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Provisional patent application entitled:

AN AIRCRAFT

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AN AIRCRAFT

BACKGROUND

[001] It is known in the art that various types of aircrafts each have limitations. For example, a traditional helicopter relies on the single, large propeller for flight and uses complicated hand and foot controls to operate. The helicopter is also inefficient due to the lack of fixed-wings for gliding and lift-off assist. A tiltrotor is an aircraft with one or more powered rotors mounted at the ends of a fixed wing. If one of the powered rotors malfunctions, the aircraft will crash because of the imbalance of the weight on the wing structure.

SUMMARY

[002] An aircraft includes a fuselage having a front section, a center section, and a rear section. A plurality of supports includes a first front support of the plurality of supports coupled to the front section of the fuselage. A second front support of the plurality of supports is opposite the first front support. A first rear support of the plurality of supports is coupled to the rear section of the fuselage. A second rear support of the plurality of supports is opposite the first rear support. The first and second front supports extend outwardly from the front section of the fuselage, and the first and second rear supports extend outwardly from the rear section of the fuselage. A first wing is opposite a second wing, and the first and second wings are coupled to the center section of the fuselage. The first and second wings extend outwardly from the center section of the fuselage. A plurality of power generators are included. Each power generator is coupled to one support of the plurality of supports and to a propeller, and includes an electric motor. Each power generator is controlled independently from one another. Each power generator rotates the propeller on a first axis, the first axis being horizontal to the ground. Each power generator pivots an angle of the propeller, and the propeller pivots in a range between a 0° horizontal position to a 90° vertical position. A first amphibious landing gear system is coupled to an underside of the fuselage, and has an aerodynamically-shaped flap, a bladder and a wheel. The bladder is located under the flap, configured to inflate and deflate, and sized to provide buoyancy for the aircraft when inflated.

BRIEF DESCRIPTION OF THE DRAWINGS

[003] FIG. 1 is a perspective view of an aircraft, in accordance with some embodiments.

[004] FIG. 2A is a perspective view of the fuselage, in accordance with some embodiments.

[005] FIG. 2B is a close-up view of a front section of the fuselage shown in FIG. 2A.

[006] FIGs. 2C and 2D are a perspective view of the aircraft and a side view of the aircraft.

[007] FIGs. 2E and 2F depict a cutaway front view of the aircraft loaded with missiles.

[008] FIG. 3A is a cutaway view of the wing, in accordance with some embodiments.

[009] FIGs. 3B and 3C are a perspective view and a side view of the plurality of panels in a non-pivoted position.

[010] FIGs. 3D and 3E are a perspective view and a side view of the plurality of panels in a pivoted position.

[011] FIG. 4 shows sample cross-sectional aerodynamic shapes of the first and second wings including types of airfoils.

[012] FIG. 5 is a sample equation for calculating the Coefficient of Lift.

[013] FIGs. 6A-6E are various views of the aircraft with the angle of the propeller non-pivoted, or at 0° in a horizontal position, in accordance with some embodiments.

[014] FIGs. 7A-7E are various views of the aircraft with the angle of the propeller pivoted 90° in a vertical position, in accordance with some embodiments.

[015] FIGs. 8A-8C are various views of the aircraft with the angle of the front propellers pivoted to 45° and the rear propellers pivoted to 15°, in accordance with some embodiments.

[016] FIGs. 9A-9B are partial cutaway views of the aircraft, in accordance with some embodiments.

[017] FIG. 10 is a perspective view of the gas engine coupled to the first and second axial flux motors, in accordance with some embodiments.

[018] FIG. 11A is an example of the axial flux motor.

[019] FIG. 11B is an example of the gas engine.

[020] FIG. 11C is an example of the axial flux motor coupled to the gas engine.

[021] FIG. 12 is a perspective view of the rocket system, in accordance with some embodiments.

[022] FIGs. 13A-13D show examples of a fuel injector, microcontroller and pumps.

[023] FIG. 14A shows an example Electronic Fuel Injection (EFI) system logic diagram.

[024] FIG. 14B shows an example of a microcontroller EFI system.

[025] FIGs. 15A-15B depict the amphibious landing gear system, in accordance with some embodiments.

[026] FIGs. 16A-16C are views of the parachute system, in accordance with some embodiments.

[027] FIGs. 17A-17E are various views of the extended aircraft with the angle of the propeller non-pivoted, or at 0° in a horizontal position, in accordance with some embodiments.

[028] FIGs. 18A-18E are various views of the extended aircraft with the angle of the propeller pivoted 90° in a vertical position, in accordance with some embodiments.

[029] FIGs. 19A-19B and 20A-20B depict the aircraft and the extended aircraft with a portion of the first and the second wings in a hinged position.

[030] FIGs. 21A-21F are various sample dimensions and calculations used in the design of the aircraft.

DETAILED DESCRIPTION

[031] The disclosed aircraft is a safe, stealth vehicle with a large payload capacity that can vertically take-off and land on land or water. The aircraft has propellers powered by electric motors, which is supplemented by a gas engine and optionally a rocket. A vertical take-off and landing aircraft having an electric motor is difficult to design because to accomplish vertical take-off by an aircraft, a great amount of power is needed. It is known in the art that an electric motor does not generate as much power as a traditional combustion gas engine. Additionally, the aircraft needs to be lightweight for lift with a strong structure to handle the forces during a vertical take-off.

[032] The disclosed aircraft has a fuselage and wings comprised of frame structures of lightweight materials, such as aluminum and carbon-fiber materials covered in a soft material such as neoprene making the aircraft strong but yet lightweight. The use of materials that are low in RADAR detectability contribute to the stealth nature of the aircraft. The fuselage has a large area for payload such as weapons or cargo which can be conveniently loaded and unloaded while being unseen in the fuselage. Storage of weapons in the fuselage aids to avoid detection by modern RADAR.

[033] The aircraft includes a plurality of power generators, each coupled to a support and propeller, and having at least one electric motor such as an axial flux motor, a rocket system and a gas engine. Each power generator rotates the propeller on a first axis of the aircraft and pivots an angle of the propeller, so that each power generator is controlled independently from one another. Each power generator pivots an angle of the propeller so that the propeller pivots in a range between a 0° horizontal position to a 90° vertical position. This enables a high amount of maneuverability of the aircraft in roll, yoke and yaw directions while enabling vertical take-off and landing. The maneuverability of the aircraft may be similar to the maneuverability of a drone. The aircraft includes a traditional pair of wings for the main lift force while cruising and landing, and the plurality of supports assist the lifting force.

[034] The different types of power generators (electric, gas and rocket) working together provide layers of redundancy while producing the required thrust and lift for vertical take-off and landing. For example, the rocket system may be used for additional power during a vertical take-off for heavy payloads. Once in the air, the aircraft can operate on the combination of the electric motor and gas engine which produces very little noise while flying compared to traditional aircrafts such as helicopters or jet-engine aircrafts. The electric axial flux motor is a high-performance and light weight motor having up to 95% efficiency thereby producing little to no heat outside of the aircraft. Hence, adversary heat-seeking missiles are unable to track the aircraft.

[035] The amphibious landing gear system allows the aircraft to land on the water, stay afloat on the water, then perform a vertical take-off from the water. The amphibious landing gear system also includes a flap which assists the lifting force and providing an aerodynamic profile. A parachute system sized to support the weight of the aircraft may be deployed in an emergency situation. This enables people onboard – in a manned configuration – to bailout of the aircraft, and the aircraft can be recovered in a manned or unmanned configuration.

[036] The features of the aircraft including the capability of vertical take-off and landing on land or water, the quiet operation, the lack of detection by RADAR and the large payload capacity make it ideal for use in many sectors such as military operations, rescue missions and firefighter missions.

[037] FIG. 1 is a perspective view of an aircraft, in accordance with some embodiments. The aircraft includes a fuselage, plurality of wings, plurality of supports, plurality of power generators, plurality of propellers, rudder, cockpit and amphibious landing gear system. FIG. 2A is a perspective view of the fuselage, in accordance with some embodiments, and FIG. 2B is a close-up view of a front section of the fuselage shown in FIG. 2A. The fuselage has a front section, a center section, and a rear section which are comprised of a frame structure. The frame structure includes a plurality of structural elements connected together, such as aluminum segments forming a hexagonally-shaped cross-section for the fuselage, with a plurality of carbon-fiber tubes connecting the aluminum segments. A soft material, such as a neoprene skin or a lightweight polymer material, covers the frame structure. An access panel located on the bottom side of the fuselage provides access to the interior of the fuselage for cargo such as weapons.

[038] For example, FIGs. 2C and 2D are a perspective view of the aircraft and a side view of the aircraft. An example payload of missiles are shown, being stored in the cargo area of the center of the fuselage. In a non-limiting example, the cargo area is 14 feet long. FIGs. 2E and 2F depict a cutaway front view of the aircraft loaded with missiles. The access panel may be utilized for loading and deploying missiles. Since the missiles are concealed in the fuselage, it is difficult for adversary RADAR to detect the presence of the missiles. In other embodiments, passenger seats can be added in the cargo area of the fuselage for commercial transportation such as for military or parks service operations. The combination of the hexagon-shaped aluminum segments and the plurality of carbon-fiber tubes connecting the aluminum segments enable the structure of the aircraft to be strong and lightweight. The neoprene skin provides a lightweight, flexible, ozone proof, waterproof and heat insulation material for protection.

[039] Referring to FIG. 1, a first wing is opposite a second wing, and the first and second wings are coupled to the center section of the fuselage. The first and second wings extend outwardly from the center section of the fuselage. FIG. 3A is a cutaway view of the wing, in accordance with some embodiments. Similar to the fuselage design, the first and second wings are comprised of a frame structure which includes a plurality of structural segments, such as hexagon-shaped aluminum segments with a plurality of carbon-fiber tubes connecting the aluminum segments. A neoprene skin or a lightweight polymer material, covers the frame structure. Additionally, there are a plurality of pivotable flaps positioned across the rear of the first and second wings which may be pivoted about an axis so that the angle of the plurality of panels along the wings can adjust the lifting force, or the Coefficient of Lift (C_L) to be between 1.45 and 2.60 C_L. FIGs. 3B and 3C are a perspective view and a side view of the plurality of panels in a non-pivoted position. FIGs. 3D and 3E are a perspective view and a side view of the plurality of panels in a pivoted position. FIG. 4 shows sample cross-sectional aerodynamic shapes of the first and second wings including types of airfoils that may be used in embodiments. FIG. 5 is a sample equation for calculating the Coefficient of Lift.

[040] Referring to FIG. 1, a plurality of supports includes a first front support of the plurality of supports coupled to the front section of the fuselage. A second front support of the plurality of supports is opposite the first front support. A first rear support of the plurality of supports is coupled to the rear section of the fuselage. A second rear support of the plurality of supports is opposite the first rear support. The first and second front supports extend outwardly from the front section of the fuselage, and the first and second rear supports extend outwardly from the rear section of the fuselage. The plurality of supports are coupled to the fuselage near the top of the fuselage to strengthen the fuselage structure. The plurality of supports can assist the lifting force during take-off and assist the roll/pitch maneuverability during flight.

[041] A cockpit is coupled to the front section of the fuselage. In some embodiments, the aircraft may be manned and in other embodiments the aircraft may be unmanned. An endcap is coupled to the rear section of the fuselage and has a rudder to help with stability during flight. The aircraft may include antennas and communication to broadband satellite communications. Passive RADAR sensors may be coupled to the cockpit, the wings and the fuselage to detect adversary active RADAR signals from various directions.

[042] A plurality of power generators are included. For example, FIG. 1 depicts four power generators. Each power generator is coupled to one support of the plurality of supports – the first front support, the second front support, the first rear support, or the second rear support – and to a propeller. Each power generator is controlled independently from one another and rotates the propeller on a first axis. The first axis is horizontal to the ground. Each power generator pivots an angle of the propeller, and the propeller pivots in a range between a 0° horizontal position to a 90° vertical position. FIGs. 6A-6E are various views of the aircraft with the angle of the propeller non-pivoted, or at 0° in a horizontal position, in accordance with some embodiments. FIGs. 7A-7E are various views of the aircraft with the angle of the propeller pivoted 90° in a vertical position, in accordance with some embodiments. In non-limiting examples, sample dimensions are noted in the figures. FIGs. 8A-8C are various views of the aircraft with the angle of the front propellers pivoted to 45° and the rear propellers pivoted to 15°, in accordance with some embodiments.

[043] Each power generator of the plurality of power generators includes at least one electric motor and further includes a rocket system and a gas engine. FIGs. 9A-9B are partial cutaway views of the aircraft, in accordance with some embodiments. A gas engine coupled to a first axial flux motor are mounted inside of the fuselage near the supports of the plurality of supports. The gas engine coupled to a first axial flux motor generates high-voltage/high-current electricity to drive a second axial flux motor coupled to the propeller. This enables the propeller to rotate at a desired revolution-per-minute (rpm). An electrical wire such as a low-gauge copper wire connects the gas engine and first axial flux motor to the second axial flux motor to transmit the high-voltage/high-current electricity required by the second axial flux motor. A battery bank is included as a backup electric power source. This is a low-weight and low-cost alternative to other backup sources such as additional gas engines. Gas tanks for storing fuel are also provided. FIG. 10 is a perspective view of the gas engine coupled to the first and second axial flux motors, in accordance with some embodiments. In some embodiments, a 360-horsepower gas engine is used with a 72-inch diameter, 3-blade propeller.

[044] FIG. 11A is an example of the axial flux motor which may have 95% efficiency and a 15 kW/kG energy/weight density. FIG. 11B is an example of the gas engine, and FIG. 11C is an example of the axial flux motor coupled to the gas engine. This configuration eliminates complicated mechanical transmission/gearboxes from the design. In a non-limiting example, the gas engine may weigh up to 163 kg and consume about 1/10 of the total weight of the aircraft. The gas engine includes the cooling system, muffler/exhaust system and low-voltage alternator to generate electricity for electronics on board.

[045] A typical Electronic Fuel Injection (EFI) combustion engine found in automobiles uses a programmable microprocessor with firmware (e.g., electronic software) to control multiple cylinders of the engine for fuel efficiency. The theory of the EFI is to control and coordinate the combustion of each cylinder such as the timing of explosion by igniting the associated spark plug, and the amount by volume of fuel sprayed into the combustion chamber. The liquid fuel is pumped by high pressure by an electronic control valve and is injected as a gas into the chamber to react with oxygen (e.g., air). Finally, the frequency of the explosion/ignition is controlled and coordinated. All of these processes are coordinated in order to drive the crankshaft at the desired rpm in an efficient way.

[046] A controlled and coordinated liquid fuel rocket system is coupled to the gas engine. FIG. 12 is a perspective view of the rocket system, in accordance with some embodiments. The rocket system is an assist-system for take-off under heavy payload and may not be used for every take-off depending on the payload. The rocket system uses liquid fuel for safety and controllability by controlling the ignition and shut-off. In some embodiments, the rocket system uses liquid fuel. Two liquid substances are needed such as a liquid fuel (e.g., high-octane unleaded gasoline) and an oxidizer (e.g., 50% hydrogen peroxide). The dry weight of the rocket system may be up to 7 kg and may generate 170 Newtons of thrust thereby lifting 17.347 kg to 5,000 feet. Use of the rocket system may allow increased payload on the aircraft and increased speed and ascent of the aircraft during take-off. After take-off when the aircraft is cruising, the rocket system may provide backup power generation if the gas engine and/or axial flux motors fail. Additional liquid fuel and oxidizer may be stored in the fuselage.

[047] In some embodiments, there are a plurality of liquid fuel tanks – rockets – coupled to each power generator so that there are multiple (e.g., 16) rockets in the aircraft design. Each of the 16 rockets are controlled and coordinated for the thrust and timing so the aircraft can vertically take-off or land safely and stably. There are two high-pressure pumps so that each pump pumps the fuel or oxidizer into a high-pressure storage tube while waiting to be injected into the combustion chamber. The microcontroller controls the timing and duration of the fuel injector by turning on the solenoid valve in the injector. In this way, the amount of fuel and the timing is controlled. FIGs. 13A-13D show examples of a fuel injector (FIG. 13A), microcontroller (FIG. 13B) and pumps (FIGs. 13C-13D).

[048] FIG. 14A shows an example EFI system logic diagram, and FIG. 14B shows an example of a microcontroller EFI system. The operation is similar to automobile EFI systems which include high-pressure fuel pumps, electronic-controlled valve/injectors and spark plugs to mix liquid fuel and oxidizer.

[049] The use of the electric motor in the disclosed aircraft is an advantageous feature. For example, electric motors produce very little noise as compared to a traditional helicopter. Also, the electric motor generates very little infrared and heat from the engines making it a difficult target for adversary missiles. This is novel over conventional missile carrier aircrafts because conventional missile carrier aircrafts emit infrared, hot air and/or flames from the exhaust nozzle in the rear of the jet engine. Moreover, conventional missile carrier aircrafts use infrared honing to deploy missiles which is a passive weapon guidance system that uses the infrared light emission from a target to track and follow it. Additionally, the aircraft as a whole generates very little heat; therefore, detection from electro-optical or infrared sensors is difficult. This enables the disclosed aircraft to fly low without being detected by EO/IR sensors or electronic RADAR.

[050] The aircraft can vertically take-off or land on land or water. This may be suitable for aircraft carriers to execute military missions. The aircraft has an amphibious landing gear system. FIGs. 15A-15B depict the amphibious landing gear system, in accordance with some embodiments. A first amphibious landing gear system is coupled to an underside of the fuselage, such as to the underside of the front section of the fuselage, via a plurality of air pistons or other spring-like device to absorb the impact when landing. The amphibious landing gear system includes an aerodynamically-shaped flap, a bladder and a wheel. The aerodynamically-shaped flap is comprised of lightweight materials and structure, such as aluminum sections, carbon-fiber tubes and a neoprene skin with an airfoil cross-sectional-shape, as described with reference to the first and second wings and the fuselage (refer to FIGs. 2A, 2B, and 3A-3E). The bladder is located under the flap, and configured to inflate and deflate. This may be accomplished using a high-pressure air tank. Hence, the bladder is sized to provide buoyancy for the aircraft when inflated. As shown in FIG. 15A, when the aircraft is in flight, the bladder is deflated and tucked away under the flap or hidden by the flap to avoid drag. This enables an aerodynamic profile. During take-off, the flap provides additional lifting power. The aircraft uses the combination of the first and second wings – traditional wings, the plurality of supports and the flap on the amphibious landing gear to increase the stability of the aircraft during vertical take-off, flight and landing.

[051] FIG. 15B depicts the bladder inflated, in accordance with some embodiments. In this mode, the aircraft can land on water and stay afloat, such as park on the water, as long as the bladder is inflated. Because the aircraft can stay afloat on the water, this enables the aircraft to vertically take-off from this position on the water. In some embodiments, the aircraft includes a second amphibious landing gear system which is similar in description to the first amphibious landing gear system. As seen in FIGs. 1, 6A, 6E, the first amphibious landing gear system is coupled to the front section of the fuselage and the second amphibious landing gear system is coupled to the rear section of the fuselage.

[052] The aircraft can include an aircraft parachute system that may be deployed in an emergency situation so that people on the aircraft may bailout and the aircraft can be recovered. FIGs. 16A-16C are views of the parachute system, in accordance with some embodiments. A door is included on the topside of the fuselage (not shown). The compact parachute may be stored in the fuselage and positioned to deploy through the door. The parachute is sized to support the weight of the aircraft. In some embodiments, the parachute system may be deployed for landing to conserve fuel for cost benefits. The ability to have a parachute that can carry the weight of the entire aircraft is made possible due to the lightweight design of the aircraft.

[053] In some embodiments, there is an extended configuration for the aircraft. This increases the overall length of the aircraft by increasing the fuselage, e.g., the center section of the fuselage, meaning more payload space. In doing so, additional supports, power generators and landing gear systems are included. FIGs. 17A-17E are various views of the extended aircraft with the angle of the propeller non-pivoted, or at 0° in a horizontal position, in accordance with some embodiments. FIGs. 18A-18E are various views of the extended aircraft with the angle of the propeller pivoted 90° in a vertical position, in accordance with some embodiments.

[054] The extended aircraft is similar to the aircraft described herein. In the extended configuration, the aircraft includes a first center support of the plurality of supports coupled to the center section of the fuselage and a second center support of the plurality of supports opposite the first front support, wherein the first and second center supports extend outwardly from the center section of the fuselage. In a non-limiting example, in the extended configuration, the overall length is 69 feet and the wing span is 65 feet whereas in the standard configuration (as shown in FIGs. 6A-6E and 7A-7E), the overall length is 58 feet and the wing span is 65 feet.

[055] In the extended configuration, two additional power generators are included in the plurality of power generators. Each power generator is coupled to one of the center supports of the plurality of supports and a propeller. As described herein, each power generator rotates the propeller on a first axis of the aircraft and pivots an angle of the propeller. Each power generator is controlled independently from one another. Further, a third landing gear system is coupled to the underside of the fuselage such as in the center section of the fuselage.

[056] In some embodiments, a portion of the first and the second wings may be hinged. FIGs. 19A-19B and 20A-20B depict the aircraft and the extended aircraft with a portion of the first and the second wings in a hinged position. For example, the first wing may include a first and second portion of the first wing and the second wing may include a first and second portion of the second wing. The first portion of the wing is hingably coupled to the second portion of the wing so that the first (outer) portion of the wings pivots relative to the second portion of the wing between 0° in a horizontal position to 90° in a vertical position or other angles. This compact mode reduces the footprint of the aircraft for more convenient storage such as in a small hanger or aircraft carrier.

[057] FIGs. 21A-21F are various sample dimensions and calculations used in the design of the aircraft.

[050] While the specification has been described in detail with respect to specific embodiments of the invention, it will be appreciated that those skilled in the art, upon attaining an understanding of the foregoing, may readily conceive of alterations to, variations of, and equivalents to these embodiments. These and other modifications and variations to the present invention may be practiced by those of ordinary skill in the art, without departing from the scope of the present invention, which is more particularly set forth in the appended claims. Furthermore, those of ordinary skill in the art will appreciate that the foregoing description is by way of example only, and is not intended to limit the invention.

What is claimed is:

1. An aircraft comprising:

a fuselage having a front section, a center section, and a rear section;

a plurality of supports including: a) a first front support of the plurality of supports coupled to the front section of the fuselage, b) a second front support of the plurality of supports opposite the first front support, c) a first rear support of the plurality of supports coupled to the rear section of the fuselage and d) a second rear support of the plurality of supports opposite the first rear support, wherein the first and second front supports extend outwardly from the front section of the fuselage, and the first and second rear supports extend outwardly from the rear section of the fuselage;

a first wing opposite a second wing, the first and second wings coupled to the center section of the fuselage, the first and second wings extending outwardly from the center section of the fuselage;

a plurality of power generators, each power generator coupled to one support of the plurality of supports and to a propeller, wherein each power generator:

includes an electric motor;

rotates the propeller on a first axis, the first axis being horizontal to the ground;

pivots an angle of the propeller, the propeller pivoting in a range between a 0° horizontal position to a 90° vertical position;

is controlled independently from one another; and

a first amphibious landing gear system coupled to an underside of the fuselage and having an aerodynamically-shaped flap, a bladder and a wheel, wherein the bladder is a) located under the flap, b) configured to inflate and deflate, and c) sized to provide buoyancy for the aircraft when inflated.

2. The aircraft of claim 1, wherein the electric motor is at least one axial flux motor.

3. The aircraft of claim 1, wherein each power generator further includes a rocket system and a gas engine.

4. The aircraft of claim 1, wherein the aerodynamically-shaped flap forms an airfoil.

5. The aircraft of claim 1, further comprising a second amphibious landing gear system, wherein the first amphibious landing gear system is coupled to the front section of the fuselage and the second amphibious landing gear system is coupled to the rear section of the fuselage.

6. The aircraft of claim 1, further comprising:

a door on a topside of the fuselage; and

a parachute positioned to deploy through the door, wherein the parachute is sized to support the weight of the aircraft.

7. The aircraft of claim 1, wherein the fuselage is comprised of a frame structure and a neoprene skin covering the frame structure.

8. The aircraft of claim 1, further comprising a first center support of the plurality of supports coupled to the center section of the fuselage and a second center support of the plurality of supports opposite the first front support, wherein the first and second center supports extend outwardly from the center section of the fuselage.

9. The aircraft of claim 8, further comprising a plurality of power generators, each power generators coupled to one center support of the plurality of supports and a propeller, each power generator rotates the propeller on a first axis of the aircraft and pivots an angle of the propeller, wherein each power generator is controlled independently from one another.