expanded, their suitability for commercial use is expected to expand. Designs that improve the efficiency and endurance of UAVs will expand their mission capabilities.

SUMMARY OF INVENTION

[0005a] According to a first aspect of the present invention, there is provided a propulsion unit, comprising:

a motor rotor that spins about a central rotational axis;

a clip-in base mount disposed on the motor rotor;

a clip-in rotor cap shaped to mate with and detachably clip into the clip-in base mount;

propeller mounts attached to the clip-in rotor cap; and

propeller blades each having a proximal base and a distal tip, wherein the proximal base of each propeller blade mounts to a corresponding one of the propeller mounts.

[0005b] According to a second aspect of the present invention, there is provided an aerial vehicle, comprising:

an airframe;

propulsion units mounted to the airframe to provide propulsion to the aerial vehicle, wherein one or more of the propulsion units includes:

a motor rotor that spins about a central rotational axis;

a clip-in base mount disposed on the motor rotor;

a clip-in rotor cap shaped to mate with and detachably clip into the clip-in base mount;

propeller mounts attached to the clip-in rotor cap; and

propeller blades each having a proximal base and a distal tip, wherein the proximal base of each propeller blade mounts to a corresponding one of the propeller mounts.

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

like parts throughout the various views unless otherwise specified. Not all instances of an element are necessarily labeled so as not to clutter the drawings where appropriate. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the principles being described.

[0007] FIG. 1 is a perspective view illustration of an aerial vehicle with propeller blades of vertical propulsion units in a deployed position, in accordance with an embodiment of the disclosure.

[0008] FIG. 2 is a plan view illustration of an aerial vehicle with propeller blades of vertical propulsion units in a stowed position, in accordance with an embodiment of the disclosure.

[0009] FIG. 3 is a perspective view illustration of a subassembly for coupling propeller blades to a motor rotor including a clip-in rotor cap that mates to a clip-in base mount, in accordance with an embodiment of the disclosure.

[0010] FIG. 4 is a perspective view illustration of the subassembly including an underside view of the clip-in rotor cap, in accordance with an embodiment of the disclosure.

[0011] FIG. 5 is an exploded view illustration of the subassembly including the clip-in rotor cap, in accordance with an embodiment of the disclosure.

[0012] FIG. 6A is a perspective view illustration showing how the clip-in rotor cap attaches to the clip-in base mount, in accordance with an embodiment of the disclosure.

[0013] FIG. 6B is a perspective view illustration of the clip-in base mount, in accordance with an embodiment of the disclosure.

[0014] FIG. 7 is a perspective view illustration of a subassembly for coupling propeller blades to a motor rotor, in accordance with an embodiment of the disclosure.

[0015] FIGs. 8A and 8B are perspective view illustrations of a holder cap, in accordance with an embodiment of the disclosure.

CLAIMS

~~The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:~~

~~1. A propulsion unit, comprising:~~

~~a motor rotor that spins about a central rotational axis;~~

~~a clip-in base mount disposed on the motor rotor;~~

~~a clip-in rotor cap shaped to mate with and detachably clip into the clip-in base mount;~~

~~propeller mounts attached to the clip-in rotor cap; and~~

~~propeller blades each having a proximal base and a distal tip, wherein the proximal base of each propeller blade mounts to a corresponding one of the propeller mounts.~~

~~2. The propulsion unit of claim 1, wherein the clip-in base mount includes one or more cam grooves and the clip-in rotor cap includes holding cams that mate to the one or more cam grooves.~~

~~3. The propulsion unit of claim 2, wherein the clip-in rotor cap is attachable to the clip-in base mount by hand without a tool.~~

~~4. The propulsion unit of claim 2, wherein the clip-in rotor cap further includes:~~

~~a spring cavity; and~~

~~a spring disposed in the spring cavity that asserts a repelling force between the clip-in base mount and the clip-in rotor cap when the clip-in rotor cap is mated to the clip-in base mount.~~

~~5. The propulsion unit of claim 2, wherein the clip-in base mount further comprises:~~

~~detents disposed in the one or more cam grooves to provide resistance to a rotational separation of the holding cams from the one or more cam grooves.~~

~~6. The propulsion unit of claim 5, wherein the detents each comprise a beveled stop in the one or more cam grooves.~~

~~7. The propulsion unit of claim 6, wherein a slope direction of the beveled stop along with a direction of the rotational separation of the holding cams from the one or more grooves enables a pop off separation of the clip in rotor cap and the propeller blades from the motor rotor in an event that a physical object of a threshold mass impacts one or more of the propeller blades when the propeller blades are spinning.~~

~~8. The propulsion unit of claim 2, wherein the clip in base mount further comprises:~~

~~a raised alignment ring extending at least partially around a perimeter of the clip in base mount.~~

~~9. The propulsion unit of claim 7, wherein the one or more cam grooves are disposed along inside edges of the raised alignment ring.~~

~~10. An aerial vehicle, comprising:~~

~~an airframe;~~

~~propulsion units mounted to the airframe to provide propulsion to the aerial vehicle, wherein one or more of the propulsion units includes:~~

~~a motor rotor that spins about a central rotational axis;~~

~~a clip in base mount disposed on the motor rotor;~~

~~a clip in rotor cap shaped to mate with and detachably clip into the clip in base mount;~~

~~propeller mounts attached to the clip in rotor cap; and~~

~~propeller blades each having a proximal base and a distal tip, wherein the proximal base of each propeller blade mounts to a corresponding one of the propeller mounts.~~

~~11. The aerial vehicle of claim 10, wherein the clip in base mount includes one or more cam grooves and the clip in rotor cap includes holding cams that mate to the one or more cam grooves.~~

~~12. The aerial vehicle of claim 11, wherein the clip-in rotor cap is attachable to the clip-in base mount by hand without a tool.~~

~~13. The aerial vehicle of claim 11, wherein the clip-in rotor cap further includes:~~

~~a spring cavity; and~~

~~a spring disposed in the spring cavity that asserts a repelling force between the clip-in base mount and the clip-in rotor cap when the clip-in rotor cap is mated to the clip-in base mount.~~

~~14. The aerial vehicle of claim 11, wherein the clip-in base mount further comprises:~~

~~detents disposed in the one or more cam grooves to provide resistance to a rotational separation of the holding cams from the one or more cam grooves.~~

~~15. The aerial vehicle of claim 14, wherein the detents each comprise a beveled stop in the one or more cam grooves.~~

~~16. The aerial vehicle of claim 15, a slope direction of the beveled stop along with a direction of the rotational separation of the holding cams from the one or more grooves enables a pop off separation of the clip-in rotor cap and the propeller blades from the motor rotor in an event that a physical object of a threshold mass impacts one or more of the propeller blades when the propeller blades are spinning.~~

~~17. The aerial vehicle of claim 11, wherein the clip-in base mount further comprises:~~

~~a raised alignment ring extending at least partially around a perimeter of the clip-in base mount.~~

~~18. The aerial vehicle of claim 16, wherein the one or more cam grooves are disposed along inside edges of the raised alignment ring.~~

~~19. The aerial vehicle of claim 10, wherein the aerial vehicle comprises a vertical takeoff and landing (VTOL) unmanned aerial vehicle (UAV) and the propulsion units~~

~~include horizontal propulsion units mounted to the airframe to provide horizontal propulsion and vertical propulsion units mounted to the airframe to provide vertical propulsion.~~

1. A propulsion unit, comprising:

a motor rotor that spins about a central rotational axis;

a clip-in base mount disposed on the motor rotor;

a clip-in rotor cap shaped to mate with and detachably clip into the clip-in base mount;

propeller mounts attached to the clip-in rotor cap; and

propeller blades each having a proximal base and a distal tip, wherein the proximal base of each propeller blade mounts to a corresponding one of the propeller mounts.

2. The propulsion unit of claim 1, wherein the clip-in base mount includes one or more cam grooves and the clip-in rotor cap includes holding cams that mate to the one or more cam grooves.

3. The propulsion unit of claim 2, wherein the clip-in rotor cap is attachable to the clip-in base mount by hand without a tool.

4. The propulsion unit of claim 2, wherein the clip-in rotor cap further includes:

a spring cavity; and

a spring disposed in the spring cavity that asserts a repelling force between the clip-in base mount and the clip-in rotor cap when the clip-in rotor cap is mated to the clip-in base mount.

5. The propulsion unit of claim 2, wherein the clip-in base mount further comprises:

detents disposed in the one or more cam grooves to provide resistance to a rotational separation of the holding cams from the one or more cam grooves.

6. The propulsion unit of claim 5, wherein the detents each comprise a beveled stop in the one or more cam grooves.

7. The propulsion unit of claim 6, wherein a slope direction of the beveled stop along with a direction of the rotational separation of the holding cams from the one or more grooves enables a pop off separation of the clip-in rotor cap and the propeller blades from the motor rotor in an event that a physical object of a threshold mass impacts one or more of the propeller blades when the propeller blades are spinning.

8. The propulsion unit of claim 7, wherein the one or more cam grooves are disposed along inside edges of the raised alignment ring.

9. The propulsion unit of claim 2, wherein the clip-in base mount further comprises:

a raised alignment ring extending at least partially around a perimeter of the clip-in base mount.

10. An aerial vehicle, comprising:

an airframe;

propulsion units mounted to the airframe to provide propulsion to the aerial vehicle, wherein one or more of the propulsion units includes:

a motor rotor that spins about a central rotational axis;

a clip-in base mount disposed on the motor rotor;

a clip-in rotor cap shaped to mate with and detachably clip into the clip-in base mount;

propeller mounts attached to the clip-in rotor cap; and

propeller blades each having a proximal base and a distal tip, wherein the proximal base of each propeller blade mounts to a corresponding one of the propeller mounts.

11. The aerial vehicle of claim 10, wherein the clip-in base mount includes one or more cam grooves and the clip-in rotor cap includes holding cams that mate to the one or more cam grooves.

12. The aerial vehicle of claim 11, wherein the clip-in rotor cap is attachable to the clip-in base mount by hand without a tool.

13. The aerial vehicle of claim 11, wherein the clip-in rotor cap further includes:

a spring cavity; and

a spring disposed in the spring cavity that asserts a repelling force between the clip-in base mount and the clip-in rotor cap when the clip-in rotor cap is mated to the clip-in base mount.

14. The aerial vehicle of claim 11, wherein the clip-in base mount further comprises:

detents disposed in the one or more cam grooves to provide resistance to a rotational separation of the holding cams from the one or more cam grooves.

15. The aerial vehicle of claim 14, wherein the detents each comprise a beveled stop in the one or more cam grooves.

16. The aerial vehicle of claim 15, a slope direction of the beveled stop along with a direction of the rotational separation of the holding cams from the one or

more grooves enables a pop off separation of the clip-in rotor cap and the propeller blades from the motor rotor in an event that a physical object of a threshold mass impacts one or more of the propeller blades when the propeller blades are spinning.

17. The aerial vehicle of claim 16, wherein the one or more cam grooves are disposed along inside edges of the raised alignment ring.

18. The aerial vehicle of claim 11, wherein the clip-in base mount further comprises:

a raised alignment ring extending at least partially around a perimeter of the clip-in base mount.

19. The aerial vehicle of claim 10, wherein the aerial vehicle comprises a vertical takeoff and landing (VTOL) unmanned aerial vehicle (UAV) and the propulsion units include horizontal propulsion units mounted to the airframe to provide horizontal propulsion and vertical propulsion units mounted to the airframe to provide vertical propulsion.