lighter filler material (e.g., closed cell foam or other light polymer). Typically, the structural frame is surrounded by the outer shell material.

[0006] With some conventional technologies, the structural frame is assembled or manufactured first. Next, the outer shell (e.g., closed cell foam) is sprayed onto the frame to give a shape to the UAV. The excess outer shell material is cut away to make room for cables, engines, avionics, and other subassemblies. However, in some cases removing the excess outer shell material may be difficult and time consuming, thus decreasing the efficiency of the overall UAV manufacturing process.

[0007] Furthermore, the material of the frame and the material of the outer shell may have different coefficients of thermal expansion (CTE). As a result, the frame and the outer shell expand and contract at different rates as the temperature of the environment changes causing manufacturing and assembly defects. In time, different expansion rates may lead to bending of the frame, and, for a sufficiently high number of the temperature cycles, to material fatigue and fracturing of the frame.

[0008] Accordingly, there remains a need for the systems and methods for assembling UAVs having improved efficiency of the assembly and reduced stress on the structural frame.

SUMMARY OF INVENTION

[0008a] According to a first aspect of the present invention, there is provided an Unmanned Autonomous Vehicle (UAV), comprising:

an H-frame having a wing spar secured to two or more boom carriers, wherein the wing spar includes two or more mounting locations, wherein each of the two or more mounting locations of the wing spar is configured to secure a horizontal propulsion unit of a plurality of horizontal propulsion units, and wherein the boom carriers include a plurality of mounting locations, wherein each of the plurality of mounting locations of the boom carriers is configured to secure a vertical propulsion unit of a plurality of vertical propulsion units;

a pre-formed wing shell attached to the H-frame

; and

a pre-formed boom shell attached to a boom carrier of the two or more boom carriers.

[0008b] According to a second aspect of the present invention, there is provided an Unmanned Autonomous Vehicle (UAV), comprising:

a structural frame having a wing spar and boom carriers, and wherein the boom carriers are connected with boom clamps to the wing spar;

a pre-formed wing shell attached to the structural frame; and

a pre-formed boom shell attached to a corresponding boom carrier of the boom carriers.

DESCRIPTION OF THE DRAWINGS

[0009] The foregoing aspects and many of the attendant advantages of inventive technology will become more readily appreciated as the same become better understood by reference to the following detailed description, when taken in conjunction with the accompanying drawings, wherein:

[0010] FIGURE 1 is an isometric view of a UAV in accordance with an embodiment of the present technology;

[0011] FIGURE 2 is an isometric view of a frame of a UAV in accordance with an embodiment of the present technology;

[0012] FIGURE 3 is an isometric view of cable routing of a UAV in accordance with an embodiment of the present technology;

[0013] FIGURE 4 is a partial isometric view of a UAV in accordance with an embodiment of the present technology;

[0014] FIGURE 5 is a cross-sectional view 5-5 of the UAV shown in Figure 4;

[0015] FIGURE 5A is an exploded cross-sectional view 5-5 of the UAV shown in Figure 4;

CLAIMS

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

1. An Unmanned Autonomous Vehicle (UAV), comprising:

an H-frame having a wing spar secured to two or more boom carriers, wherein the wing spar includes two or more mounting locations, wherein each of the two or more mounting locations of the wing spar is configured to secure a horizontal propulsion unit of a plurality of horizontal propulsion units, and wherein the boom carriers include a plurality of mounting locations, wherein each of the plurality of mounting locations of the boom carriers is configured to secure a vertical propulsion unit of a plurality of vertical propulsion units;

a pre-formed wing shell attached to the H-frame; and

a pre-formed boom shell attached to a boom carrier of the two or more boom carriers.

2. The UAV of claim 1, wherein the pre-formed wing shell comprises:

a wing body;

an upper wing skin; and

a lower wing skin separate from the upper wing skin.

3. The UAV of claim 2, wherein the wing body comprises closed cell foam and the upper wing skin and lower wing skin comprise hard plastic.

4. The UAV of claim 3, wherein a motor mount of the horizontal propulsion unit comprises:

a 2-piece C-shell in contact with the hard plastic of the pre-formed wing shell, and

a fastener protruding through the 2–piece C-shell and through the wing spar.

5. The UAV of claim 2, further comprising:

a wing skin clip connecting the upper wing skin and the lower wing skin.

6. The UAV of claim 2, wherein the wing body includes a first groove and two or more second grooves, wherein the first groove is shaped to mate with the wing spar, wherein the second grooves are shaped to mate with the boom carriers, and wherein the first groove crosses the second grooves.

7. The UAV of claim 2, wherein the wing body includes wing tips pointing away from the H-frame.

8. The UAV of claim 2, wherein the wing body includes ailerons at a trailing edge of the wing body, and wherein the ailerons are connected to the wing body through a flexible connection formed as a groove in a material of the wing body.

9. The UAV of claim 7, further comprising:

a first plurality of motor mounts, each of the first plurality of motor mounts configured to couple to a horizontal propulsion unit of the plurality of horizontal propulsion units, wherein the first plurality of motor mounts are secured at the two or more mounting locations of the wing spar;

wherein each horizontal propulsion unit of the plurality of horizontal propulsion units is attached to one of the first plurality of motor mounts;

a second plurality of motor mounts, each of the second plurality of motor mounts configured to couple to a vertical propulsion unit of the plurality of vertical propulsion units, wherein the second plurality of motor mounts are secured at the plurality of mounting locations of the boom carriers; and

wherein each vertical propulsion unit of the plurality of vertical propulsion units is attached to one of the second plurality of motor mounts.

10. The UAV of claim 1, further comprising:

a clamp carried by the wing spar; and

a fuselage body attached with the clamp to the wing spar, wherein the fuselage body is a modular fuselage body comprising:

a battery compartment,

an avionics compartment, and

a delivery unit configured to handle a payload,

wherein the battery compartment, the avionics compartment, and the delivery unit are detachable from the fuselage body.

11. The UAV of claim 10, further comprising:

a plurality of printed circuit boards (PCBs) fastened to inside edges of the boom carriers, wherein the inside edges face the fuselage, and wherein a side of the PCBs that faces the fuselage is at least partially exposed; and

a plurality of electrical cables attaching the PCBs to the fuselage body.

12. The UAV of claim 1, wherein the wing spar is a carbon fiber tube with pre-drilled holes, and wherein the boom carriers are carbon fiber tubes with pre-drilled holes.

13. An Unmanned Autonomous Vehicle (UAV), comprising:

a structural frame having a wing spar and boom carriers, and wherein the boom carriers are connected with boom clamps to the wing spar;

a pre-formed wing shell attached to the structural frame; and

a pre-formed boom shell attached to a corresponding boom carrier of the boom carriers.

14. The UAV of claim 13, further comprising:

a spar clamp carried by the wing spar; and

a fuselage body attached with the spar clamp to the wing spar, wherein the fuselage body is a modular fuselage body comprising:

a battery compartment,

an avionics compartment, and

a delivery unit configured to handle a payload,

wherein the battery compartment, the avionics compartment, and the delivery unit are detachable from the fuselage body.

15. The UAV of claim 13, further comprising:

a plurality of printed circuit boards (PCBs) fastened to the boom carriers to face an opposing boom carrier; and

a plurality of electrical cables attaching the PCBs to the fuselage body.

16. The UAV of claim 15, wherein the wing spar is a carbon fiber tube with pre-drilled holes configured to carry motor mounts for horizontal propulsion units, and wherein the boom carriers are carbon fiber tubes with pre-drilled holes configured to carry motor mounts for vertical propulsion units.

17. The UAV of claim 16, further comprising:

a plurality of horizontal propulsion units, wherein each horizontal propulsion unit of the plurality of horizontal propulsion units is attached to a corresponding motor mount; and

a plurality of vertical propulsion units, wherein each vertical propulsion unit of the plurality of vertical propulsion units is attached to a corresponding motor mount,

wherein the PCBs are electrically connected to the vertical propulsion units and the horizontal propulsion units.

18. The UAV of claim 17, wherein the PCBs carry power converters and controllers.

19. The UAV of claim 16, wherein the boom carriers include a first boom carrier and a second boom carrier, the UAV further comprising:

a first rudder attached to the first boom carrier; and

a second rudder attached to the second boom carrier.

20. The UAV of claim 13, wherein the wing shell comprises:

a wing body, including a first groove and two or more second grooves, wherein the first groove is shaped to mate with the wing spar, wherein the second grooves are shaped to mate with the boom carriers, and wherein the first groove crosses the second grooves;

an upper wing skin; and

a lower wing skin separate from the upper wing skin.

21. The UAV of claim 15, wherein the pre-formed boom shell comprises a groove configured to mate with the corresponding boom carrier, and wherein the pre-

formed boom shell is adhered with the corresponding boom carrier without obstructing sides of the PCBs that face away from their corresponding boom carrier.