended from the end of the tether. The UAV approaches the payload retrieval apparatus, and as it nears the payload retrieval apparatus, the tether comes into contact with a tether engager, and as the UAV moves forward, the tether slides inwardly along the tether engager where it is directed towards the first end of the channel. With further forward or upward movement of the UAV, or upward winching of the payload retriever, the tether moves into and through a tether slot in the channel and the payload retriever attached to the tether is pulled into the channel by the tether. The payload retriever is pulled through the channel where it engages, and secures, the payload positioned on a payload holder. The payload retriever then pulls the payload free from the payload holder. Once the payload is free from the payload holder, the payload may be winched upwardly into secure engagement with the UAV, and the UAV may continue on to a delivery site where the payload may be delivered by the UAV. In this manner, automatic pick up of a payload by a UAV is achieved without the need for a person to participate in the retrieval of the payload from a retrieval site.

[0009] In one aspect, a payload retrieval apparatus is provided including an extending member having an upper end and a lower end, a channel having a first end and a second end, the channel coupled to the extending member, a first tether engager that extends in a first direction from the first end of the channel section, and a payload holder positioned near the second end of the channel and is adapted to secure a payload.

[0010] In another aspect, a system for payload retrieval is provided that includes a tether coupled to a payload retriever and a payload retrieval apparatus having an extending member having an upper end and a lower end, a channel having a first end and a second end, the channel coupled to the extending member, a first tether engager that extends in a first direction from the first end of the channel, a payload holder positioned near the second end of the channel that is adapted to

secure a payload, wherein at least an upper portion of the channel includes a tether slot that extends from the first end of the channel to the second end of the channel, the tether slot configured to guide passage of ~~a~~ the tether ~~coupled to a payload retriever~~ when the payload retriever is passing within the channel.

[0011] In yet another aspect, a method of retrieving a payload is provided, including the steps of (i) positioning a payload having a handle with an aperture on a payload holder coupled to a channel on a payload retrieval apparatus; (ii) causing a UAV having a payload retriever attached to a tether suspended from the UAV to position the tether to come into contact with ~~the~~ a first tether engager; (iii) causing the UAV to advance the tether into ~~the~~ a tether slot, wherein the tether slot has a width that is narrower than a width of the payload retriever; (iv) causing the UAV to advance the payload retriever into the channel; (v) causing the UAV to advance the payload retriever until the payload retriever engages the handle of the payload; and (vi)causing the UAV to pick up the payload by the payload retriever thereby disengaging the payload from the payload holder.

[0012] The present embodiments further provide means for automatically retrieving a payload from a payload retrieval apparatus with a UAV having a payload retriever attached to a tether that is suspended from the UAV.

[0013] These as well as other aspects, advantages, and alternatives will become apparent to those of ordinary skill in the art by reading the following detailed description with reference where appropriate to the accompanying drawings. Further, it should be understood that the description provided in this summary section and elsewhere in this document is intended to illustrate the claimed subject matter by way of example and not by way of limitation.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] Figure 1A is an isometric view of an example unmanned aerial vehicle 100, according to an example embodiment.

[0015] Figure 1B is a simplified illustration of an unmanned aerial vehicle, according to an example embodiment.

[0016] Figure 1C is a simplified illustration of an unmanned aerial vehicle, according to an example embodiment.

[0017] Figure 1D is a simplified illustration of an unmanned aerial vehicle, according to an example embodiment.

[0018] Figure 1E is a simplified illustration of an unmanned aerial vehicle, according to an example embodiment.

CLAIMS

What is claimed is:

1. A payload retrieval apparatus comprising:

an extending member having an upper end and a lower end;

a channel having a first end and a second end, the channel coupled to the extending member;

a first tether engager that extends in a first direction from the first end of the channel; and

a payload holder positioned near the second end of the channel and is adapted to secure a payload.

2. The payload retrieval apparatus of claim 1, wherein an angled extender is secured to the extending member and secured to the channel.

3. The payload retrieval apparatus of claim 1, wherein a first shield extends from the first end of the channel.

4. The payload retrieval apparatus of claim 1, wherein a first shield extends from the first tether engager.

5. The payload retrieval apparatus of claim 1, further including a second tether engager that extends in a second direction from the first end of the channel section.

6. The payload retrieval apparatus of claim 5, wherein a first shield extends from the first tether engager and a second shield extends from the second tether engager.

7. The payload retrieval apparatus of claim 1, wherein an upper portion of the channel includes a tether slot that extends from the first end of the channel to the second end of the channel.

8. The payload retrieval apparatus of claim 7, wherein the channel has an interior having cams or slots adapted to cooperate with external cams or slots on a payload retriever attached to an end of a tether suspended from a UAV, to orient the payload retriever within the channel.

9. The payload retrieval apparatus of claim 7, wherein a plurality of magnets are positioned on an interior of the channel ~~attached to an end of a tether suspended from a UAV~~ adapted to magnetically engage a plurality of magnets, or a metal, positioned on the payload retriever, to orient the payload retriever within the channel.

10. The payload retrieval apparatus of claim 7, wherein the channel has an interior that tapers downwardly towards the second end of the channel.

11. The payload retrieval apparatus of claim 1, wherein the payload holder comprises a pair of pins adapted to extend through openings in a handle of a payload.

12. The payload retrieval apparatus of claim 1, wherein the payload holder comprises one or more magnets adapted to magnetically engage one or more magnets positioned on the payload.

13. The payload retrieval apparatus of claim 1, wherein a payload loader is positioned adjacent the payload holder; and

wherein after a first payload is retrieved from the payload holder, a second payload positioned on the payload loader moves into position on the payload holder.

14. A system for payload retrieval comprising:

a tether coupled to a payload retriever; and

a payload retrieval apparatus comprising:

an extending member having an upper end and a lower end;

a channel having a first end and a second end, the channel coupled to the extending member;

a first tether engager that extends in a first direction from the first end of the channel;

a payload holder positioned near the second end of the channel that is adapted to secure a payload;

wherein at least an upper portion of the channel includes a tether slot that extends from the first end of the channel to the second end of the channel, the tether

slot configured to guide passage of the tether when the payload retriever is passing within the channel.

15. The system of claim 14, wherein the payload retriever comprises a capsule having a slot adapted to engage a handle of the payload; and

wherein the channel has an interior having cams or slots in engagement with external cams or slots on the capsule, to orient the capsule within the channel section.

16. The system of claim 14, wherein the payload retriever comprises a capsule having a slot adapted to engage a handle of the payload; and

wherein a plurality of magnets are positioned on an interior of the channel adapted to magnetically engage with a plurality of magnets, or a metal, positioned on the payload retriever, to orient the capsule within the channel.

17. The system of claim 14, further including a payload loader positioned adjacent the payload holder; wherein after a first payload is retrieved from the payload holder, a second payload positioned on the payload loader moves into position on the payload holder.

18. The system of claim 14, wherein the payload retriever comprises a capsule having a slot with a lip positioned below the slot, with the lip adapted to extend through an aperture in a handle of the payload during retrieval of the payload.

19. The system of claim 18, wherein the lip of the capsule extends downwardly within the slot, and the lip is outwardly extendable from a body of the capsule to facilitate entry into the aperture of the handle of the payload, and the lip is retractable towards the body of the capsule to secure the handle of the payload to the capsule following retrieval of the payload.

20. The system of claim 14, wherein the payload comprises a handle with an aperture, the payload secured to the payload holder;

wherein the payload retriever is attached to the tether that is suspended from a UAV; and

wherein the tether slot has a width that is narrower than a width of the payload retriever.

21. A method of a retrieving a payload with a UAV, comprising the steps of:

positioning a payload having a handle with an aperture on a payload holder coupled to a channel on a payload retrieval apparatus;

causing a UAV having a payload retriever attached to a tether suspended from the UAV to position the tether to come into contact with a first tether engager;

causing the UAV to advance the tether into a tether slot, wherein the tether slot has a width that is narrower than a width of the payload retriever;

causing the UAV to advance the payload retriever into the channel;

causing the UAV to advance the payload retriever until the payload retriever engages the handle of the payload; and

causing the UAV to pick up the payload by the payload retriever thereby disengaging the payload from the payload holder.

22. The method of claim 21, wherein the payload retriever comprises a capsule having a slot adapted to engage the handle of the payload; and

wherein the channel has an interior having cams or slots in engagement with external cams or slots on the capsule, to orient the capsule within the channel.

23. The method of claim 21, wherein the payload retriever comprises a capsule having a slot adapted to engage the handle of the payload; and

wherein a plurality of magnets are positioned on an interior of the channel adapted to magnetically engage with a plurality of magnets, or a metal, positioned on the capsule, to orient the capsule within the channel.

24. The method of claim 21, further including the step of positioning a payload loader adjacent the payload holder; and

after the payload is disengaged from the payload holder, moving an additional payload positioned on the payload loader into position on the payload holder.